


# Student Ideas about Wavefront Aberrometry\*

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\* Supported by NSF grant DUE 04-27645



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## Introduction

- Part of Modern Miracle Medical Machines
  - Introductory physics concepts applied to medical imaging techniques
  - Investigate transfer<sup>1</sup> of previous knowledge to new contexts
- Wavefront Aberrometry
  - Relatively new method
  - Gaining popularity
  - Used in LASIK procedures

1 - Green(1993), Rebelo(2005)

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## Physics of Wavefront Aberrometry

- A low-power laser beam is shone into the eye and focused on the retina.
- The light is reflected back through the eye.
  - It passes through the media, lens, and cornea, so it picks up those aberrations.
- Light exits the eye through an array of tiny lenses.


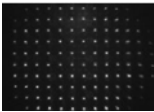



Image from www.optics.ru

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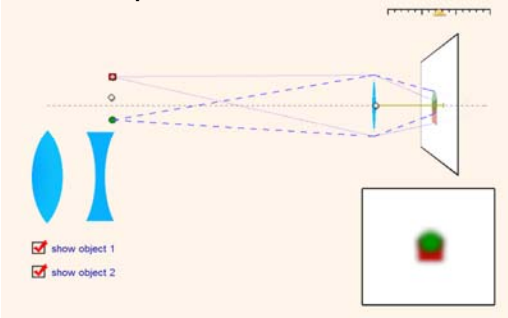
## Instructional Materials

(Still being developed)

- Progressive development of eye model
  - Starts with pinhole eye
  - Add single lens
  - Add accommodation ability
    - Then defines the parts of human eye
- Vision defects
- Diagnosis methods

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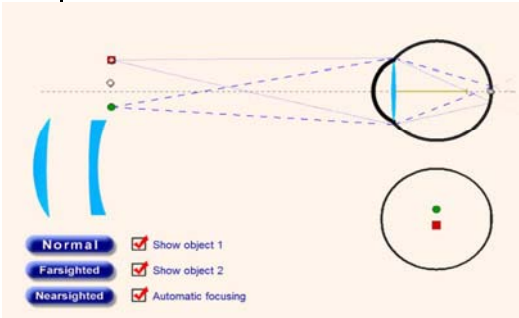
## Computer Simulation



show object 1  
 show object 2

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## Computer Simulation cont'd



**Normal**  Show object 1  
**Farsighted**  Show object 2  
**Nearsighted**  Automatic focusing

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## How do students build an understanding of wavefront aberrometry?

- No expectation of prior knowledge
- Prior experience with optics

- Conduct research to follow how students develop a model of aberrometry

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## Modeling Aberrometry



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## Reasoning Resources<sup>1</sup> Used to Understand Aberrometry

- Light moves as a straight line (9 of 12)
- Light entering a lens differently will focus differently (10 of 12)
- Big change on grid means a big aberration (4 of 12)
  - Phenomenological primitive<sup>2</sup>

1 - Hammer (2001) 2 - Sessa (1993)

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## Subjectivity vs Objectivity

Notion of subjectivity shifts from one part of the interview to the other:

- Objectivity is like a test
  - Same for everyone
  - Errors average out
- Objectivity means no interpretation
  - Human error removed

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## Conclusions


- Students were very responsive to learning about aberrometry
- Many students had the reasoning resources appropriate for understanding aberrometry
  - Need to figure out how to activate them
  - Scaffolding

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## Future Work

- Currently conducting two-part interviews
  - Work through eye material
  - Aberrometry
- Subjectivity/Objectivity - further investigation
- Best way to activate necessary resources?
- Transfer from eye lesson to aberrometry?

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## Acknowledgements:

Hartmut Wiesner and Giuseppe Colicchia  
Lehrstuhl fuer Didaktik der Physik  
Ludwig Maximilian University

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# THANK YOU!

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