CUSP – Real-world Science Workshop I: Scientific Measurements and Observations

Fleet-work:
In this workshop we have been examining the process of science. One of the critical features of scientific investigation is conducting valid and reliable measurements and observations.
A valid measurement refers to something that is considered accurate or "correct." For instance, if you measure the height of your instructor, Dr. Ed Price, you'd probably get 6' 2" tall. A measurement of 9 ft. tall is not valid. A reliable measurement is one that you can repeatedly or consistently achieve. If you were to measure his height to 6 significant figures (i.e. 6.13423 feet) it would be hard to get that consistently. Also it should be the case that you and a different person can repeatedly measure the same thing.

The exercises are designed to investigate the process of observation and measurement.

Measurement is the comparison of the known with the unknown. It involves a measurement device (known), interacting with the unknown, and an observation (detection).

Observation is the detection of an object (known or unknown) with a detector or detection system.

I. check out **Relative Motion Pendula.** Here two pendulums are running at the same time. First, convince yourself that you can trace out each of the four straight lines. Describe how you did this

Next the circles:

You observe the circular path of the center pendulum. Does it really travel in a circular path? Explain.

Did you make an observation or a measurement?

Label the known, unknown, detection system

Where (in this exhibit) would you have to place a camera to observe the center pendulum traveling in a circular path? Which part(s) of the measurement system are you changing?

II. Compare this to the **Silage beach.** This has to be done in pairs. Face your partner inside the tent. What do you observe (what / who appears to be moving)? What is your detector? What is known and unknown?

III. Check out the **About Faces Exhibit**. Start with both images down. At first impression do the two pictures seem the same?

Turn them upright. Do they appear the same?

What is changing, the known, unknown, or the detector?

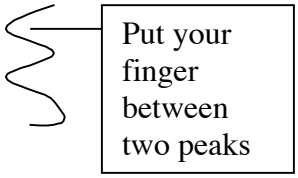
IV Spend time at the **Water Strobe.**
Draw a sketch of the path of the water with the strobe running at one frequency.

Draw a sketch of the path of the water with the strobe at a different frequency (faster or slower).

Press the button to turn on the incandescent (constantly illuminated) light.. Draw a sketch of the path of the water.

In each of these three scenarios has the water been changing its path? Explain.

Go back to the strobe scenario, Put your finger in between two of the side peaks of the vertical path of the water. Does it get wet? Explain.



What is changing? The path of the water? Your eye? The Light? What is the detection system comprised of? Can your finger count as a detector?

V: Try the same variations with the **Oscillinderscope**. Pluck one of the guitar strings the same way every time (hold it out the same amount). Change the speed of the drum behind it. What is going on? Explain this in terms of known, unknown, and detectors.

VI: Lastly, Go to the **Fragment of Jericho**. Where was Jericho?

Draw a sketch of the system. Identify the measurement device, the known and unknown.

What would happen if the width of the laser beam were more than on groove on the pot? Explain.

What if you changed the speed that the pot is turning? (think about a record player).

VII: identify **another exhibit** in the hall where you could explain what both OBSERVATION and MEASUREMENT are. Give a brief description of how you would explain this to someone who didn't know any science. Feel free to use analogies from your own life experience (for example, what you use a ruler for and how it is used, hint hint hint). Don't forget to include the known, the unknown, and the detection system.