Study of mind
Inside intelligence

BCS153 Week 2.2
1/24/2019
Roadmap

• Innateness
• Mind-brain identity
• Intelligence
  ➢ How do we define it
  ➢ Theories of intelligence
Innateness

What’s innate?

What’s not innate?
Innateness – is everything biologically programmed and fixed?

Neural plasticity – “the ability of the central nervous system (CNS) to adapt in response to changes in the environment or lesions. This property of the CNS may involve modifications in overall cognitive strategies to successfully cope with new challenges (i.e., attention, behavioral compensation)” – Sharma et al. (2016)
Innateness – is everything biologically programmed and fixed?

Liu & Kager (2014)

Head-turn procedure

Discrimination of two tones

U-shape performance
Mind-brain identity

• Mental processes, experiences and senses all from brain

• Mind = brain?

Consider this feeling: I’m afraid of losing my beloved ones.

Is the brain solely responsible for the occurrence of this feeling?
Mind-brain identity

• If mind $\neq$ brain, then what is mind?

• If cognition $\neq$ brain, then what is cognition?
  ➢ Mind-Body relation: Embodiment
  ➢ Social cognition
Inside intelligence

• Mind = Intelligence?

• Cognition = intelligence?

• If mind = cognition, then mind = intelligence?
Inside intelligence

• Intelligence = ability to think?

https://www.youtube.com/watch?v=HtoqLZ5XhQ8

• What kind of abilities does Kanzi exhibit?

• What’s essential and not essential to be an intelligent life form?
How do we define intelligence?

Some definitions from dictionary:

Merriam-Webster
• “the ability to learn or understand or to deal with new or trying situations”
• “the ability to apply knowledge to manipulate one's environment or to think abstractly as measured by objective criteria”

Oxford
• “the ability to acquire and apply knowledge and skills.”

Britannica
• “mental quality that consists of the abilities to learn from experience, adapt to new situations, understand and handle abstract concepts, and use knowledge to manipulate”
How do we define intelligence?

Four major theories (Gardner 2011)
1. Psychometric theory
2. Cognitive theory
3. Cognitive contextual theory
4. Biological theory
How do we define intelligence?

Four major theories (Gardner 2011)

1. Psychometric theory
   - Spearman (1904)
   - IQ tests
   - Two factors
     - General factor
     - Specific ability
   - Pros and cons?

2. Cognitive theory

3. Cognitive contextual theory

4. Biological theory
How do we define intelligence?

Four major theories (Gardner 2011)

1. Psychometric theory
2. Cognitive theory
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• Cognitive processes contributing to intelligence
• Information processing
• Behavioral tasks (e.g., word recall, attention control, recognition, etc.)
• Pros and cons?
How do we define intelligence?

Four major theories (Gardner 2011)

1. Psychometric theory
2. Cognitive theory
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• Context-dependent problem solving skills
• Sternberg’s triarchic theory of intelligence
Sternberg’s triarchic theory of intelligence

• Three major components
  ➢ Analytic intelligence (componential/internal): similar to crystallized intelligence
  ➢ Creative intelligence (experiential): similar to fluid intelligence
  ➢ Practical intelligence (contextual/external)
How do we define intelligence?

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- Reductionism
- Biological basis, brain functions and cognitive processes
- Neuropsychological approaches
Inside intelligence

- Cognitive functions
  - Attention
  - Memory
  - Executive control
  - Processing speed
- Higher-level cognitive processes
  - Reasoning
  - Problem-solving
  - Decision making
Sternberg (1986)

- Encoding of information: “Translating a stimulus into a mental representation”
- High IQ scorers faster or slower in encoding info?
- High IQ scorers spend more time on *global planning*
- Metacognitive process
Sternberg (1986)

- Chase & Simon (1973): Difference between expert vs. novice chess players: *the number of mental representations* available
  - Experts have more mental representations than novices?
  - Number of stored patterns in long-term memory
Representation....again?

- A representation of a stored chess pattern
- Visually encoded as mental images?
- Converted the patterns into abstract codes?
Representation....again?

- Visualizing representation from fMRI
  https://www.youtube.com/watch?v=6FsH7RK1S2E

  (Pay attention to the representation of familiar vs. unfamiliar images)

- What’s represented and what’s not?
Representation....again?

Representations employed in problem solving strategies

- Verbal
- Visual and spatial

→ One is better than another?
Sternberg (1986)

- Selective encoding: choose the relevant information for learning
- But how do we know what’s relevant?
- Tacit knowledge

- Selective combination in the learning new words: figure out the co-occurrence of words in a coherent way → bigram frequency
Summary of Sternberg (1986)

• Being intelligent
  ➢ Efficient allocation of resources for processing
  ➢ Processing speed
  ➢ Encoding of information
  ➢ Reasoning
  ➢ Problem-solving skills