Waves and Light

In Week 1 we'll introduce light and look at some examples of how it is relevant to art. We'll then cover some elementary properties of waves and light.
Class Session: Waves & Light
20fa01.pdf *PowerPoint slide presentation for synchronous Zoom class*
20fa01_h.pdf *6-up slides for exam review*

I. Required watching/reading

Problems of Philosophy (*Bertrand Russell*)
Philosophy.pdf
The Case of the Color-Blind Painter (*Oliver Sacks*)
Color-BlindPainter.pdf
Introduction to waves
https://www.youtube.com/watch?v=c38H6UKt3_I
Waves *by Khan Academy* (13:02 minutes)
Introduction to wave parameters
https://www.youtube.com/watch?v=tJW_a6JeXD8
Properties of Periodic Waves *by Khan Academy* (14:26 minutes)
Architects of Air Video
https://www.youtube.com/watch?v=YVYSKN6I6Zc
Luminarium *by Alan Parkinson* (9:50 minutes)
James Turrell - Roden Crater video
https://vimeo.com/67926427
James Turrell's Roden Crater (8:04 minutes)

II. Optional/additional reading

Class Project (*by Hao Lin*): Camera Obscura
HaoLin.pdf
Science + Art in New York
SciArt.pdf
Fiction Informed by Science (*by A.S. Byatt*)
Fiction.pdf
Aesthetic perception, art, and science (*by composer Roger Reynolds*)
AstheticPerception.pdf
Experimental physics, experimental art (*by filmmaker Ken McMullen*)
ExperimentalPhysics.pdf
Turning 3D to 2D: Your body is my canvas
https://www.youtube.com/watch?t=9&v=UMn2q35HBeQ
Your body is my canvas TED Talk *by Alexa Meade* (7:04 minutes)

Ray Tracing

This week we'll start to look at the technique known as Ray Tracing how the wave properties of light affect its behavior. We'll cover light interference and how images are produced in pinhole cameras and mirrors.

Class Session: Ray Tracing

20fa02.pdf *PowerPoint slide presentation for synchronous Zoom class*

20fa02_h.pdf *6-up slides for exam review*

I. Required watching/reading

Specular & Diffuse Reflection

https://www.khanacademy.org/science/physics/geometric-optics/reflection-refraction/v/specular-and-diffuse-reflection

specular-and-diffuse-reflection *by Khan Academy* (10:59 minutes)

Image Formation

https://www.youtube.com/watch?v=SCgrQIPx_3E

Physics 11.1.2a - Image Formation *by Derek Owens* (3:44 minutes)

Virtual Images

https://www.youtube.com/watch?v=nrOg85VPQgw

Virtual Images *by Khan academy* (7:52 minutes)

Why do mirror flip things?

https://www.youtube.com/watch?v=6tuxLY94LXw

Richard Feynman Mirror *by Richard Feynman* (3:15 minutes)

II. Optional/additional reading

Class Project (*by Trent Steelman*): Ray Tracing and Rendering

Steelman.pdf

Colliding Worlds - *Arthur I Miller*

CollidingWorlds.pdf

Ray Tracing at Pixar Studios

https://www.khanacademy.org/computing/pixar/rendering/rendering1/v/rendering-1

What is Ray Tracing *by Khan Academy* (3:28 minutes)

Interference

https://www.youtube.com/watch?v=blur0MemUQA

Wave Interference *by Khan Academy* (14:28 minutes)

How to build a Jelly Baby Wave Machine

https://www.youtube.com/watch?v=VE520z_ugcU

Wave Machine Demo *by National Stem Centre* (4:10 minutes)

Museum of Light

https://www.vice.com/en_us/article/53wbad/take-an-electrifying-look-inside-the-worlds-first-light-art-museum

Center for International Light Art Unna (Germany)

Refraction & Curved Mirrors

This week we will introduce the concept of Curved Mirrors, where the shape of the mirror drastically affects the behavior of light, and Refraction, the bending of light as it travels from one medium to another.

Class Session: Curved Mirrors

20fa03.pdf *PowerPoint slide presentation for synchronous Zoom class*

20fa03_h.pdf *6-up slides for exam review*

I. Required watching/reading

Rainbows

This is WNYC's Radiolab podcast on "Colors" *Hosted by Jad Abumrad, and Robert Krulwich*. Online as May 14,2012 Colors Sneak Peak and May 21,2012 Colors at:
https://www.wnycstudios.org/podcasts/radiolab/podcasts/28
Sneak Peak (10:04 minutes); Colors (1:07:17 hours)

Parabolic Mirrors & Real Images: Part I

https://www.youtube.com/watch?v=8X1AS9qD5AQ
Parabolic mirrors 1 *by Khan Academy* (11:36 minutes)

Parabolic Mirrors & Real Images: Park II

https://www.youtube.com/watch?v=7m0u6dxA5Xo
Parabolic mirrors 2 *by Khan Academy* (12:48 minutes)

Refraction & Snell's Law

https://www.youtube.com/watch?v=y55tzg_jW9I
Refraction and Snell's Law *by Khan Academy* (14:23 minutes)

II. Optional/additional reading

Class Project (*by Sophia Dorfsman*): Reflection

Dorfsman.pdf

20 Ways to See the Light (*Johnathon Keats*)

20Ways.pdf

Convex Parabolic Mirrors

https://www.youtube.com/watch?v=dWY25vb1ZB0
Convex Parabolic Mirrors *by Khan Academy* (5:59 minutes)

Snell's Law & Lenses

This week we introduce Snell's Law that describes how light bends when it travels from one medium to another. We work through a few examples, and see how Total Internal Reflection can occur when the incoming angle is too great. We also see a few examples of refraction in nature and art. Finally, we introduce convex lenses and how they create images.

Class Session: Snell's Law & Refraction

20fa04.pdf *PowerPoint slide presentation for synchronous Zoom class*

20fa04_h.pdf *6-up slides for exam review*

I. Required watching/reading

Tim's Vermeer

https://www.youtube.com/watch?v=q0pxP8PUIKU

Tim's Vermeer (1:19:58 hours)

A link to the YouTube version of the 2013 movie is provided above (Amazon $2.99 Rent, $12.99 Buy) It is also available on iTunes, and on loan from the Department Office.

NOTE: Students in previous years have also found free copies on the web.

Convex lenses

https://www.youtube.com/watch?v=K0sjZ5nqQ7g

Convex lenses *by Khan Academy* (9:22 minutes)

Convex lens examples

https://www.youtube.com/watch?v=xxF_mdoZom0

Convex lens examples *by Khan Academy* (9:35 minutes)

II. Optional/additional reading

Class Project (*by James Kittel*): Light Rays and Refraction

Kittel.pdf

Convex Parabolic Mirrors

https://www.youtube.com/watch?v=dWY25vb1ZB0

Convex Parabolic Mirrors *by Khan Academy* (5:59 minutes)

Hockney-Falco Thesis

This website on the *Hockney-Falco* thesis describes the work *by David Hockney and Charles Falco* on the use of lenses and mirrors in art throughout history. This material is the subject of the movie *Tim's Vermeer* and Hockney's book *Secret Knowledge.*

https://wp.optics.arizona.edu/falco/art-optics/

Vermeer's Secret Tool - Vanity Fair

https://www.vanityfair.com/culture/2013/11/vermeer-secret-tool-mirrors-lenses

Adjustable liquid filled eyeglasses

https://www.ted.com/talks/joshua_silver_adjustable_liquid_filled_eyeglasses#t-263691

What Flat Lenses could do for photography!

https://www.premiumbeat.com/blog/this-new-flat-lens-may-revolutionize-the-lens-industry/?utm_source=facebook&utm_medium=post&utm_content=This-New-Flat-Lens-May-Revolutionize-the-Lens-Industry&utm_campaign=03-2015-facebook-posts

Trig refresher

https://www.youtube.com/watch?v=ZffZvSH285c

Unit Circle Definition of Trig Functions *by Khan Academy* (10:12 minutes)

Artist Joseph Morris - Glass & Light drawings

https://emotivemachine.net

Photography and the Eye

Starting with the eye, we cover various vision problems. We then move onto photography and cover areas including focusing, Bokeh, circles of confusion, depth of field, depth of focus, thin lens and magnification formula, f-number and types of cameras.

Class Slides: **More lenses in preparation for photography & the eye File**

20fa05.pdf *PowerPoint slide presentation for synchronous Zoom class*

20fa05_h.pdf *6-up slides for exam review*

I. Required watching/reading

Properties of Camera Lenses

https://www.youtube.com/watch?v=CGGUXAMliqM

Properties of Camera Lenses *by Filmmaker IQ* (20:50 minutes)

Depth of Field

https://www.youtube.com/watch?v=34jkJoN8qOI

A Simple Guide to Depth of Field *by Dylan Bennett* (16:28 minutes)

The Human Eye

https://www.youtube.com/watch?v=cTZl2qnzifc

The structure of the eye *by Khan Academy* (10:27 minutes)

III. Optional/additional reading

Class Project (*by Alexandra Chan*): Tilt and Shift Photography

Chan.pptx

Convex Parabolic Mirrors

https://www.youtube.com/watch?v=dWY25vb1ZB0

Convex Parabolic Mirrors *by Khan Academy* (5:59 minutes)

Vintage structure of the eye (Video)

https://www.youtube.com/watch?v=QW4ugV7wcms

How The Eye Functions (1941) *by Knowledge Builders* (11:26 minutes)

Photography Readings

Photography 1: Understanding Depth of Field

https://www.cambridgeincolour.com/tutorials/depth-of-field.htm

Photography 2: Understanding Camera Lenses: Focal Length & Aperture

https://www.cambridgeincolour.com/tutorials/camera-lenses.htm

Photography 3: Understanding Camera Exposure: Aperture, ISO & Shutter Speed

https://www.cambridgeincolour.com/tutorials/camera-exposure.htm

Invention of Photography: In Our Time - Radio show

https://www.youtube.com/watch?v=O43lIgJwFF0 **(48:54 minutes)**

Lens formula proof

https://www.youtube.com/watch?v=rse0I7rZ8jM

Object Image/Focal Distance Proof *by Khan Academy* (12:28 minutes)

Overview of the camera

https://www.youtube.com/watch?v=qS1FmgPVLqw

How does a Camera Work *by Allversity* (14:43 minutes)

Three-eyed lizards are not uncommon. Four-eyed ones are a novelty

https://www.economist.com/science-and-technology/2018/04/05/three-eyed-lizards-are-not-uncommon-four-eyed-ones-are-a-novelty

Photography and the Eye – 2

Starting with the eye, we cover various vision problems. We then move onto photography and cover areas including *focusing, Bokeh, circles of confusion, depth of field, depth of focus, thin lens and magnification formula, f-number and types of cameras*.

Class Slides: **Photography and the human eye File**

20fa06.pdf *PowerPoint slide presentation for synchronous Zoom class*

20fa06_h.pdf *6-up slides for exam review*

I. Required watching/reading

Your homework this week is to start preparing for your midterm.

Mid-term Review Material - Courtesy Dr. Rosin

MidtermReviewMaterial.pdf