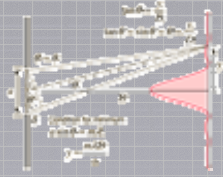


# Studio Optics Revisited



Summer 2006  
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# Summer Project

Studio Optics make-over Spring 2006 leaves several research ideas wide open...

General Idea:

- Test how the new labs work
- Use interviews to help out TA for Studio optics
- Insight on student procedure thru lab
- Insight on student reasoning thru lab

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# Session I

## Single-Slit Diffraction

Shine a laser onto a close adjustable slit. Slowly open the slit until the interference pattern appears on a distant screen or wall. Observe and sketch how the pattern changes with varying widths, and qualitatively explain. Can you calculate the wavelength of the laser? Compare this to the known wavelength of the laser. Note that you can also try to recreate the diffraction pattern by "squeezing" the laser beam with your thumb and index finger.

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Session I : Single Slit Diffraction  
Procedure behind interview...

•Consent Forms come first

Given the following along with Write-up:

- Large paper
- "giant" marker
- Calculator
- Hecht
- Green Laser
- Optics bench and accessories



- Students work through lab with minimal comments from observer(s) / interviewer
- Answer lab clarification questions from interviewee
- Asked that students explain their lab "notebook"

If students had apparent difficulty explaining their own write-up, interviews were guided toward related concept questioning based upon their own observations / writing.

ie)

What is diffraction?

Could you show me how two waves can add together? How they can cancel?

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# A project is reframed...

- Literature review brings forth new ideas::
- Student epistemologies (**their** views about the nature of knowledge and learning)
  - Knowledge as transmitted stuff (passed from one person to another)
  - Knowledge as fabricated stuff (knowledge built from prior knowledge)
  - Knowledge as free creation ("I made it up")
- Frames
  - Students' expectations of an event based on their interpretation of how it fits previous and similar experiences.

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## Goals for Session II

- Second Interviews must continue to focus on their procedural method and focus more on concepts
- Circular Diffraction and Poisson's Spot cut down to just Poisson's Spot
- Ask conceptual questions that are relevant to previous experiment
- Review old experiment with interviewee and clarify any areas that were unclear.

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## Session II

### ▪ Poisson's Spot

Expand the beam of the laser using a diverging lens. Put a circular obstacle with a diameter of a few mm in the beam (the spherical head of a stick pin works well) to create a shadow on a screen or wall a few meters away. Look at the shadow and observe and sketch Poisson's spot. Experiment with the position of the spherical obstacle.

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Start Question: Do you remember what you did last week?

Allowed interviewees to work through lab same way that we did in session I.

Lab is shorter; spent more time asking for verbal clarification

le)

- what do you think causes the image on the screen to occur?
- Could you show me the path of light with a picture?
- Does this remind you of anything you've seen in past experience?
- How about anything from our previous experiment?

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For those that hit a complete mental wall, a "nudge" was given.

Are you familiar with Huygens' Principle?

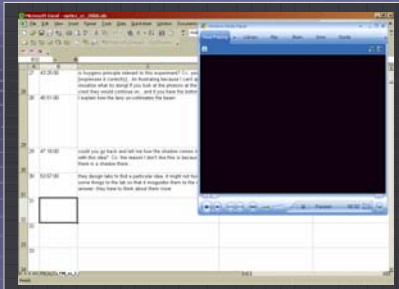
"Huygens Principle states that every point along the circumference of a circular obstacle, acts as a new point source of light when light shines on it."

Some interviewees found the nudge extraordinarily helpful; it came off as completely irrelevant to others.

If there was enough time, we reviewed sections of the previous interview so that I could answer any questions that I may have come up with in the meantime.



•For the majority of the interviews, I just typed the transcription directly into excel while keeping windows media player open on the side. (WMP has a setting that allows you to keep the window on top at all times)



This was after I spent a week "futzing" around with Transana, its codecs, and my computers' general hatred for the program.

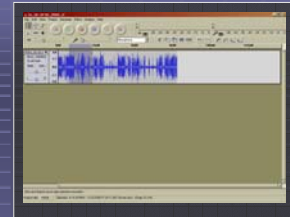
(Kudos Dyan, I don't know how you did it!)

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Quick note for my fellow PER comrades:

Audacity is Freeware

- Takes all sorts of sound files (I used .wav)
- Slows wav files as you would like
- Allows you to take clips of file for presentations or any other excuse



Audacity came in very handy for those few interviews that were clearly harder to hear on video.

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## Questions to be addressed:

- How do students frame their lab?[1]
- What effect does the observers' agenda have on the data interpretation? How does one detect and eliminate the "research interest filter"? [4,5]
- What cognitive and epistemological knowledge do they activate? [3]
- Do students' transfer what they learned previously? [1]
- Where do their resources come from?

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## Current Objective:

- Review Transcriptions
- Take Note of any noticeable patterns
- Review Literature
- Answer Questions to be addressed if data allows

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## Literature!

1. Hammer, D., Elby, A., Scherr, R. E., & Redish, E. F. (2005). Resources, framing, and transfer. In J. Mestre (Ed.), *Transfer of Learning from a Modern Multidisciplinary Perspective* (pp. 89-120). Greenwich, CT: Information Age Publishing.
2. Gray, K.E., Hrapic, Z. (2003) *Implications of a framework for student reasoning in an interview, 2003 Proceedings of the Physics Education Research Conference, Madison, WI, ID: PERC Publishing.*
3. Hammer, D., & Elby, A. (2002). On the form of a personal epistemology. In P. R. Pintrich & B. K. Hofer (Eds.), *Personal Epistemology: The Psychology of Beliefs about Knowledge and Knowing* (pp. 169-190). Mahwah, N.J.: Lawrence Erlbaum
4. Wittmann, M.C., Scherr, R. E. (2002) *Student epistemological mode constraining researcher access to student thinking: An example from an interview on charge flow, 2002 Proceedings of the Physics Education Research Conference, Boise, ID: PERC Publishing.*
5. Wittmann, M.C., Scherr, R. E. (2002) *The challenge of listening: the effect of researcher agenda on data collection and interpretation, 2002 Proceedings of the Physics Education Research Conference, Boise, ID: PERC Publishing.*

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# Thank You!

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