

Artistic Stylization of Images and Video

Part IV – Future Challenges

Eurographics 2011

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- **Non-Photorealistic Rendering and The Science of Art**
A. Hertzmann, NPAR 2010.
- **Visual Explanations**
D. DeCarlo, M. Stone. NPAR 2010.
- **Towards Mapping the Field of Non-Photorealistic Rendering**
A. Gooch, NPAR 2010.
- **“Aaron’s Code: Meta-art, Artificial Intelligence and the Work of Harold Cohen”**
P. McCorduck. W.H. Freeman & Co. 1990. ISBN: 0716721732
- **Non-photorealistic Rendering in Context: An Observational Study**
T. Isenberg, P. Neumann, S. Carpendale, M. de Sousa, J. Jorge, NPAR 2006
- **Real-time Video Abstraction**
Salisbury et al., SIGGRAPH 2006
- **Perception and Painting: A search for effective, engaging Visualizations**
Healey, IEEE CG&A 2002.
- **Human Facial Illustrations: Creation and psychophysical evaluation**
B. Gooch, E. Reinhard, A. Gooch. ACM ToG 2004.
- **Influencing User Perception Using Real-time Adaptive Abstraction**
N. Redmond. PhD Thesis, Trinity College Dublin, 2011.

Panel session on
Grand Challenges in NPR
(NPAR 2010)

- **“Cubist-like Rendering from Photographs”**
J. Collomosse and P. Hall. IEEE TVCG 2003.
- **An Invitation to Discuss Computer Depiction**
F. Durand. NPAR 2002
- **“RTCams: A new perspective on non-photorealistic rendering from photos**
P. Hall, J. Collomosse, Y-Z. Song, P. Shen. IEEE TVCG 2007.
- **Self-similar texture for coherent line stylization**
P. Benard, F. Cole, A. Golovinskiy. NPAR 2010.
- **Human Facial Illustrations: Creation and psychophysical evaluation**
B. Gooch, E. Reinhard, A. Gooch. ACM ToG 2004.
- **Where do people draw lines?**
F. Cole, A. Golovinskiy, A. Limpacher, H. Barros, A. Finkelstein. SIGGRAPH 2008.
- **Waking Life (Movie)**
Directed by R. Linklater. Fox Searchlight 2001.
- **The Painting Fool**
www.paintingfool.com (S. Colton, Imperial College)
- **Genetic Paint: A search for salient paintings**
J. Collomosse, P. Hall. EvoMUSART 2005.

Artistic Stylization

■ Why?

Visualization

Comprehension

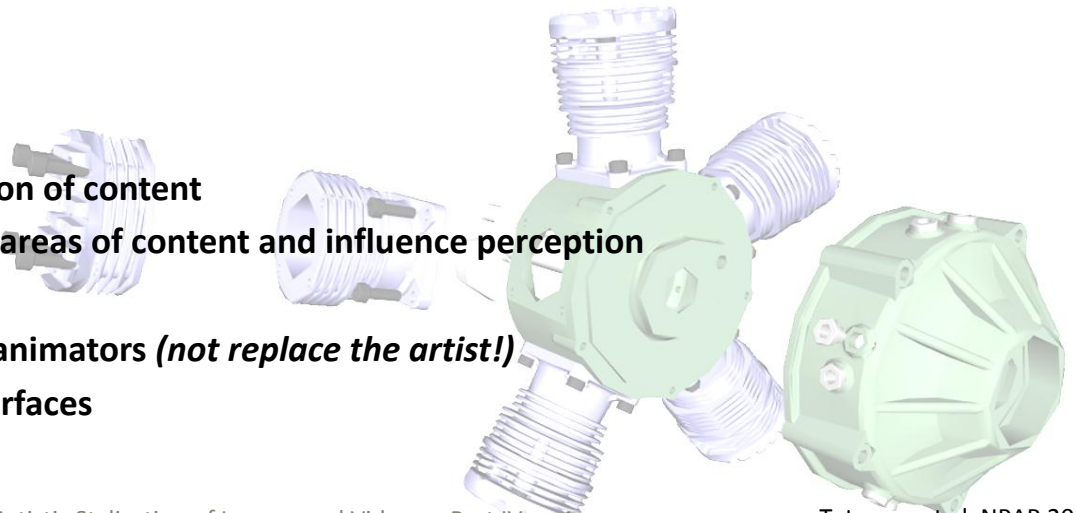
Communication

Aesthetics

Animation

■ Artistic Stylization can

- Simplify and structure the presentation of content
- Selectively guide attention to salient areas of content and influence perception
- Learn and emulate artistic styles
- Provide assistive tools to artists and animators (*not replace the artist!*)
- Help us to design effective visual interfaces



Challenges in Aesthetics

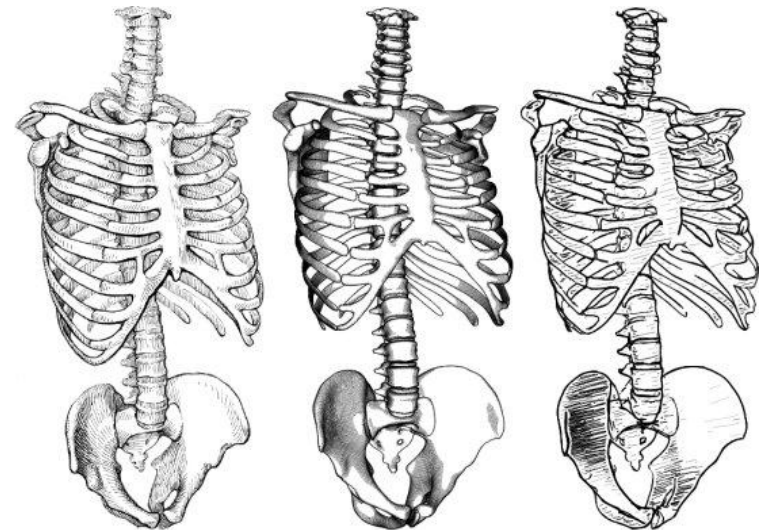
- Easy to show novelty in style
- ... but today there are few styles remaining to pioneer
- Difficult to show superiority of one style vs. another
- Usually papers include visual comparisons side-by-side



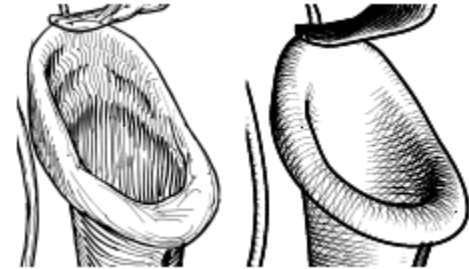
Collomosse et al.
EvoMUSART 2005

Evaluation

- First qualitative study by Isenberg et al. '06
- Compares hand-drawn and NPR images
- Unconstrained pile-sort
 - No prescribed criteria
 - Users manually group images
- Semi-structured Interview



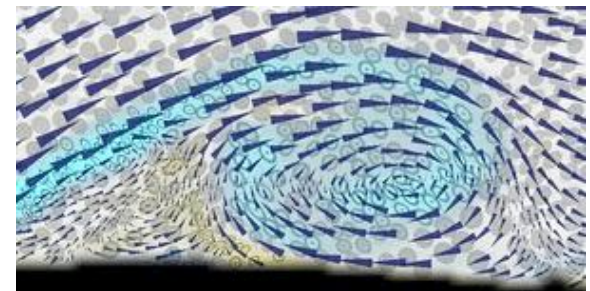
- **Observations (on 3D pen-and-ink renderings)**
 - **Visual “Turing test” not yet passed**
 - Pure line art most obviously CG
 - Regularities should be avoided
 - c.f. more recent work by Cole et al. (SIGGRAPH '08 '09, NPAR '10)
 - **Styles less obviously CG**
 - Stippling
 - Sketchy (Renderbots)
 - Simplified forms
- **Know the goal / audience**
- **Portray materials (c.f. Zhu et al. ACM ToG 09)**



- **Challenges of Communication/Comprehension**
- NPR often claims to be aiming for, or to have achieved:
 - creation of a useful artist / animator's tool
 - simplification of content
 - improvements in of visual communication
- But these are rarely backed up by any form of user study
- No standard methodology has yet been agreed
 - Few have been proposed
 - Task specific:
 - Portrait recognition (Gooch, Winnemoeller)
 - Scientific visualisation (Healey)

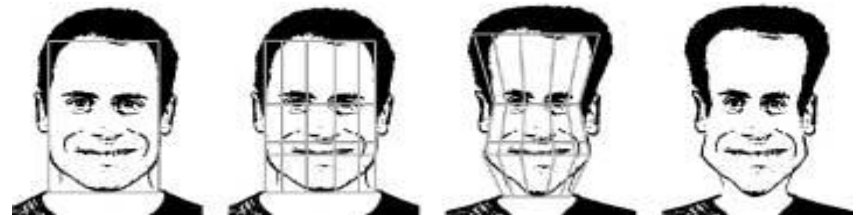


Winnemoeller et al. 2006



C. Healey. 2002

- **Early studies measuring the effect of NPR on visual communication**
 - Recognition speed from caricature (Gooch et al. 2004)
 - Recognition speed and image recall speed / accuracy (Winemoeller et al. 2006)
- **Results:**
 - Participants recognise stylized celebrities more quickly.
 - Abstraction reduces recognition latency (13% reduction)
 - Participants can recall stylized images more quickly / accurately.
 - Memory “pairs” game faster with stylized images (28% faster)



Gooch et al. 2004

- **NPR influences perception in real-time interactive environments**
 - Timed recognition tasks
 - Attention measurement (Gaze tracking)
- **Tasks evaluated**
 - Person / face recognition
 - Shape / object recognition
 - Crowds
 - Urban Navigation
 - Volume Visualisation
- **Multi-way ANOVA to measure real effect**
- **Newman-Keuls post-hoc analysis**



Redmond 2011

▪ Challenge of Temporal Coherence

- Reducing flicker in stylized video remains unsolved in the general case
 - Segmentation is stable but content limited
 - Filtering is more general but unstable where texture is absent or poorly expressed
- Flicker most distracting from **6-10Hz** (*typical NPR fps!*)

▪ Twin Challenges

- Defining temporal coherence beyond “*shower door effect*”
 - Objective measures of coherence
 - Community agreement on a preferred definition
- Solving temporal coherence
 - Flicker reduction may take priority over accuracy

Defacto test clips



Hayes & Essa (NPAR 04)
J. Wang [SIGGRAPH 04]

- **Interaction with Creatives**
 - Most NPR is pitched as a creative tool
 - Few are built with users in the loop
 - ...Even fewer study use of tool in a creative context
- **Mainstream NPR could collaborate with creative communities**
- **Examples of Computer Science/Artist interaction**
 - Evolutionary Art Community (EvoMUSART)
 - Computational Aesthetics (CAe)
- **This year NPAR, SBIM and CAe combined workshop (at SIGGRAPH'11)**
 - Paper submission 25 April
 - <http://www.cl.cam.ac.uk/conference/cae-sbim-npar-2011>

■ Portraits and Caricature

- Common NPR applications are in consumer media

- Mainly people and faces
- Strong perceptual prior and high expectation

■ Current NPR for portraits

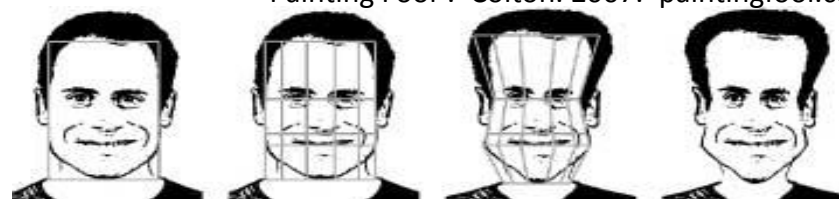
- Caricatures by global non-linear warping (e.g. Gooch '04)
- Generally poor at emphasising salient facial detail
- Higher level models needed



Waking Life. Linklater. (c) Fox Searchlight. 2001



"Painting Fool". Colton. 2007. paintingfool.com



Gooch et al. 2004

■ Composition and Depiction

- Most NPR still focuses on low-level representation, preserving scene structure
- Artistic projections are common in artwork
 - Depiction of form not sufficiently addressed (Durand, NPAR 2002)
 - Related to “Computational Photography”

RTCams – Artistic views from stereo



Hall et al. 2007

Cubist-like Composition



Collomosse et al. 2003

- Full circle
 - Artistic composition was arguably the first NPR problem tackled (~30 years)
 - Harold Cohen's AARON – heuristic / expert system generative art
 - And it is still unsolved...



```
if (left-arm-posture is "hand-on-hip")  
  (add-upper-arm left -.3 .5 .65)  
else  
if (left-arm-posture is "arms-folded")  
  ...
```

"Aaron's Code". W.H. Freeman & Co. 1990





Open Q & A Session