

Department of Computer Science



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**BATH**

Phil Willis

Director, National Centre for Digital  
Entertainment

[www.bath.ac.uk](http://www.bath.ac.uk)





[digital-entertainment.org](http://digital-entertainment.org)

## National Doctoral Training Centre

Joint with Bournemouth University's  
National Centre for Computer  
Animation

Research in graphics/vision/CHI

Main industries involved:

Games, Animation, Visual Effects



National Doctoral Training Centre

50 doctoral students

35 faculty

30 companies

\$10 million funding, growing.

Sponsored by EPSRC and industry.

Full-on, academic research.

[digital-entertainment.org](http://digital-entertainment.org)

## Vector image research at Bath

1982 - 1984

Quadtree display system. Pixel-based, 512 resolution colour screen but real-time, detail-revealing zoom into a 4k image.

David Milford

## Vector image research at Bath

**1984 - 1987**

UltraPaint: all in one drawing programme and re-renderer. Achieved 32k by 32k resolution in colour.





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## Vector image research at Bath

**1995**

Virtual Manufacturing

Same vector approach as our paint program  
but in 3D

Adrian Bowyer (Mech Eng)

Phil Willis

Richard Taylor (postdoc)

Gary Bayliss (PhD student)

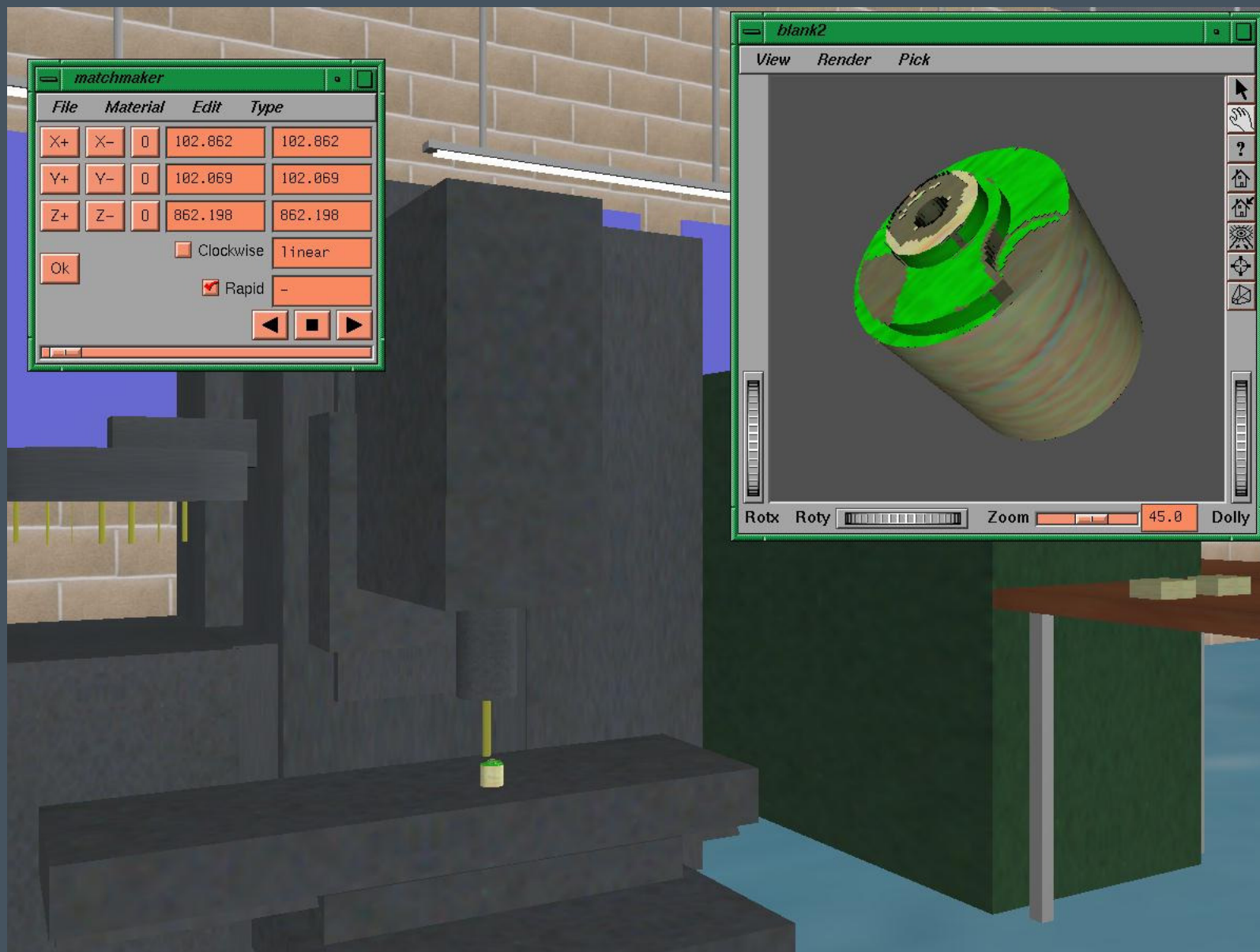
## Vector image research at Bath

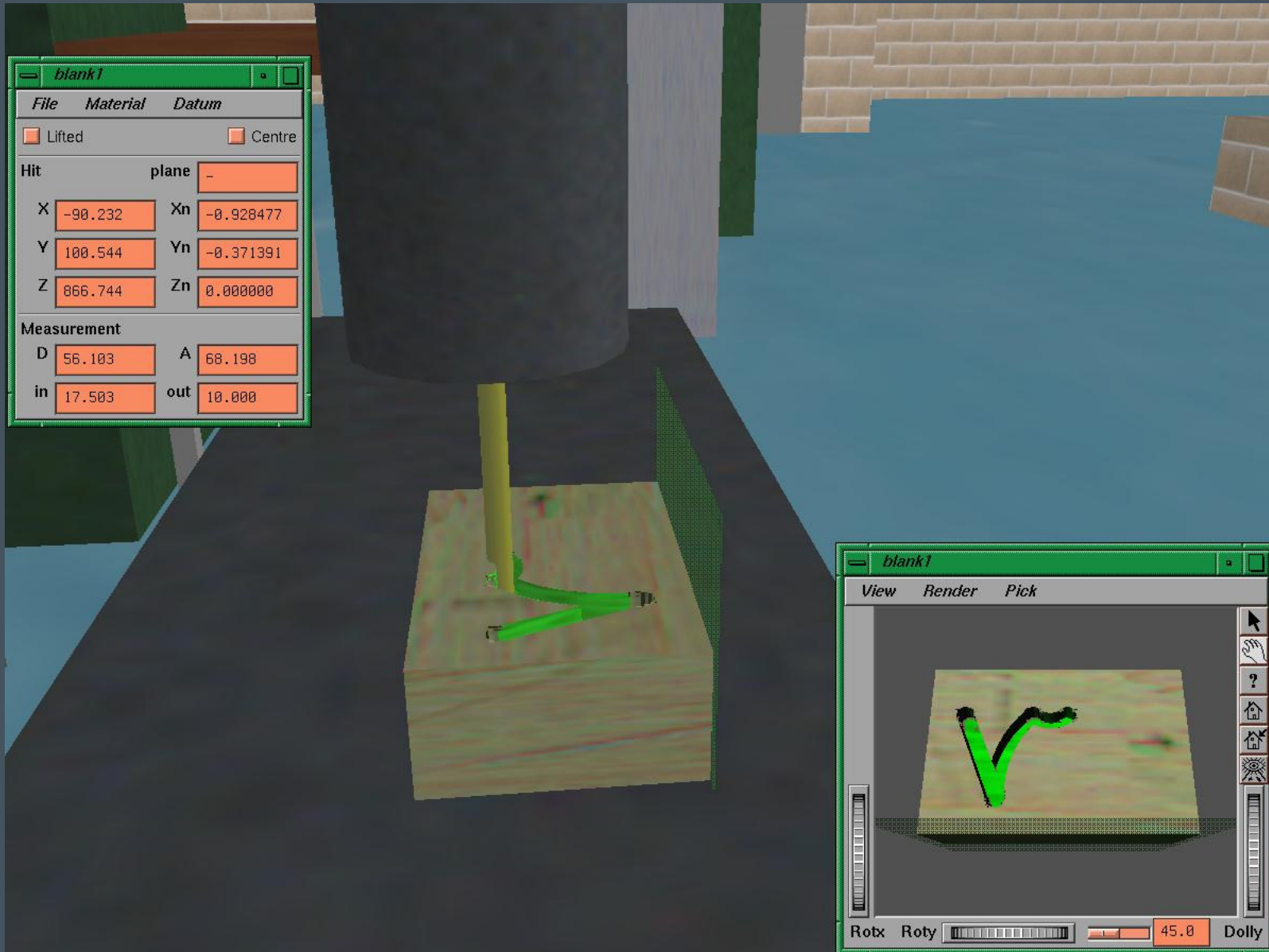
**1995**

Virtual Manufacturing

No 3D printers: straight to metal using a numerically-controlled milling machine, lathe etc!







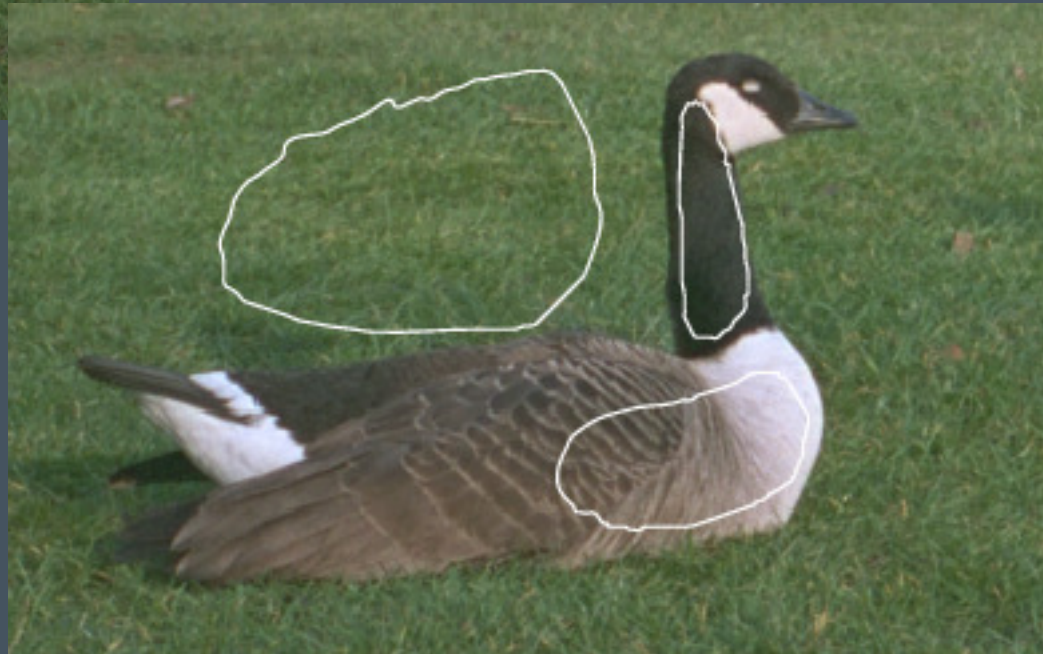


## Vector image research at Bath

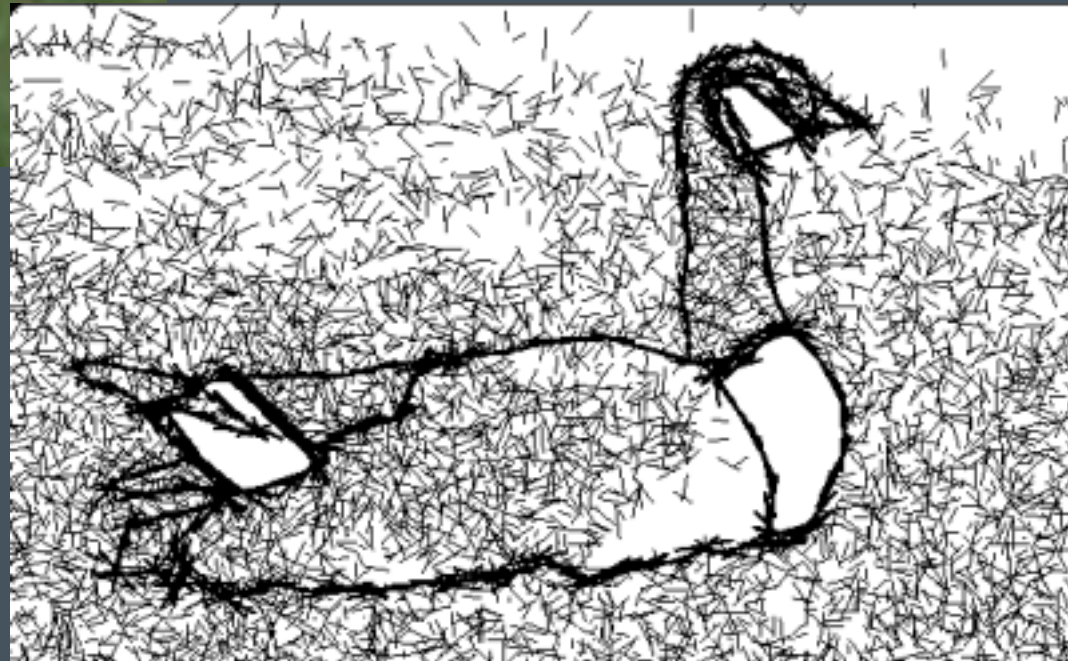
**2001**

Continuous (photographic) images. Our first attempt to produce vector forms of photographs.

Frederick Labrosse  
Max Froumentin







## Vector image research at Bath

**2003**

Demosaicing of colour images using pixel level data-dependent triangulation

**2004**

Image interpolation by pixel-level data-dependent triangulation

Dan Su (PhD student)

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## Lens effect





## Vector image research at Bath

**2006, 2008**

Highly stylised drawn animation.

Frank Van Reeth, Fabian Di Fiore (UoHasselt)

John Patterson (UoGlasgow)

Phil Willis (UoBath)





Now offered commercially through the company  
UltraPictura

<http://www.ultrapictura.be>

<http://www.youtube.com/UltraPictura>

## Vector image research at Bath

**2009**

Reconstructing vectorised photographic images.

**2012**

Constructing and rendering vectorised photographic images.







## Death of the Pixel?

More pixels means:

Greater storage demand

Higher processing demand

Higher energy costs

Bigger bandwidth to deliver

Do we *need* pixels in the pipeline?

We need pixels at the **input**: cameras, computers

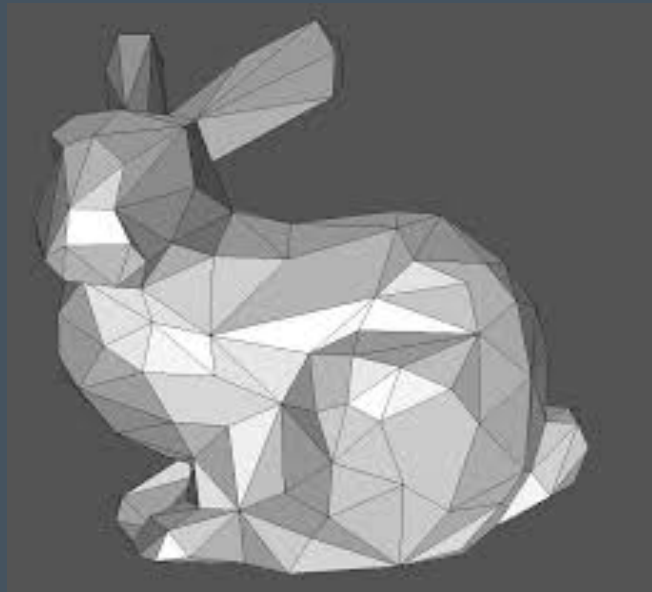
We need pixels at the **output**: displays, projectors

... But for the pipeline in between?

... When shipping product around the world?

# Computer Graphics

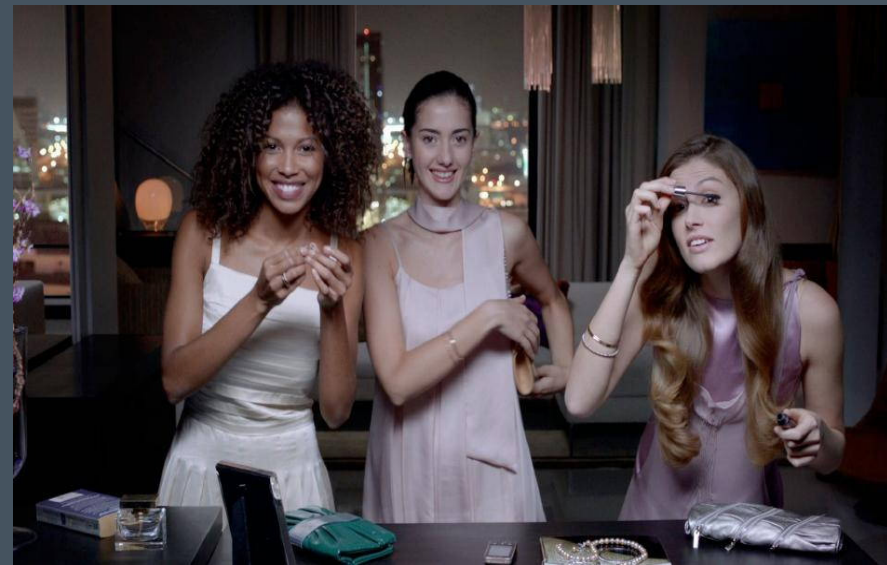
CAD -> CG model -> Render -> Pixels



# Digital Images

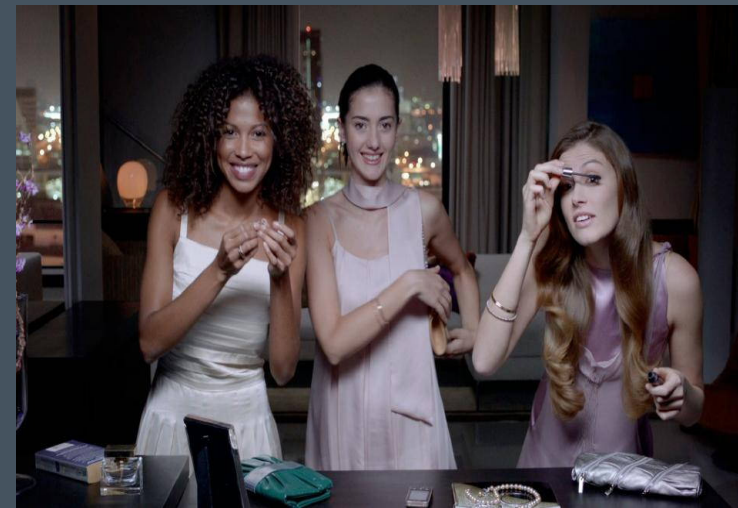
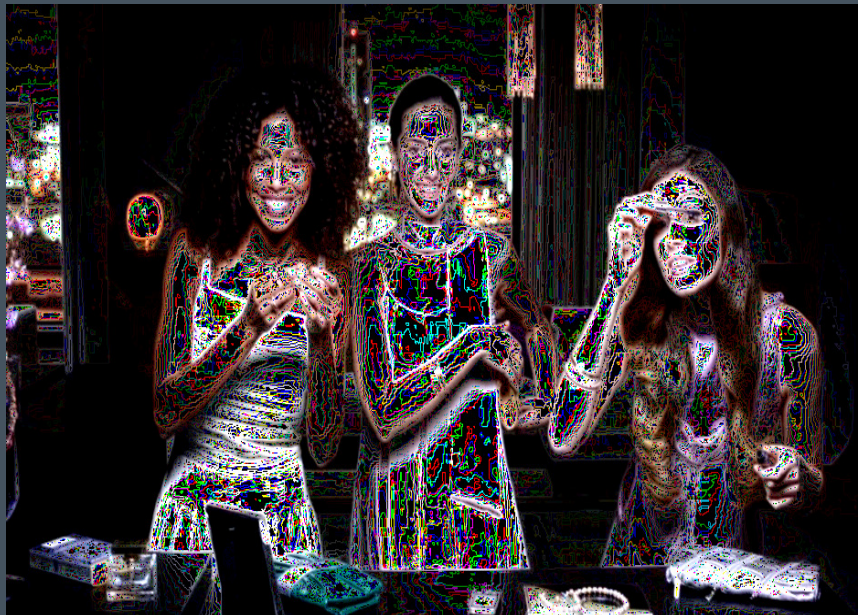
~~CAD~~ -> ~~CG model~~ -> ~~Render~~ -> Just Pixels

?



# Contourised images

Contourise -> Contour model -> Render -> Pixels



## Contour images

Think terrain maps: smooth curves of constant height

Image contours are curves of **constant brightness**.

**Scale free vectors**, not discrete samples. Scale and rotate are easy.

## Contour images

They pass **through** pixels – not along pixel edges

There can be several contours in each pixel

There can be no contours in many pixels

# Contoured Frame



# Contour images

Unlike map-makers, we can't use constant colour  
or we get posterisation:



Wiki Commons: Leon Schultz

We want this:



©skiathos

to look like this:

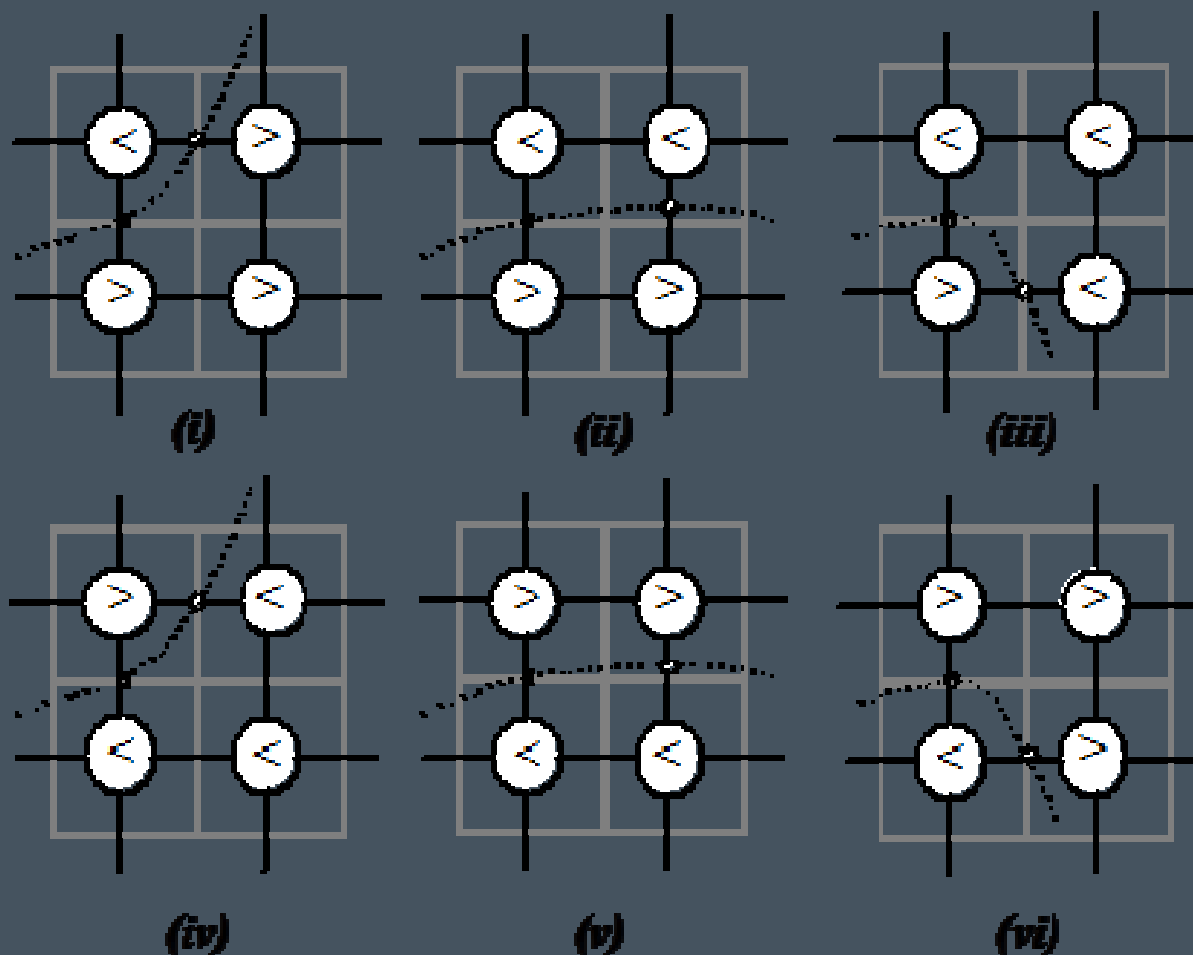


We want to see unblocked highlights and shadows:



[illegible]

# Placing contours









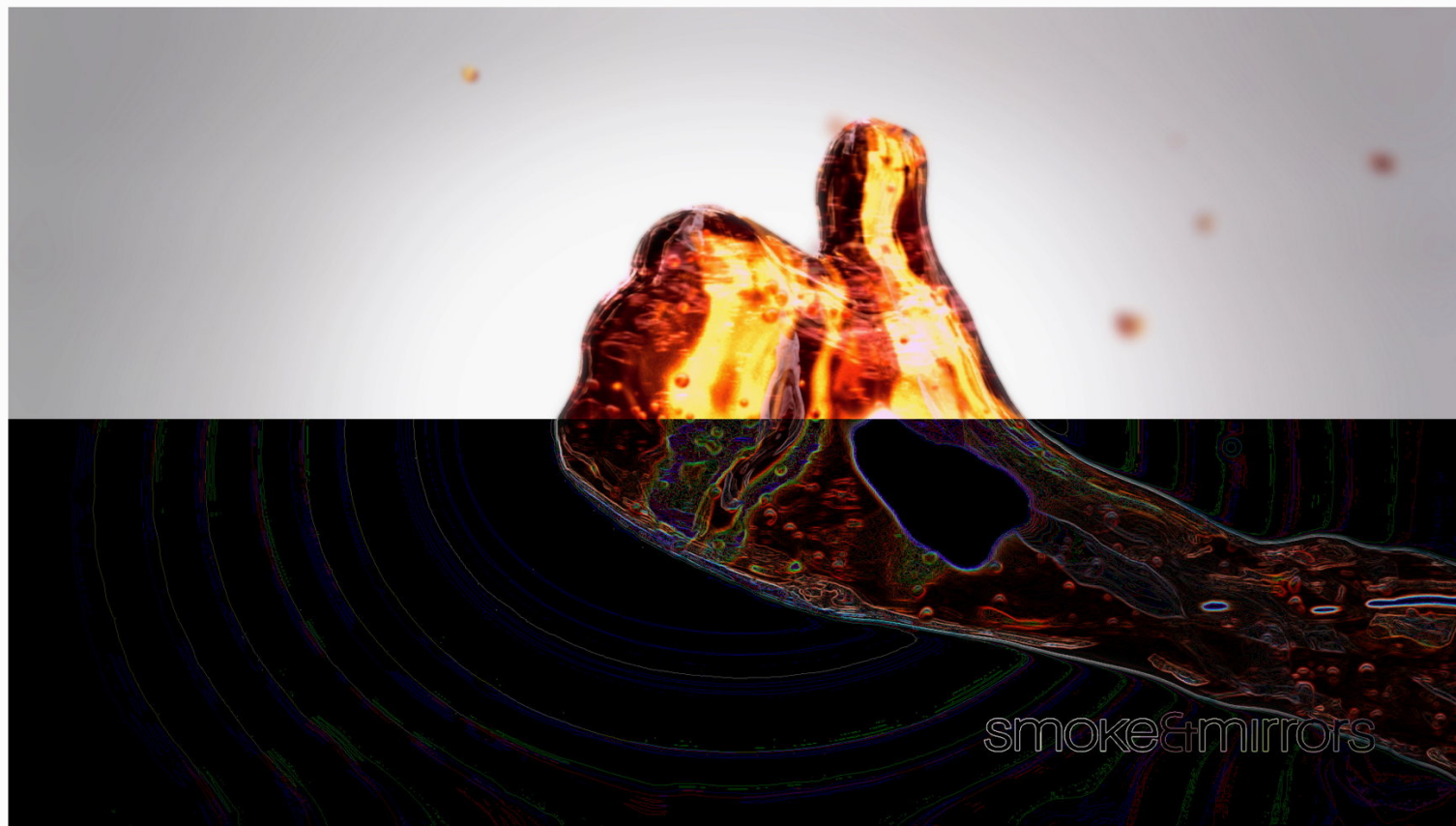
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 **OvationData**  
Total Data Management Solutions

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Driving Innovation



Movie!

## Our Project Partners

Root6 (lead)



Smoke & Mirrors



Ovation Data



Funder

Technology Strategy Board  
Driving Innovation

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Thank you!