

Unit 1:

Human Computer Interaction



EXPLORING COMPUTER SCIENCE

Introduction

Computers and other computing technology have become an integral part of our society. Because of that it is easy to forget that not every student will come to this course with the same background and skills. For many students this course will be the first opportunity they have to become facile with using the keyboard and navigating the internet.

The topics in this unit are designed to allow all students to gain familiarity with computers and computing in the context of activities that give students an opportunity to work at their own pace, collaborate in groups where they can learn from each other and generally gain an overview of the many and varied ways in which computers and computing are used.

The unit is divided into three main sections.

- Exploring the concepts of computer and computing by investigating computer hardware components and a variety of internet resources (Days 1-7)
- Exploring the use of computers in a variety of circumstances and fields (Days 8-13)
- The computer as a machine that needs to be provided specific instructions (Days 14-19)

The goal is for all students in the class to reach a level of comfort in using the computer and understand that the computer is not magic. The fact that for a computer to accomplish its tasks it needs to be given precise instructions motivates the need for the problem solving techniques that will be addressed in Unit 2.

Specific topics for each instructional day are listed in the overview chart on the next page.

Daily Overview Chart	
Instructional Day	Topic
1-2	Explore the concepts of <i>computer</i> and <i>computing</i> .
3-4	“Demystify” and learn the function of the parts of a personal computer. Learn the terminology of hardware components necessary for the purchase of a home computer.
5-7	Explore the world wide web and search engines. Experiment with a variety of search techniques, internet resources, and Web 2.0, applications. Evaluate websites.
8-9	Examine the implications of data on society and how computers are used for communications.
10	Tell a story with data.
11-14	Explore how computers are used as a tool for visualizing data, modeling and design, and art in the context of culturally situated design tools.
15-16	Introduce the concept of a computer program as a set of instructions.
17-19	Explore the idea of intelligence—especially as it relates to computers. Explore what it means for a machine to “learn”. Discuss whether computers are intelligent or whether they only behave intelligently.

Daily Lesson Plans

Instructional Days: 1-2

Topic Description: What is computing? In this lesson the concepts of *computer* and *computing* are explored through examples of each.

Objectives:

The student will be able to:

- Explain and give examples of the concepts of *computer* and *computing*

Outline of the Lesson:

- Journal Entry (10 minutes)
- Exploring computers (60 minutes)
- Classification of computing groups (10 minutes)
- Definition of the terms *computer* and *computing* (10 minutes)
- Demo of Computer Buying Project Assignment (20 minutes)

Student Activities:

- Complete journal entry.
- Groups of students create lists of their ideas of what a computer is.
- Groups do presentations.
- Participate in discussion of classification groups and definition of computer and computing.

Teaching/Learning Strategies:

- Journal Entry: How many computers are in the room?
 - Have students write responses to the question in their journals and then share the response with their elbow partner.
 - Ask a few student pairs to share their responses.
- Exploring computers
 - Some students may have counted only the desktop computers in the room while others may have recognized that there are other items that are computers as well.
 - Divide students into groups of 3 or 4. Ask the students to discuss additional examples of computers (or things containing computers). Have students write their examples on post-its and add them to a large chart at the front of the room or have groups make a list on flipchart paper and tape their list somewhere in the classroom. (Examples of computers include: Macintosh, Windows PC, cell phone, mp3 player, most appliances (television, coffee maker,

- washer, dishwasher, etc.), cars, medical equipment, planes, watches, cash registers, ATMs, traffic lights, scoreboards, humans, and calculators.)
- Have student groups share their ideas. After each presentation, give the other students an opportunity to suggest why any particular example seems not to be a computer (or is not obviously a computer). If necessary, ask questions to draw out the student questions and responses. (For example, if the student says “dishwasher,” you might ask, “why is a dishwasher a computer.”)
 - Have a brief discussion of the power of cell phones. Mention collection of data as a foreshadowing of unit 5.
 - Classification of computing groups
 - Ask students to suggest possible classifications for the items on the list; create a new list with the various items listed under a group classification.
 - Definition of the terms *computer* and *computing*.
 - Revisit the question “What is a computer?” and ask the more pertinent question, “What is *computing*?”
 - Have the students use their list of “computers” and their classifications to help formalize their answers.
 - Note that there is no “correct” answer. These definitions will be revisited and possibly modified throughout the course of the unit.
 - Reinforce the idea of different types of computers and classifications by reviewing the lists and groups created by the students.
 - Computer Buying Project Assignment
 - Each student will interview a family member or friend to find out what features that person would like to have if they were buying a new personal computer.
 - Demonstrate the interview process by asking a student to participate in an interview and ask them questions such as: What will be the uses of the computer? What are the space constraints? What is the price range? Etc. You may wish to provide students with a specific list of interview questions.

Resources:

- No additional resources needed

Instructional Days: 3-4

Topic Description: Students complete a project related to choosing appropriate components for a personal computer.

Objectives:

The student will be able to:

- Describe the uses for computer hardware components
- Choose hardware components for various types of users

Outline of the Lesson:

- Research and development of computer buying project (85 minutes)
- Project presentations by student teams (25 minutes)

Student Activities:

- Student teams research and complete projects.
- Student teams present projects.

Teaching/Learning Strategies:

- Distribute project information and rubric.
 - Have students work in the same teams as they did on the previous day.
 - Explain project and rubric; answer questions; Have each team choose one of the interviews they did to use for the project.
- Project presentations by student teams
 - Have each team discuss the scenario they used, display their comparison chart and explain which computer was chosen and why.

Resources:

- Computer Buying Project
- Computer Components Checklist
- Computer Buying Project Sample Rubric

Computer Buying Project

Choose one of the interviews of buying a new computer to use for this project. Your task is to give them at least 4 options and then give them advice on which one to buy. Your project will be presented to the class.

The final product can be a:

- PowerPoint
- Debate
- Skit
- Video
- Other approved product

Your final product should have:

- A title with group members' names
- The questions and responses from the interview chosen
- Computer comparison chart
- Which computer is chosen
- Justification for choosing that computer, including completion of the Computer Components Checklist.
- You should be prepared to answer questions about your choices from other students.

Example computer comparison chart (more information can be added):

	Dell Inspiron	MacBook
Laptop or Desktop		
Processor (CPU)		
Operating System		
Memory (RAM)		
Hard Drive (storage)		
Optical Drive		
Monitor or Screen Size		
Video Card		
Sound Card		
Other Accessories		
Cost		

Student Grouping:

You will be in a group of up to 4 students.

Computer Components Checklist

Below are the different components for you to investigate:

1. Processor
2. Operating System
3. Memory
4. Hard Drive
5. Optical Drive
6. Monitor
7. Video Card
8. Sound Card
9. Speakers
10. Keyboard
11. Mouse
12. Modem

For each of the components write down:

- The name
- What it is used for
- What are the different options or sizes for the components
- Why you included the component in the list of components for the person who is buying the computer.

Computer Buying Project Sample Rubric

Group Members Names: (up to 4)

_____	_____
_____	_____

Do you have?	Points Possible	Yes	No	Points Earned
Product				
Title with group members' names	5			
Interview scenario is described	10			
Computer comparison chart with at least 4 options	10			
Chart has specifications of options	5			
Options on chart fit your scenario	10			
Show justification for your computer choice	10			
Your choice fits the scenario	10			
Visuals of your choices (pictures or video of choices)	10			
Computer Components Checklist	5			
Presentation				
Present all required parts of project	10			
All group members participate	5			
Able to answer questions	10			
Extension				
Project exhibits creativity above and beyond	Up to 10			
TOTAL:	100 + 10			

Instructional Days: 5-7

Topic Description: Search engines and how they work are explored through trying various internet search techniques. A selection of Internet resources that are useful for finding information are introduced as well as a selection of Web 2.0 applications. Several websites are evaluated by using a rubric to determine if they are “good” websites.

Objectives:

The student will be able to:

- Perform searches and explain how to refine searches to retrieve better information
- Identify resources for finding information in addition to ranking based search engines
- Differentiate between ranking based search engines and social bookmarking (collaborative) search engines
- Use a variety of Web 2.0 applications
- Develop and use a rubric to evaluate websites

Outline of the Lesson:

- Journal Entry (5 minutes)
- Internet Scavenger Hunt (25 minutes)
- Discussion of other resources for finding information (10 minutes)
- Experimentation with these resources (15 minutes)
- Jigsaw activity involving Web 2.0 applications (55 minutes)
- Journal entry (5 minutes)
- Web site evaluation criteria (20 minutes)
- Hands-on evaluation of web sites (30 minutes)

Student Activities:

- Complete journal entry.
- Perform internet searches using varying levels of refinement.
- Identify other resources for finding information.
- In groups use the other resources to find relevant information.
- In groups complete jigsaw Web 2.0 activity and presentations.
- Complete journal entry
- Identify evaluation criteria and work in groups to evaluate websites using the rubric.

Teaching/Learning Strategies:

- Journal Entry: List at least three ways in which you currently use the internet.
 - Have students share their responses with their elbow partner.
- Have student groups complete an internet scavenger hunt.
 - A sample is provided, but you may want to create your own that is more specific to the interests of your students or have the groups create their own and exchange with another group.

- Other resources for finding information
 - In discussing the results of the scavenger hunt have students identify at least three resources other than search engines that they use to find information on the internet along with advantages (or disadvantages) over a general search engine.
 - Some examples might be:
 - Sites such as Google Maps or Mapquest to get directions or see satellite or street view images of anywhere in the country.
 - Address and telephone number lookup sites such as Switchboard or Yellow Pages to get personal and business information.
 - Sites such as the Internet Movie Database to get information on movies and television shows.
 - Sites such as Dictionary and Thesaurus to look up the meaning or spelling of a word or to find a synonym of a word.
 - Encyclopedic sites such as Wikipedia, Encyclopedia Britannica, or How Stuff Works to find an overview of a particular topic.
 - The Wayback Machine which stores snapshots of websites on various dates so that you can “go back in time” to see a site as it used to be.
 - Video-based information sources such as YouTube and Howcast
- Experimentation with these resources
 - Have the students work in groups to use the resources identified above in ways that are relevant to them. For example,
 - Use Google maps and StreetView to find and display where they live or the location of the school.
 - Use Wikipedia and Encyclopedia Britannica to find information on a topic they’re studying in another class. Have them compare the two articles and decide which provides more information.
 - Use the Wayback Machine to view an early version of the school website. Compare how much it has changed from the school’s current website.
- Jigsaw activity involving Web 2.0 applications
 - Divide students into groups to work on each of three different Web 2.0 applications. (Depending on the size of the class, more than one group may need to work on each application.) Applications should include a social bookmarking site (delicious.com or stumbleupon.com), a word cloud site (wordle.net) and a list creation site (tadalist.com). Each group should:
 - Set up an account in the application.
 - Explore the site and its features.
 - Prepare a presentation on their site for the remainder of the class.
 - During the student presentations, ensure that the following questions/issues are addressed:
 - What are the differences between ranking based and social bookmarking search engines?
 - Why would you want to create word clouds?
 - What are the advantages of using tadalist? Disadvantages?
 - What issues might there be with creating accounts online? (Lead into a discussion on privacy—what information should be kept private and why? Discuss encryption.)

- Journal Entry: Why do you need to evaluate websites?
- Web site evaluation criteria
 - It is important to be able to tell when a site is a hoax or subtly biased.
 - Brainstorm criteria that they could use to evaluate websites. As a group develop an evaluation rubric. (You can use the Sample Website Evaluation Rubric as a reference.)
- Hands-on evaluation of web sites.
 - Have the students work in groups and ask them to use the website evaluation rubric to evaluate websites they might need for a school project or an assignment from another class.
 - Discuss the results of their evaluations.

Resources:

- Sample Scavenger Hunt
- The Wayback Machine: <https://archive.org/web/>
- Google Maps (including StreetView): <http://maps.google.com>
- Wikipedia: <http://www.wikipedia.org>
- Encyclopedia Britannica: <http://www.britannica.com>
- Mapquest: <http://www.mapquest.com>
- Internet Movie Database: <http://www.imdb.com>
- Switchboard: <http://www.switchboard.com>
- Yellow Pages: <http://www.yellowpages.com>
- How Stuff Works: <http://www.howstuffworks.com>
- YouTube: <https://www.youtube.com/>
- Howcast: <http://howcast.com>
- <http://www.delicious.com>
- <http://www.stumbleupon.com>
- <http://www.wordle.net>
- Website Evaluation Rubric

Sample Scavenger Hunt

In your group, use the internet to find the following items. For each item include the steps you took to find each item.

1. A picture of the mayor of your town or city
2. A bus schedule
3. The address of the Chamber of Commerce for your town or city
4. A map of your state—and you have to point out where your town or city is!
5. A copy of the front page of your town's or city's web site
6. Something in writing that tells how many people live in the city
7. A picture of any historical landmark in the city
8. A picture of your congressman
9. A program or flyer from a local arts event
10. The names of all the city council members
11. Something that gives information about your local hospital
12. A list of schools in your town or city
13. The phone number of the local police department
14. Anything with the colors or mascot of a local college or community college
15. A picture of the state flag
16. A picture of the state bird
17. A schedule of activities or a pamphlet from a local nursing home or senior citizens center
18. A sticker or button from a local election
19. A list of safety tips from the local fire department
20. A speech by your governor

Sample Website Evaluation Rubric			
Authority			
Is the author identified?	Yes	No	Unsure
Does the author have appropriate qualifications with respect to the information being presented?	Yes	No	Unsure
Purpose			
Is the purpose to inform or give factual information?	Yes	No	Unsure
Coverage			
Is the information primary or secondary in nature?	Yes	No	Unsure
Is the information presented comparable to information on the same topic presented by other sites?	Yes	No	Unsure
Accuracy			
Is the information free of factual errors?	Yes	No	Unsure
Do the conclusions appear to be well-reasoned and supported by the facts presented?	Yes	No	Unsure
Is the information properly referenced?	Yes	No	Unsure
Objectivity			
Is the information free from obvious bias?	Yes	No	Unsure
Does the author avoid the use of emotional or inflammatory language?	Yes	No	Unsure
Does the author avoid trying to sell something or persuade the reader of a particular viewpoint?	Yes	No	Unsure
Currency			
Is the information up-to-date?	Yes	No	Unsure
Are there creation and revision dates?	Yes	No	Unsure
Accessibility			
Does the site have a professional appearance?	Yes	No	Unsure
Does it use proper grammar, spelling, and composition?	Yes	No	Unsure

Instructional Day: 8-9

Topic Description: The use of computers for communications and the impact this has had on society is discussed.

Objectives:

The student will be able to:

- Explain how computers are used for communications
- Recognize various forms of communication as data exchange
- Describe the implications of data exchange on social interactions
- Consider privacy of data that they create

Outline of the Lesson:

- Journal Entry (5 minutes)
- Identification of communications mechanisms (10 minutes)
- Communication Methods Chart (30 minutes)
- Impact of changes to communications on society (10 minutes)
- Privacy Activity (55 minutes)

Student Activities:

- Complete journal entry.
- Identify communications mechanisms.
- Pairs of students complete the Communication Methods Chart.
- Groups discuss the impact of changes to communications on society.
- Groups share a summary of their discussions with the class.
- Groups of students complete the Privacy Activity.

Teaching/Learning Strategies:

- Journal Entry: List as many computer-based communications mechanisms as you can.
- Identification of communications mechanisms
 - Volunteers provide examples from their journal entry. Post the responses.
 - Prompt students as necessary with examples.
 - Internet-based communication (email, chat, Facebook, Internet telephony)
 - Telephone-based communication (cell phones, texting, “landline” telephone service)
 - News and information “on demand”
- Communication Methods Activity
 - Students complete Communication Methods Chart.

- Students work in pairs (option to have each pair complete one sheet for both or each complete one). Add/delete options that you deem appropriate based on the habits of your student population.
- Take a poll for each category to see what form of communication is most popular for each scenario.
- Have a few students share their answer to “Why you chose this Method” for each scenario.
- Have a few students share their answers to 1-2.
- Impact of changes to communications on society
 - Ask students to do the following:
 - Imagine life without some or all of the computer-based communications mechanisms that we now take for granted.
 - List some of the consequences of an absence of technology (for example, without cell phones, the ability to instantly reach anyone goes away).
 - Based on these consequences, draw conclusions about the impact of the presence of the communications mechanism. (For example, if the absence of cell phones means the absence of the ability to instantly contact anyone, then the presence of cell phones means that we now have the ability to instantly contact anyone. One conclusion we can draw is that we have less privacy than we used to.)
- Privacy Activity
 - Students are placed into groups and assigned a scenario.
 - They are to prepare a presentation to answer the questions for their given scenario.
- Groups deliver presentations.
- Challenge the students to predict what communications will be like in 5 years, 10 years, and 25 years.

Resources:

- Communication Methods Chart
- Privacy Activity

Communication Methods Chart

Let's look at the different ways you can communicate with others. For each of the following examples, fill in the table below with which method you would choose for the given scenario and why.

The methods are:

- **Texting**
- **Phone call**
- **Talking in person**
- **Facebook**
- **Twitter**
- **Email**

Scenario to communicate	Method	Why you chose this method
1. Breaking up with a significant other (boyfriend/girlfriend)		
2. Asking parents' permission to do something when you think they will likely say 'no'		
3. Figure out where and when to meet a friend to see a movie		
4. Gossip about someone who could hear you if you spoke		
5. Gossip about someone not around you		
6. Getting help on homework		
7. Feedback on a big decision (like what color prom dress, what game to buy, what phone to get)		
8. Announce you met someone famous		
9. Complain about your parents		
10. Mourn someone you lost		
11. Buy something from someone you don't know well		

1. How would life be different if you could only communicate 1 on 1 instead of with multiple people at once?
2. How would life be different if you could only communicate in person?

Privacy Activity

Data are everywhere. You are 'giving off data' and providing data to others all the time. Sometimes this data can be directly linked to you as an individual; sometimes not.

Read the scenario assigned to you (many of these are based on real stories):

- A. A boss sees an employee who called in “sick” in a picture that someone posted on Facebook. In this picture the employee is partying the night before. The boss fires the employee.
- B. A company who has contracts with the Federal Government doesn’t want to hire you because a Facebook friend leaves lots of enthusiastic “legalize marijuana” postings on your wall.
- C. A teacher is fired because there’s a picture of this teacher holding alcoholic drinks on her MySpace page.
- D. Someone’s Netflix rental history is being used as evidence in a murder case because this person rented a lot of horror movies.
- E. An 18-year-old boy is charged with distributing child pornography when he uses his cell phone to send naked images of his 17-year-old ex-girlfriend to his friends.

Prepare a 3-5 minute presentation for the class that includes answers to the following:

1. Names of everyone in your group
2. The scenario you were assigned
3. In your scenario, did the people have the right to use the information they did or should it have been private? Why?
4. Are the people who were affected by the use of this information at fault? Why?
5. Give another example of something unexpected happening because of information shared at sites such as Facebook, Twitter, blogs.
6. Think about what data you’ve made available in different places/spaces such as Facebook, Twitter, texting, Netflix, email, at the grocery store, etc. What might other people think about who you are based on these data? Is it an accurate impression of who you are?
7. Consider each of the following broad categories of societal change:
 - Privacy
 - Safety
 - Globalization
 - Connectivity (keeping in touch with people)
 - Permanence of historical information

Discuss whether availability of data has had a positive or negative impact on each aspect of society and, if negative, how these consequences can be minimized.

Instructional Day: 10

Topic Description: Points of view: Telling a story with data

Objectives:

The students will be able to:

- Explain how different views of data can tell a different story
- Recognize that data is an incomplete record of reality
- Describe the limits of measurement (what can and can't be captured in data)

Outline of the Lesson:

- Journal Entry (10 minutes)
- Room Activity (45 minutes)

Student Activities:

- Complete journal entry.
- Groups complete first part of Room Activity.
- Groups share responses with another group.
- Groups complete second part of Room Activity and share responses.

Teaching/Learning Strategies:

- Journal Entry: What do you think about when you hear the word data? Where can it be found? Where does it come from?
 - Class discussion of journal entries
 - Write down ideas from students.
 - Emphasize that this lesson is meant to stretch their thinking about data.
- Room Activity
 - Assign various groups different versions of the Room Activity.
 - Depending on the amount of time available and the size of the class, you can have some students work with the picture (in the Supplemental Materials) and some work with the entire word list OR you can assign different subsets of the word list to different groups of students.
 - When each group is finished with their first 4 instructions, have them compare with a group that has a different version.
 - Have groups share their answers to #2 with the entire class.
 - Show groups the different versions of the room.
 - Have groups complete questions 5-7.
 - Have some groups share their answers for 5-7
 - Emphasize that the appearance of the data and amount of data collected inform the inferences that can be made.

- Homework: Complete Communications Methods and Data Chart and Data Journal
 - Explain that they will be adding to the Communications Methods Chart of the previous day by adding information about data.
 - Introduce the Data Journal.
 - Both of these assignments will be due on the first day of Unit 2.
 - Clarify questions.

Resources:

- Room Activity Picture (Supplemental Materials)
- Room Activity Picture Instructions (to go with the picture)
- Room Activity Entire Word List
- Room Activity Possible Word Subsets
- Communications Methods and Data Chart
- Data Journal

Room Activity Picture Instructions

Look at the picture displayed on your computer or on the handout provided.

1. Make a list of the objects in the picture.
2. What does this data tell you about the person who lives in this room? What does it not tell you?
3. What are most of the items in this room related to?
4. How many toy soldiers are there?

Now compare with the other group.

5. Are there any advantages to one representation or another?
6. Do you think different representations can tell different stories?
7. What do you think came first the drawing of the room or the list?

Room Activity Entire Word List

Look at the following list of items found in someone's room.

Laptop	Globe
Nintendo DS	Person
Mobile phone	Paintings (2)
iPod with ear buds	Shoe
PS3	Burger
Radio (2)	Books (75)
Television	Pizza
Toy Car (3)	Guitar
Calendar	Sandwich
Ribbons (3)	Goldfish
Sprite Can	Toy soldiers (3)
Plaques (3)	Pringles can
Gold Medal	
Phone	
Mug	
Trophy	
Picture Frame	
Posters (8)	
Harry Potter poster	
Lava lamp	
Glasses	
Violin	

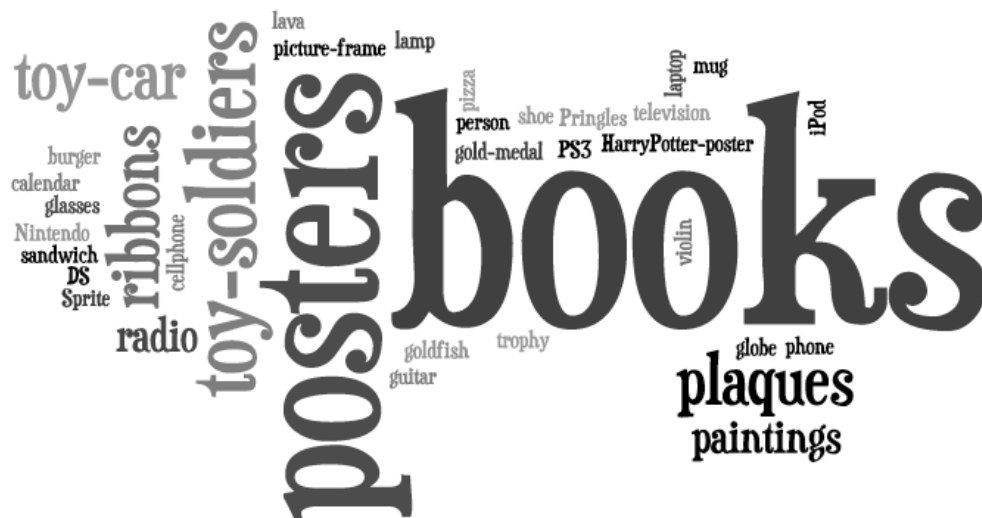
1. Draw a picture of the room including each of the items from the list above.
2. What does this data tell you about the person who lives in this room? What does it not tell you?
3. What are most of the items in this room related to?
4. How many Radios are there?

Now compare with the other group.

5. Are there any advantages to one representation or another?
6. Do you think different representations can tell different stories?
7. What do you think came first (the drawing of the room or the list?)

Room Activity Possible Word Subsets

1. Lava lamp, Books (10), Burger, Cell phone, Pringles can, Television, Calendar, Glasses, Lava lamp, Sandwich, Pizza, Paintings (2), Person, Sprite Can
2. Trophy, Pizza, Guitar, Sandwich, iPod with ear buds, Radio(2), Toy soldiers(3), Person, Shoe, Cell phone, Violin, Harry Potter poster, Ribbons(3), Sandwich, Laptop, Goldfish
3. Books (75), Burger, Globe, Gold Medal, Goldfish, Harry Potter poster, Phone, Paintings(2), Person, Plaques(3), Posters(8), Ribbons(3), Toy soldiers(3), Trophy, Violin
4. iPod with ear buds, Television, laptop, Radio(2), Cell phone, Guitar, Toy Car(3), Nintendo DS, PS3, Burger, Pizza, Person, Pringles can, Sprite Can
5. Word cloud pictured below.



Communication Methods and Data Chart

Let's look at what kinds of data you 'give off' when using the different forms of communication. For each of the following examples, fill in the table below with which method you would choose for the given scenario and why (You should already have completed that part.). Keep in mind that "data" here is not just the content you communicate (what you say or write) but could also refer to details like the time of a telephone call and the number.

The methods are:

- **Texting**
- **Phone call**
- **Talking in person**
- **Facebook**
- **Twitter**
- **Email**

Scenario to communicate	Method	What data is available?	Who has access to the data?	What can be learned from the data in aggregate?	Why you chose this method
1. Breaking up with a significant other (boyfriend/girlfriend)					
2. Asking parents' permission to do something when you think they will likely say 'no'					
3. Figure out where and when to meet a friend to see a movie					
4. Gossip about someone who could hear you if you spoke					
5. Gossip about someone not around you					
6. Getting help on homework					

7. Feedback on a big decision (like what color prom dress, what game to buy, what phone to get)					
8. Announce you met someone famous					
9. Complain about your parents					
10. Mourn someone you lost					
11. Buy something from someone you don't know well					

1. How does the type of data being exchanged affect which method you choose?

Name _____

Data Journal

During the next several days, take note of situations when you “generate data”. We’re looking for specific moments when some activity you perform can be observed, recorded and, possibly, combined with similar data from others. Ideally you will carry this paper with you and take notes over the course of your day. To start you off, think about what happens when you ride the bus or make a telephone call or browse a web site!

Time	Describe what you did to generate data

Instructional Days: 11-14

Topic Description: In this lesson, students learn how computers can be used as a tool for visualizing data, modeling and design, and art in the context of culturally situated design tools. Connections between the design of the tools and mathematics will be explored.

Objectives:

The student will be able to:

- Explain how computers can be used as tools for visualizing data, modeling and design, and art
- Identify mathematical connections in the output of the tools
- Edit an image using Photoshop

Outline of the Lesson:

- Research on the cultural background associated with the design tool (25 minutes)
- Design tool tutorials (30 minutes)
- Creation of designs using the design tools (65 minutes)
- Online presentation on how to get started using Photoshop (15 minutes)
- Design editing (30 minutes)
- Preparation of presentations (40 minutes)
- Group presentations (15 minutes)

Student Activities:

- Groups do research on the cultural background information associated with the design tools they are assigned and discuss their findings.
- Groups prepare and deliver brief presentations on the cultural aspects of their design tools.
- Students complete design tool tutorials.
- Groups create designs using the design tools.
- Watch an online presentation on how to get started using Photoshop.
- Edit images created with the design tools.
- Groups prepare presentations.
- Groups deliver presentations.

Teaching/Learning Strategies:

- Post the possible design tools:
 - Virtual Bead Loom
 - Pacific Northwest Basket Weaver
 - Navajo Rug Weaver
- Display the first page of each tool in order to give students an idea of what each does.
(<http://www.csdtrpi.edu>)

- Students divide into groups to work on the tool of their choice. Group sizes will depend on the size of the class. You may need to have more than one group per tool.
- Each member of the group should go through the entire cultural background section individually.
 - Answer any questions posed in the section in their journal.
 - Look for and write down the mathematical connections.
- All group members discuss the section.
 - Resolve answers to questions and mathematical connections.
- Each member of the group completes the tutorial.
 - Students should go through the tutorial at their own pace, but discuss with other members as questions arise. (Note: The bead loom tutorial is online; the other two are not. The print versions included here have been adapted from the bead loom tutorial.)
 - Encourage students to record in their journal points that they want to remember.
- Groups create designs using the Grade 4-12 Math software.
 - Each person should choose one of the goal pictures for practice and discuss any issues with the other group members.
 - Groups decide whether they want to create one design as a group or have multiple designs for their presentation.
 - Groups work on design/designs—these should be their own creations rather than a mimic of one of the preloaded designs.
- Edit designs with Photoshop (or another photo editor of choice).
 - Have students watch the online tutorial and create an account.
 - Edit the design.
- Prepare presentations to include:
 - Culture—an explanation in their own words
 - Math connections—an explanation in their own words
 - Demo of software
 - Display of designs—include a written description of how they created their design
- Groups deliver presentations
 - Groups respond to questions from other students and teacher.
 - Specifically ask what did the computer scientists who created the tools need to know? (computer science, graphics, culture, anthropology, visual arts, language arts, history)
- Display of designs—include a written description of how they created their design.

Resources:

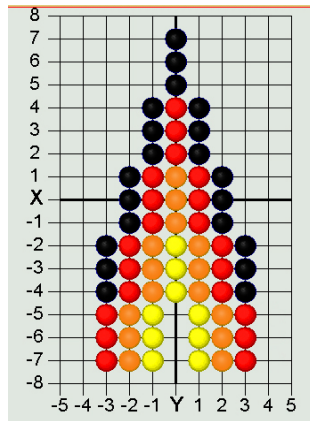
- Culturally Situated Design Tools—<http://www.csdtrpi.edu> (site and adaptations of tutorials courtesy Ron Eglash)
- Virtual Bead Loom Tutorial
- Pacific Northwest Basket Weaver Tutorial
- Navajo Rug Weaver Tutorial
- Culturally Situated Design Tools Project Sample Rubric

- <http://www.photoshop.com>

Virtual Bead Loom Tutorial

Part 1

The Virtual Bead Loom simulates the same grid pattern as the traditional bead loom. Users place colored circles in columns (the Y-axis) and rows (the X-axis).



There are several tools for placing beads on the virtual loom. In each case you use the "tab" key or the mouse to move your cursor to the field for entering the coordinates, then you enter them, and then press the button for the shape tool. The point tool places a single bead:

x =	2	y =	2
-----	---	-----	---

The line tool places lines of beads. You specify the two endpoints of the line. Diagonal lines tend to be jagged, but resizing the grid can help that (see "Options menu" on next page).

x1 =	-3	y1 =	-3
x2 =	3	y2 =	3

The rectangle tool fills in a rectangle of beads. You specify two vertices (lower right and upper left). The rectangles of this tool are always aligned with the axes.

x1 =	-3	y1 =	-3
x2 =	3	y2 =	3

Part 2

The triangle tool fills in a triangle of beads. You specify the three vertices.

x1 = -3	y1 = 1
x2 = 0	y2 = 4
x3 = 3	y3 = 1

The iterative triangle tool: Our first triangle tool made jagged edges, while traditional beadwork has beautifully regular edges. We interviewed some native beadworkers, and found that their algorithms were iterative. The triangle iteration tool reflects this tradition of indigenous mathematics. For example, the triangle in the beadwork at the top of this page was made by adding one bead on each side of the row, every three rows, as you go in the -Y direction.

Starting at x=0 y=0
 after every 3 rows
 add 1 to both ends
 for 9 rows in total
 in the ☐ +y ☒ -y direction.
☐ -x ☐ +x

- "Direction"—determines in which direction your rows will accumulate
- Starting at X, Y—that is the center of the starting row.
- "After every ___ rows"—lets you determine how many rows you go through before adding more beads to the end.
- "Add ___ to both ends"—the number of beads that will be added on each side of the center each time.
- "For ___ rows in total"—how many rows you will bead in this triangle.

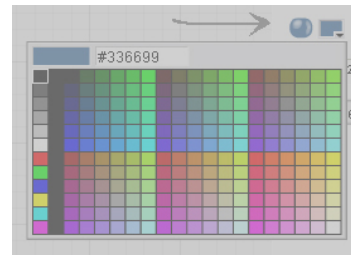
Note that this tool has two colors—some traditional bead work shifts color in each iteration. This allows you to select the starting color and ending color; the software does the shifting for you.

Part 3

There are also controls that apply to all the tools. "Clear" deletes everything. Normally "Create" is selected, so that your tools will fill their specified shape with beads. "Remove" will erase all beads in the specified shape, so if you make an error use "undo" not "remove." The color button allows you to select the bead color. Clicking on the little square in the upper right of the screen will give you a list of all the colors you have selected so far. The "Save" menu allows you to save the work on your hard drive and edit the design later. Make sure your file name is only letters, not spaces or numbers, and that you go back to the same computer when you want to edit your work.

The "Options" menu allows you to resize the grid smaller or larger—maximum size is 150 by 150. You can also change the location of the coordinate values, hide the grid, or create a title or notes about your design. You can also switch to Wampum beads, using either traditional 1X2 Wampum or a 1X1 Wampum (which is easier for math teaching—special thanks to Joyce Lewis of the Onondaga Nation for that concept!).

Printing: after you have your design completed, do a screen capture. In windows you can do that by pressing the "print screen" button on your keyboard, usually located at the upper right above the F10 key. On a Macintosh press shift + apple + 3 at the same time (also shift + apple +4 to select just a portion). That screen capture will save an image of the entire screen to your clipboard. You can then paste the clipboard image into a blank canvas in Word, Photoshop, Imaging (comes free in the "Accessories" folder in Windows) or other image editor.



Pacific Northwest Basket Weaver Tutorial

Part 1

The Virtual Basket Weaver simulates the same grid pattern as the traditional basket weaving loom. Users place colored circles in columns (the Y-axis) and rows (the X-axis).



There are several tools for placing wefts on the virtual loom. In each case you use the "tab" key or the mouse to move your cursor to the field for entering the coordinates, then you enter them, and then press the button for the shape tool. The point tool places a single weft:

x =	2	y =	2
-----	---	-----	---

The line tool places lines of wefts. You specify the two endpoints of the line. Diagonal lines tend to be jagged, but resizing the grid can help that (see "Options menu" on next page).

x1 =	-3	y1 =	-3
x2 =	3	y2 =	3

The rectangle tool fills in a rectangle of wefts. You specify two vertices (lower right and upper left). The rectangles of this tool are always aligned with the axes.

x1 =	-3	y1 =	-3
x2 =	3	y2 =	3

Part 2

The triangle tool fills in a triangle of wefts. You specify the three vertices.

x1 =	-3	y1 =	1
x2 =	0	y2 =	4
x3 =	3	y3 =	1

The iterative triangle tool: Our first triangle tool made jagged edges, while traditional basket work has beautifully regular edges. The triangle iteration tool reflects the tradition of indigenous mathematics. For example, a triangle can be made by adding one weft on each side of the row, every three rows, as you go in the -Y direction.

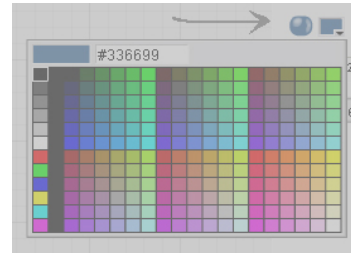
Starting at x=0 y=0
 after every 3 rows
 add 1 to both ends
 for 9 rows in total
 in the ☐ +y ☒ -y direction.
☐ -x ☐ +x

- "Direction"—determines in which direction your rows will accumulate
- Starting at X, Y—that is the center of the starting row.
- "After every ___ rows"—lets you determine how many rows you go through before adding more wefts to the end.
- "Add ___ to both ends"—the number of wefts that will be added on each side of the center each time.
- "For ___ rows in total"—how many rows you will weft in this triangle.

Note that this tool has two colors—some traditional basket work shifts color in each iteration. This allows you to select the starting color and ending color; the software does the shifting for you.

Part 3

There are also controls that apply to all the tools. "Clear" deletes everything. Normally "Create" is selected, so that your tools will fill their specified shape with wefts. "Remove" will erase all wefts in the specified shape, so if you make an error use "undo" not "remove." The color button allows you to select the weft color. Clicking on the little square in the upper right of the screen will give you a list of all the colors you have selected so far. The "Save" menu allows you to save the work on your hard drive and edit the design later. Make sure your file name is only letters, not spaces or numbers, and that you go back to the same computer when you want to edit your work.



The "Options" menu allows you to hide the grid, or create a title or notes about your design.

Printing: after you have your design completed, do a screen capture. In windows you can do that by pressing the "print screen" button on your keyboard, usually located at the upper right above the F10 key. On a Macintosh press shift + apple + 3 at the same time (also shift + apple +4 to select just a portion). That screen capture will save an image of the entire screen to your clipboard. You can then paste the clipboard image into a blank canvas in Word, Photoshop, Imaging (comes free in the "Accessories" folder in Windows) or other image editor.

Navajo Rug Weaver Tutorial

Part 1

The Virtual Rug Weaver simulates the same grid pattern as the traditional rug loom. Users place colored circles in columns (the Y-axis) and rows (the X-axis).



There are several tools for placing wefts on the virtual loom. In each case you use the "tab" key or the mouse to move your cursor to the field for entering the coordinates, then you enter them, and then press the button for the shape tool. The point tool places a single weft:

x =	2	y =	2
-----	---	-----	---

The line tool places lines of wefts. You specify the two endpoints of the line. Diagonal lines tend to be jagged, but resizing the grid can help that (see "Options menu" on next page).

x1 =	-3	y1 =	-3
x2 =	3	y2 =	3

The rectangle tool fills in a rectangle of wefts. You specify two vertices (lower right and upper left). The rectangles of this tool are always aligned with the axes.

x1 =	-3	y1 =	-3
x2 =	3	y2 =	3

Part 2

The triangle tool fills in a triangle of wefts. You specify the three vertices.

x1 =	-3	y1 =	1
x2 =	0	y2 =	4
x3 =	3	y3 =	1

The iterative triangle tool: Our first triangle tool made jagged edges, while traditional rug work has beautifully regular edges. The triangle iteration tool reflects the tradition of indigenous mathematics. For example, a triangle can be made by adding one bead on each side of the row, every three rows, as you go in the -Y direction.

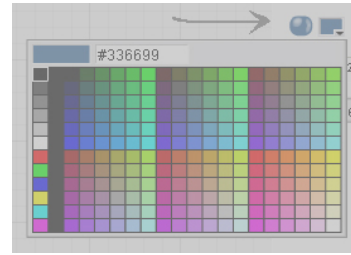
Starting at x=0 y=0
 after every 3 rows
 add 1 to both ends
 for 9 rows in total
 in the ☐ +y ☒ -y direction.
☐ -x ☐ +x

- "Direction"—determines in which direction your rows will accumulate
- Starting at X, Y—that is the center of the starting row.
- "After every ___ rows"—lets you determine how many rows you go through before adding more wefts to the end.
- "Add ___ to both ends"—the number of wefts that will be added on each side of the center each time.
- "For ___ rows in total"—how many rows you will weft in this triangle.

Note that this tool has two colors—some traditional basket work shifts color in each iteration. This allows you to select the starting color and ending color; the software does the shifting for you.

Part 3

There are also controls that apply to all the tools. "Clear" deletes everything. Normally "Create" is selected, so that your tools will fill their specified shape with wefts. "Remove" will erase all wefts in the specified shape, so if you make an error use "undo" not "remove." The color button allows you to select the weft color. Clicking on the little square in the upper right of the screen will give you a list of all the colors you have selected so far. The "Save" menu allows you to save the work on your hard drive and edit the design later. Make sure your file name is only letters, not spaces or numbers, and that you go back to the same computer when you want to edit your work.



The "Options" menu allows you to hide the grid, or create a title or notes about your design.

Printing: after you have your design completed, do a screen capture. In windows you can do that by pressing the "print screen" button on your keyboard, usually located at the upper right above the F10 key. On a Macintosh press shift + apple + 3 at the same time (also shift + apple +4 to select just a portion). That screen capture will save an image of the entire screen to your clipboard. You can then paste the clipboard image into a blank canvas in Word, Photoshop, Imaging (comes free in the "Accessories" folder in Windows) or other image editor.

Culturally Situated Design Tools Project Sample Rubric

Group Members Names: (up to 4)

_____	_____
_____	_____

Do you have?	Points Possible	Yes	No	Points Earned
Product				
Title with group members' names	5			
Information related to the culture (explanation in own words)	10			
Mathematical connections (explanation in own words)	10			
Demo of software	5			
Display of designs (explanation of how the design was created)	15			
Design is original	10			
Design has been edited with a photo editor	10			
Presentation				
All group members participate	10			
Present all required parts of project	15			
Answer questions from audience	10			
Extension				
Project exhibits creativity above and beyond	Up to 10			
TOTAL:	100 + 10			

Instructional Days: 15-16

Topic Description: This lesson introduces the concept of a computer program within the context of a set of instructions for completing a common activity.

Objectives:

The student will be able to:

- Explain the concept of a computer program

Outline of the Lesson:

- Following directions (55 minutes)
- Designing a program (15 minutes)
- Running a program (25 minutes)
- Being more precise with instructions (15 minutes)

Student Activities:

- Complete the Following Directions quiz.
- Complete the Drawing Pictures Activity.
- Write the instructions for making a peanut butter and jelly sandwich.

Teaching/Learning Strategies:

- Following directions
 - Distribute copies of Following Directions Quiz to each student face down in front of them. Each student should have a blank piece of paper and a pencil as well.
 - Give the students five minutes to do the quiz. Make note of how many students stand up and shout “hooray.”
 - Collect the papers when time has expired.
 - Point out that a perfect paper is one which has only the word “December” written in the top left corner. (The directions said to read all parts of the test before doing anything and step 14 says to only complete step #3.)
 - Give students about 10 minutes to complete the Drawing Pictures Activity.
 - Ask volunteers to show their pictures and explain why they drew the pictures as they did.
 - After the first volunteer, ask if someone drew it differently.
 - Ask the students what following directions has to do with computers. Prompt them as necessary that a computer follows a specific set of instructions called a computer program and must follow all of the directions precisely.
- Designing a program

- Ask the students to write down a set of instructions for a computer to make a peanut butter and jelly sandwich. (Check in advance to determine if any students have peanut allergies. Other spreads can easily be substituted.) Give them 5-10 minutes to write down these instructions.
- Collect the instructions.
- Running a program
 - Take out the bread, peanut butter, jelly, and knife and put them on your desk. Pick a set of instructions for making a sandwich (best to pick one which is not too detailed).
 - Read each instruction and carry it out—literally. For example, if the first instruction is “put the peanut butter on the bread,” take the jar of peanut butter and put it on the loaf of bread. If an instruction says to “spread the peanut butter on the bread,” use your fingers rather than a knife. If an instruction says to “cut the sandwich in half,” be creative and cut it between the two slices of bread. In other words, your goal is to show that instructions need to be very precise.
 - Repeat the process with another set of instructions.
 - Highlight the implicit knowledge that students bring to the task and how that has to be “unpacked” for the computer.
- Being more precise with instructions
 - Clearly, no matter how precise they tried to be, the instructions for making a peanut butter and jelly sandwich were open to interpretation. Ask the students to brainstorm how we could overcome this problem so that a computer could follow the instructions and make a perfect sandwich each time.
 - Guide the students toward the idea that we need a better “language” than English for describing the instructions. This is, in fact, the idea behind a computer program. There is a limited set of instructions which define very precisely what the computer does. For example, we can have a computer turn on a “dot” of a specific color in a specific location on the screen. By having the computer turn on many different dots in different colors, we can have the computer draw a picture. Note though that we don’t have an instruction for the computer to “draw a picture of a house” as that’s much too general and too open for interpretation.

Resources:

- <http://www.justriddlesandmore.com/direct.html>
The basis for the “following directions” quiz (the quiz was modified slightly.)
- Following Directions Quiz
- Drawing Pictures Activity
- Bread, peanut butter, jelly, and a knife.

Following Directions Quiz

Directions: You have a 5 minute time limit to complete the parts of this quiz. Carefully read all of the parts of the quiz before doing anything. In order to ensure the accuracy of this quiz, you should not use more than the allotted time of 5 minutes. Good Luck!!

You may begin now!!

1. Write today's date—month-day-year in the top right hand corner of your quiz paper.
2. Write the answer to the following multiplication problem directly underneath the date on your quiz paper— $6 \times 5 = ?$
3. Write the name of the month that begins with the letter "D" in the top left hand corner of your quiz paper.
4. Add 15 to the answer you got in part #2, and write this new total directly underneath your answer for part #3.
5. In the lower left hand corner of your quiz paper, write the names of your favorite singer and your favorite group.
6. Just above your answer to part #5, write "This quiz is very easy."
7. In the lower right hand corner of your quiz paper, draw a rectangle and inside the rectangle draw a five pointed star. The size of these drawings is not important.
8. Directly above your answer to part #7, draw a row of three small circles. Once again, size is not important.
9. Write the name of the first president of the United States on the back of your quiz paper anywhere you choose. If you don't know who this is, write your own name instead.
10. Write the name of any country that begins with the letter "I" directly underneath you answer to part #2.
11. Stand up, shout "hooray!", and sit down.
12. Take the number of dwarfs in the Snow White story and add it to the number of bears in the Goldilocks story. Divide by 2. Write this total in the approximate center of your quiz paper.
13. Think of a number between 1 and 50. Double that number. Add 20. Add 6. Subtract 17. Subtract 9. Divide by 2. Write this number on your quiz paper directly underneath your answer to part #11.
14. Now that you have carefully read all of the parts so far, and you have not carried out any of the actual work, skip the next 2 parts and go back and only complete part #3.
15. The name of the first president of the United States is George Washington. He was president from 1789 until 1797. Add the 2 dates together to see if the total is less than 5000.
16. You should not be reading the end of the exam before the beginning of the exam, but now that you are here you have just wasted some of the time you may need to complete the quiz.

Drawing Pictures Activity

1. Draw a picture of a house in the middle of the page.
2. Draw a picture of a stick figure father, mother and daughter.
3. Draw a picture of a mustang next to the house.
4. Draw a picture of the sun in the sky.

Instructional Days: 17-19

Topic Description: The question “What is intelligence?” is addressed through discussion of the differences between humans and computers. Various models of machine learning are investigated along with the concept of natural language understanding.

Objectives:

The student will be able to:

- Explain the idea of intelligence especially as it relates to computers
- Explain what it means for a machine to “learn”
- Discuss whether computers are intelligent or whether they only behave intelligently

Outline of the Lesson:

- Journal Entry (15 minutes)
- Differentiation between humans and computers (95 minutes)
- A simple model of machine learning (55 minutes)

Student Activities:

- Complete journal entry.
- Complete CS Unplugged Activity 20: Conversations with Computers—The Turing Test.
- Interact with web-based chatterbots (Part I of The Computer Intelligence Activity).
- In groups, play several rounds of a guessing game (Part II of The Computer Intelligence Activity).

Teaching/Learning Strategies:

- Journal Entry: What is intelligence? Are computers intelligent? Why or why not?
 - Volunteers share their responses.
- Differentiating between humans and computers
 - CS Unplugged Activity 20: Conversations with Computers—The Turing Test
 - This activity can be downloaded from <http://csunplugged.com> From the menu, click on Activities, click on Turing Test, and then download the pdf for Activity 20. Note there are many additional resources listed that you may wish to explore.
 - It will be helpful for you to read through the entire activity before beginning it with your students. In addition to the explanation of the activity, it provides good background information that you will want to ensure is part of the discussion you have with students.
 - Based on the directions under “What to Do” (p. 214), assign and explain roles to 4 students.
 - Follow the remaining directions under “What to Do” (p.214-215).
 - Have students complete Part I of Computer Intelligence Activity.

- Assign each pair of students (students work with their elbow partner) two of the questions from the Turing Test Activity.
 - Discuss the results.
- A simple model of machine learning.
 - Have students complete Part II of the Computer Intelligence Activity.
 - Assign students to groups of 3 or 4 and assign each group 2 of the games in the activity.
 - Discuss the results.
- As part of the discussion make the distinction between a computer’s ability to perform some operations quickly and what it means to “know”.
 - Speed is not necessarily knowledge.
 - Humans are “smart”; computers are “fast” and follow code explicitly.
 - Intelligence is context dependent—e.g., being able to thrive in mountains versus downtown in a city. If you are familiar with a city, you can find streets easily, etc. whereas if you are a newcomer, you need to have a map and more precise instructions. This ties to the peanut butter and jelly sandwich example.

Resources:

- Computer Science Unplugged Activity 20: Conversations with Computers—The Turing Test (<http://www.csunplugged.com>), pp. 213-226
- Computer Science Unplugged Activity 20: Conversations with Computers—The Turing Test, p. 225—questions (one copy for each pair of students)
- Computer Science Unplugged Activity 20: Conversations with Computers—The Turing Test, p. 226—answers (one copy to post or display)
- Computer Intelligence Activity

Computer Intelligence Activity

Part I

A program passes [The Turing Test](http://en.wikipedia.org/wiki/Turing_Test) (en.wikipedia.org/wiki/Turing_Test) if a person can have a conversation with both it and a person and not be able to tell which one is the computer.

Try each of these chatterbots with the questions you were assigned. (Note: all of these websites were correct at the time of writing. You can also use a Google search to find these and others.)

1. Try to chat with [Eliza](http://nlp-addiction.com/eliza/) (http://nlp-addiction.com/eliza/). How realistic is she? Would she pass the Turing Test?
2. Try to chat with [Athena](http://Athena.blueinfos.com) (Athena.blueinfos.com). How realistic is she? Would she pass the Turing Test?
3. Try to chat with [Friend4U](http://virtualentities.com/friend4u) (virtualentities.com/friend4u). How realistic is she? Would she pass the Turing Test?
4. Try to chat with [InteliAvatar](http://inteliwise.com) (inteliwise.com). How realistic is she? Would she pass the Turing Test?
5. Which of the above chatterbots was the most like a real person?
6. What [Chatterbox Challenge](http://www.chatterboxchallenge.com) (http://www.chatterboxchallenge.com)?

Part II

1. Go to 20q.net. Choose your language (Think in American is recommended). Choose one of the games from the bottom that was assigned to your group. You are supposed to think of something in that category and answer the computer's questions by clicking them. The computer will try to guess what you chose in 20 questions or less. Play the game several times addressing each of the following:
 - Pick an item and see how many questions are required.
 - Choose the same item and see if you can make it require more questions
 - Repeat this with another item.
 - How intelligent is this? Would this pass the Turing Test?
 Play the second game you were assigned and repeat the process above.
2. The Turing test is a person checking to see if it is talking to a computer. Can you think of any occasions that a computer might want to know if it is talking to *another* computer or a real life person?