Prefrontal Lobes-Tuning in and out: From Jazz to Mental disorders

Your prefrontal lobes on jazz*

- the dorsolateral prefrontal cortex, (8,9,10) showed a slowdown in activity during improvisation.
- This area has been linked to planned actions and self-censoring, such as carefully deciding what words you might say at a job interview.
- Shutting down this area could lead to lowered inhibitions

Difference in the Behaviors of Infants With and Without Autism: *Communication

- Normal
- Study mother's face
- Easily stimulated by sounds
- Keep adding to vocabulary and expanding grammatical usage

- Autistic
- Avoid eye contact
- Seem deaf
- Start developing language, then abruptly stop talking altogether

Difference in the Behaviors of Infants With and Without Autism:

Social*

- Normal
- Cry when mother leaves the room and are anxious with strangers
- Get upset when hungry or frustrated
- Recognize familiar faces and smile
-

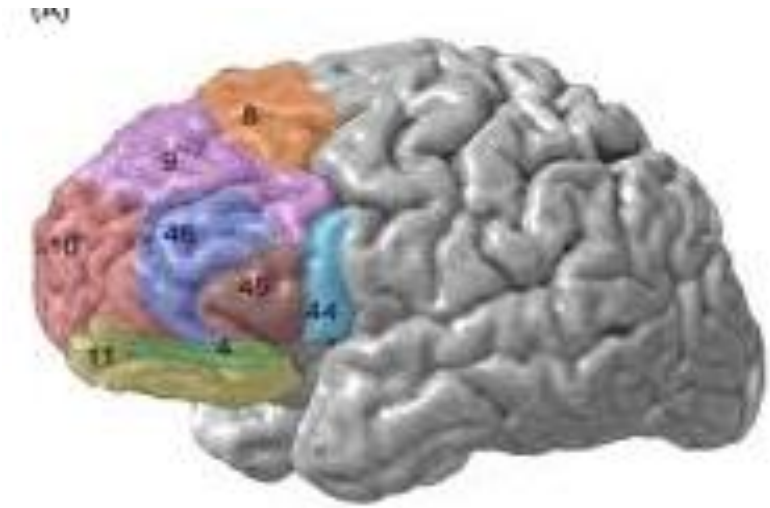
- Autistic
- Act as if unaware of the coming and going of others
- Physically attack and injure others without provocation
- Inaccessible, as if in a shell

Difference in the Behaviors of Infants With and Without Autism: *Exploration of environment

- Normal
- Move from one engrossing object or activity to another
- Use body purposefully to reach or acquire objects
- Explore and play with toys
- Seek pleasure and avoid pain
-

- Autistic
- Remain fixated on a single item or activity
- Practice strange actions like rocking or hand-flapping
- Sniff or lick toys
- Show no sensitivity to burns or bruises, and engage in self-mutilation, such as eye gouging

Brain development & Infant Autism*



- From approximately 1 year to about 18 months a key area of the right frontal lobe is developing
- The right orbital frontal (11)
- Shapes the circuits for maintaining human attachments and regulation of emotions (both reading other people's emotions and regulating own emotions)
- This area is found to be smaller in autistic children

Children with Autism*

- When children's perceptions are accurate, they can learn from what they see, feel, or hear.
- On the other hand, if sensory information is faulty or if the input from the various senses fails to merge into a coherent picture, the child's experiences of the world can be confusing.
- People with autism seem to have one or both of these problems.
- There may be problems in the sensory signals that reach the brain or in the integration of the sensory signals-and quite possibly, both.

Children with Autism*

- Of the problems that can occur with autism, mental retardation is the most widespread.
- Seventy-five to 80 percent of people with autism are mentally retarded to some extent.
- Fifteen to 20 percent are considered severely retarded, with IQs below 35. (A score of 100 represents average intelligence.)
- But autism does not necessarily correspond with mental impairment.
- More than 10 percent of people with autism have an average or above average IQ. A few show exceptional intelligence.

Back to Prefrontal lobes and Autism*

- Thus there appears to be similarities between autism and executive function deficits at both descriptive and behavioral levels
- The Autistic child/adult can be described in EF terms as
- rigid, inflexible (the need for routine)
- Extreme perseverative, repetitive behaviour
- Impulsive (difficulty in inhibiting responses)
- Difficulty integrating their store of knowledge
- Focused on details - difficulty in seeing the big picture

Why the frontal cortex in autism might be talking only to itself: local over-connectivity but long-distance disconnection*

Eric Courchesne and Karen Pierce

Current Opinion in Neurobiology 2005, 15:225–230

- It is suggested that connectivity within frontal lobe is excessive, disorganized and inadequately selective,
- But connectivity between frontal cortex and other systems is poorly synchronized, not very responsive and a deficit of information.
- Increased local but reduced long distance cortical–cortical reciprocal activity impairs the fundamental frontal function of integrating information from widespread and diverse systems and providing complex feedback, guidance and control to lower-level systems

The Case of a woman with half a brain*

from Doidge - The brain that Changes Itself (2007)

- A 29yr old born (Michelle) with only her right hemisphere (possible due to lack of a blood supply during fetal development)
- As a baby, she wasn't active (no crawling, right side partially paralyzed), visually didn't track things with her eyes and almost blind.
- Then at age of about 1 changes occurred, some movement on right side, visual tracking) and at age 2 beginning of language followed by a beginning to crawl (keep in mind the order of the development)
- Essentially her learning pattern was emerging but significantly delayed

The Case of a woman with half a brain*

- Michelle has some extraordinary skills & sensory abilities
- Calculating skills way above normal in speed (savant like)
- Very acute hearing & touch
- Loves repetitive tasks - folding flyers (1000 church flyers in an hour with one hand
- Extremely decisive and quick when no ‘subjective’ assessments were needed (e.g. playing solitaire)
- Superior memory for concrete details -a very good speller, events, what day of the week a particular date was back to the mid-eighties when she started school, very rapid response for concrete ‘similarities & differences e.g. chair & horse - four legs, can sit on both - difference horse can move by itself, very good in arithmetic at school but, importantly, not algebra

The Case of a woman with half a brain*

- Michelle's weaknesses
- her strength was memory for details but abstract thinking was a challenge
- Can't interpret proverbs like 'people in glass houses….'
- Difficulty extracting a theme from a series of events - so difficulty in getting the main point in a movie
- Difficulty in planning
- Difficulty sorting out social situations that require abstracting abilities empathy, understanding motives, forecasting behaviour of others). This weakness
- Increases her anxiety in social situations and makes it hard for her to control impulses

The Case of a woman with half a brain*

from Doidge - The brain that Changes Itself (2007)

- Although what follows is a hind-sight explanation, it is intriguing
- 1/ Early in development, hemispheres are quite similar and only later do they become specialized as to function (e.g. sounds processed by both hemispheres in 1st year)
- 2/ Later, in normal development each hemisphere tends to specialize in certain functions and
- 3/ normal development would see the right hemisphere process visual-spatial activities involved in such things as taking in the visual environment, crawling and later, the left hemisphere with language related activities
- 4/ the age at which we learn a skill influences the area in which it gets processed and, again, normal maturation of areas of the brain follow a trajectory based on normal physical maturation and environmental exposure

The Case of a woman with half a brain*

from Doidge - The brain that Changes Itself (2007)

- From a prefrontal perspective a similar ‘mirror plasticity’ occurred with the right prefrontal area
- because of necessity taking over what normally would be left prefrontal roles- registering and storing memories of individual events.
- Such a registration is an earlier ‘requirement’ compared to the need to integrate information
- As the right prefrontal can only do so much the normal role of the right prefrontal - abstraction, theme extraction, foresight) was usurped by the unusual demands placed upon it. -

Savant and left/right brain*

- Researchers have uncovered that this *savant* ability relates to two things.
- 1/constraints placed on the right hemisphere of the brain by the patterns of learning and perception of the left hemisphere, so that the impairment of left hemisphere liberates certain aspects of the right hemisphere.
- 2/ compensatory development of the right hemisphere *because* the left hemisphere has dysfunction.
- Interestingly, researchers have also discovered that they can induce heightened problem solving skills in individuals with normal function by temporarily quieting neural activity in the left hemisphere
- So - we may all have the capacity for these kinds of things.