

## PART ONE -- CONCERNING THE MODULAR MIND

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### FODORIAN MODULES - Jerry Fodor's 2-tier architecture of the mind

Tier 1: MODULAR - perception/input systems: includes language, vision, hearing, touch, smell

1. domain specificity
  2. informational encapsulation: no access to information from other modules
  3. obligatory firing
  4. rapid speed
  5. shallow outputs: serial processing vs. complex processing
  6. inaccessibility to consciousness
  7. characteristic ontogenetic course: ref. onset
  8. dedicated neural architecture: based on neural modelling, animal studies
  9. characteristic pattern of breakdown
- ORIGINS: archaic, modules are shared with other primates and (often) other mammals

Tier 2: CENTRAL SYSTEMS - cognition

1. dedicated to problem solving
  2. domain neutral
  3. unencapsulated
  4. integrate information from all input systems
  5. operate slowly
- ORIGINS: ??
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**MASSIVE MODULARITY** – a “mosaic = absence of hierarchy, executive, central processor; “ego” = an illusion

1. domain specificity
2. informational encapsulation
3. obligatory firing
4. rapid speed
- ~~5. shallow outputs: serial processing vs. complex processing~~
6. inaccessibility to consciousness
7. characteristic ontogenetic course
8. dedicated neural architecture
- ~~9. characteristic pattern of breakdown~~ → characteristic psychopathology

ORIGINS:

1. Each module originates during the Paleolithic period; therefore these modules are distinctively hominid  
Each module originates as a solution [mechanism] to “environmental demands” affecting reproductive success  
“Adaptation” = reproductive success
2. Therefore the evolutionary history of the mind is the sum of the evolutionary narratives of its component modules
3. These adaptive mechanisms [modules] correspond to various domains, including:
  - physical causality
  - features and properties of the biological world
  - manufacture and employment of artefacts
  - sources of danger and ways of responding to danger
  - beliefs and motivations of other individuals → ref Social Intelligence or Machiavellian Intelligence
4. These mechanisms are described as:  
modules, design features, inference engines, mental organs, neurological circuits, neural programs
5. The Paleolithic period lasted for 5 to 6 million years.  
The Paleolithic period was characterized by a relatively stable environmental adaptation [a contested assumption].

50, to 60,000 years ago, human populations radiated out of Africa. There were two previous waves of hominid migration, but they are not represented in contemporary populations. The Paleolithic period ended a mere 10,000 years ago in southwest Asia and China, and more recently in other parts of the world. Thus the post-Paleolithic period has been too short and its challenges too unstable for comparable hard-wired mechanisms [modules] to emerge.

### PSYCHOPATHOLOGIES CHARACTERISTIC OF THE MODULAR MIND

Each of these psychopathologies originated in a distinctive evolutionary adaptation.

We learn these adaptations via reverse engineering the relevant pathology.

Bridge principles – connecting adaptation/module to psychopathology:

1. GENOME LAG: Our Palaeolithic bodies are mismatched to the demand characteristics of post-industrial society.

2. EVOLUTIONARY TRADE-OFFS [BY-PRODUCTS]

Adaptations have costs as well as benefits: e.g. fear → anxiety → anxiety disorders

3. PATHOLOGICAL TAILS OF NORMAL DISTRIBUTIONS

4. A BROKEN MODULE

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**PUZZLE:** The unfavourable cost/benefits of an expanding hominid brain; ref metabolic costs  
Two solutions:

SOCIAL INTELLIGENCE [MACHIAVELLIAN INTELLIGENCE] = one or more modules

*Primus inter pares*: first among equals: a module and its evolutionary narrative

The cognitive arms race thesis = the brain is an adaptation to other brains

A mind reading capacity [intentionality detector: the capacity interpret and predict behaviour] →

mind reading capacity also provides the capacity to deceive →

deception increases, predictability declines →

deception detector 1.0 emerges →

more sophisticated forms of deception utilizing deception detector 1.0 →

deception detector 2.0 emerges → etc.

The Sally-Anne Test: vindicates the Theory of Mind module

The Wason Selection Test: vindicates the Social Intelligence Module

Proposition 1: If a card shows an even number on one face, then its opposite face shows a primary colour

You are shown a set of 4 cards on a table. The visible faces are: **3, 8, red, brown**

Which cards do you turn over to test the truth of the proposition?

Proposition 2: Only people over the age of 18 are permitted to drink alcohol

Each card has an age on one side and a beverage on the other side

You are shown a set of 4 cards on a table: **17, 22, beer, coffee**

Which cards do you turn over to test the truth of the proposition?

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### A COMPLEMENTARY THESIS

#### CRITIQUE OF MASSIVE MODULARITY

Just-so stories:

The starting point for constructing many modular narratives is s psychopathology

The specification of the selected psychopathology is incomplete and tendentious

Every psychopathology can generate a large number of evolutionary histories – i.e. myths

The FRAME QUESTION:

Modularity theory presumes that the interpretation of stimulus situation is unproblematic

In reality, the interpretation is holistic:

The stimulus situation activates on a vast constellation of associations

The processing of these associations is via abduction [including analogy] not algorithm

So-called “mental modules” are end-products of developmental trajectories

Their characteristic pathologies result from abnormalities in upstream neurological mechanisms

What is "INTENTIONALITY": mechanism vs. function? – ref. Daniel Dennett

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### **STEPHEN MITHEN ON THE EVOLUTION OF THE HUMAN MIND**

PHASE 1: Generalized intelligence: general purpose learning – now survives only in very young children

PHASE 2: Multiple specialized intelligences: specific domains working in isolation from each other

1. social intelligence
2. natural history intelligence: e.g. notion of species essence and taxonomy even in the absence of utilitarian value (Scott Atran)
3. technical intelligence [manufacturing and manipulating wooden and stone tools]
4. linguistic intelligence

PHASE 3: Specialized intelligences working together (permeability) - beyond the Neanderthals

1. Direct access between domains: metaphor, analogy, symbolism, anthropomorphism; ref cave art
  2. Language switches from a social function to a general-purpose function c.30, to 40,000 years ago
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**KARMILOFF-SMITH** - Critique of Baron-Cohen focuses on concept of modularity

Williams Syndrome: face reading function seems normal [i.e. modular] but it is not:

EXPERIMENT: Normal individuals read upright faces quickly, inverted faces slowly; WS individuals read upright and inverted faces with equal facility. EXPLANATION: There are two different kinds of processing: configural (normal) vs. feature-by-feature (WS)

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## **PART TWO -- THE MIND INSIDE THE BRAIN THE NEURO-IMAGING REVOLUTION AND THE DISCOVERY OF MIRROR NEURONS**

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### **A BRIEF HISTORY OF THE MIRROR NEURON SYSTEM**

#### **1980s: Discovery of MN in monkeys**

1. 1980s - **visuomotor**: motor neurons a seeing goal-directed activity  
e.g. grasping fruit cf. lifting arm  
Technology = transcranial magnetic stimulation
2. 1990s - followed by **audiovisual**: hearing sounds associated with goal-directed activity
3. These responses are instances of **resonance**  
Resonance creates multi-modal internal copy = primary representation
4. Evolutionary importance of these internal copies
  - the capacity to interpret behaviour with incomplete evidence
  - but insufficient for imitation [perspective taking plus generalization]
5. From **resonance to emotional contagion**: seeing emotional display → enactment

#### **From monkey MN to Human MN: Resonance → Empathy**

1. Technology = fMRI
2. Empathy is based on secondary representations of observed actions
  - Imitation = perspective taking plus generalization
  - Deception = dissimulation = a human capacity
3. This development is made possible by the expansion of the human MNS
  1. mirror neurons reach into the amygdala and memory regions
    - ref dissociation and 'time travel' [Suddendorf]
  2. advent of language = embodiment of meaning
    - in experiments: stimulus = action words which are visualized via fMRI and = motor neurons linked to the action
    - contra language meaning centres

### **EMPATHY AND THE SOCIAL ORDER**

1. Three dimensions of empathy: cognitive [understand, interpret], emotional, motor

- Mirror neuron theory: motor dimension is always present
2. Three kinds of responses ref emotional empathy:
    - [a] response matches: joy with joy etc.
    - [b] response is different but socially appropriate: pain: pity
    - [c] response is socially incongruent: pain: joy
  3. Implications for social evolution
    - Version 1  
Empathy is pro-social: social glue ref. Baron-Cohen on autism = extreme male brain  
Empathy = [a] + [b], not [c]: 'counter-empathy'  
Empathy cf. sympathy [impulse to action] cf. 'empathic cruelty' [c]
    - Version 2:  
Empathy is irrelevant  
*The Fable of the Bees* by Bernard de Mandeville: self interest, egoism, division of labour, and interdependence -- cf. 'intersubjectivity'  
Cf. Adam Smith
    - Version 3:  
Empathy = [a] + [b] + [c]  
And [c] can be pro-social: ref Altruistic Punishment  
*Deep History* by Daniel Lord Smail: the evolution of neurohormonal regimes, teletropic, autotropic

## COMPLETION OF THE HUMAN MIRROR NEURON SYSTEM – THE EXECUTIVE FUNCTIONS [EF]

1. EF = a set of functions including: selection [access to memory, prototypes, templates], generalization and modification, planning, flexible execution, monitoring [e.g. monitoring alter's responses], and inhibiting [sensory/empathic input, associational nodes and pathways, etc.]
2. Is there an 'inner-self' concealed in executive function circuitry? The '**ghost in the machine**'  
Todd Feinberg's emergent structure [Hughlings-Jackson redux] vs. Daniel Dennett's 'Cartesian theatre'

## PSYCHOPATHOLOGY ILLUSTRATES THE EXECUTIVE FUNCTION

### Pseudopsychopathic Personality Syndrome

[I]n the normal situation the liar is called upon to do at least two things simultaneously. He must construct a new item of information (the lie) while also withholding a factual item (the truth).... [Since] the truthful response comprises a form of baseline, or pre-potent response, ... responding with a lie demands some form of additional cognitive processing, that it will engage executive, prefrontal systems (more so than telling the truth) ... [and] may be tested using functional neuroimaging. (Spence et al. 2004:1757)

A competent lie is an evolutionary achievement and may lubricate social relations. This point is illustrated by an unusual clinical condition, 'pseudopsychopathic personality syndrome'. This condition is associated with orbitofrontal brain lesions and (presumably) damage to the mirror neuron system and executive function connectivity. Affected individuals can simulate and predict but not dissimulate. They are incompetent social actors who are unable to inhibit the pre-potent truth and are routinely and indiscriminately tactless. One might say that they have regressed to an earlier evolutionary stage.

### Schizophrenia

1. Characteristic 'positive' features include delusions and thought disorder
2. Thought disorder = utterances [ref Nancy Andraesen] –  
-- Explanation of thought disorder = failure to inhibit associational nodes = failure of EF
3. Delusions =
  1. Efforts to explain to self disparity between planning and execution of utterances
  2. For example: paranoid explanations and passivity symptoms [intrusions]
  3. Cf. the 'anarchic hand'

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Martin Brüne (2004) Theories of schizophrenia

1. Haeckel x Spencer
  - schizophrenia originates in insufficient suppression of the reptilian brain
  - schizophrenia originates in insufficient recapitulation of final developmental steps
2. schizophrenia = a failure of neotony [retention of juvenile features into adulthood]
3. schizophrenia = a delay in maturation resulting in
  - reduced connectivity,
  - incomplete connectivity,
  - overly connected, or
  - misconnected
4. schizophrenia = an evolutionary trade-off ref social intelligence module
  - 5-6 million years ago: dramatic increase in connectivity, ref. fronto-temporal cortex affecting the anterior cingulate cortex: spindle cells, particular to great apes and humans:
    - emerge post-natally
    - their survival depends on environmental input and enrichment
    - therefore, stress during early development may impair functional development of the ACC
  - 150.000 years ago: emergence of ToM module and evolution of the social brain: read signals from con-specifics [facial expressions]; time travel; language
5. T.J. Crow: theory of cerebral asymmetry, language, and psychosis
  - Core of psychosis = lack of hemispheric dominance and lack of specialization of language area on left hemisphere
  - Lack of hemispheric dominance = mistiming: perception that my thoughts are not my own
  - Evidence ref lack of hemispheric dominance =
    - Higher prevalence in psychosis: ambidexterity, language disorders
    - Greater asymmetry in males: but more vulnerable to delayed maturation
    - Continuum hypothesis: from normal to psychotic, from bipolar disorder to schizophrenia

