FRINGE
THU 9/8c

THE SCIENCE OF FRINGE
EXPLORING: INFORMATION ENCODING

A SCIENCE OLYMPIAD THEMED LESSON PLAN
SEASON 3 - EPISODE 6: **6955 kHz**

Overview:
Students will learn about information encoding, which is the process of converting a piece of information into another form or representation.

Grade Level: 9–12

Episode Summary:
Several people simultaneously suffer from amnesia while listening to a mysterious radio broadcast listing numbers. Once the Fringe team discovers a device from the alternate universe that inserted a special signal into the broadcast to trigger the amnesia, they work to determine why the device was deployed. By piecing together different bits of information, the team is able to decode the secret of the numbers broadcasts and understand why agents from the alternate universe were trying to prevent its discovery.

Related Science Olympiad Event:
Write It/Do It - A technical writing exercise where students write a description of a contraption and other students will attempt to recreate it using only the written description.

Learning Objectives:
Students will understand the following:
• Information needs to be encoded for a variety of reasons, including standardization, machine readability, size constraints, and security.
• Many types of encoding exist even for the same base information or communication method.
• Knowledge of the encoding schema is needed in order to restore encoded information back to its original form.

Episode Scenes of Relevance:
• Nina explaining to the team what little is known about numbers stations
• Astrid trying to break the code behind the numbers stations
• View the above scenes: http://www.fox.com/fringe/fringe-science

FOX CODE

FOR SMARTPHONES

Online Resources:
- Fringe "6955 kHz" full episode: http://www.fox.com/watch/fringe
- Science Olympiad Write It Do It event: http://soinc.org/write_do_c
- Information about Bar Codes: http://www.adams1.com/pub/russadam/barcode1.html
- Wikipedia page on Information Encoding: http://en.wikipedia.org/wiki/Information_encoding

Procedures:
1. Tell your students that they are going to learn about information encoding.
2. Have your students research codes and in particular barcodes in resources such as computer science textbooks and websites and discuss what they have learned.
3. Divide your class into small groups. Have each group complete the following activity:
   a. Materials: rulers, barcodes from various sources such as food packages, books, mail and shipping labels, and store loyalty cards
   b. Examine each of the barcodes. Can you easily read what information is encoded? Determine how many digits or characters are encoded.
   c. Try to decipher the patterns used to represent each digit or character in the barcode. If this is not possible, use references such as the Wikipedia page on barcodes to determine the pattern.
   d. Measure the size of each barcode.
   e. Create a chart showing the relative size of each barcode versus the amount of information it encodes.
4. Discuss with the class the results of the activity. Be sure to address:
   a. There are 1D and 2D barcodes. Is there a correlation between the type of barcode and the nature of the information encoded?
   b. Some barcodes incorporate human readable information, while others don't. What is the nature of the objects barcoded in each case and why is this significant?
   c. Is there a correlation between the information density of the barcode and the nature of the information encoded?

Additional Discussion Suggestions:
- Cryptography is a special form of information encoding where the objective is to conceal information. What are some everyday uses of cryptography and why is it important in those applications?
- Coding schemes do not have to utilize numbers and letters, but can alternatively utilize other symbols or characteristics of something. Examples include Braille, musical scores, sign language, and traffic lights.

Extension to Other Subjects:
Health Sciences: DNA is referred to as a genetic code because it consists of only 4 types of base molecules. What is the encoding scheme for DNA and what special features does it contain?

Music: Sheet music is a special form of information encoding that converts sounds into written notation. What are some of the standard musical notation symbols and how does their representation relate to the related musical characteristic?

History: Much of the Allied success during WWII was a direct result of the breaking of the German ENIGMA code. What was the process utilized to break this code and how did that plant the seeds for the computer age?

National Science Standards Alignment:

E. Science and Technology – An understanding of science and technology establishes connections between the natural and designed world, linking science and technology.

H.E.1 Abilities of technological design
e. Communicate the problem, process, and solution.