Interactive NPAR: What type of tools should we create?

Tobias Isenberg
In NPAR, we’ve come a long way ...

[Saito and Takahashi, 1990]
[Dooley and Cohen, 1990]
[Haeberli, 1990]
In NPAR, we’ve come a long way ...

[Zhao & Zhu, 2010]

[Semmo & Döllner, 2014]

[Bénard et al., 2013]

[Bousseau et al., 2007]

[Cole et al., 2009]
Largely a focus on rendering/animation
What about the interaction with the tools?

[Nijboer et al., 2010]
Salesin’s 7 Grand Challenges [2002]

Non-Photorealistic Animation & Rendering:

7 Grand Challenges

David Salesin
June 2002
Salesin’s 7 Grand Challenges [2002]

Challenge 4: Interactivity
Salesin’s 7 Grand Challenges [2002]

“All you need is a strong Art Director and willing TDs. . . .”

— Tom Porter, PIXAR
Salesin’s 7 Grand Challenges [2002]

Challenge:

*How do you build tools for “right-brained” thinking?*

Or:

*How do you lose the TDs?*
Salesin’s 7 Grand Challenges [2002]

Common elements for a good system:

• Should let artists and computers each do what they are good at
• Needs to be simple yet flexible
• Should support full design cycle:
  
Create / Evaluate / Rework
• interaction not only for people trained in the arts
• Heinlein’s model of field maturation (imitation, optimization, acceptance)
• interaction still difficult, need to focus on interaction with our algorithms

Gooch et al. [2010] revisit Salesin’s challenges

Isenberg – Interactive NPAR: What type of tools should we create?

Lum & Ma [2002]: Expressive Visualization

- scientists are not expert illustrators
- illustrative visualization provides tools, but “interactivity is the key”
- interactivity as high fps
- applies at interaction design as well
Goals & Application Domains of NPAR

- artists (& illustrators)
- non-artists ("everyone")
- scientists (data visualization)
- doctors (patient data)
Goals & Application Domains of NPAR

NPAR tools for

artists (& illustrators)

non-artists ("everyone")

scientists (data visualization)

doctors (patient data)
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NPAR tools for:

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NPAR for Artists: In-Betweening

TicTacToon
[Fekete et al., 1995]
NPAR for Artists: In-Betweening

source

[Image of gnome character]

= target

[Image of gnome character]

our approach

[Image of gnome character]

[Papenberg et al. 2007]

[Image of gnome character]

[Glocker et al. 2008]

[Sýkora et al., 2009a]
NPAPR for Artists: In-Betweening

[Whited et al., 2010]
NPAR for Artists: Interactive Cartoon Colorization

[Sýkora et al., 2009b]
NPAR for Art.: (Photo-)Realistic Media Simulation

[Curtis et al., 1997]  [Bousseau et al., 2006]  [Luft & Deussen, 2006]  [DiVerdi et al., 2013]

DAB [Baxter et al., 2001]  IMPaSTo [Baxter et al., 2004]

[Isenberg – Interactive NPAR: What type of tools should we create?
Expressive 2016, May 8, 2016]
NPAR for Artists: Interactive Environments

Disney's Deep Canvas
NPAR for Artists: Control Needed at Multiple Levels

NPAR: low-level, tedious tasks; artist: higher-level decisions
Salesin: “let artists and computers each do what they are good at”

IMPaSTo [Baxter et al., 2004]
IntuPaint [Vandoren et al., 2008]
Low-level vs. High-level Tasks and Control

workload/control over result

influence of input

[Sýkora et al., 2009b]

[Semmo et al., 2015/16]

[Curtis et al., 1997]

[Curtis et al., 2000b]

[http://two-n.com/pics]
Low-level vs. High-level Tasks and Control

workload/control over result

high-level control

influence of input

low-level control
Goals & Application Domains of NPAR

NPAR tools for:

- artists (& illustrators)
- scientists (data visualization)
- doctors (patient data)
- non-artists ("everyone")
NPAR Tools for Non-Artists: Higher-Level Control

1. Color Palette Extraction
2. Seed Placement and Propagation
   - Seed Placement
   - Color Seeds
3. Colorization and Luminance Quantization
   - (Re-)colorized
   - Quantized
4. Edge Detection
   - Contours (DoG)
   - Signed FLog
5. Flow Extraction
   - Flow Field
6. Paint Texture Computation
   - Brush Texture
   - Varnish Texture
7. Image Smoothing
   - Smoothed

[Semmo et al., 2015/16]
NPAR Tools for Non-Artists: Filters (w/ Interaction)
NPAR Tools for Non-Artists: Filters (w/ Interaction)

[Deussen et al., 2000]
NPAR Tools for Non-Artists: Filters (w/ Interaction)

[Schwarz et al., 2007]
NPAR Tools for Non-Artists: Filters for Video

[Wang et al., 2004]
NPAR Tools for Non-Artists: Filters for Video

[Winnemöller et al., 2006]
NPAR Tools f. Non-Artists: Simple Drawing/Painting

Harold [Cohen et al., 2000]
NPAR Tools f. Non-Artists: Simple Drawing/Painting

SnakeToonz [Agarwala, 2002]
NPAR Tools f. Non-Artists: Simple Drawing/Painting

[Ritter et al., 2006]
NPAR Tools for Non-Artists: Mobile Apps

[PaintCan by Winnemöller et al.]

[PencilFX by Gooch et al.]

SnapDot based on [Secord 2002]
Goals & Application Domains of NPAR

NPAR tools for:
- artists & illustrators
- non-artists ("everyone")
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- doctors (patient data)
Expressive/Illustrative Visualization

Interactivity is the Key to Expressive Visualization

V I S F I L E S

Lum & Ma, 2002

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NPAR Tools for Scientists (& Science Illustrators)

[Bruckner & Gröller, 2007a]

[Bruckner & Gröller, 2007b]
NPAR Tools for Scientists (& Science Illustrators)

Isenberg – Interactive NPAR: What type of tools should we create?

NPARR Tools for Scientists (& Science Illustrators)

[Li et al., 2007]
NPAR Tools for Scientists (& Science Illustrators)

[van der Zwan et al., 2011]

[Parulek et al., 2013/14]

[Cipriano & Gleicher, 2007]
NPAR Tools for Scientists (& Science Illustrators)

[Everts et al., 2009]

[Svetachov et al., 2010]

[Everts et al., 2015]
Goals & Application Domains of NPAR

- NPAR tools for artists (& illustrators)
- NPAR tools for non-artists ("everyone")
- NPAR tools for scientists (data visualization)
- NPAR tools for doctors (patient data)
NPAR Tools for Doctors (and Patients)
NPAR Tools for Doctors (and Patients)

[Bruckner & Gröller, 2007b]

[Gerl & Isenberg, 2012]

[Svetachov et al., 2010]
Low-level vs. High-level Tasks and Control

workload/control over result

high-level control

influence of input

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[Semmo et al., 2015/16]

[http://two-n.com/pi/]
[http://two-n.com/av/]

An Interaction Spectrum

RealBrush [Lu et al., 2013]

Sisley the abstract Painter [Zhao & Zhu, 2010]
An Interaction Spectrum

artists (& illustrators)

RealBrush [Lu et al., 2013]

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An Interaction Spectrum

artists (& illustrators)

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low-level control

high-level control

Sisley the abstract Painter [Zhao & Zhu, 2010]
An Interaction Spectrum

artists (& illustrators)  non-artists ("everyone")

Low-level control  High-level control

RealBrush [Lu et al., 2013]  Sisley the abstract Painter [Zhao & Zhu, 2010]
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Low-level control

High-level control
Mapping the Interaction Spectrum

The interaction spectrum ranges from little skill to highly skilled, with low-level control at one end and high-level control at the other. The spectrum illustrates the different levels of control and skill required for various types of interactions.
Mapping the Interaction Spectrum

artists?
artists in training?
non-artists?
scientists?
Challenges of Providing Appropriate Control

• How to cope with system complexity?

A. Finkelstein: “The user interface provides a myriad of controls for paper and brush qualities ...”

WYSIWYG-NPR [Kalnins et al., 2003]

[Zander et al., 2004]
Challenges of Providing Appropriate Control

• How to cope with system complexity?

[Image: Paint by Relaxation [Hertzmann, 2001]]
Challenges of Providing Appropriate Control

• How to cope with system complexity?

[Montesdeoca et al., 2016]
Challenges of Providing Appropriate Control

• How to cope with system complexity?

[Collomosse, 2006]

[Shugrina et al., 2006]
Challenges of Providing Appropriate Control

- How to cope with system complexity?
Challenges of Providing Appropriate Control

• How to cope with system complexity?

[Montesdeoca et al., 2016]
Challenges of Providing Appropriate Control

- example-based operators vs. media simulations: adjustable level of control

[Hurtut et al., 2008]

[WYSIWYG-NPR [Kalnins et al., 2003]]

[Yukic et al., 2013]

[Martín et al., 2010/11]

[Bénard et al., 2013]
Challenges of Providing Appropriate Control

- example-based operators vs. media simulations: adjustable level of control

[Gerl & Isenberg, 2013]
Challenges of Providing Appropriate Control

• How to evolve the interactivity with growing skill?
Challenges of Providing Appropriate Control

- learn from HCI (support of creative work); e.g., [Resnick et al., 2005]
  - Support Exploration
  - Low Threshold, High Ceiling, and Wide Walls
  - Support Many Paths and Many Styles
  - Support Collaboration
  - Support Open Interchange
  - Make It As Simple As Possible - and Maybe Even Simpler
  - Choose Black Boxes Carefully
  - Invent Things That You Would Want To Use Yourself
  - Balance user suggestions, with observation and participatory processes
  - Iterate, Iterate - Then Iterate Again
  - Design for Designers
  - Evaluation of Tools
What Kind of Tools to Create? – Three Theses

1. better involve target audiences of the tools
   - [Bleser et al., 1988; Meier, 1999; Seims 1999]
   - “user-centric NPR” [Winnemöller, 2013]
   - evaluation
What Kind of Tools to Create? – Three Theses

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2. cover larger ranges of the interaction spectrum
What Kind of Tools to Create? – Three Theses

[Martín et al., 2010/11]
What Kind of Tools to Create? – Three Theses

[Martín et al., 2010/11]
What Kind of Tools to Create? – Three Theses

[Image: Two images of a building, one showing the structure in its natural state and the other showing the same structure with annotations and color-coding.]

[Text: Martín et al., 2010/11]
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2. cover larger ranges of the interaction spectrum

3. NPAR success stories

[PaintCan]  [Luft et al., 2008]  [Universal Pictures/Winnemöller, 2013]  [Harvill, 2007]  [Mitchell et al., 2007]
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* The selection of examples is biased and many more excellent examples exist for the mentioned approaches.