

STRATEGIC MANAGEMENT AND THE NEUROSCIENCES

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THE AGENDA

1. Why neuroscience in strategic management?
2. Observing the mind of managers and entrepreneurs
3. What are we seeing?
4. The future of mind at work

THE PROBLEM WITH STRATEGIC MANAGEMENT

- We understand the macro-factors of success
 - Industry dynamics
 - Macro-economic conditions
 - Cultural and institutional factors
 - We are also increasingly aware of organizational factors
 - Which resources generate competitive advantage
 - How collective competencies evolve
 - The role of organizational structures and relationships
 - We know a lot less about the role of INDIVIDUAL traits in strategic decision-making
-

SEARCHING FOR THE HUMAN SIDE OF STRATEGY

- Original “Sin”: evolved from applied neo-classic ECONOMICS
 - “homo economicus” is a (bad) caricature of the strategic manager
 - Perfect knowledge, completely selfish, emotionless, morally agnostic
- Even the “behavioral revolution” (Simon & March, Nelson & Winter) fails to capture the individual drivers of managerial behavior
- What makes managers and entrepreneurs facing the same context decide/act differently?
 - Yes, it depends on the history and current feature of the organization...
 - ... but also on what goes on inside the mind of the individual decision-maker

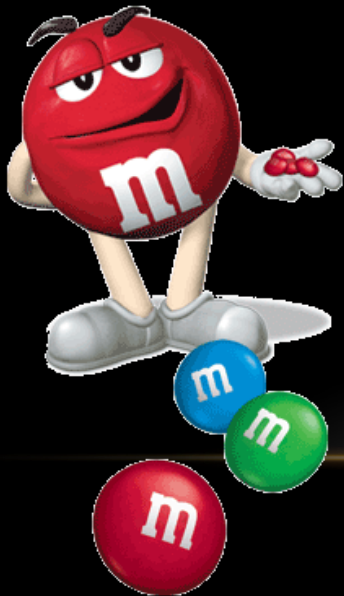


ENTER NEURO-SCIENCE...!

- Neuro-psychology, cognitive sciences and technologies, have generated ideas, concepts and tools increasingly applied to social-scientific problems
 - Creativity, decision-making, motivation, risk evaluation, expectations ...
 - fMRI, virtual reality, interactive brain scans, neuro-physiological biofeedback
- The advent of NEUROPLASTICITY has fundamentally revolutionized both neuroscience and its possible application to social sciences
- The discovery of MIRROR NEURONS has given new meanings to the concept of “human being” and of the society it inhabits
- Neuro-scientists and social scientists have started to SPEAK to each other!

2. OBSERVING THE MIND OF MANAGERS & ENTREPRENEURS

- Based on joint work with:
 - **Daniella Laureiro-Martinez and Stefano Brusoni** (Department of Management and Technology, Bocconi University)
 - **Stefano Cappa and Nicola Canessa** (Dept of Cognitive Neurosciences, Vita-Salute San Raffaele University)



M&Ms are all mine
(Mistakes & Misunderstandings)

WHAT WE WANTED TO FIND OUT

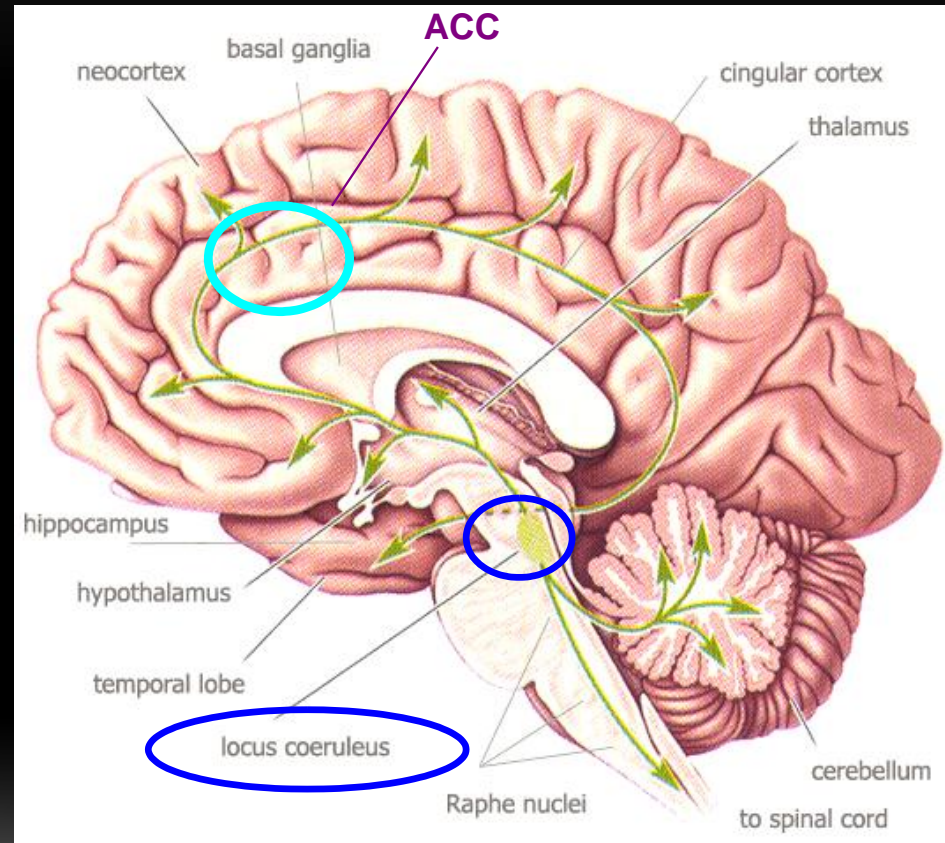
1. What happens in the mind of individuals when they:
 - EXPLOIT the resources currently available to get better outcomes
 - EXPLORE to find new resources or ways to generate outcomes
 - Shift from one to the other?
 2. What explains the performance of decisions?
 3. What influence does prior experience/background has on the way the brain works and decisions perform?
 - Experienced managers v. Entrepreneurs of start-ups
-

EXPLORATION AND EXPLOITATION IN OUR BRAIN

The Role of the Neuromodulation of Attention (Locus Coeruleus, LC)

(Laureiro-martinez, Brusoni, Zollo, 2010, *Journal of Neuroscience, Psychology and Economics*)

- Interactions between OFC, ACC and the LC modulate attention (Usher et al. 1999, Aston-Jones and Cohen, 2005, Cohen et al. 2007)
- 2 LC operating modes
 - Phasic → narrow → exploitation
 - Tonic → broad → exploration



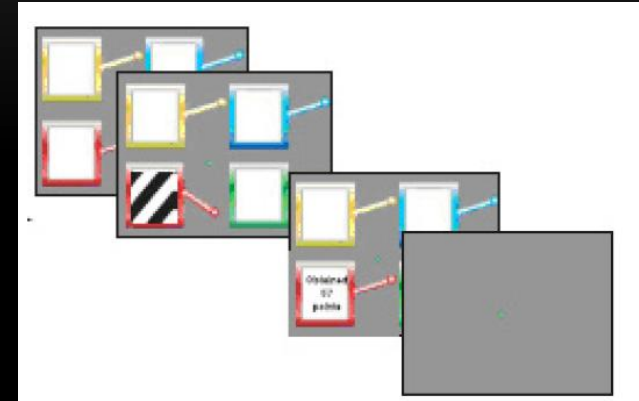
WARNING #1 and #2

THE AGENDA

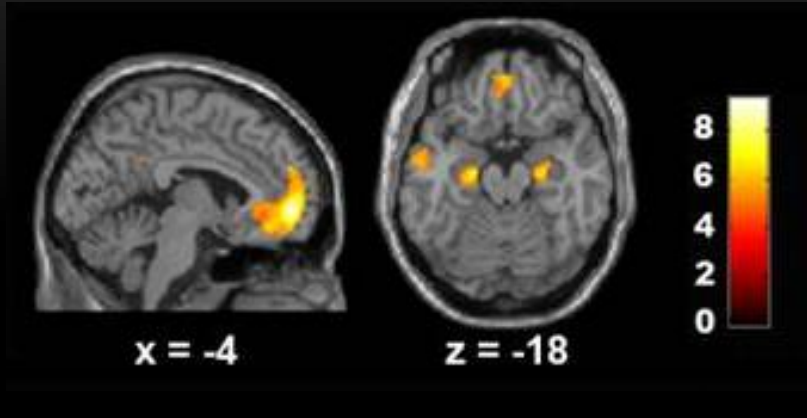
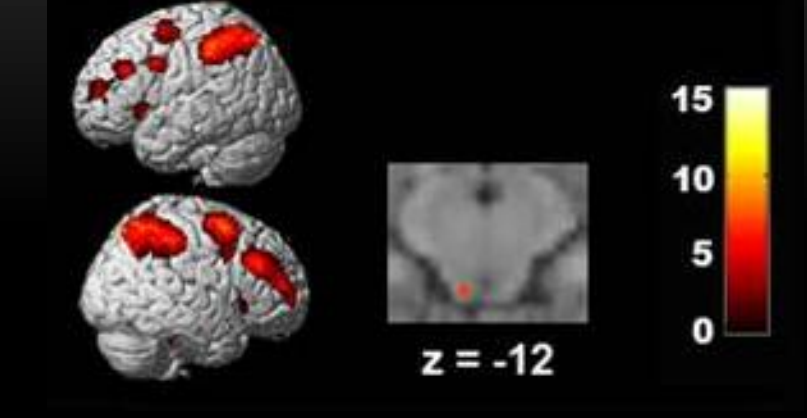
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STUDY DESIGN

- Four-armed bandit Gambling game (Daw et al. 2005)
 - Simple and repetitive: 4 sessions of 75 trials each
- Measures
 - Actions
 - Response times
 - Self-reports on how the participants played the game
- **Sample of expert decision makers**
 - 28 managers, 25 entrepreneurs
 - Similar for age, gender, health conditions and education, different for start-up experience

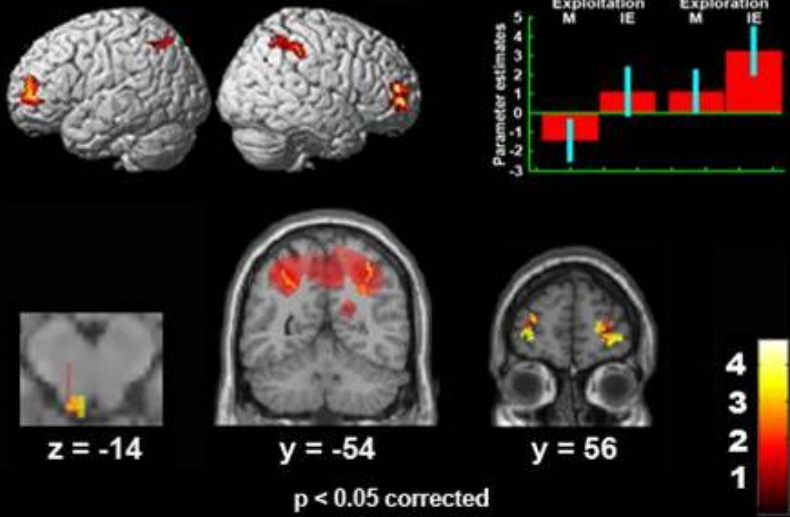


Results

Exploitation	Exploration
 <p>Brain scans showing activation in the Exploitation condition. The left image is a sagittal view at $x = -4$ and the right image is an axial view at $z = -18$. A color scale on the right indicates intensity from 0 to 8.</p>	 <p>Brain scans showing activation in the Exploration condition. The left image shows a 3D surface rendering of the brain with red clusters, and the right image is an axial view at $z = -12$. A color scale on the right indicates intensity from 0 to 15.</p>
<p>Learning, reward perception, perseveration</p> <p>Dopaminergic regions</p> <p>Ventro medial pre frontal cortex</p> <p>Hippocampus (subiculum)</p>	<p>Cognitive control regions, planning, idea generation, switching.</p> <p>Bilateral fronto-parietal regions</p> <p>Fronto polar cortex</p> <p>Anterior cingulate cortex</p> <p>Thalamus</p> <p>Anterior insula</p> <p>Locus coeruleus</p>

What explains performance?
Cognitive capabilities or Routinization?

Cognitive control regions



Routinization

Decision-making performance

The capacity to routinize improves directly performance, and is developed by cognitive control capabilities

ENTREPRENEURS VS. MANAGERS

- No significant differences in the number of exploitative vs explorative choices and the number of switches
 - Behaviorally 'equivalent'!
- Entrepreneurs ROUTINIZE more (develop "simple rules" faster)
- They also "EXPLORE" better
 - with both sides of the brain (Right side as well)
 - more active cortical levels (fronto-parietal and fronto-polar cortex)
 - more active LC (switching swiftly between exploration and exploitation)
- Entrepreneurs' decision-making PERFORMANCE is better
 - Higher cumulative payoff

CONCLUSIONS

1. Studying the brain at work is crucial to understand how:
 - Innovative decisions are made and how they influence performance
 - individual differences influence the performance of decisions
2. Cognitive control capabilities are important but do NOT improve performance directly...
 - The ability to translate strategic insights into “simple rules” is the KEY
3. We are starting to understand why Entrepreneurs are different from Managers in fundamental ways
 - Ability to switch ‘cognitive style’ and use the full frontal cortex to explore

Current and Future Developments

Genetics
&
Personality

**Multiple
Methods**

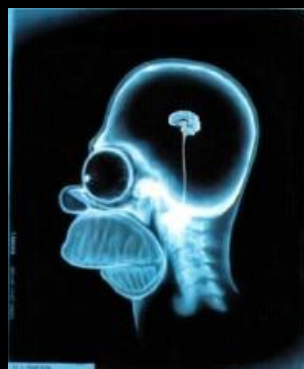


**Simulations
& Tests**

Are cognitive control capabilities and routinization learnable? What is the relative effectiveness of different approaches to learning?

Understanding the neuro-scientific basis of SUSTAINABILITY decisions by managers?
Can Sustainability in business decisions be developed by innovative learning processes?

THANKS!





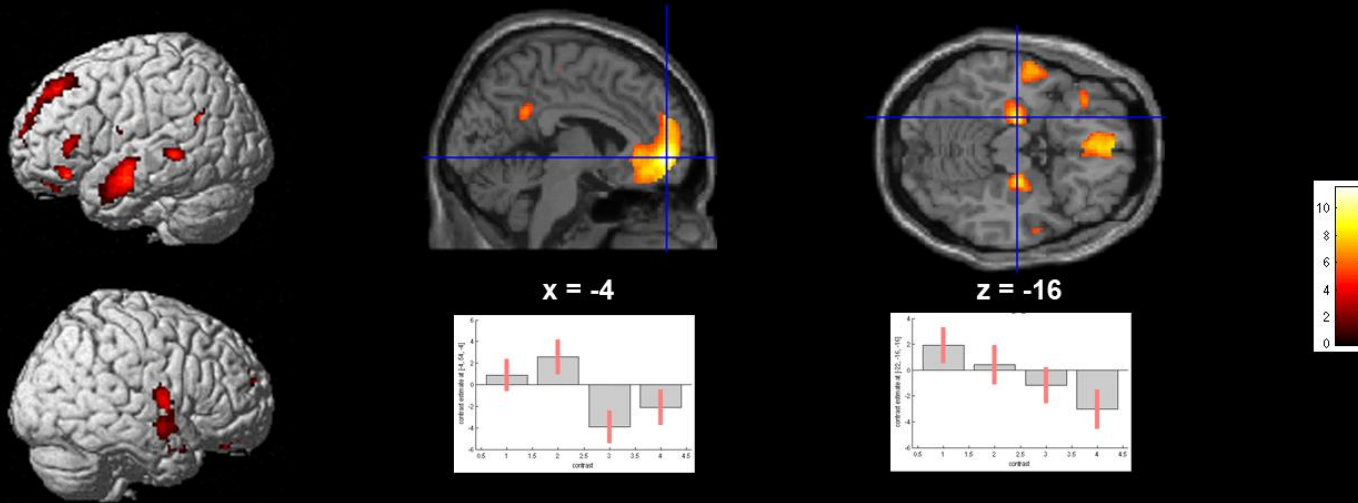
Attention



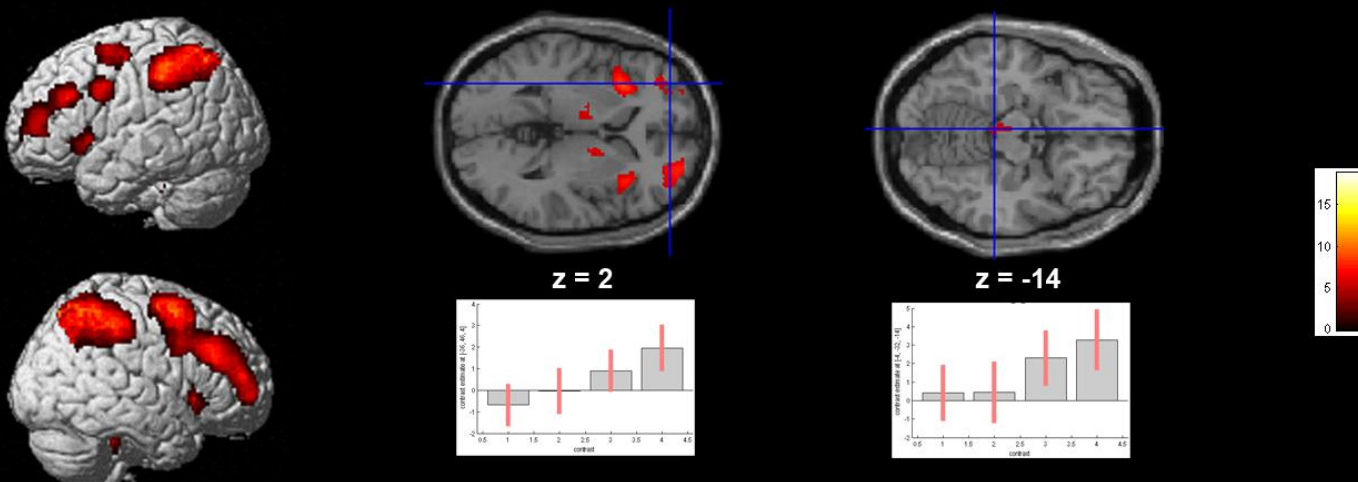
Attention modulation processes

- ❑ Processes we use to **monitor** (awareness) and **respond** to ongoing events
- ❑ **Cognitive Flexibility**, i.e. “ability to modulate **the attention** and consequently switch the **behavior** when **changes** in the environment lead to alterations in the **outcomes** of actions”

Exploitative decision > Explorative decision

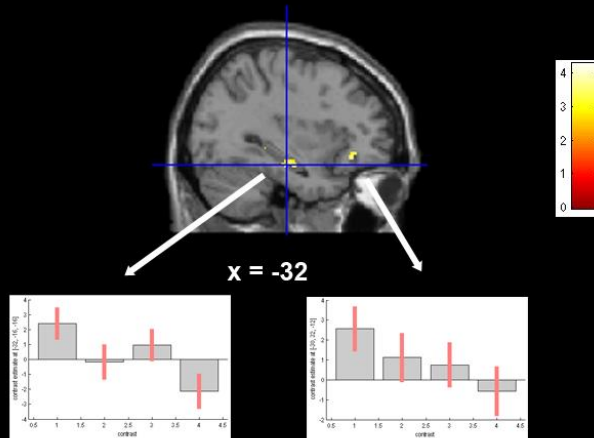


Explorative decision > Exploitative decision

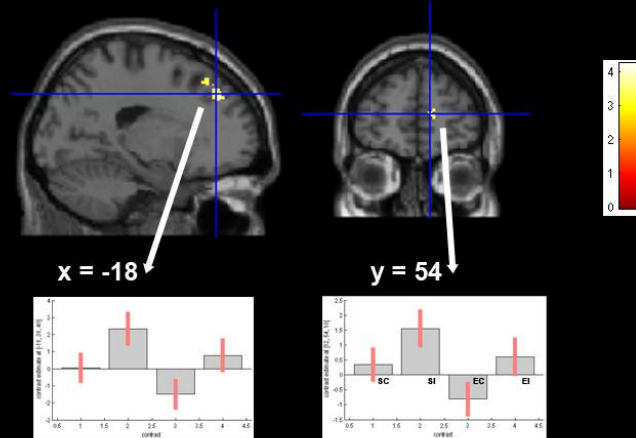


$p < 0.05$ FWE corrected for multiple comparisons

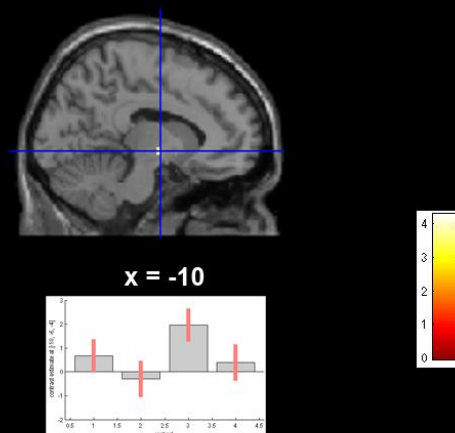
Exploitative decision in specialists



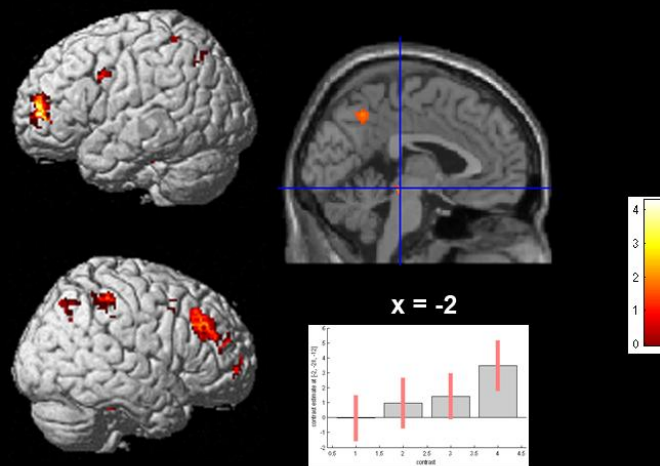
Exploitative decision in generalists



Explorative decision in specialists



Explorative decision in generalists



$p < 0.001$ uncorrected for multiple comparisons

MAIN RESULT

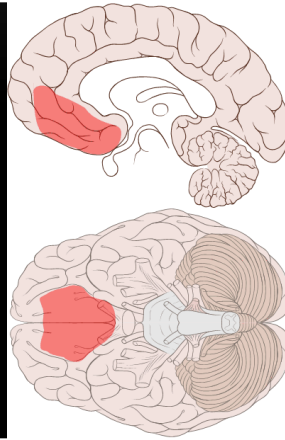
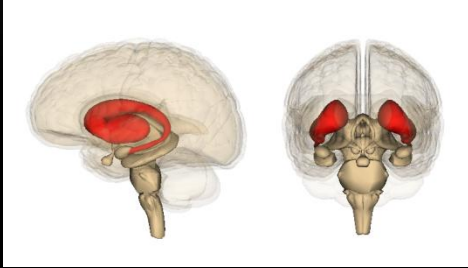
- Managers and entrepreneurs exhibited behaviorally-equivalent decisions in terms of ‘how much’ exploitative decisions they took
- **Differences are about ‘how’ they shift, and what neurological paths are activated while performing the same task!**
- Qualitative and structural differences are visible at the neurological level, not at the behavioural level!

WARNING #3

Neural antecedents of exploitation

(Aston-Jones and Cohen 2005, Daw et al. 2006)

Exploitation



Focused attention → high
engagement → reward regions

Ventro medial prefrontal cortex

Limbic system –

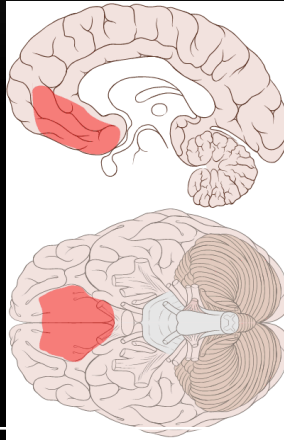
Striatum

Hippocampus

Neural antecedents of exploitation

(Aston-Jones and Cohen 2005, Daw et al. 2006)

Exploitation

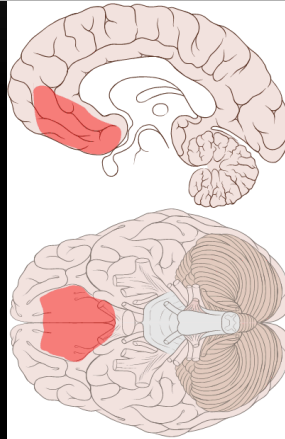
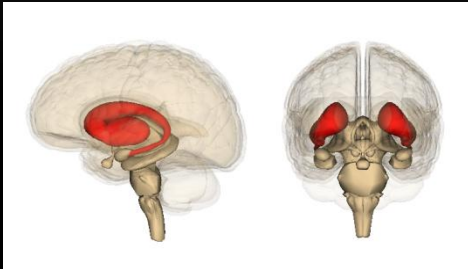


H1. Exploitative behavior is related to a stronger activation of the 'reward regions'

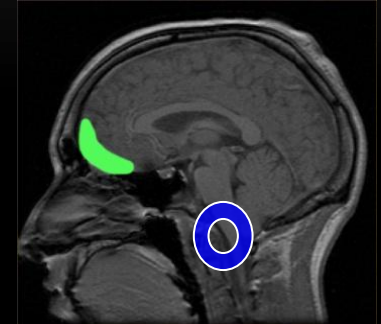
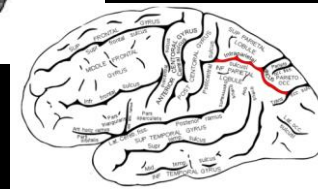
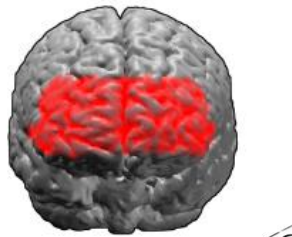
Neural antecedents of exploration

(Aston-Jones and Cohen 2005, Daw et al. 2006)

Exploitation



Exploration



H1. Exploitative behavior will show a stronger activation of the 'reward regions'

Broad attention → search alternatives → attention control regions

Frontopolar cortex -FPC

Intra parietal sulcus – IPS

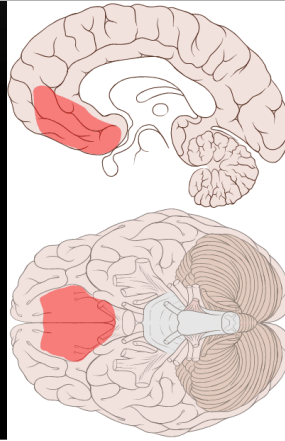
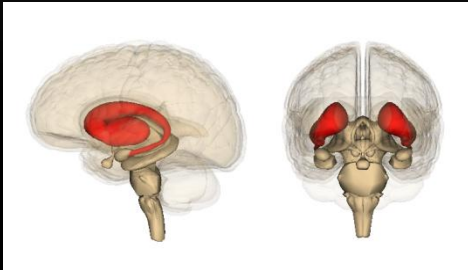
Orbitofrontal cortex – OFC

Locus coeruleus – LC

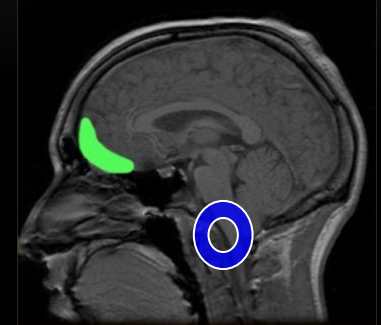
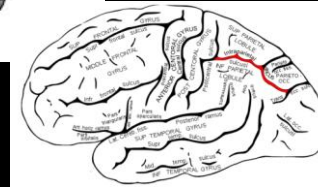
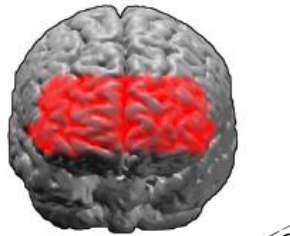
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(Aston-Jones and Cohen 2005, Daw et al. 2006)

Exploitation



Exploration

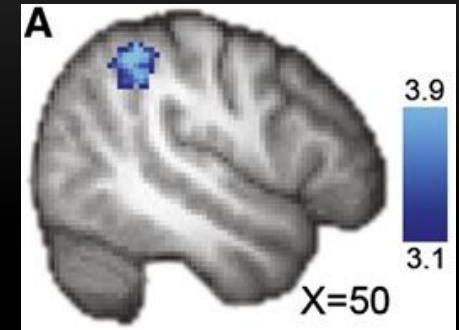
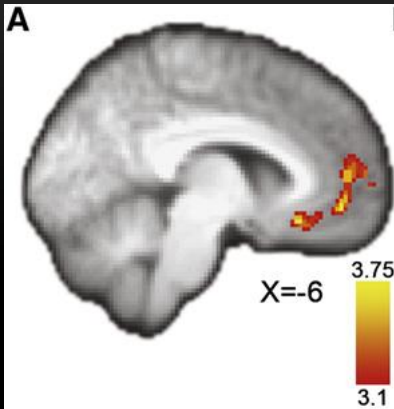


H1. Exploitative behavior will show a stronger activation of the 'reward regions'

H2. Explorative behavior is related to a stronger activation of the 'cognitive control regions'

Neural antecedents of the 'switching' ability

(Boorman et al. 2009)



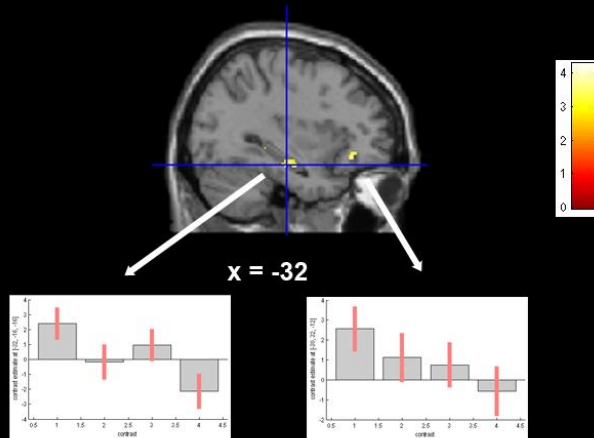
Differences in cognitive control regions' activation predict:

- pattern identification → routinization
- effective switching between exploitation and exploration → performance

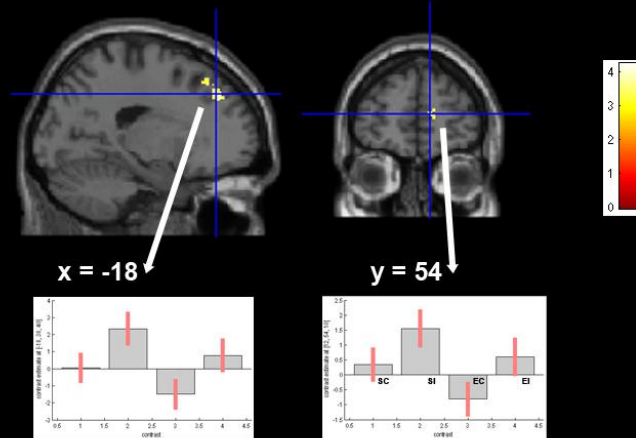
H3. Compared to managers, entrepreneurs will show:

- H3a. stronger activation of the cognitive control regions
- H3b. higher routinization
- H3c. better performance

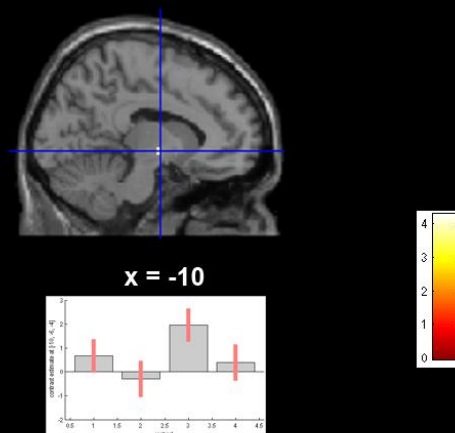
Exploitative decision in specialists



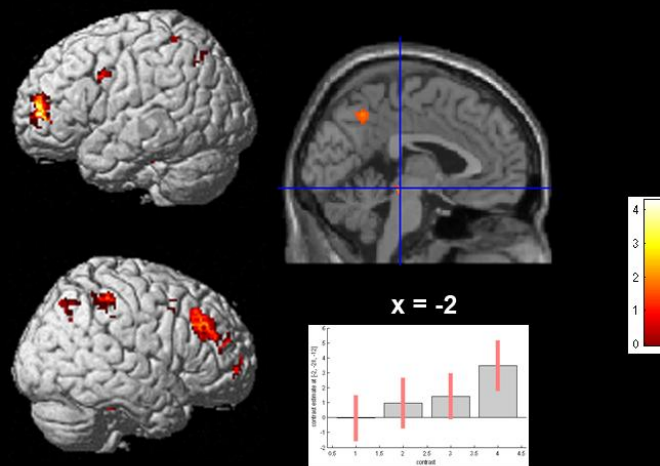
Exploitative decision in generalists



Explorative decision in specialists



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$p < 0.001$ uncorrected for multiple comparisons

IMPLICATIONS

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 - **Differences are about ‘how’ they shift, and what neurological paths are activated while performing the same task!**
 - Qualitative and structural differences are visible at the neurological level, not at the behavioural level!
-

FINAL COMMENTS & OPEN ISSUES

- Why neuro? Same behaviour can be achieved by different neurological means
 - We believe such means affect decision-making performance
 - Reward dependence vs. attentive circuitry
 - The ‘nature vs. nurture’ debate
 - Neuro studies are fundamentally important to understand what can be ‘improved’ and what instead is given
 - Modularity of the brain
 - Or phrenology?
 - Final **warning** (on small samples)
 - Theoretical sampling vs. statistical sampling
 - (social-scientific inspired theoretical sampling)
 - Microfoundations of what?
-