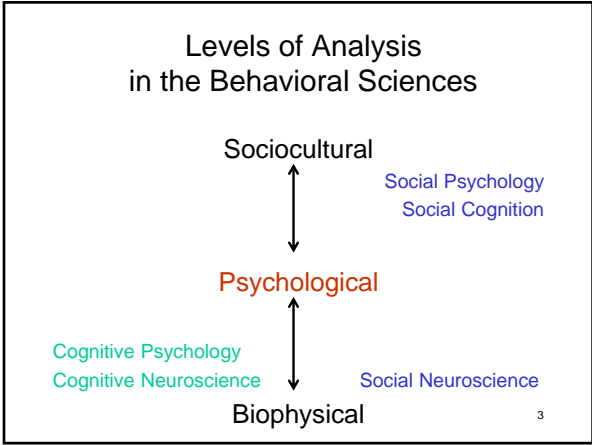


# Prospect for a Social Neuroscience

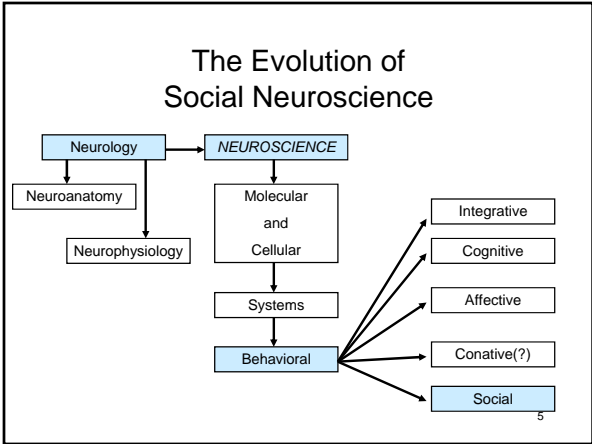
Berkeley Social Ontology Group  
Spring 2014


1

- ### Levels of Analysis in the Behavioral Sciences
- Psychological
    - Mental structures and processes
  - Sociocultural
    - Social, cultural structures and processes
  - Biophysical
    - Biological, physical structures and processes
- 2



- ### On Terminology
- Physiological Psychology (1870s)
    - Animal Research
  - Neuropsychology (1955, 1963)
    - Behavioral Analysis
    - Brain Insult, Injury, or Disease
  - Neuroscience (1963)
    - Interdisciplinary
      - Molecular/Cellular
      - Systems
      - Behavioral
- 4



- ### Towards a Social Neuropsychology
- Klein & Kihlstrom (1998)
- 
- Beginnings with Phineas Gage (1848)
    - Phrenology, Frontal Lobe, and Personality
  - Neuropsychological Methods, Concepts
    - Neurological Cases
    - Brain-Imaging Methods
  - But Neurology Doesn't Solve Our Problems
    - Requires Psychological Theory
    - Adequate Task Analysis at Behavioral Level
- 6

## The Rhetoric of Constraint

“Knowledge of the body and brain can usefully constrain and inspire concepts and theories of psychological function....”

Cacioppo & Berntson (1992), p. 1025

“Cognitive psychology underwent [a] transformation as data about the brain began to be used to constrain theories about the cognitive processes underlying memory, attention, and vision, among other topics.”

Ochsner & Lieberman (2001), p. 726

## “Rethinking Social Intelligence”

Goleman (2006), p. 324

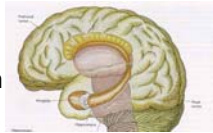
The new neuroscientific findings on social life have the potential to reinvigorate the social and behavioral sciences. The basic assumptions of economics, for example, have been challenged by the emerging “neuro-economics”, which studies the brain during decision-making. Its findings have shaken standard thinking in economics....

A rethinking of social intelligence should more fully reflect the operation of the social brain, so adding often-ignored capacities that nonetheless matter immensely for our relationships.

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## Explaining Hippocampal Amnesia

- “Learning”
- Short-Term vs. Long-Term
- Encoding vs. Retrieval
- Shallow vs. Deep Processing
- Procedural vs. Declarative Memory
- Episodic vs. Semantic Memory
- Explicit vs. Implicit Memory
- Relational vs. Non-Relational Memory



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## Psychology and Neuroscience

Kihlstrom (2010)

- “Psychology without neuroscience is still the science of mental life.
- “Neuroscience without psychology is just the science of neurons.”

10

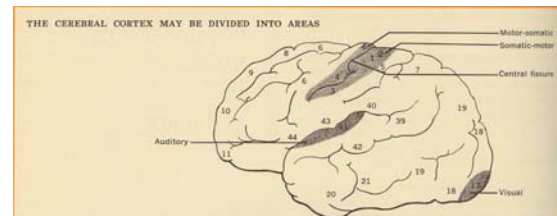
## Two Views of Brain Function

- Brain as General-Purpose Information-Processor
  - Learning
  - Associationism
- Doctrine of Functional Specialization
  - Localization of Function
  - Brain Systems

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## Functional Organization of the Cortex

Morgan & King (1966), Fig. 20.1



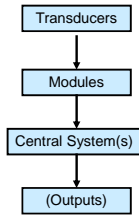
“The extreme frontal area of the cortex, sometimes called the prefrontal cortex, is a region about which much has been claimed, but little has been proved.”

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## The Doctrine of Modularity

Fodor (1983)



- **Domain-Specific**
- Mandatory
- Limited Central Access
- Fast
- **Informationally Encapsulated**
- Shallow Outputs
- Characteristic Breakdown
- Characteristic Development
- **Fixed Neural Architecture**

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## Examples of Modularity

- Language
- Visual Perception
- Motor Behavior
  - Including Speech
- Social Cognition?
  - And other aspects of social interaction

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## The Phrenological Faculties

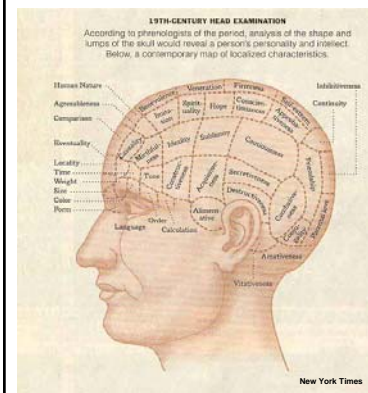
Spurzheim (1834)

### AFFECTIVE FACULTIES

- |                        |                      |
|------------------------|----------------------|
| <b>PROPSITIES</b>      | <b>SENTIMENTS</b>    |
| ? Desire to live       | 10 Cautiousness      |
| * Alimentiveness       | 11 Approbativeness   |
| 1 Destructiveness      | 12 Self-Esteem       |
| 2 Amativeness          | 13 Benevolence       |
| 3 Philoprogenitiveness | 14 Reverence         |
| 4 Adhesiveness         | 15 Firmness          |
| 5 Inhabitiveness       | 16 Conscientiousness |
| 6 Combativeness        | 17 Hope              |
| 7 Secretiveness        | 18 Marvelousness     |
| 8 Acquisitiveness      | 19 Ideality          |
| 9 Constructiveness     | 20 Mirthfulness      |
|                        | 21 Imitation         |

### INTELLECTUAL FACULTIES

- |                          |                   |
|--------------------------|-------------------|
| <b>PERCEPTIVE</b>        | <b>REFLECTIVE</b> |
| 22 Individuality         | 34 Comparison     |
| 23 Configuration         | 35 Causality      |
| 24 Size                  |                   |
| 25 Weight and Resistance |                   |
| 26 Coloring              |                   |
| 27 Locality              |                   |
| 28 Order                 |                   |
| 29 Calculation           |                   |
| 30 Eventuality           |                   |
| 31 Time                  |                   |
| 32 Tune                  |                   |
| 33 Language              |                   |



## A Classic Phrenological Head

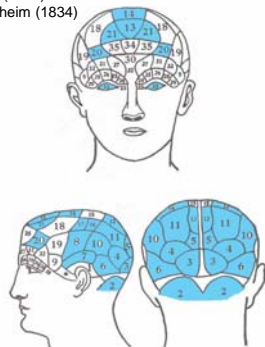
16

## Social Faculties in Phrenology

Gross (1998)

after Spurzheim (1834)

1. Destructiveness
2. Amativeness
3. Philoprogenitiveness
4. Adhesiveness
5. Inhabitiveness
6. Combativeness
7. Secretiveness
8. Acquisitiveness
9. Cautiousness
10. Approbativeness
11. Self-Esteem
12. Benevolence
13. Veneration
14. Conscientiousness
15. Hope
16. Mirthfulness
17. Imitativeness
18. Individuality
19. Language
20. Causality



## Milestones in Functional Specialization

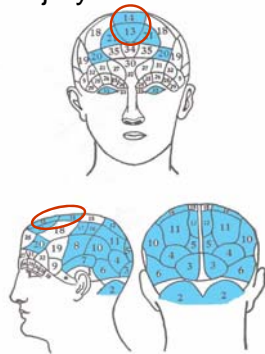
- Language Function
  - Broca (1860)
    - Motor (Expressive) Aphasia
  - Wernicke (1874)
    - Sensory (Receptive) Aphasia
- Personality and Social Interaction
  - Harlow (1848, 1850, 1868)
    - The Case of Phineas Gage

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## Gage's Injury

1. Destructiveness
2. Amativeness
3. Philoprogenitiveness
4. Adhesiveness
5. Inhabitiveness
6. Combativeness
7. Secretiveness
8. Acquisitiveness
10. Cautiousness
11. Approbativeness
12. Self-Esteem
13. Benevolence
14. Veneration
16. Conscientiousness
17. Hope
20. Mirthfulness
21. Imitativeness
22. Individuality
33. Language
35. Causality



## Immediate Aftermath

Harlow (1868), Macmillan (1986, 2000)

- Attempted to return to work, 1849
  - First Epileptic Seizure
- Traveled Around New England 1849-1851
  - Barnum's Museum (?)
- Livery Stable, Stagecoaching
  - New England, 1851-1852
  - Chile, 1852-1859
- San Francisco (1859)
  - Farm Laborer
  - Seizures Persisted



26

## Later History of Phineas Gage

Harlow (1868), Macmillan (1986, 2000)

- Died May 21, 1860 (*Not* 1861)
  - Buried at Lone Mountain Cemetery, Laurel Hill
- Exhumed 1867
  - Skull taken to Harvard Medical School, 1868
    - David Dustin Shattuck, brother-in-law
      - Member of S.F. Board of Supervisors
  - Brain Not Preserved
- Remains Removed to Colma
  - Cypress Abbey
    - Laurel Hill Mound, Pioneer Monument



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## Malcolm Macmillan (2000)



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## Theory of Multiple Intelligences

Gardner (1983)

- Linguistic
- Logical-Mathematical
- Spatial
- Musical
- Bodily-Kinesthetic
- Intrapersonal
  - Ability to Gain Access to One's Own Internal, Emotional Life
- Interpersonal
  - Ability to Notice and Make Distinctions Among Other Individuals



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## Methods for Identifying Multiple Intelligences

Gardner (1983)

- Identifiable Core Operations
  - Impression-Formation, Causal Attribution
- Psychometrics
  - Vineland Test of Social Maturity
- Experimental Tasks
  - Detection of Deception
- Exceptional Cases
- Isolation by Brain Damage

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## Isolation by Brain Damage

- Impair Cognitive, Spare Social
  - Alzheimer's Disease
  - Down Syndrome
  - The Case of Zazetsky (Luria, 1972)
- Impair Social, Spare Cognitive
  - The Case of Phineas Gage (Harlow, 1868)
  - Pick's Disease
  - Fronto-Temporal Dementia

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## A Faculty of Social Cognition?

Jackendoff (1992, 1994)

- Possible Central Modules
  - Conceptual Structure
  - Spatial Cognition
  - Body Representation
  - Music?
  - Social Cognition
    - Who is it?
    - What is this person's relation to me and others?

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## Arguments for a Faculty of Social Cognition

- Domain Specificity
  - Social Organization unrelated to Perception
- Specialized Input Capacities
  - Face and Voice Recognition
  - Affect Detection
  - Intentionality
- Developmental Priority
  - Proper Names
    - Animate vs. Inanimate Objects

33

## Arguments for a Faculty of Social Cognition

- Universality of Cultural Parameters
  - Kinship
  - Ingroup-Outgroup Distinctions
  - Social Dominance
  - Ownership, Property Rights
  - Social Roles
  - Group Rituals
- Evolution
  - Mammalian Social Structure
    - Primates

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## Modules for Social Cognition

Jackendoff (1992, 1994, 2007)

### Specialized Input Capacities

Face Recognition  
Voice Recognition  
Affect Detection  
Intentionality Detection

### Developmental Priority

Animate vs. Inanimate  
Proper Names

### Universal Cultural Parameters

Kinship  
Ingroup vs. Outgroup  
Social Dominance  
Ownership, Property Rights  
Social Roles  
Group Rituals

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## The Face as a Social Stimulus

- Universal Social Stimulus
  - Obvious Evolutionary Significance
- Contact Between Infant, Caregiver
  - Beginnings of Attachment
- Face in Social Interaction
  - Physical Attraction
  - Communicate Emotion
  - Cues to Deception

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## Aspects of Face Perception

Bruce & Young (1986).

- Structural Description
  - Viewpoint-Centered
  - Expression-Independent
- Expression Analysis
- Facial Speech Analysis
- Face Recognition
- Name Generation

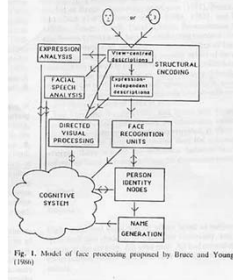


Fig. 1. Model of face processing proposed by Bruce and Young (1986).

### *Dissociations Among Neurological Patients*

Analogous to Dyslexias

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## Visual Object Agnosia

- Can Describe an Object
- But Cannot...
  - Name Object
  - Recognize Object as Familiar
  - Demonstrate How Object is Used

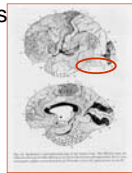
“Normal Percept Stripped of Meaning”

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## Prosopagnosia

Bodamer (1947)

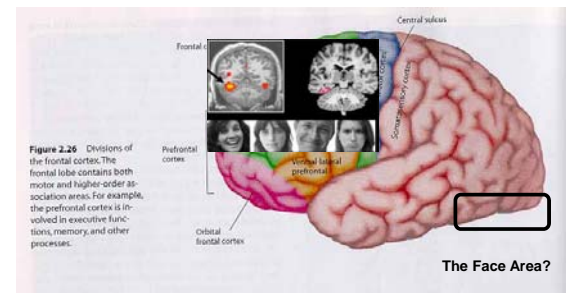
- Specific Deficit in Recognizing Faces
  - Not in Perceiving, Describing Faces
  - Inability to Put Name to Face
- “Pure”
  - Specific to Face
- Bilateral Damage, Visual Association Cortex
  - Occipital, Temporal Lobes
    - Brodmann's Areas 18, 19, 37
  - The “Face Area”?



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## The Fusiform Face Area?

Sergent et al. (1992); Kanwisher et al. (1997)



## Strong Modularity in Face Perception

Kanwisher (2000)

“a cognitive function with its own private piece of real estate in the brain”



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## Levels of Categorization

Gauthier (1998); Gauthier & Tarr (2000); Tarr & Gauthier (2000)

- Basic Object Level
  - “What is this?”



- Subordinate Level
  - “Who is this?”




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## Levels of Categorization

Gauthier (1998); Gauthier & Tarr (2000); Tarr & Gauthier (2000)

- Subordinate Object Level
  - “What is this?”



- Subordinate Level
  - “Who is this?”

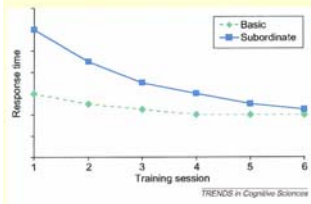


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## The Entry-Level Shift

Bukach et al. (2006) after Rosch ((1976)

**Entry-level shift:** Novices identify objects at the basic level more efficiently than at a more specific, subordinate level [44] but expertise can lead to faster responses at the subordinate level [45] as training progresses (Figure 1). This entry-level shift has been demonstrated for faces, birds, dogs and Greebles [5, 18, 45, 46].



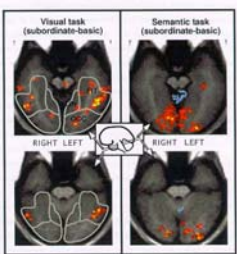
TRENDIS in Cognitive Sciences

**Figure 1.** Hypothetical data showing the entry-level shift across training sessions. Statistical equivalence between response times for basic and subordinate judgments is used as a criterion for expertise in many training studies.

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## Is it a *bird*? Is it a *Pelican*?

Gauthier et al. (1997)



RIGHT LEFT


**Figure 2.2.** Brain activation, averaged across right subjects for the Visual and Semantic subordinate-level tasks (n = 8, 2; cluster size = 15). The figure includes a schematic representation of the region of interest: fusiform and inferior temporal gyri (FTI), lingual gyrus (LIG), and occipital cortex (OCX). Values correspond to the highest activation within the activation clusters. A color threshold is used here that for the double-subtraction (although the ROI analysis is based on the same threshold for all comparisons in order to illustrate the absence of response FTE activation in the Semantic task, which would have produced more positive FTE activation in the double-subtraction.

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## Categorization and Expertise

Bukach, Gauthier, & Tarr (2006)

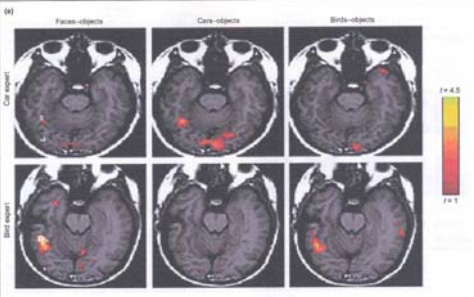
- Expertise
  - Cars
  - Birds
- Expert Training
  - Greebles
  - Snowflakes
  - Fingerprints



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## Expertise and Categorization Level

Gauthier et al. (2000)

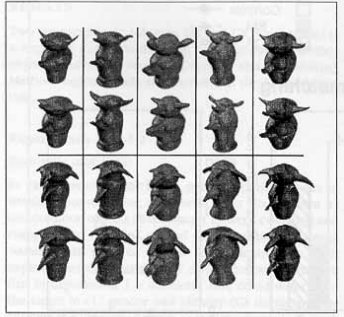


Novices Experts

7

## “Greeble” Stimulus Figures

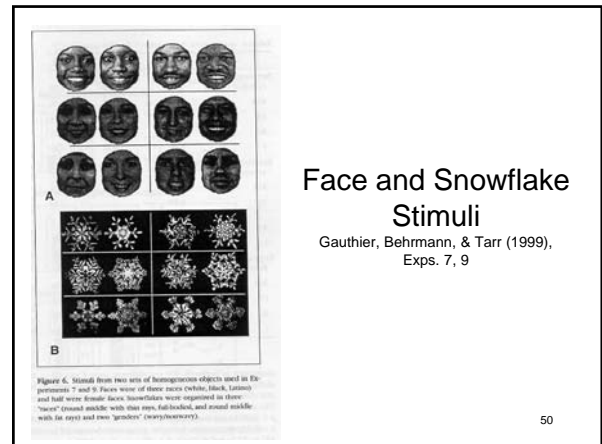
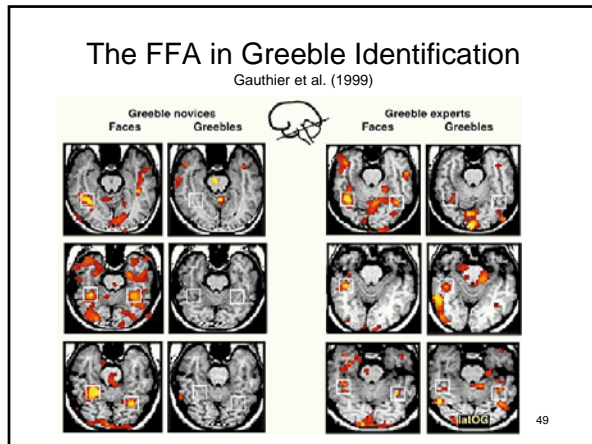
Gauthier, Behrmann, & Tarr (1999), Exps. 3-4; Scott Yu



**Figure 3.** Greeble stimuli from the set used in Experiments 3, 4, and 7. Greebles are organized in five “families” (columns) according to their body shape and two “genders” defined by the orientation of their parts (up/down, top two rows vs. two lower rows).

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### Fusiform Face Area or Flexible Fusiform Area?

Tarr & Gauthier (2000)

- Localization of Content
  - Recognition of Faces vs. Nonfaces
- Localization of Function
  - Recognition at Subordinate Levels of Categorization
    - Specific Faces, Nonfaces

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### Alternative Interpretations of the FFA

- Fusiform Face Area
  - Dedicated to Face Identification
- Flexible Fusiform Area
  - Dedicated to Subordinate-Level Classification
    - Faces a Universal Example
    - Also Underlies Other Areas of Expertise
- Fusiform Face Area Redux
  - Programmed for Face Identification
  - Can Be Recruited for Other Areas of Expertise

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### The Problem of Spatial Blurring

McGugin et al. (2012)

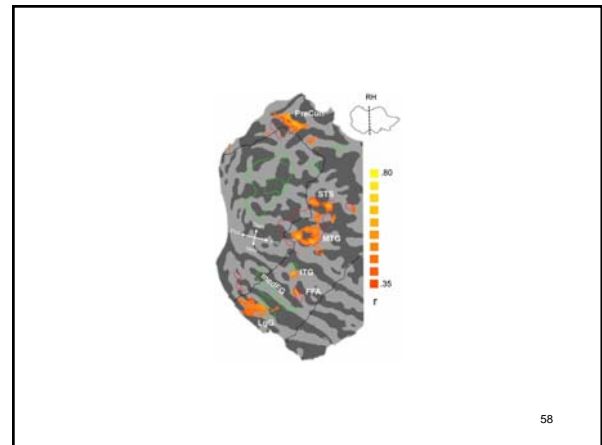
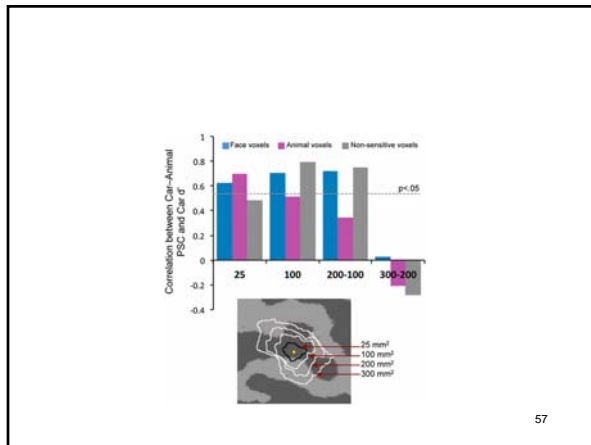
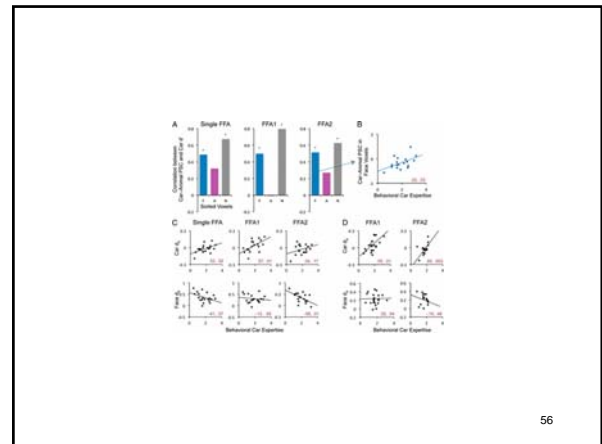
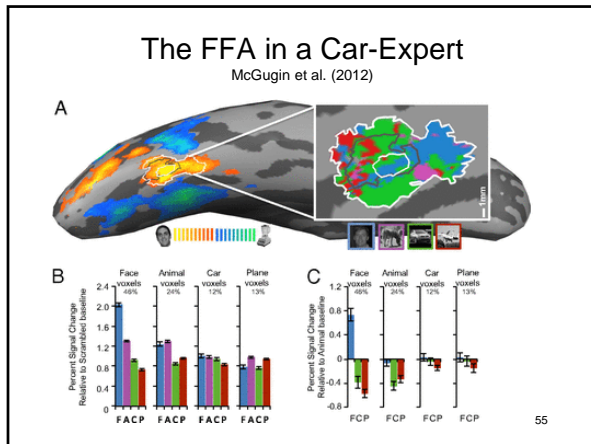
- Limited Resolution of Standard fMRI
  - Used in Expertise Studies
- True FFA Revealed by High-Resolution fMRI
  - Have Not Measured Expertise
- Nonface-Selective Regions Border True FFA
  - Need High-Resolution fMRI to Separate Them

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### Stimulus Materials for HR-fMRI

McGugin et al. (2012)

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- ### The Bottom Line (So Far) on the FFA
- McGugin et al. (2012)
- When You Don't Consider Expertise
    - HR-fMRI Reveals Face-Selective Regions
  - When You *Do* Consider Expertise
    - Object Sensitivity Present in “FFA”
  - Expertise Overlaps with Face-Selectivity
    - Tight Spatial Contiguity
    - Especially When Expertise Involves Holistic Processing
  - Face-Selectivity Still Possible
    - At Level of Individual Neurons
- 59

- ### Prospect for a Social Neuroscience
- The Social Psychology May Be Right or Wrong.
  - The Neuroscience May Be Right or Wrong.
  - But If the Social Psychology is Wrong, the Social Neuroscience Can't Be Right.
- 60