



Social Neuroscience

Instructor Manual

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This instructor resource module is designed to help facilitate a lesson about social neuroscience. This module reviews the main methods used in social neuroscience research (including EEG, fMRI, and cortisol measures) and insights into social psychology gleaned from them—namely, the automaticity of social categorization, how people engage in thinking about others' minds, and the causes and mediators of stress. General recommendations for structuring the lesson, as well as more specific recommendations for activities, discussion questions, and outside resources to augment it are also included. PowerPoint slides that correlate with these recommendations are available at the Noba website.

Learning Objectives

- **Relevant APA Learning Objectives (Version 2.0)**
 - Describe key concepts, principles, and overarching themes in psychology (1.1)
 - Develop a working knowledge of psychology's content domains (1.2)
 - Use scientific reasoning to interpret psychological phenomena (2.1)
 - Demonstrate psychology information literacy (2.2)
 - Adopt values that build community at local, national, and global levels (3.3)
- **Content Specific Learning Objectives:**
 - Define social neuroscience and describe its major goals.
 - Describe how measures of brain activity such as EEG and fMRI are used to make

inferences about social processes.

- Discuss how social categorization occurs.
- Describe how simulation may be used to make inferences about others.
- Discuss the ways other people can cause stress or protect us against stress.

Abstract

This module provides an overview of the new field of social neuroscience, which combines the use of neuroscience methods and theories to understand how other people influence our thoughts, feelings, and behavior. The module reviews research measuring neural and hormonal responses to understand how we make judgments about other people and react to stress. Through these examples, it illustrates how social neuroscience addresses three different questions: (1) how our understanding of social behavior can be expanded when we consider neural and physiological responses, (2) what the actual biological systems are that implement social behavior (e.g., what specific brain areas are associated with specific social tasks), and (3) how biological systems are impacted by social processes.

Class Design Recommendations

This topic may be taught in one long class period (75-90 minutes) or two short class periods (50-60 minutes each). It is preferable to teach this as a 2-class-period lesson because some of the content may be difficult to understand. Ensuring there is ample time for explaining neuroscience methods and social neuroscience results will likely result in better learning. Class period 1 should focus on an overview of social neuroscience and EEG research on social categorization. Class period 2 should focus on fMRI research on thinking about others' minds and neuroendocrine research on stress.

- Introduction
- Overview of social neuroscience
 - Overlap between neuroscience and social psychology
 - Goals/types of questions addressed

- EEG research on social categorization
 - Social categorization
 - EEG method
 - What does EEG research tell us about social categorization?
- fMRI research on thinking about others' minds
 - Mentalizing/theory of mind
 - fMRI method
 - What does fMRI research tell us about mentalizing?
- Neuroendocrine research on stress
 - Stress
 - Hormones/neuroendocrine measures
 - What does neuroendocrine research tell us about stress?
 - Stressors
 - Buffers against stress

Module Outline

Introduction: There is a long-standing tradition in the field of psychology to try to understand the link between the brain, body, and behavior. For example, early research with monkeys found that removing a part of the brain called the amygdala led to a lack of fear, providing evidence that the amygdala plays a role in emotion.

Overview of Social Neuroscience

- Overlap between neuroscience and social psychology

- Social neuroscience is aimed at understanding the links between the brain, body, and social behavior.
- Goals/types of questions addressed
- Questions in this field are similar to those of social psychology, but they are addressed through the perspective of neuroscience.
- There are three main types of questions that social neuroscientists try to answer:
 - What can we learn about social behavior when we consider neural and physiological responses?
 - What are the actual biological systems (e.g., regions of the brain) involved in social behavior?
 - How are biological systems impacted by social processes?

EEG Research on Social Categorization

- Social categorization
 - **Social categorization** is the process of thinking about the social groups individuals belong to (e.g., gender, race, religion). Social categorization facilitates quick thinking about other people, but these quick thoughts can be erroneous (e.g., negative **stereotypes** about members of different ethnic groups).
 - Social categorization is challenging to study because people are not always aware if/when they are doing it, and they may be reluctant to report it even if they are aware of it.
 - One way to study social categorization is to measure what is happening in people's brains when they encounter people from different groups.
- EEG method
 - Electroencephalography (EEG) assesses brain activity by measuring the electrical activity produced by neurons (brain cells). To measure the activity of neurons, researchers place a set of electrodes on a participant's head (often this is done using a cap). The electrodes don't poke the participant or cause any pain. They simply measure the electrical activity being generated by neurons.

- EEG is very good at measuring precise differences in the timing of brain activity. Therefore, it can be used to answer questions about how quickly a type of thinking occurs.
- What does EEG research tell us about social categorization?
 - Researchers have used EEG to measure how quickly social categorization occurs (by showing pictures of people of different social categories and assessing how quickly changes in brain activity can be detected).
 - This line of research has found that social categorization is an **automatic process**, in that it occurs incredibly rapidly (200ms) and happens whether or not individuals are directed to attend to social categories.

fMRI Research on Thinking About Others' Minds

- Mentalizing/theory of mind:
 - In social interactions it is important to understand what is going on in the minds of others (e.g., what are they thinking or feeling?). There has been debate over how this is accomplished. One hypothesis is that individuals come to understand the minds of others via **simulation**. If the simulation hypothesis is correct, then individuals should use the same brain regions to think about themselves and to think about others.
- fMRI method
 - This research question can be tested using (functional magnetic resonance imaging) fMRI. This approach measures changes in the oxygenation of blood as an indicator of brain activity. Participants lie very still on a bed inside a scanner that consists of large magnets. The procedure is noninvasive and does not cause any pain.
 - The fMRI method is very good at precisely measuring which parts of the brain are active while a person does different tasks.
- What does fMRI research tell us about mentalizing?
 - fMRI studies have found that the **medial prefrontal cortex (mPFC)** is used when thinking about oneself AND when thinking about the mental states of others (known as mentalizing). Activation in this region is particularly strong when individuals are thinking about the mind of another person who they see as being very similar to themselves.

These findings provide support for the simulation hypothesis.

- It should be noted that the mPFC isn't the only region activated when thinking about others; rather there is a network of brain regions that support social processing.

Neuroendocrine Research on Stress

- Stress
 - **Stress** (broadly defined as a threat or challenge to our well being) comes in many forms, from relatively minor events (such as an exam) to extreme events (such as a natural disaster).
- Hormones/neuroendocrine measures
 - Our bodies respond to stressors by activating the **sympathetic nervous system** (to prepare us to respond to the stressor). As part of this stress response, the **hypothalamic-pituitary-adrenal (HPA)** axis releases **cortisol** (a stress hormone). The release of cortisol serves an important function, preparing us to respond to the stressor. However, cortisol can also impair attention, memory, and self-control.
 - **Neuroendocrinology** is the study of how the brain and **hormones** act together to regulate the physiology of the body. This approach can be used to study what causes stress in people and what protective factors might buffer us from stress.
- What does neuroendocrine research tell us about stress?
 - Stressors
 - Stress hormone levels become elevated when individuals are asked to perform a task in front of others who might judge them (but not individuals performing another random task in the same room). This research shows that fear of judgment by others is a cause of social stress.
 - Other physiological measures (cardiac output) have also shown that people become stressed when interacting with members of an **outgroup** (i.e., a social group which they are not a member of).
 - Buffers against stress

- Interestingly, the presence of others can be a protective buffer against stress: people who have greater **social support** networks show less of an increase in stress hormones when faced with a stress-inducing situation (such as giving a speech in front of evaluators).

Difficult Terms

Amygdala
Automatic process
Cortisol
Electroencephalogram (EEG)
Fight or flight response
Functional magnetic resonance imaging (fMRI)
Functional neuroanatomy
Hormones
Hypothalamic-pituitary-adrenal (HPA axis)
Ingroup
Lesions
Medial prefrontal cortex (mPFC)
Neuroendocrinology
Outgroup
Simulation
Social categorization
Social support
Stereotypes
Stress
Superior temporal sulcus (STS)
Sympathetic nervous system
Temporal parietal junction (TPJ)

Lecture Frameworks

Overview: This lecture framework is based on a 2-class-period lesson. It can be condensed

into one long lecture period, but this is not recommended because the content may be unfamiliar and difficult for students to understand. Day 1 begins by having students reflect upon their own performance on a social psychology test (the IAT). Next, students learn about how social neuroscience uses brain and body measures to understand social behavior. Finally, students learn about EEG and how it can be used to answer research questions about social categorization. This lesson ends with a classroom assessment technique (CAT) that is used to assess student understanding. Day 2 begins with a review of the previous class's materials (based on the results of the CAT from Day 1). The content for Day 2 covers fMRI (and how it can be used to study mentalizing) and neuroendocrinology (and how it can be used to study stress). This lesson also ends with a CAT.

First Class (50-60 minutes)

- **Warmup—Implicit Association Task (IAT)**
 - Have students complete the IAT <https://implicit.harvard.edu/implicit/takeatest.ht...> as a homework assignment prior to class. See the Activities/Demonstrations section below for a full description of this activity.
 - Students should discuss their results by answering these questions: Were you surprised by your results? How do you think most people would probably score on this test? What kinds of experiences do you think lead to the formation of implicit attitudes? What might be done to overcome these automatic responses?
 - Explain that the IAT measures automatic associations our brain forms, outside of conscious awareness. These associations are formed via our experiences; when two things are experienced together frequently, the brain learns to associate them. This leads to automatic responses in the brain, which are outside of our conscious awareness. Thus, if we want to truly understand how we think about and interact with other people, we need to study the brain, as well as behavior.
 - Social neuroscience is a field that uses brain and body measures to try to understand social behavior and thinking.
- **Direct Instruction—What is Social Neuroscience?**
 - Refer to the slides to:
 - Explain that social neuroscience is at the intersection of social psychology and neuroscience and review the different kinds of questions the field addresses.

- Provide a brief overview of the different kinds of measures that are used. Discuss why it is important to use these neuroscientific measures in addition to self-report or other methods. (You might have students generate some of the benefits of including these measures.)
- **Direct Instruction—Neuroscience of Social Categorization**
 - Refer to the slides to:
 - Define social categorization, explain why it can be problematic, and explain the outstanding research question (how automatic is social categorization?).
 - Review Electroencephalography (EEG).
 - Explain how the EEG method has been used to shed light on how social categorization operates in humans.
- **Discussion and Application**
 - Refer to the slides to discuss the implications of this EEG research.
 - Ask students questions such as:
 - What are some implications of these findings for the real world?
 - Now that we know this, what can we do about it?
- **Classroom Assessment Technique (CAT)—The Muddiest Point**
 - Ask students to take 1-2 minutes to answer these questions:
 - What was the muddiest point about today's class?
 - Write down the concept you are still struggling to understand.
 - Review answers after class and use students' responses to help guide your review at the start of day 2.

Second Class (50-60 minutes)

- **Review:** Review content from the previous lesson, based on responses to the one-minute paper CAT.
- **Discuss Overview:** Explain that you're going to talk next about the neuroscience of mental state inference, or "mentalizing."
- **Activity, Video, and Discussion—Sally-Anne Task**
 - Students complete the *Sally-Anne task* as an introduction to mental state inference.
 - Show a video of developmental differences in performance on the Sally-Anne task. Discussion questions:
 - How do 3- and 4-year-olds approach the task differently? Why?
 - For more details, see Activities/Demonstrations section below.
- **Direct Instruction—Neuroscience of Understanding Others' Minds**
 - Refer to the lecture slides to review:
 - Simulation hypothesis
 - fMRI
 - Testing the simulation hypothesis
 - Results & implications
- **Activity—What Does Stress Feel Like? AKA Design a Social Neuroscience Study**
 - Show students the slide "Activity: Design a Social Neuroscience Study." The actual title of the activity is *What does stress feel like*, but you don't want to tell students that because you want to trigger a stress response in them (by telling them they have to design a neuroscience study and give a brief speech about it).
 - Tell students they are to give a 1-minute speech to the class about a social neuroscience study that can be done using fMRI, and that they will have five minutes to think about their idea and prepare their speech. (NOTE: You will not actually have students do this;

the aim is simply to trigger a stress response in them.)

- After a few minutes, tell the class you're just kidding, they aren't going to have to give a speech.
 - Ask, by a show of hands, how many people started to feel stressed when they thought about giving the speech.
 - Ask what it feels like in their body when they feel stressed. What are the physical symptoms? What are some other times they felt this way?
 - Use the questions as a jumping-off point to talk about stress and stress response.
- **Direct Instruction—Stress and Hormones**
 - Refer to the lecture slides to review:
 - Stress
 - Stress response
 - Using cortisol to study stress
 - Social stressors
 - Social buffers
- **CAT—Defining Features Matrix of Social Neuroscience Methods**
 - Print out the slide to use as a handout. Have students identify which statements are true of each type of method.
 - Use remaining class time to discuss students' responses.

Activities & Demonstrations

Implicit Association Task (IAT): This activity provides students with an opportunity to participate in a social psychology task that typically reveals unconscious bias. Students are asked to reflect on their performance. This can be used as a jumping-off point/example for the kinds of questions social neuroscience attempts to answer, and how neuroscience measures can help

inform our understanding of social processes.

- Time: 20-30 minutes (including taking the test and discussion)
- Materials: online IAT, which is found at <https://implicit.harvard.edu/implicit/takeatest.ht...>
- Directions:
 1. As a homework assignment, or during class, have students complete the online Implicit Association Test: <https://implicit.harvard.edu/implicit/takeatest.ht...>
 2. Have students discuss their results (either in a short reflection paper or in conversation). Possible questions might include:
 - Were you surprised by your results?
 - How do you think most people would probably score on this test?
 - What kinds of experiences do you think lead to the formation of implicit attitudes?
 - What might be done to overcome these automatic responses?
 3. Explain to students that there are some caveats to keep in mind when thinking about how people perform on the IAT (see Kauffman, 2011, *Psychology Today*; <https://www.psychologytoday.com/blog/beautiful-min...> Review these findings and discuss the importance of using multiple methods to comprehensively understand social thinking and social behavior.

Sally-Anne Task: This task was developed and used in Baron-Cohen, S., Leslie, A. M., & Frith, U. (1985). Does the autistic child have a theory of mind? *Cognition*, 21, 37-46. doi:10.1016/0010-0277(85)90022. Students participate in the task as an introduction to the concept of mentalizing.

- Time: 5 minutes
- Materials: Sally-Anne drawings (see lecture slides)
- Directions:
 1. Students are told the story of Sally-Anne (follow script on pictures).
 2. Students are asked to answer the final prompt, "Where will Sally look for her ball?"
 3. Explain that to answer the question correctly, you have to set aside your knowledge and imagine how Sally would think.

4. Show video of developmental differences in performance on the Sally-Ann Task:
<https://www.youtube.com/watch?v=41jSdOQQpv0>

Activity—What does stress feel like? AKA Design a Social Neuroscience Experiment: The purpose of this task is to trigger a stress response in students and have them reflect on what it feels like.

- Time: 5 minutes
- Materials: None
- Directions:
 1. Tell students they are now going to be asked to give a 1-minute speech to the class about a social neuroscience study that could be done using fMRI, and that they will have five minutes to think about their idea and prepare their speech.
 2. After a few minutes, tell them you're just kidding, they aren't going to have to make a speech to the class, after all.
 3. Ask, by a show of hands, how many people started to feel stressed when they thought about giving a speech.
 4. Ask: What does it feel like in your body when you feel stressed? What are the physical symptoms? When else have you felt this way?

Additional Activities

McGuire, L. C., & Zwaahr, M. D. (1999). Tying it together: Two comprehensive projects for adult development and aging courses. *Teaching of Psychology, 26*, 53-54. doi:10.1207/s15328023top2601_16

- This activity focuses on stereotypes about older adults, but can be expanded to include other social groups.

Dewall, C. N., & Meyer, D. G. (2013). Teaching students about the sunny side of stress. *APS Observer, 26*. Retrieved from <http://www.psychologicalscience.org/index.php/publ...>

- This paper reviews evidence about how stress can lead to positive impacts, and how to

teach students to use reappraisal to harness stressful responses for positive outcomes.

Discussion Points

1. Social psychologists have been studying social behavior and social thinking for decades. Why is it necessary to add neuroscience methods to this line of research?
 - This question is designed to get students thinking about the value added by neuroscience measures (e.g., an additional level of analysis, increased precision, the ability to answer questions unable to be addressed via self-reporting).
2. What are the benefits of social categorization and stereotypes? What are the costs?
 - This question is designed to facilitate a discussion about the nature of social information processing.
3. Compare and contrast EEG and fMRI (e.g., in terms of what is measured, precision in terms of time, precision in terms of localization in the brain).
 - This comparison question is designed to deepen students' conceptual understanding of these two methods
4. Generate a question a social neuroscientist might study. What kind of research study would you use to tackle this question?
 - This question is designed to prompt students to think creatively about possible uses of social neuroscience research methods.

Outside Resources

Society for Social Neuroscience

<http://www.s4sn.org>

Video: See a demonstration of fMRI data being collected.

<https://www.youtube.com/watch?v=ILORKtkf2n8>

Video: See an example of EEG data being collected.

<https://www.youtube.com/watch?v=1ovv6lmPHSI>

Video: View two tasks frequently used in the lab to create stress – giving a speech in front of strangers, and doing math computations out loud in front of others. Notice how some subjects show obvious signs of stress, but in some situations, cortisol changes suggest that even people who appear calm are experiencing a physiological response associated with stress.

<http://www.youtube.com/watch?v=aYl6lCeeT5g>

Video: Watch a video used by Fritz Heider and Marianne Simmel in a landmark study on social perception published in 1944. Their goal was to investigate how we perceive other people, and they studied it by seeing how readily we apply people-like interpretations to non-social stimuli.

<https://www.youtube.com/watch?v=n9TWwG4SFWQ>

Evidence-Based Teaching

Cacciopo, J. T. (2013). Psychological science in the 21st Century. *Teaching of Psychology*, 40, 304-309. doi:10.1177/0098628313501041

- This article reviews current trends in psychology, including the rising importance of neuroscience and an interdisciplinary approach to research. It recommends that university instruction about psychology keep up with these trends (and is thus an endorsement for the importance of teaching a unit like this one).

Stewart, P. C. (2015). This is your brain on psychology: Wireless electroencephalography technology in a university classroom. *Teaching of Psychology*, 42, 234-241. doi:10.1177/0098628315587621

- This paper describes a kind of EEG technology that may be feasible for use in classroom settings, and experiments that can be conducted using this system to increase student understanding and interest in electrophysiological assessment measures.

Links to ToPIX Materials

Activities & Demonstrations: Free Neuroscience Course

<http://topix.teachpsych.org/w/page/19981022/Neuroscience%20in%20the%20Classroom>

Activities & Demonstrations: The "Guess Who?" Game (The Costs of Racial "Color Blindness")

<http://topix.teachpsych.org/w/page/19981041/Social%20in%20the%20Classroom>

Books and Films: The Psychology of Prejudice

<http://topix.teachpsych.org/w/page/39236320/Social-Psychology>

Books and Films: Why Zebras Don't Get Ulcers

<http://topix.teachpsych.org/w/page/39236320/Social-Psychology>

Video/Audio: Sarah Jayne Blakemore TED Talk

<http://topix.teachpsych.org/w/page/19981021/Neuroscience%20Video>

Video/Audio: Social Cues in the Brain

<http://topix.teachpsych.org/w/page/19981021/Neuroscience%20Video>

Teaching Topics

Teaching The Most Important Course

https://nobaproject.com/documents/1_Teaching_The_Most_Important_Course.pdf

Content Coverage

https://nobaproject.com/documents/2_Content_Coverage.pdf

Motivating Students

https://nobaproject.com/documents/3_Motivating_Students_Tips.pdf

Engaging Large Classes

https://nobaproject.com/documents/4_Engaging_Large_Classes.pdf

Assessment Learning

https://nobaproject.com/documents/5_Assessment_Learning.pdf

Teaching Biological Psychology

https://nobaproject.com/documents/6_Teaching_Bio_Psych.pdf

PowerPoint Presentation

This module has an associated PowerPoint presentation. Download it at https://nobaproject.com//images/shared/supplement_editions/000/000/334/Social%20Neuroscience.ppt?1475874013.

About Noba

The Diener Education Fund (DEF) is a non-profit organization founded with the mission of re-inventing higher education to serve the changing needs of students and professors. The initial focus of the DEF is on making information, especially of the type found in textbooks, widely available to people of all backgrounds. This mission is embodied in the Noba project.

Noba is an open and free online platform that provides high-quality, flexibly structured textbooks and educational materials. The goals of Noba are three-fold:

- To reduce financial burden on students by providing access to free educational content
- To provide instructors with a platform to customize educational content to better suit their curriculum
- To present material written by a collection of experts and authorities in the field

The Diener Education Fund is co-founded by Drs. Ed and Carol Diener. Ed is the Joseph Smiley Distinguished Professor of Psychology (Emeritus) at the University of Illinois. Carol Diener is the former director of the Mental Health Worker and the Juvenile Justice Programs at the University of Illinois. Both Ed and Carol are award-winning university teachers.

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