

LESSON TITLE: The Language Spark

Grade Levels: 9-12

Time Allotment: Two to three 45-minute class periods

Overview:

In this lesson, students will use selected segments from the PBS series The Human Spark to explore how the capacity for language develops in the human brain, and about how that capacity distinguishes us from other animals.

The Introductory Activity first asks students to brainstorm what distinguishes humans from other primates, and then presents a video clip in which psycholinguist Stephen Pinker suggests that language is one of three unique human qualities. The Learning Activities further explores the development of language in children, the possible origins of words, the function and nature of grammar, and the interconnected anatomy of the brain's "language loop." For the Culminating Activity, students will write a short essay summarizing what they've learned and posing an unanswered question as a jumping-off point for further research.

This lesson is best used as an introduction to linguistics or psychology, or as a supplement to a biology unit on the anatomy of the brain

Subject Matter: Psychology, Biology, Linguistics, Evolution

Learning Objectives:

Students will be able to:

- Describe several ways in which humans are unique among species
- Outline the sequence of language developmental in children
- Suggest theories for the origins of language
- Explain how tool use and language capacity may be linked in the brain
- Name the parts of the brain involved in language, describing their specific function and relative location in the brain's anatomy

Standards:

From the National Science Education Standards at www.nap.edu

Content Standard: 9-12

SCIENCE AS INQUIRY

Content Standard A: As a result of activities in grades 9–12, all students should develop:

UNDERSTANDINGS ABOUT SCIENTIFIC INQUIRY

- Scientists usually inquire about how physical, living, or designed systems function. Conceptual principles and knowledge guide scientific inquiries.

- Historical and current scientific knowledge influence the design and interpretation of investigations and the evaluation of proposed explanations made by other scientists.
- Scientists conduct investigations for a wide variety of reasons. For example, they may wish to discover new aspects of the natural world, explain recently observed phenomena, or test the conclusions of prior investigations or the predictions of current theories.
- Scientists rely on technology to enhance the gathering and manipulation of data. New techniques and tools provide new evidence to guide inquiry and new methods to gather data, thereby contributing to the advance of science. The accuracy and precision of the data, and therefore the quality of the exploration, depends on the technology used.
- Results of scientific inquiry—new knowledge and methods—emerge from different types of investigations and public communication among scientists. In communicating and defending the results of scientific inquiry, arguments must be logical and demonstrate connections between natural phenomena, investigations, and the historical body of scientific knowledge. In addition, the methods and procedures that scientists used to obtain evidence must be clearly reported to enhance opportunities for further investigation.

Media Resources:

Video:

Clip 1: “Dr. Steven Pinker: Language Makes Us Human”

<http://www.pbs.org/wnet/humanspark/video/spark-blog-video-dr-steven-pinker-language-makes-us-human/212/>

In this outtake from *The Human Spark*, Psycholinguist Stephen Pinker discusses the three things he believes makes us distinctly, uniquely human: language, cooperation, and technological “know how.”

Clip 2: “The Language Spark”

An excerpt from episode 3 of *The Human Spark*, Episode Three: “Brain Matters” exploring the human brain’s unique capacity for complex language.

Websites:

“Language on the Brain”

<http://www.amnh.org/sciencebulletins/?sid=h.f.language.20090318>

A video exploring how the brain processes language, produced by the American Museum of Natural History for its exhibit “Brain: The Inside Story.”

“The Language Loop”

http://thebrain.mcgill.ca/flash/d/d_10/d_10_cr/d_10_cr_lan/d_10_cr_lan.html

An educational website from McGill University in Montreal exploring how specific parts of the brain process different aspects on language comprehension and production.

Materials:

For the teacher:

- A computer with internet access connected to a projector and speakers for classroom use.
- “The Sound of Language” Student Organizer Answer Key
- “The Language Loop” Student Organizer Answer Key

For each of five groups of students:

- A computer with internet access.

For each student:

- “The Sound of Language” Student Organizer (download [here](#))
- “The Language Loop” Student Organizer (download [here](#))

Prep for Teachers:

Prior to teaching this lesson, you will need to:

Preview all of the video segments and websites used in the lesson.

Download the video segments used in the lesson to your classroom computer, or prepare to watch them using your classroom’s internet connection.

Bookmark the website used in the lesson on each computer in your classroom. Using a social bookmarking tool such as [delicious.com](#) or [diigo](#) (or an online bookmarking utility such as [portaportal](#)) will allow you to organize all the links in a central location.

Introductory Activity

1. Ask students what they think might set humans apart from other animals. Explain that there are no “right” answers, but each response should be accompanied by an explanation or justification. (*Accept all answers, writing them all on a blackboard or whiteboard.*) Explain that the debate about what is or is not uniquely human is highly controversial and always evolving. Ask students why they think the debate is always evolving? (*Answers will vary; suggest that it is largely because so much of what informs the debate about what is uniquely human is our understanding of the human brain—the most complex human organ, and that which we understand the least.*) Frame the first video clip from the PBS series ***The Human Spark*** by explaining to students that it features Dr. Stephen Pinker speaking with series host Alan Alda, attempting to answer the same question they just were by considering themselves: what makes us unique? Provide a focus question by asking students what the three parts of Pinker’s response are. PLAY Clip 1: “Dr. Steven Pinker: Language Makes Us Human.”
2. Review the focus question: what are the three parts of Dr. Pinker’s response to the question, “what makes us unique?” (*Language, cooperation, and technological “know-how.”*) Explain that while two other ***The Human Spark*** lesson plans focus on Cooperation (“[Social Skills](#)”) and technology (“[Sticks and Stones](#)”), this lesson will be

examining language as it exists in our brains, and what it may tell us about what it means to be human.

Learning Activities

1. Frame the next clip from *The Human Spark* by explaining that it follows host Alan Alda as he speaks with Harvard University professor Elizabeth Spelke about what she thinks might constitute “the human spark.” Provide a focus question by asking students what Spelke believes this spark is and whether she thinks it exists in humans at birth. PLAY Clip 2: “The Language Spark.”

2. PAUSE the clip at 10:45, after Alda says that language is “an innate ability, but one which doesn’t begin to kick in until we’re a year old.” Review the focus question: what does Spelke believe the human spark is, and does she think we have it at birth?” (*Spelke agrees with Pinker that language is what distinguishes us, but she does not see it in us at birth or early infancy.*) Does Spelke think that human children in their early months as infants are very developmentally different from other primates? (*No.*) What is Spelke’s conclusion about the experiments involving children placing Kermit in the correct bucket? (*That children learn by explicit linguistic instruction rather than by inference.*) Ask students how they would define language? (*Answers will vary, but encourage an understanding that language is a capacity for thinking and communicating through the manipulation of symbols.*) Ask students what some examples of those symbols might be? (*Words, sign language signs.*) What might the manipulation of those symbols be called? (*Grammar.*) Frame the next clip by explaining that it follows Alda as he learns more about human language development from Helen Neville, a professor at the University of Oregon. Provide a focus question by asking students what the earliest stages of language acquisition are for children, according to Neville. RESUME playing Clip 2.

3. PAUSE the clip at 11:36, after Alda says “his first two word sentence was ‘eat out.’” Review the focus question: according to Neville, what are the earliest stages of language development among human children? (*First sounds, then nouns, then verbs, then simple sentences at 1.5 years of age.*) Ask students if they think this developmental sequence makes sense. (*Yes.*) Why? (*The ability to consistently make certain sounds necessarily precedes the ability to attach meaning to those sounds to make nouns, which in turn precedes the ability to arrange those nouns and other word types in complete sentences.*) Ask students if they think there is any connection or correspondence between the sound and the meaning of words? (*Accept all answers.*) Have the class divide into five groups and distribute a “The Sound of Language” student organizer to each student. Assign each group one of the columns and allow groups 5-10 minutes to brainstorm as many words as they can think of which start with their column’s two-letter sound.

4. When time is up, have each group present their list of words to the class. Ask students in other groups to contribute any other words they can think of that were not listed. Ask the class as a whole if they can think of any commonalities in many or most of the words chosen for each sound. Do they tend to have something to do with one of the senses, or one of the sense organs? (*Accept all answers, revealing those listed in the student organizer answer key when no more suggestions are forthcoming. Remind students that there will be “outlier” words with no clear connection to the others in its phonetic group.*) Ask students who speak or are learning foreign languages if they think such

connection between sound and meaning exists in other languages? (*Generally speaking, they do.*) After explaining that no answer is definitive, ask students for theories about why certain sounds seem to connote certain meanings, or apply to certain senses and/or perceptions (*Answers will vary. Explain that while linguistic theory may never definitively explain the origin of human language, it is widely accepted that language evolved from simpler noises and sounds similar to those made by other animals.*)

5. Ask students what they think the similarities and differences might be between human language and animal sounds. (*Accept all answers.*) Do they think the sounds made by animals might have specific meanings for the animals? (*Accept all answers.*) Do they think animals capable of understanding the meaning of human words, even if they're unable to replicate the words themselves? (*Accept all answers.*) Provide a focus for the next portion of the clip by asking students to be looking for what Professor Neville thinks is the primary difference between human language and other animal communication systems. RESUME playing Clip 2.

6. PAUSE the clip at 13:26, after Neville says "I think everybody agrees about that." Review the focus question: according to Neville, what is the primary difference between human language and the other animal communication methods? (*Grammar.*) What is grammar? (*The set of rules that govern the composition of complex sentences, conjugations, and words.*) Ask students if they think that the human capacity for grammar is something we're born with, or something we learn? (*Accept all answers.*) Frame the next clip by explaining that it delves deeper into how our brains process grammar, and in so doing suggests an intriguing connection between our capacity for language and another distinguishing human characteristic which the class discussed earlier in the Introductory Activity. Provide a focus question by asking students to be watching for what this connection might be. RESUME playing Clip 2 through to the end.

7. Review the focus question: what distinguishing human characteristic shares a connection with our capacity to process grammar? (*Tool use/technology.*) What is the connection? (*Both activities make use of the same portion of the brain, and both activities are based upon logical, sequenced action planning. Just as a tool like a spear must be assembled in a certain manner to be useful, so too must words be assembled in certain configurations in order to make sense.*) What does the EEG brain scan test undergone by Alda and the young girl reveal about the portion of the brain that processes grammar? (*It is quicker and more focused in an adult brain than in a child's.*) Does this same area of the brain also process the meaning of language? (*No—that is a separate part of the brain.*) What does this suggest about the way language works in the brain? (*Answers will vary, but encourage an understanding that language involves the use of many different parts of the brain and is a process which is refined during our maturation.*)

8. Go to the "Language on the Brain" website (at <http://www.amnh.org/sciencebulletins/?sid=h.f.language.20090318>). Provide a focus for the video clip on the website by asking students to be watching for unique capacities of human language, as opposed to animal communication. PLAY the video clip.

9. PAUSE at 1:27, after the clip of Martin Luther King, Jr, giving his "I Have A Dream" speech. Review the focus question: according to the clip, what are some unique capacities of human language? (*Humans can talk about the future, abstractions, culture, and technology.*) Ask students if they think these capacities could be considered

subjects? (*Yes.*) Could they also be considered fundamental modes of thinking that might be beyond other species? (*Yes. For example, a detailed prediction about the future is certainly beyond other species, but on an even more basic level, the very notion of “the future” is fundamentally--and perhaps uniquely--human.*) Suggest to students that both the vocabulary and grammar of language are not only a means of our communication or expression, but the medium and currency of our thoughts. Frame the remainder of the clip by explaining that it will explore some categories of those thoughts and where they may originate in the brain. Provide a focus for the next portion of the clip by asking students to be looking for some of the specific brain processes involved with language. RESUME playing the clip.

10. PAUSE at 5:10, after Columbia neuroscientist Joy Hirsch says “our language system can be revealed through an orderly sequence of specific tasks that we use to probe it.” Review the focus question: what are some of the specific brain processes involved with language? (*Conceptualizing, modulation, object naming, passive listening, problem solving, and decision making.*) Ask students if they can think of any other processes involved with language. (*Answers will vary, but may include word choice or physical articulation of speech.*) Ask students if they think these processes might use different parts of the brain? (*Yes.*) Provide a focus for the remainder of the clip by asking students to list the parts of the brain which Hirsch described as the “language toolbox.” RESUME playing clip through to the end.

11. Review the focus question: what are the parts of the brain that Hirsch describes as the “language toolbox?” (*Auditory cortex, Wernicke’s area, arcuate fasciculus, Broca’s area, motor cortex, visual cortex.*) Ask students what they think the linguistic function of each of these parts might be? (*Answers will vary; the auditory, motor, and visual cortices are clearly linked to hearing, speaking/signing, and seeing, respectively, while Wernicke’s area, Broca’s area, and the arcuate fasciculus will be obscure.*) Have the class reform the five groups they were split into earlier. Have groups log on to the “The Language Loop” website (at http://thebrain.mcgill.ca/flash/d/d_10/d_10_cr/d_10_cr_lan/d_10_cr_lan.html). Distribute a copy of the “The Language Loop” Student Organizer to each student and allow groups 10 minutes to complete them.

12. When time is up, ask for volunteers from all groups to answer the questions on “The Language Loop” Student Organizer for the class. Explain to students that the schematic of the brain’s linguistic function which they’ve just looked at is an extreme simplification of what is known, and that what is known is very little compared to what remains unknown. Even at this very low level of understanding, however, it is possible to appreciate in this interweaving of language functions throughout the brain what neuroscientist Joy Hirsch describes in the video as the difference between human brains and those of other primates. Ask students if they can recall what that is. (*Although they share a similar anatomy, the human brain is far more interconnected than a non-human primate’s.*)

Culminating Activity

1. As homework, have students write a one page essay summarizing what they learned in the course of the lesson. Each essay should make mention of the following themes:

- Language development in children
- A definition of grammar and its role in language
- What makes animal communication different than human language
- How the brain processes and produces language

Additionally, the essay should include one unanswered question about the material covered.

2. In the following day's class, before the essays are collected, go around the room and have each student ask their question aloud. Promote classroom discussion of what the answer might be; where no answer is known solicit suggestions of what further research or experiments would need to be undertaken in order to find an answer.