Administrive Details
To Do
Syllabus
Learning Outcomes
Computer Graphics: A Hierarchy
Perception

Computer Graphics

P. Healy

CS1-08
Computer Science Bldg.
tel: 202727
patrick.healy@ul.ie

Spring 2021–2022

Outline

1. Administrive Details
   - Meeting Times
   - General Issues
   - Assessment
2. To Do
3. Syllabus
4. Learning Outcomes
5. Computer Graphics: A Hierarchy
6. Perception
   - Human Factors

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Lectures / Labs

Lecture Hours:	Mon. 12.00,	*S206*
	Tue. 10.00	*S206*
Problem Solving:	Wed. 11.00	*S206*
Lab	Thu. 09.00	*CS3-(0)04B*
	Thu. 10.00	*CS3-(0)04B*
	Fri. 13.00	*CS3-(0)04B*

4 contact hours $\rightarrow$ 6 non-contact hours

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Class Home Page

1. All lectures, homeworks, past exams, etc. can be found on the class home page: `garryowen.csisdmz.ul.ie/~cs4815/` (also, `goo.gl/uLkL`)
2. Class lists and attendance records will also be available here

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Attendance

- Attendance at all lectures and labs / tutes is expected
- Handing up weekly lab exercises (8 of them) is mandatory – and a good idea

What's this about? Why is this on the slide?

Resources

- ICT in CS bldg. CS-1046
- Maths LC, http://www.ul.ie/~mlc/
- Teaching and Learning Centre, http://www.ul.ie/ctl/

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Assessment Instruments

Final:	60%	Week15
Weekly Lab Projects	30%	(8 weeks x 3.75%)
Mid-Term Exam	10%	Week07

- Labs, tutes start next week; read “Tute01” in your own time
- September repeat exam will count for same fraction as final (60%)
- So mid-term, doing weekly labs is really important

Grade Bands

F	0 – 29
D2	30 – 34
D1	35 – 39
C3	40 – 47
C2	48 – 51
C1	52 – 55
B3	56 – 59
B2	60 – 63
B1	64 – 71
A2	72 – 79
A1	80 – 100

Reading List

1. *Hearn, D., M. P. Baker, & W. R. Carithers*: **Computer Graphics with OpenGL** 4th International Edition (2011) Required
2. *Foley, J. D. et al.* **Computer Graphics: Principles and Practice** (2nd ed.) (1990)
3. *Angel, Edward*: **Interactive Computer Graphics** (3rd ed.) (2003)

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CS4815

- CS4815 (like school) (like life) is hard
- “Genius is one percent inspiration, ninety-nine percent perspiration.” Thomas Edison (Sept. 1932)
- “Not every legend is a myth, some are flesh and blood. Some legends walk among us, but they aren’t born, they’re built. Legends are made from iron & sweat, mind and muscle, blood and vision and victory. ...” Arnold Schwarzenegger

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To Do (for You)

- ➜ Linux password resetting will be done by Liam O'Riordan, `liam.oriordan@ul.ie`, (CS2-004) between 14.30 - 15.30 daily
- Don't forget to register online at `http://www.si.ul.ie`
- Sign up for Study Skills Workshop (Weeks 1, 2, 3) via the CTL's `Student Supports page`
- Maths / Erasmus / Exchange students: email your Name, ID, program of study to me, `patrick.healy@ul.ie`, in order to get a linux acct.

Detailed Syllabus

- Physical devices for graphics systems: Input and Output devices, Raster Scan devices, RGB colour systems, Video Memory Models; Implications of these for interactive graphics systems
- General structure of Interactive Graphics systems;
- Issues involved in digitising analogue information: antialiasing techniques.
- Design and implementation of drawing algorithms for basic shapes: Issues and techniques
- Establishing Device, Language and Application Independence: Conceptual levels in graphics systems
- Frames of reference and Viewing systems;

Detailed Syllabus (contd.)

- Control and manipulation of graphics elements: Input and Output primitives, Clipping functions, Transformation (rotation, scaling, translation, reflection, shears) and Segmentation functions.
- Transformations in 3-D; Projections; Viewing in 3D;
- Drawing Curves: Techniques, Properties of different types of curves
- Basic Modelling: Representation of surfaces via polygons; Realism; Hidden surface removal; Surface generation via bi-cubic curves; Rendering.

Learning Outcomes

Learning Outcome	**Ass. Method**
Without reference to a resource, students will be able to debug a number of graphic algorithms	Written exam
Participants will design and implement a program that makes controls and manipulates a number of graphics elements using affine transformations	Course work
Participants will design and implement a program that makes drawing curves and list the properties of different types of curves	Course work

Learning Outcomes (contd.)

Learning Outcome	**Ass. Method**
Participants will summarise in writing what are the elements of the RGB colour systems and formulate how these interact to produce an image	Written exam
Participants will summarise in writing what are the elements of human vision and perception that relate to the RGB colour systems	Written exam
Participants will summarise in writing how surfaces are represented via polygons and how this relates to realism and hidden surface	Written exam

Computer Graphics: A Hierarchy

- Hardware: Devices; Framebuffers; Refresh rates; Graphics Processor Unit (GPU)
- Basic Algorithms: Bézier curves; Affine transformations; Cohen-Sutherland algorithm for line clipping; Matrix representations
- Graphical components: Paths; Rectangles; Polygons; Circles
- Application Components: Frame; Buttons; Radio; Sliders; Pulldown Menus; Check Boxes; Event-based programming
- Human Factor: The eye; Cognition; Perception; Information Visualisation

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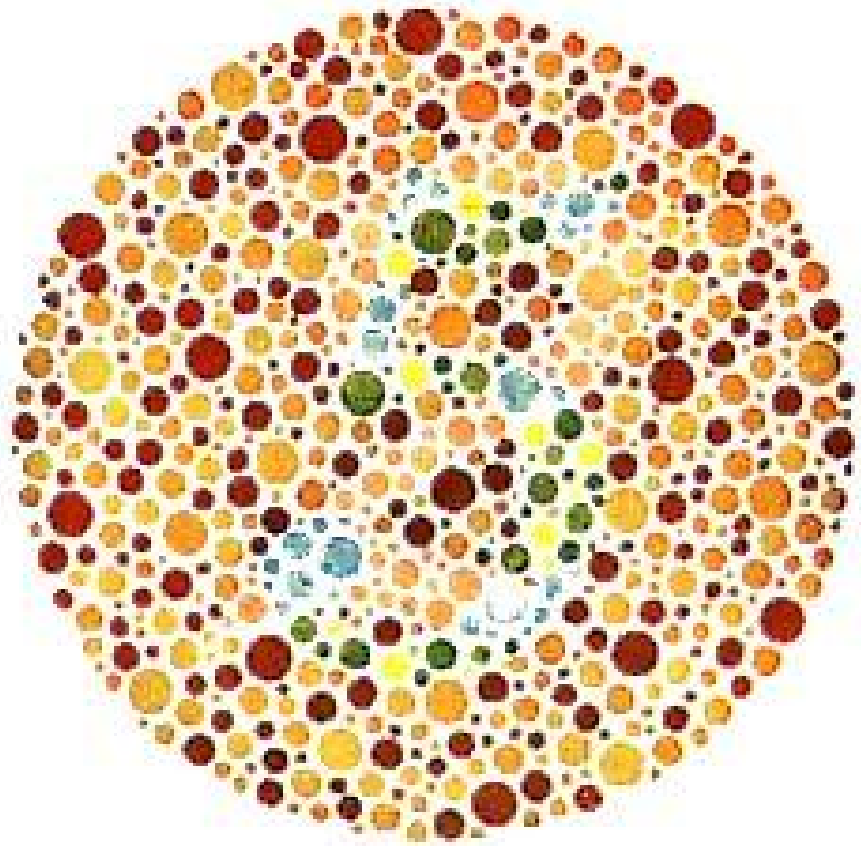
Colour

- Human perception responds to *luminance*
- Humans' "vision system" responds differently to different colours, so we need tools to describe and control colour
- Colour depends on interactions between the physics of light radiation and the eye-brain system
- How are colours described in numerical terms, and how do these descriptions relate to everyday ways of describing colour?
- Colour spaces: RGB, CMYK, HSV, Lab (http://en.wikipedia.org/wiki/Colour_spaces)

Colour

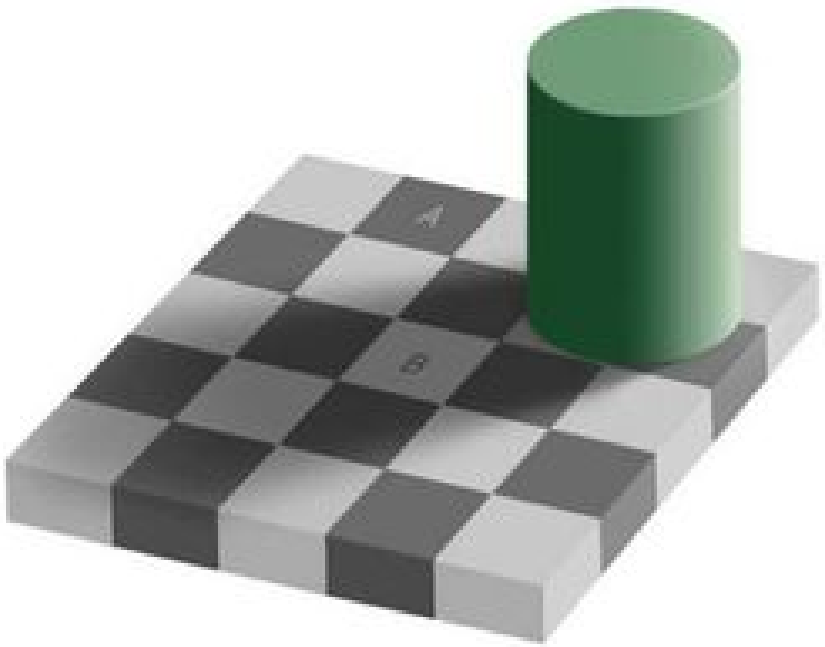


http://en.wikipedia.org/wiki/Colour-blindness

Contrast

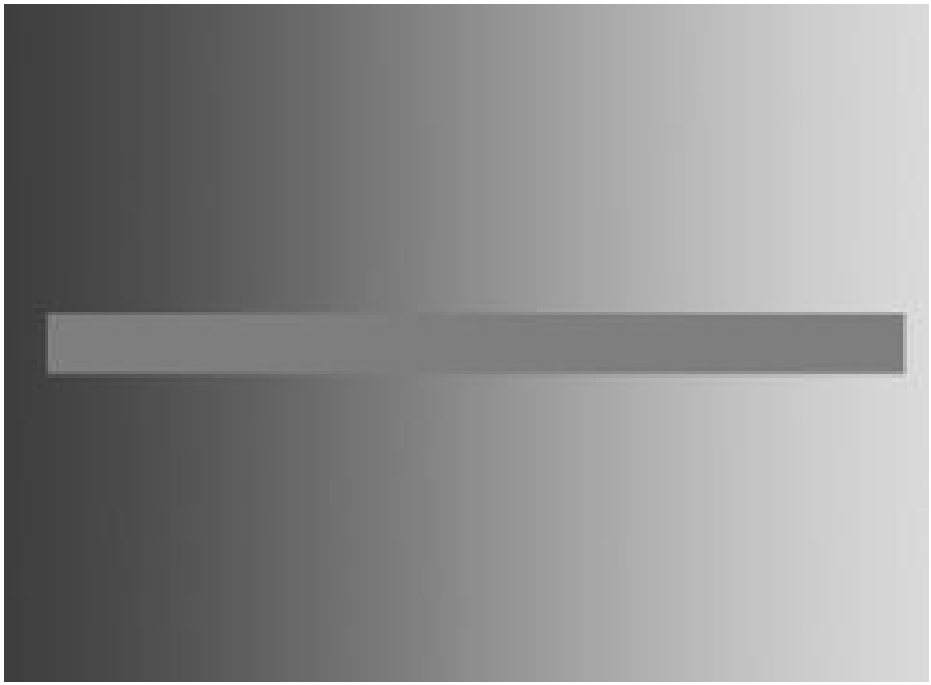
- Associated with luminance is *contrast*
- Hence dotted or dashed lines tend to be noticed by us more than solid lines (all other things being equal)
- When a *feature* becomes a **distraction**...
- Similarly, we are very good at picking up on movement in a scene (changes in contrast again?)

Is it or isn't it?



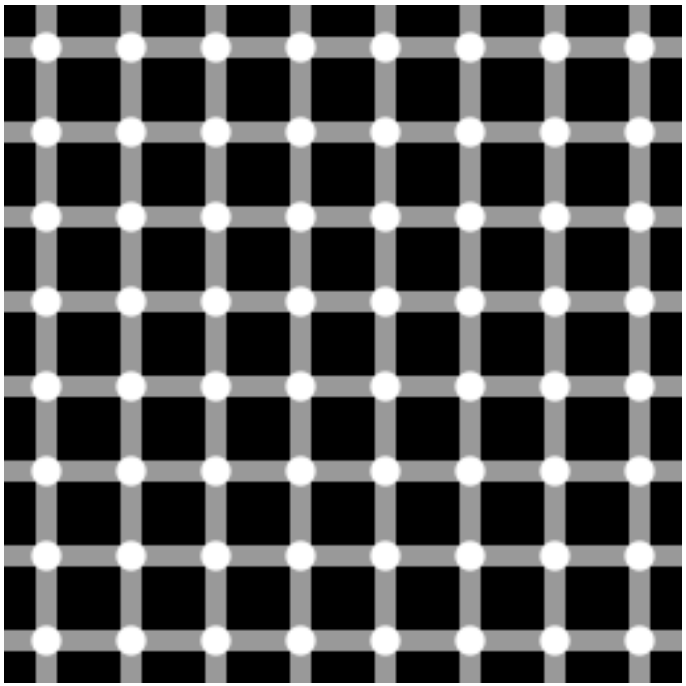
Squares 'A' and 'B' are actually the same shade

Is it or isn't it?



Centreline has even shading all the way across

Is it or isn't it?



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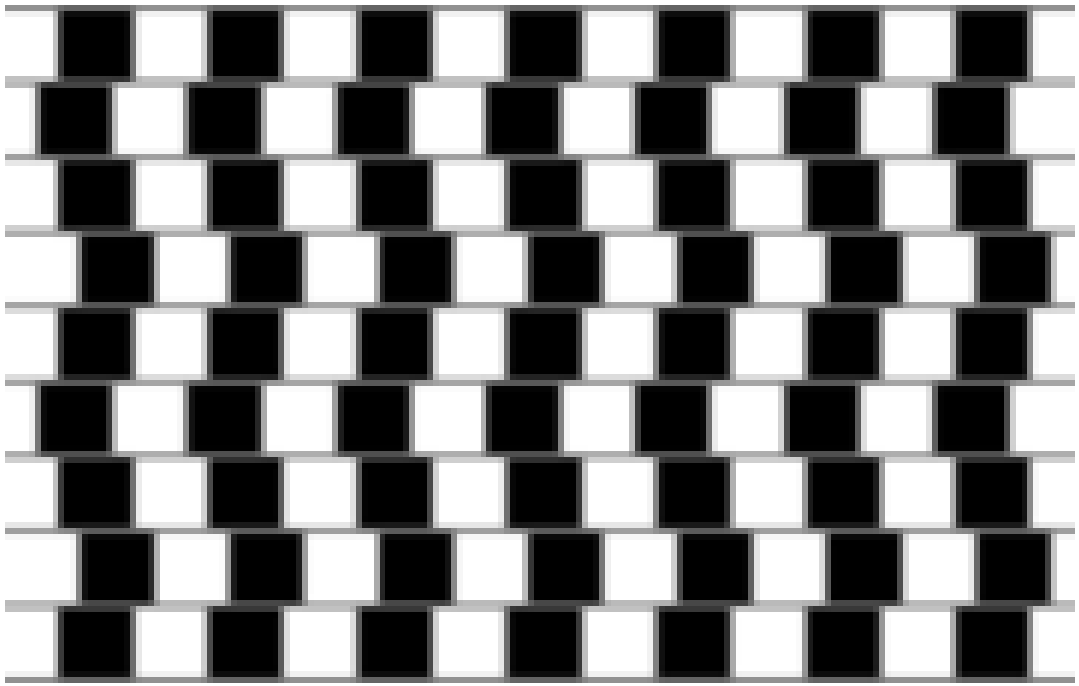

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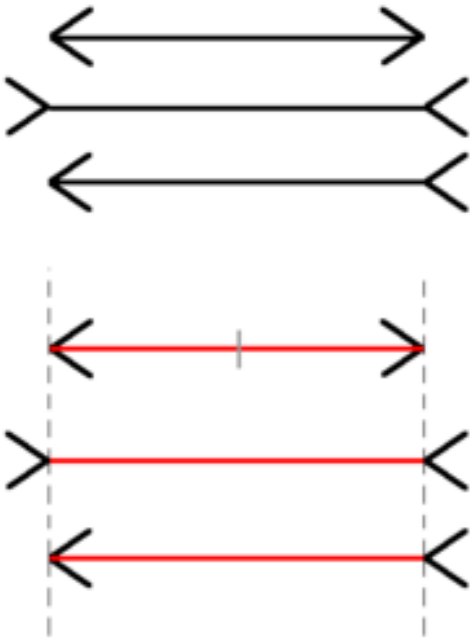

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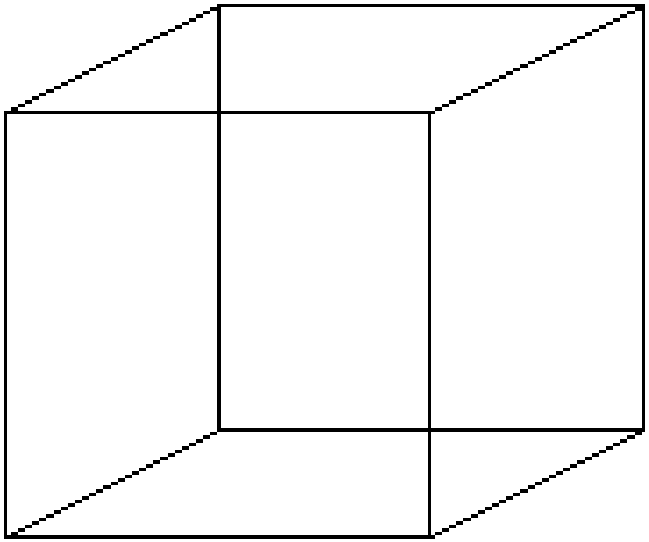

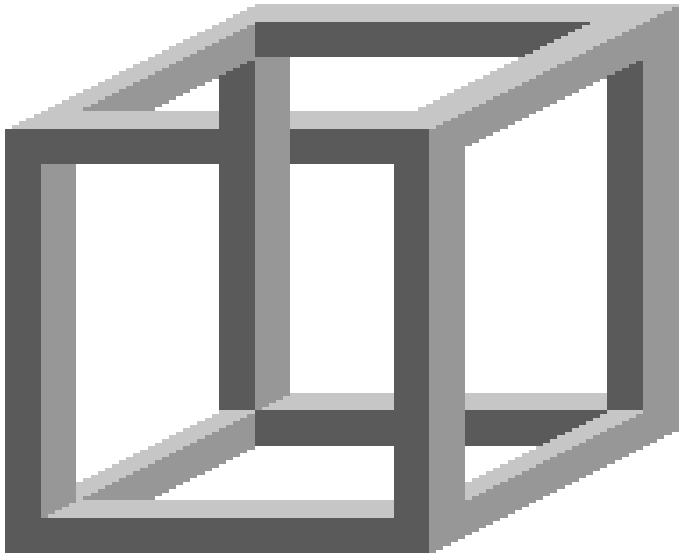

Is it or isn't it?

Other famous illusions:

- Rubin vase
- Anything by M. C. Escher (http://en.wikipedia.org/wiki/M._C._Escher)
- more at http://en.wikipedia.org/wiki/Optical_illusion