

# Fast Realistic Rendering

Pere-Pau Vázquez

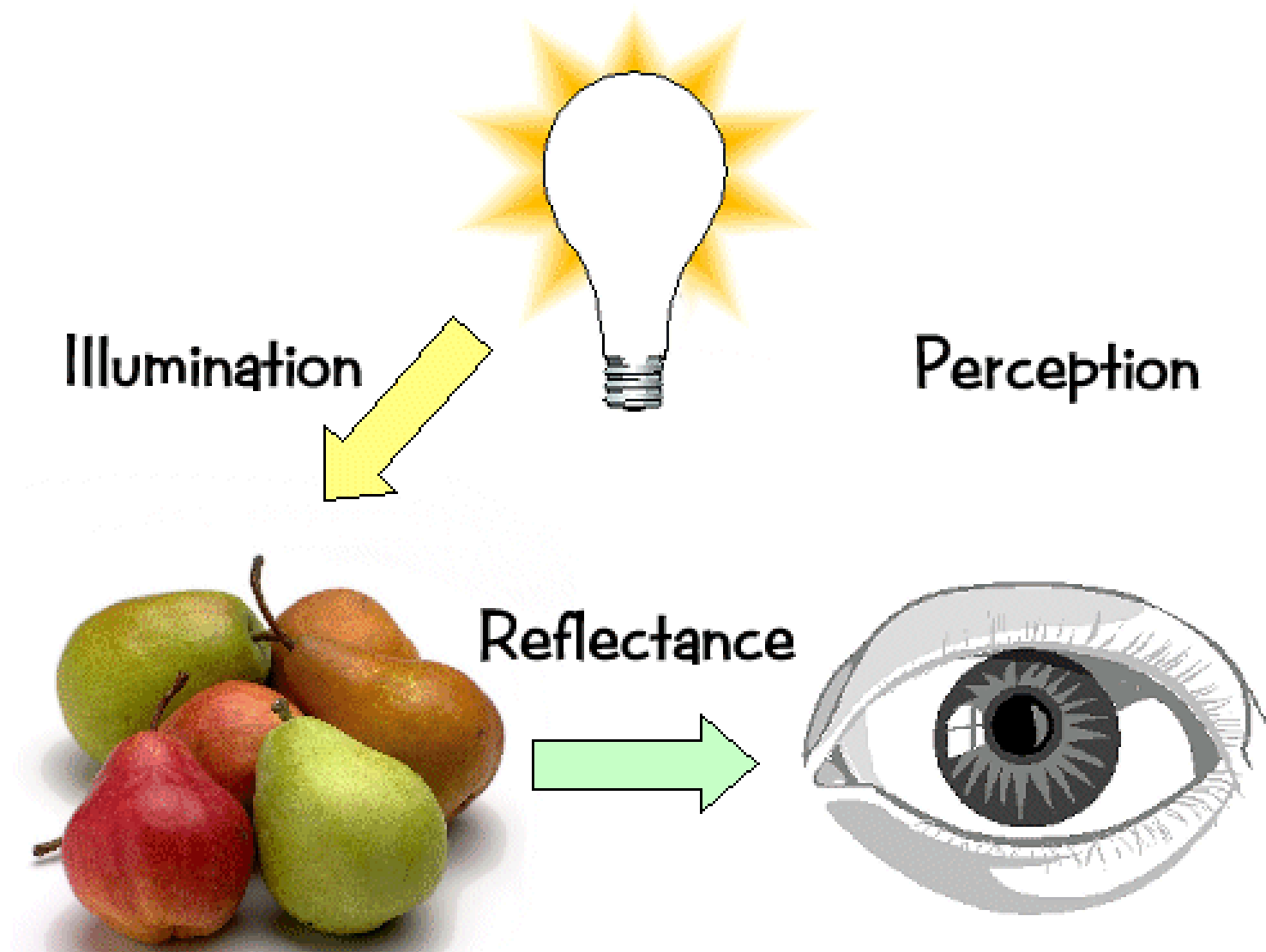
# Organization

- Pere-Pau Vázquez, [pere.pau@cs.upc.edu](mailto:pere.pau@cs.upc.edu),  
Omega – 137
  - Use “FRR” in subject

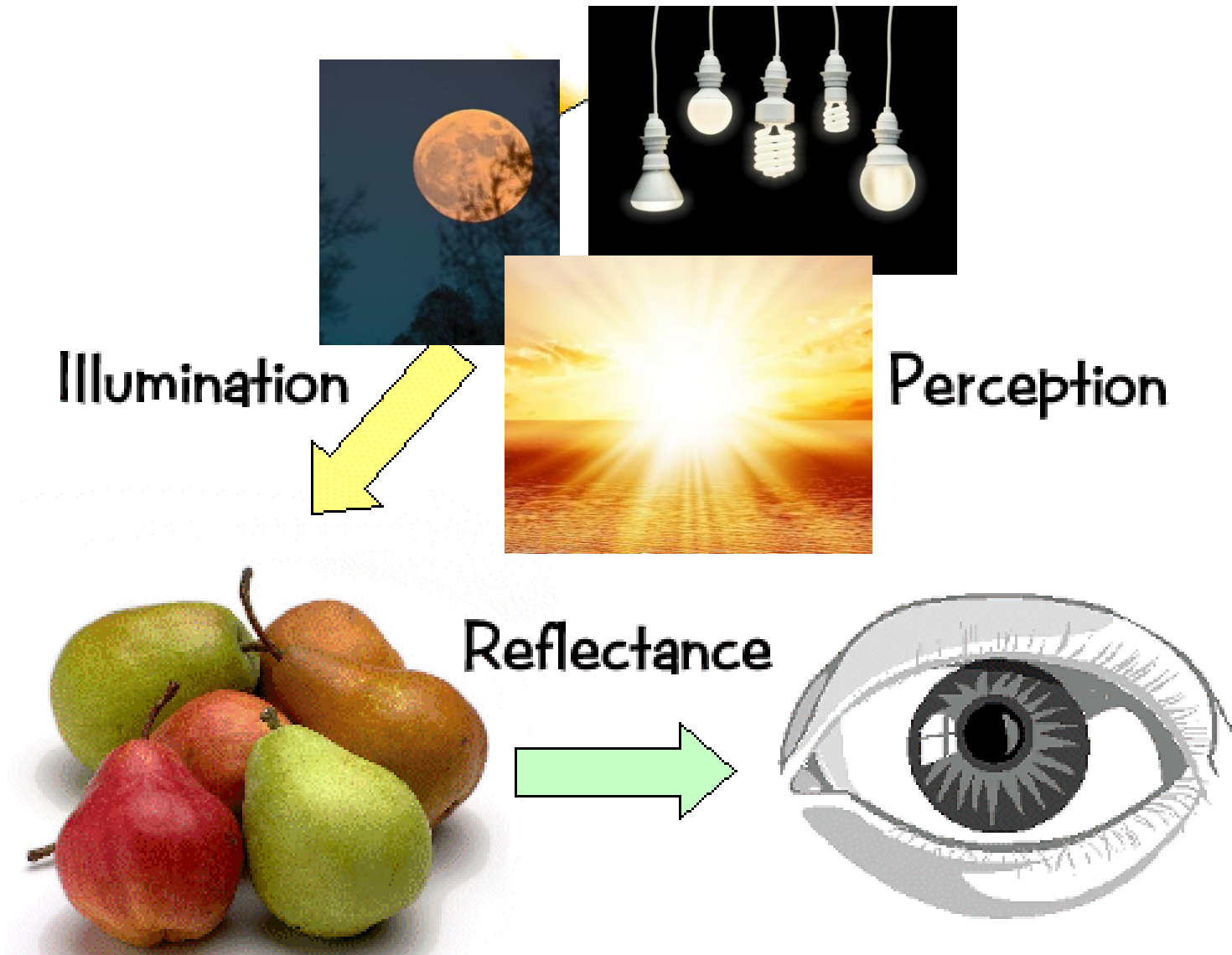
# What is Computer Graphics?

- CG is Image Synthesis
  - Computerized creation of images
  - Based on physics and light behavior

# What is Computer Graphics?

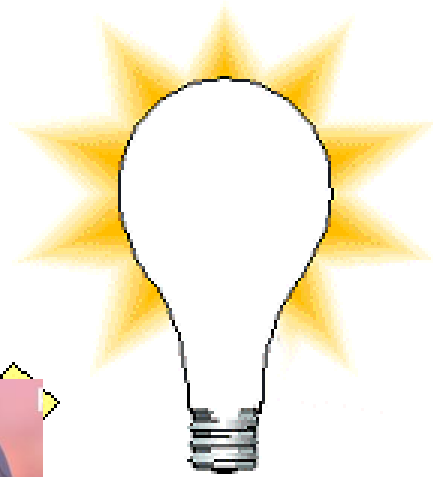


# Not all light sources are equal...



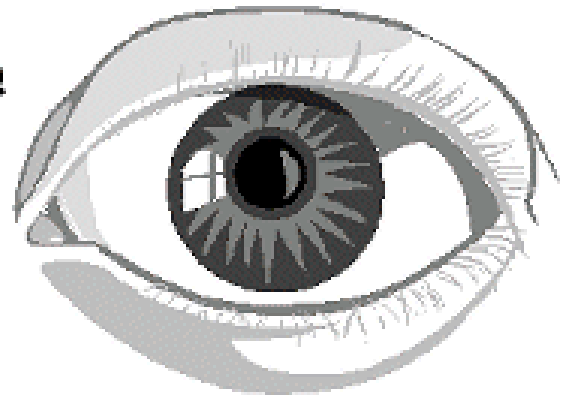
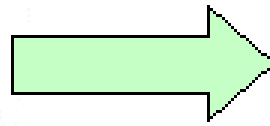
...not all materials are the same...

Illumination

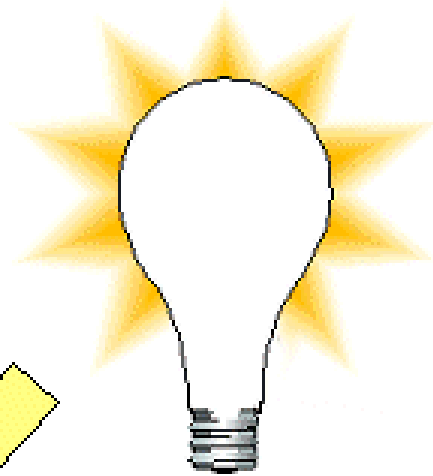


Perception

Reflectance



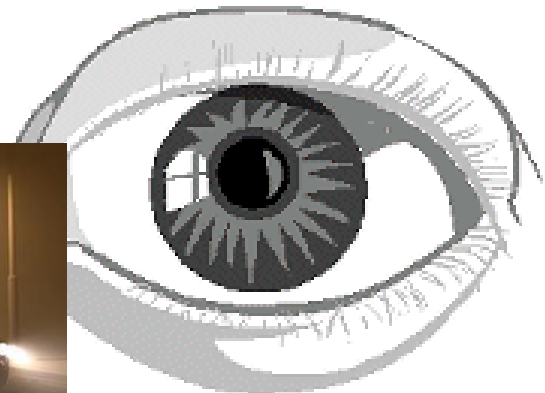
# ... and the atmosphere ...



Perception

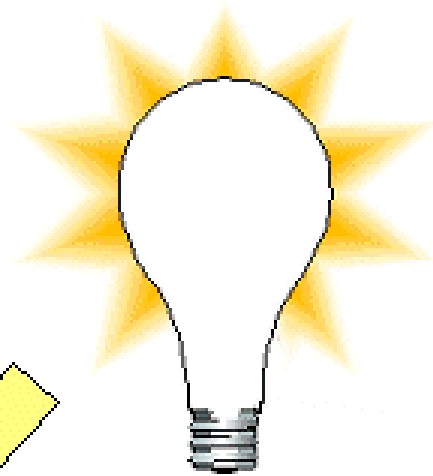


Reflectance



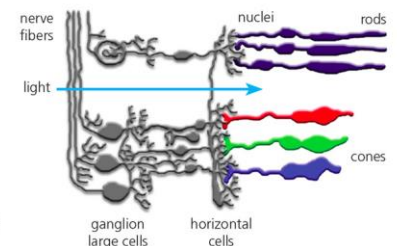
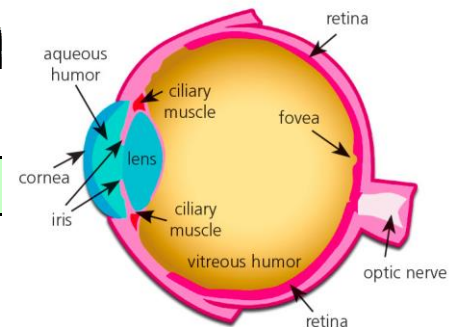
# ... and our visual system ...

Illumination



Perception

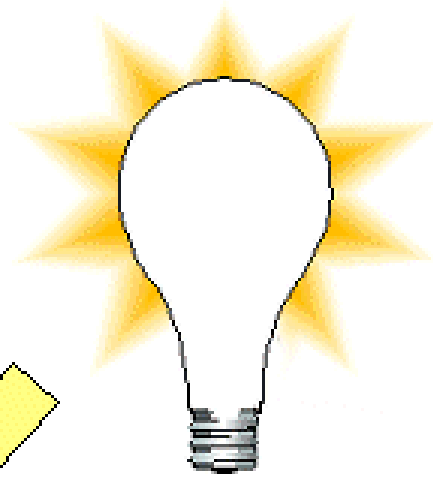
Reflection





# ... and animation ...

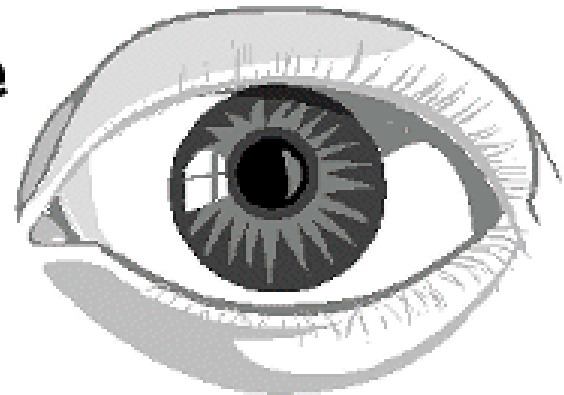
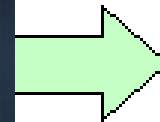
Illumination



Perception

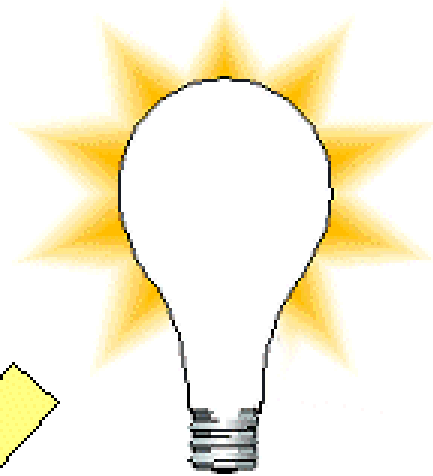


Reflectance



... and geometry micro-detail ...

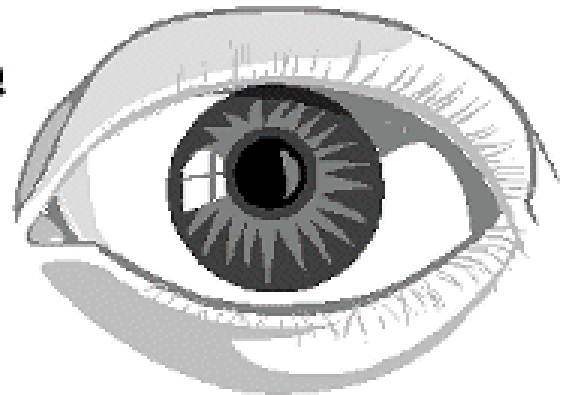
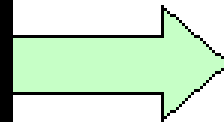
Illumination



Perception



Reflectance



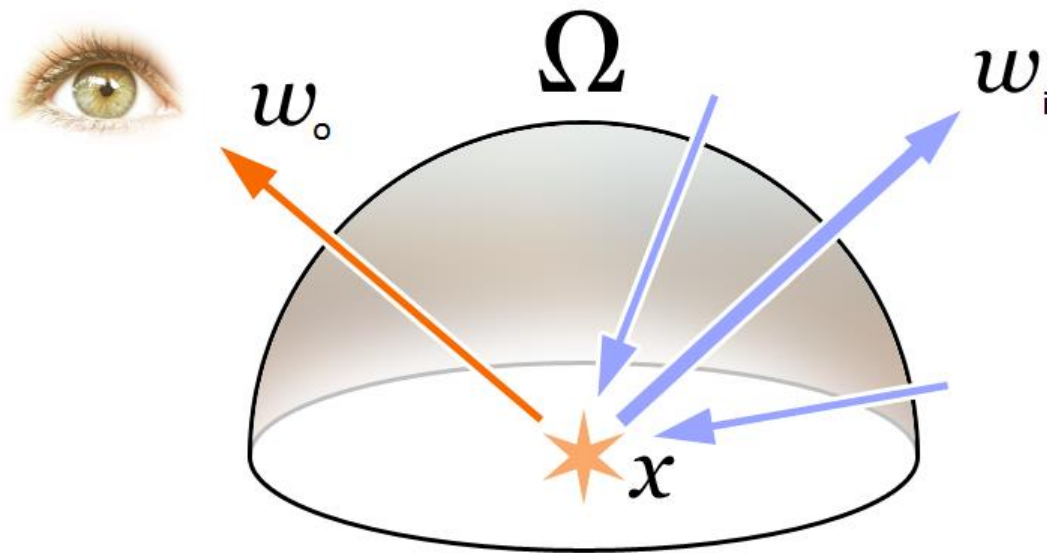
# Computer Graphics

- Need to simulate light behavior
  - From different light sources
  - For different materials
  - With detailed geometry
  - In participating media
  - ... **very, very quick!!!!**

# But we have Physics!!!

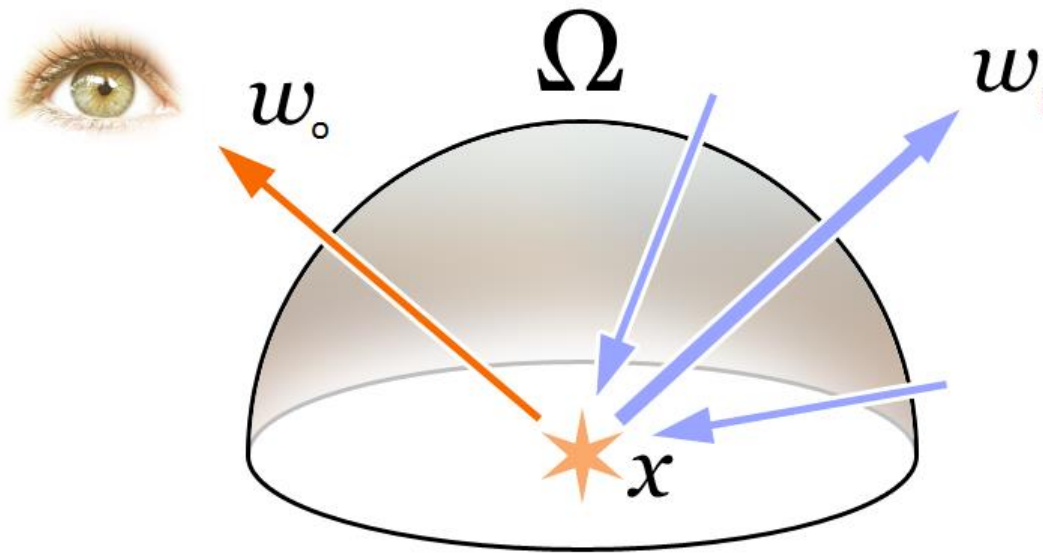


# But we have Physics!!!



$$L_o(\mathbf{x}, \omega_o, \lambda, t) = L_e(\mathbf{x}, \omega_o, \lambda, t) + \int_{\Omega} f_r(\mathbf{x}, \omega_i, \omega_o, \lambda, t) L_i(\mathbf{x}, \omega_i, \lambda, t) (\omega_i \cdot \mathbf{n}) d\omega_i$$

# But we have Physics!!!



$$L_o(\mathbf{x}, \omega_o, \lambda, t) = L_e(\mathbf{x}, \omega_o, \lambda, t) + \int_{\Omega} f_r(\mathbf{x}, \omega_i, \omega_o, \lambda, t) L_i(\mathbf{x}, \omega_i, \lambda, t) (\omega_i \cdot \mathbf{n}) d\omega_i$$

This is recursive!!!!

# CG by physics

- Is too slow
  - We use tricks
  - ... that approximate the rendering equation in different ways ...
  - ... to synthesize images

# Rendering

- Means **realistic** image synthesis



# Fast Realistic Rendering

- Means **realistic** image synthesis
- ... very, very quick
  - ... using the GPU to accelerate
- GPU is (only) good for triangle-based rendering
  - ... until very recently

# Organization

- Contents:
  - GPU texturing (1 session)
  - Physically-based rendering (lab)
  - Hard & soft shadows (2 sessions)
  - Deferred rendering (1 session)
  - Ambient occlusion (2 sessions)
  - Image-based rendering (2 sessions)
  - Skin rendering (1 session)
  - Paper presentations (1 session)
  - Advanced OpenGL concepts (1 session)

# Organization

- Evaluation:
  - Paper presentation (30%)
  - Programming project (40%)
  - Final exam (30%)

# Organization

- Paper presentation:
  - 2 Sessions: TBD
  - Each presentation: 20-25 min. + questions
  - Prepare questions for the other students
  - I will suggest papers

# Organization

- Programming project (tentative):
  - Physically-based rendering (50%)
  - Ambient occlusion (50%)

# Organization

- **Tentative** schedule Lab:
  - Physically-based rendering:
    - Dates: 14<sup>th</sup>, 21<sup>st</sup> February, 6<sup>th</sup>, 13<sup>th</sup>, and 20<sup>th</sup> March.
    - Delivery: 26<sup>th</sup> March.
    - Presentation: 3<sup>rd</sup> April.
  - Ambient occlusion:
    - Dates: 27<sup>th</sup> March, 3<sup>rd</sup>, 17<sup>th</sup>, 24<sup>th</sup> April, 7<sup>th</sup>, 15<sup>th</sup>, 22<sup>th</sup> May.
    - Delivery: 28<sup>th</sup> May.
    - Presentation: 29<sup>th</sup> May.