Artistic Stylization of Images and Video
Part IV – Future Challenges
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http://kahlan.eps.surrey.ac.uk/EG2011
References

- **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”**

- **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**

- **Human Facial Illustrations: Creation and psychophysical evaluation**

- **Influencing User Perception Using Real-time Adaptive Abstraction**

Panel session on
Grand Challenges in NPR (NPAR 2010)
References

- “Cubist-like Rendering from Photographs”

- An Invitation to Discuss Computer Depiction
  F. Durand. NPAR 2002

- “RTCams: A new perspective on non-photorealistic rendering from photos

- Self-similar texture for coherent line stylization

- Human Facial Illustrations: Creation and psychophysical evaluation

- Where do people draw lines?

- Waking Life (Movie)

- The Painting Fool
  www.paintingfool.com (S. Colton, Imperial College)

- Genetic Paint: A search for salient paintings
Recap – Common NPR Motivations

Artistic Stylization

Why?

- Comprehension
- Communication
- Visualization
- 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
**Challenge - Evaluation**

- **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

- **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 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)
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 (Winnemoeller 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)
- 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
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
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
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
**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

[Images of RTCams example]

### Cubist-like Composition

[Images of Cubist-like composition]

Hall et al. 2007

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")
        ...
```

Open Q & A Session