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## Data Representation, Binary Numbers, and Images

Wednesday, May 12, 2010



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## Admin Stuff

- My office hours will now be in 5336 HP
- Use forums to ask questions (email ok too)
- Fill in TA office hours survey!
- Be mindful of disturbing others in class
- We need a volunteer note taker



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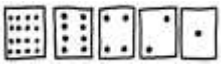
## Binary Numbers





-CS Unplugged activity: http://csunplugged.org/sites/default/files/activity_pdfs_full/unplugged-01-binary_numbers.pdf

-Introduction, using big printed cards at front of class

-Worksheet activity: Sending Secret Messages

-Worksheet activity: Email and Modems

-Worksheet activity: Counting Higher than 31

-Worksheet activity: More on Binary Numbers

-What's it all about?

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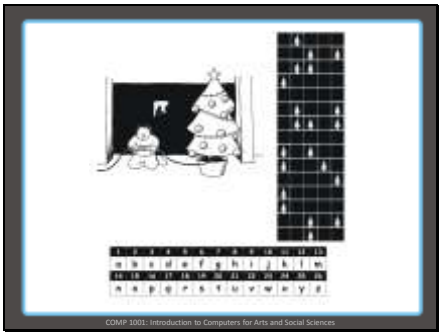


-From “Worksheet Activity: Sending Secret Messages” from the binary numbers CS Unplugged activity
-**Answer**: HELP IM TRAPPED

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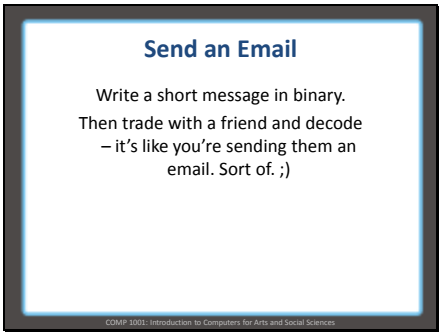

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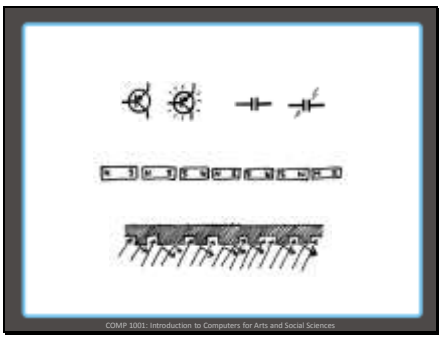


- Different ways of representing 1 and 0 from CS Unplugged binary activity "What's it all about"

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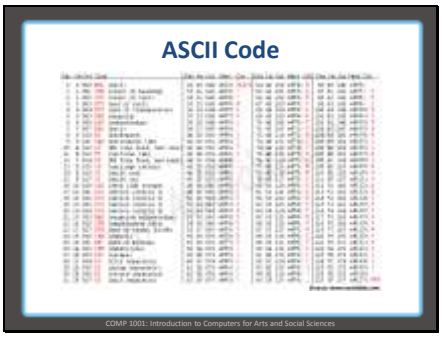


- Just like in the Christmas light code, we can represent a letter by a number (which will ultimately be binary in the computer)

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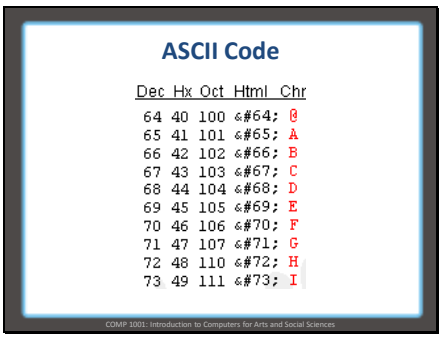

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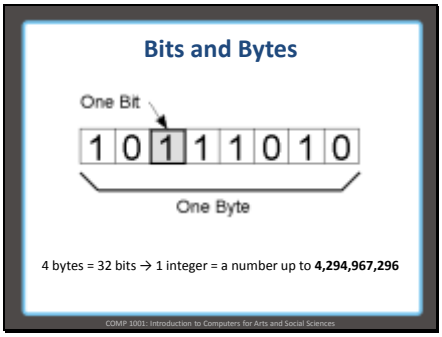


-It's more efficient for the computer to group bits together into groups of 8 (why 8? Was probably just easier to make hardware that supported it when it was decided)
-Usually:
    -1 byte for 1 character
    -4 bytes for 1 number
-Balancing act to decide between:
    -Using more bytes for a number (bigger numbers, but fewer of them)
    -Using fewer bytes for a number (smaller numbers, but more of them)
-By the way, 10111010 binary = 186 decimal

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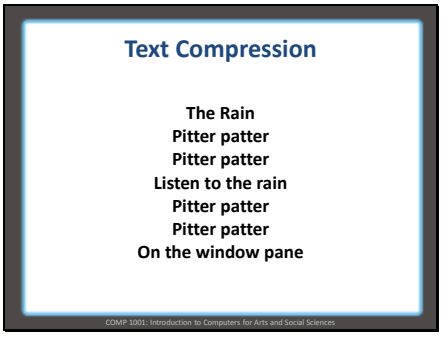


-CS Unplugged activity on text compression
    -http://csunplugged.org/sites/default/files/activity_pdfs_full/unplugged-03-text_compression.pdf
-What letters or words are repeated in this poem?

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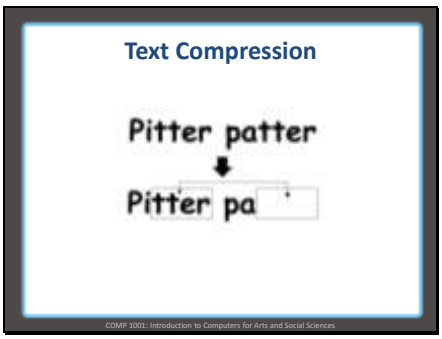


-Draw boxes around the first occurrence of a set of letters (two or more), then don't repeat those letters; just draw an arrow to the original

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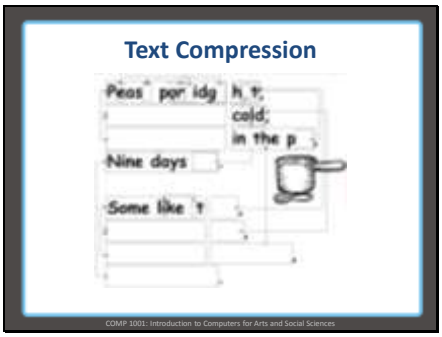


**Solution:**
Pease porridge hot,
Pease porridge cold,
Pease porridge in the pot,
Nine days old.
Some like it hot,
Some like it cold,
Some like it in the pot,
Nine days old.

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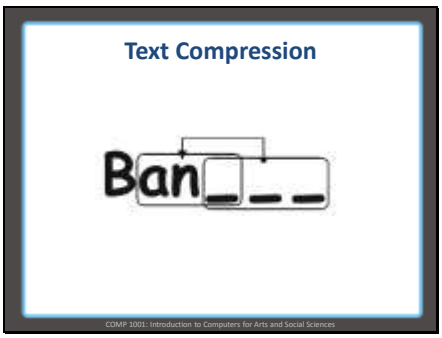


**Answer**: Banana

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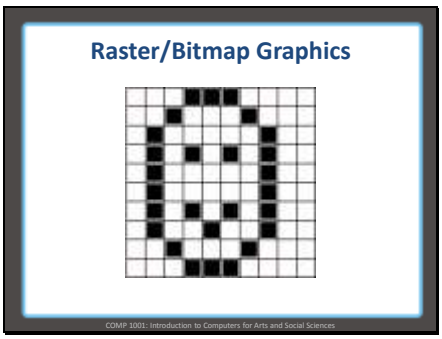


-Draw a picture in the spaces of a grid
-Lower resolution images have fewer pieces in the grid to fill in

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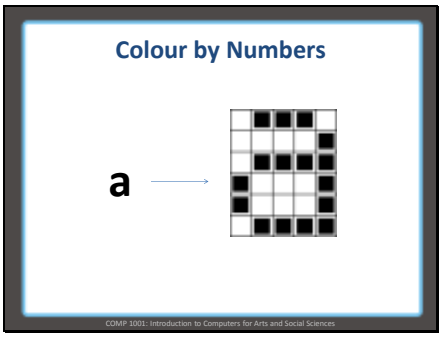


-CS Unplugged Activity: Colour by Numbers: Image Representation
-http://csunplugged.org/sites/default/files/activity_pdfs_full/unplugged-02-image_representation.pdf

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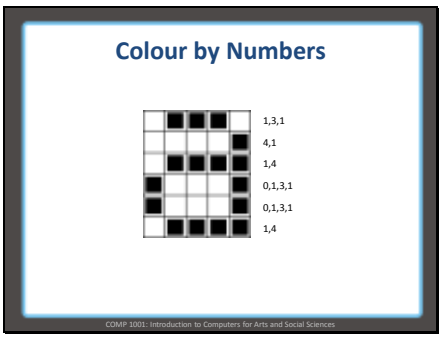


- CS Unplugged Activity: Colour by Numbers: Image Representation

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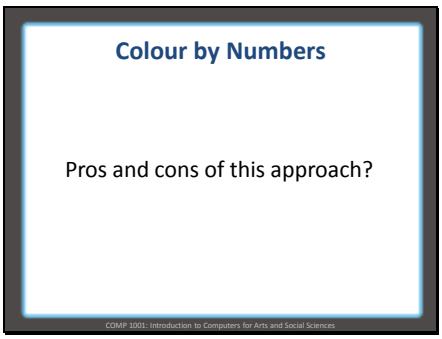


-CS Unplugged Activity: Colour by Numbers: Image Representation
-Pros:
    -Don't need to write out what each piece of the grid is supposed to be
    -Takes less space
-Cons:
    -When transmitting data something might get lost
    -Losing one number might affect the image a lot more
    -Harder to make work with something other than a black-and-white image

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-Each piece in the grid might be black or white, so just one bit per piece
    -If want more shades of gray, can use a whole byte per
    -1 byte = 8 bits = numbers up to 255 -> 255 shades of gray
-Colour photos:
    -Three colours – red, green, blue
    -How much of each colour?
    -Use one byte per colour = 3 bytes per piece
-Photographs are an example of a raster (aka bitmap) graphic
-Digital cameras have a sensor laid out, more or less, like a grid
    -Light hits the pieces of the grid and is recorded
    -More megapixels = more pieces of the grid
-A 'piece' in the grid is called a **pixel**

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-Vector graphics are made of individual shapes and curves
-They allow you to zoom in or stretch the image as much as you want without degrading the quality

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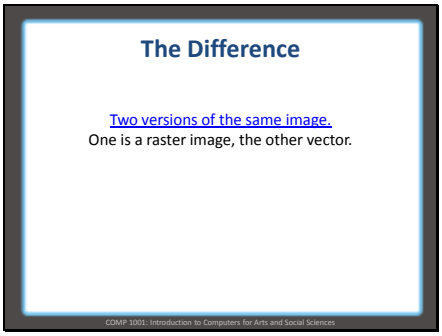


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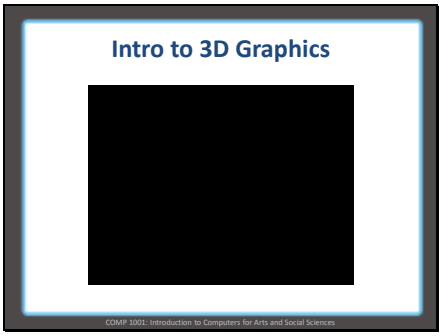


-Video introducing what 3D graphics are

-http://video.google.com/videoplay?docid=-5705559709668742546&q=intro+to+3d+graphics&ei=LxMhSMSpMY6y-wGStNDAAQ

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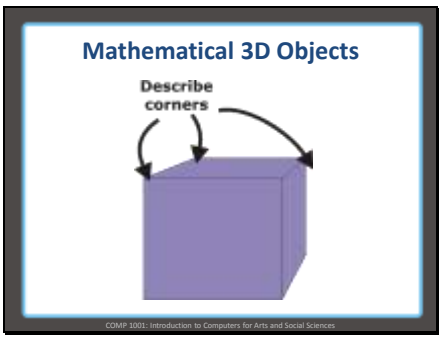


-Shapes in 3D graphics are defined by giving the locations of all their key points in 3D space, and how they are connected
-Curves require more complex information

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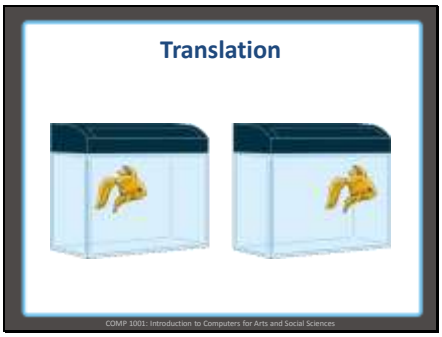


-The basic shapes can be manipulated
-For example, they can be translated, or simply moved

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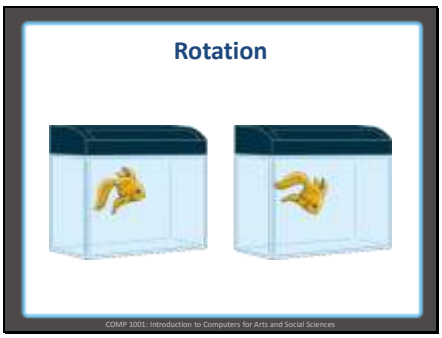


- Rotation can occur around any axis in three dimensions

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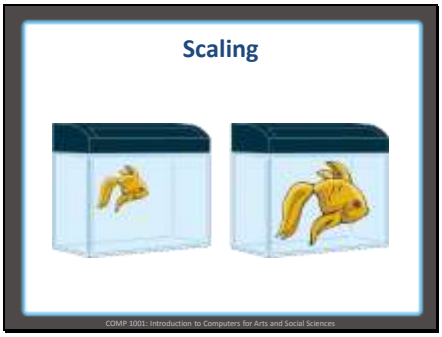


-Scaling is simply changing the size; this is possible because the shapes are defined like vector graphics
-Other transformations are possible, and they can all be combined in various ways

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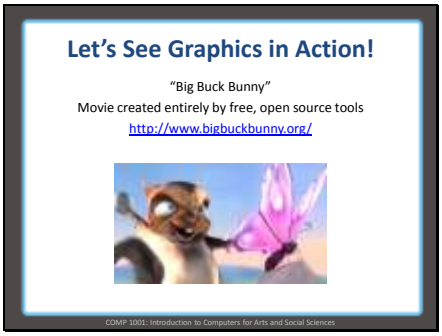


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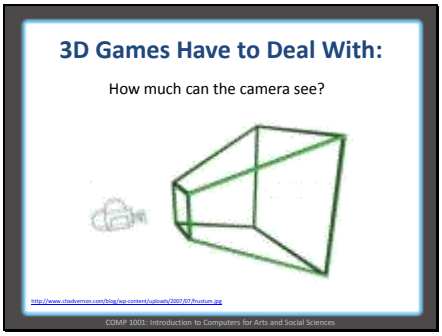

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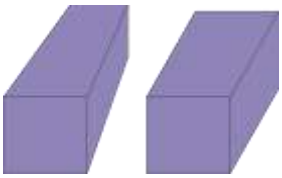
## 3D Games Have to Deal With:

Should objects further away look smaller?





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## 3D Games Have to Deal With:

Should objects further away look smaller?

YES →



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## 3D Games Have to Deal With:

Should objects further away look smaller?

NO →