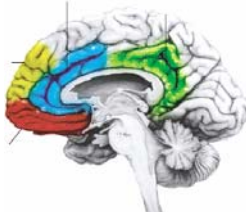


2006 Summer School, Sofia, Bulgaria  
July 5, 2006

Cognitive Neuroscience of Thought  
Kalina Christoff

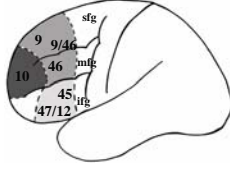
### Emotional Aspects of Thought



Thinking in the medial prefrontal cortex

### Lateral prefrontal cortex

RLPFC (BA 10)
DLPFC (BA 9, 46, 9/46)
VLPCF (BA 45, 47/12)



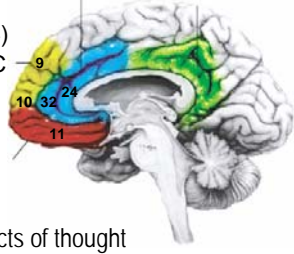
Goal-directed thought

### Medial prefrontal cortex

(Anterior Cingulate Cortex) ACC


(Dorsomedial PFC) DMPFC 9

(Ventromedial PFC) VMPFC 10, 32, 24, 11




Emotional aspects of thought  
Interaction between thinking and emotions

Thinking about one's own thoughts



Lateral Area 10

Thinking about one's own emotions



Medial Area 10

### The influence of thought on emotions

We can change the way we feel by changing our thoughts

For example, we could

- lessen the emotional consequences of an otherwise distressing experience
- enhance a positive experience by increasing our awareness of it

*"There is nothing either good or bad, but thinking makes it so."*  
Shakespeare, *Hamlet*

If you are distressed by anything external, the pain is not due to the thing itself, but to your estimate of it; and this you have the power to revoke at any moment.  
Marcus Aurelius (*Meditations*)

Task: reappraise highly negative scenes in unemotional terms

## Reappraisal

The cognitive transformation of emotional experience

Reappraisal, which is fundamentally a thinking process, forms the basis of emotional regulation.

K.N. Ochsner et al. / NeuroImage 23 (2004) 483-499

### Attend

let yourself respond emotionally to the following photo by being aware of your feelings without trying to alter them



### Reappraise

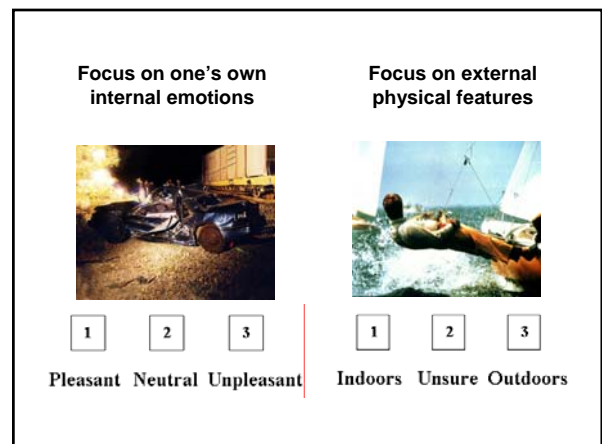
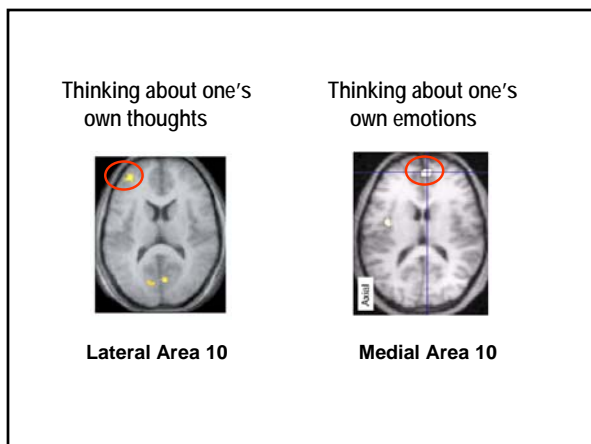
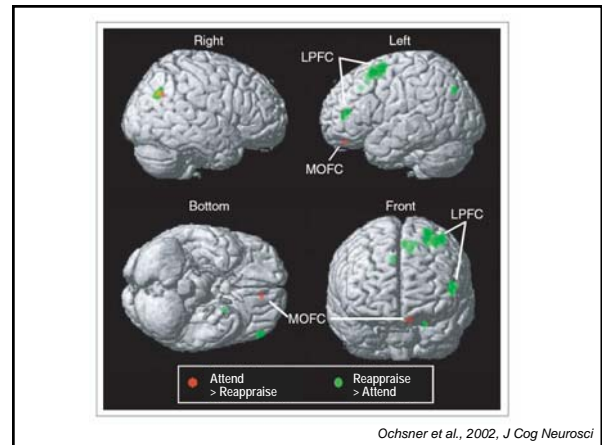
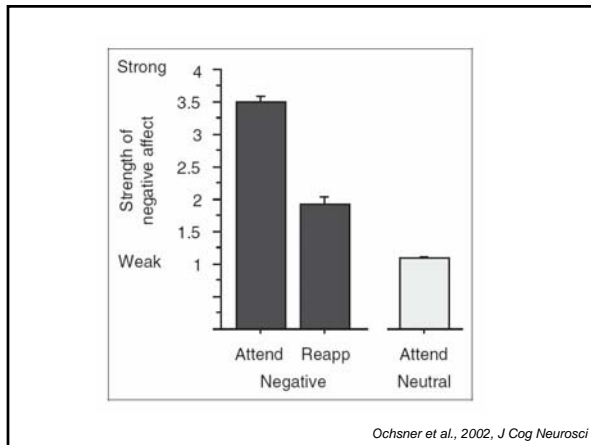
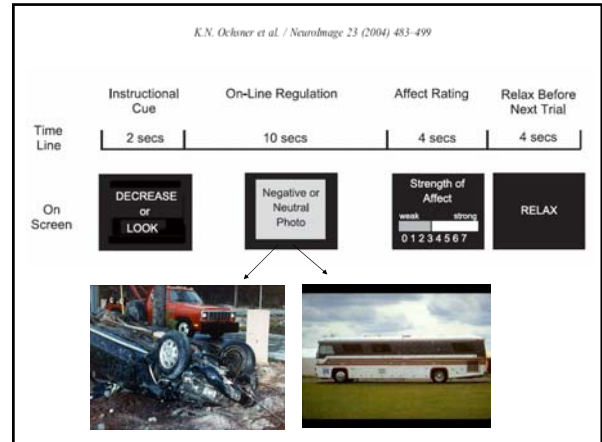
interpret the photo so that you no longer feel negative in response to it



*K.N. Ochsner et al. / NeuroImage 23 (2004) 483-499*

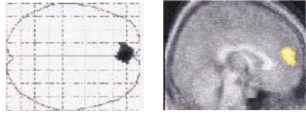
**Reappraise condition**  
 interpret photos so that you no longer feel negative in response to them

**Attend condition**  
 let yourself respond emotionally to each photo by being aware of your feelings without trying to alter them



### Thinking about one's own emotions

internal vs. external focus



Medial prefrontal cortex: Brodmann Areas 10 & 32  
 (x,y,z = 0,50,16)

Lane et al., 1997, Neuroreport

### The medial prefrontal cortex

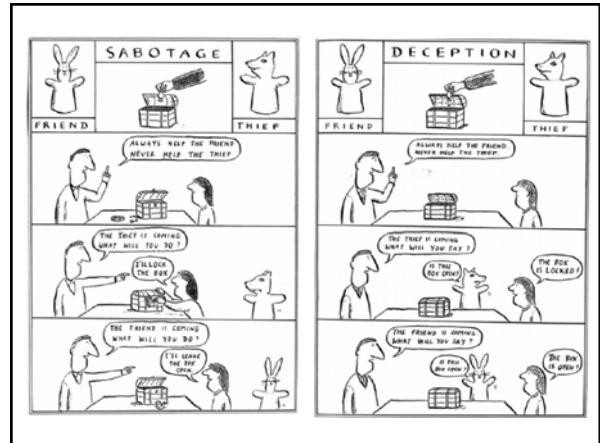
Is involved when we think about our own emotions

But also, when we think about other people's emotions and mental states

### "Theory of mind" (mentalizing)

The ability to explain and predict the behavior of others by attributing to them independent mental states such as beliefs, desires, emotions or intentions.

- Considered a uniquely human ability



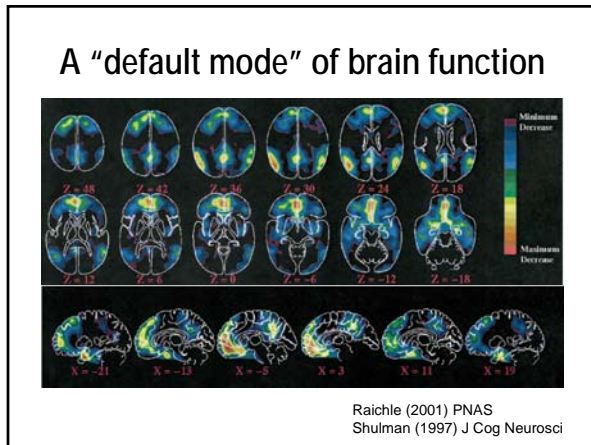
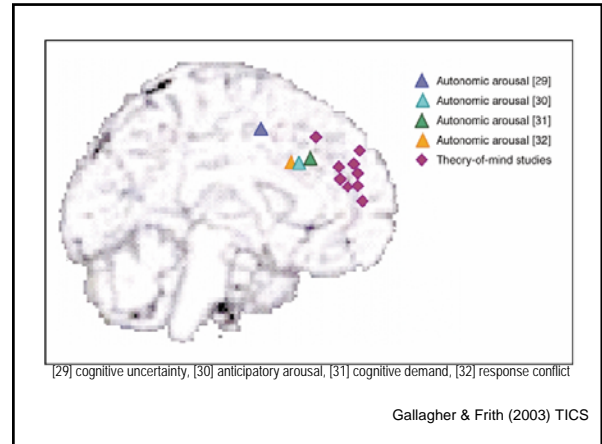
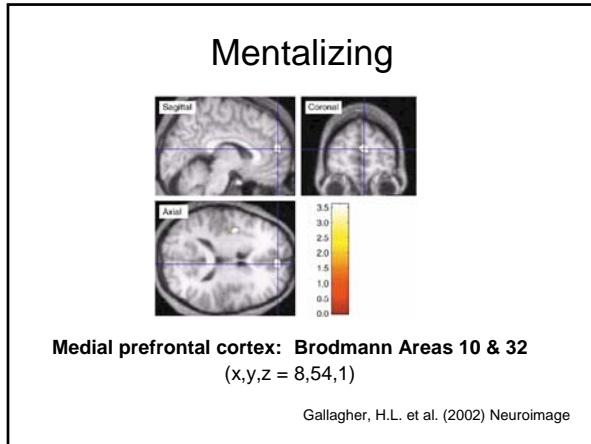
### Autism

- Suggests dissociation between mentalizing and other cognitive abilities
- Autistic children
  - performed worse than control on deception task
  - performed as well as controls on sabotage task
- Autistic children's failure on the deception task
  - not due to an inability to understand the task
  - due to inability to "understand the mind" of others

### Mentalizing

- Subjects played a competitive game on a computer
- In the mentalizing condition
  - subjects believed they were playing against the experimenter
  - adopted an *intentional stance* (Dennett, 1996)
- In the control condition
  - subjects believed they were playing against a computer using a predetermined, rule-based strategy
  - treated their opponent as a machine
- In fact, in both instances they played against a random sequence.

Gallagher, H.L. et al. (2002) Neuroimage



### A "default mode" of brain function

Shulman, Fiez, Corbetta, Buckner, Miezin, Raichle (1997) J Cog Neurosci - observed consistent decreases in activation during attention demanding tasks, regardless of what the task is

Raichle, MacLeod, Snyder, Powers, Gusnard, & Shulman (2001) PNAS "We posit that when an individual is awake and alert and yet not actively engaged in an attention-demanding task, a default state of brain activity exists.

"Information broadly arising in the external and internal milieu is gathered and held in mind."

Gazzaniga, Aron, & Shulman, Raichle (2001) PNAS "When focused attention is required, particularly if this activity is novel, activity in these areas may be attenuated or suppressed."

