Interactive NPAR:
What type of tools should we create?

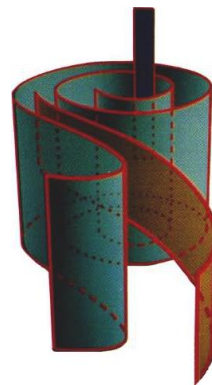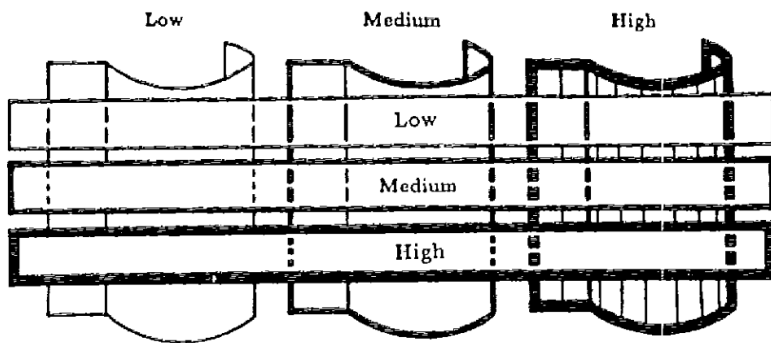Tobias Isenberg

Tobias Isenberg

In NPAR, we've come a long way ...

[Saito and Takahashi, 1990]
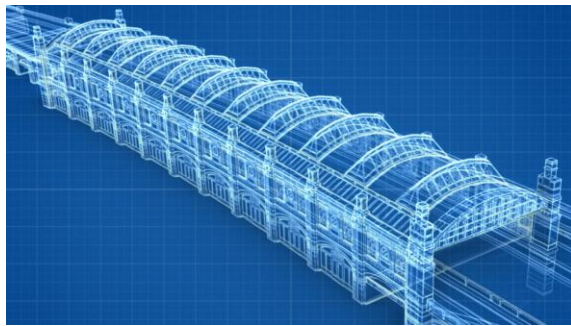
[Haeberli, 1990]

[Dooley and Cohen, 1990]

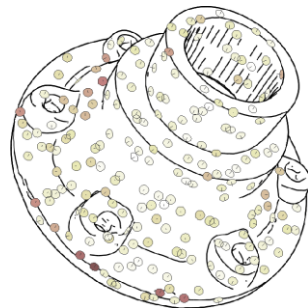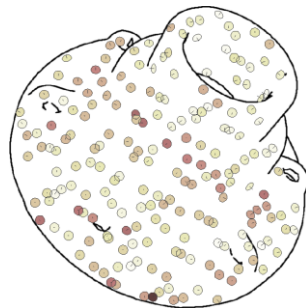# In NPAR, we've come a long way …

[Zhao & Zhu, 2010]

[Semmo & Döllner, 2014]

[Bousseau et al., 2007]

[Bénard et al., 2013]

[Cole et al., 2009]

Largely a focus on rendering/animation

[nVidia]

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]

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

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

- 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]

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
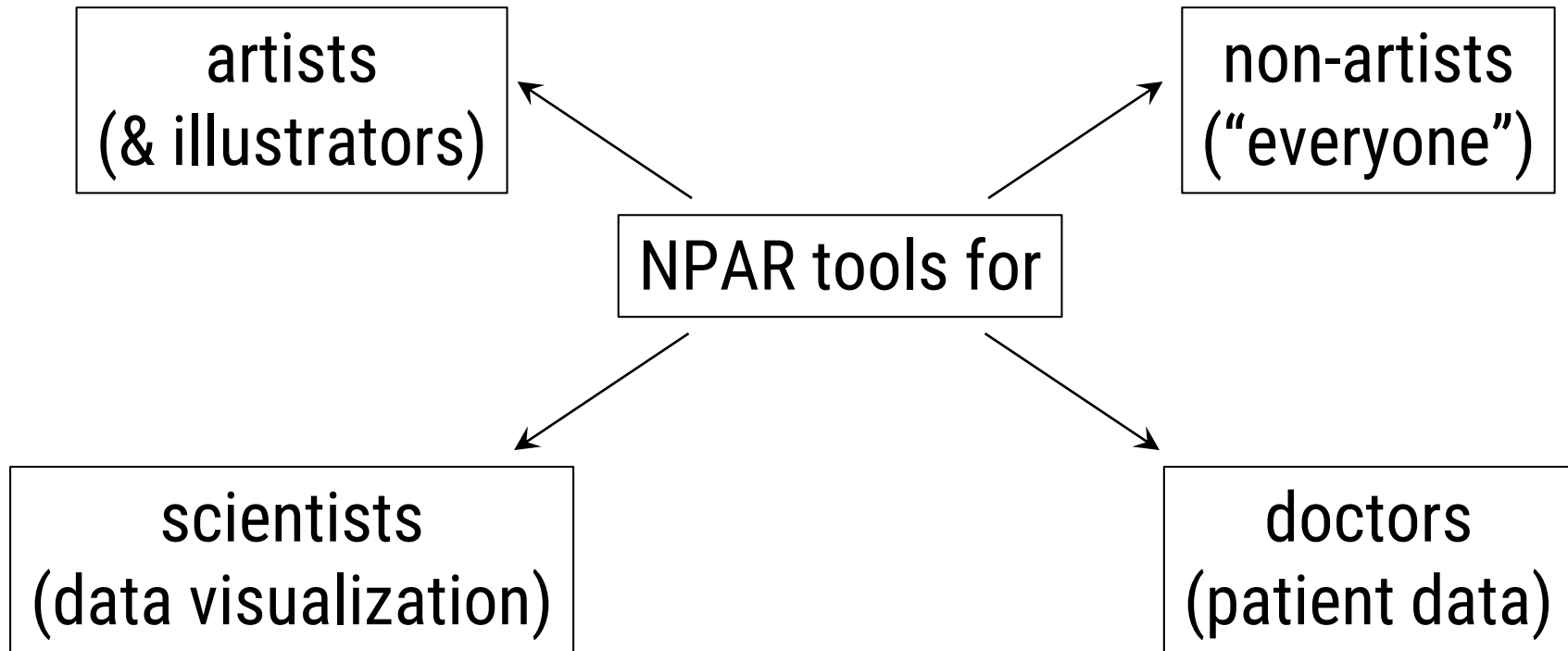
[Lum & Ma, 2002]

Goals & Application Domains of NPAR

artists
(& illustrators)

non-artists
("everyone")

NPAR tools for

scientists
(data visualization)

doctors
(patient data)

Goals & Application Domains of NPAR

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Goals & Application Domains of NPAR

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⊃

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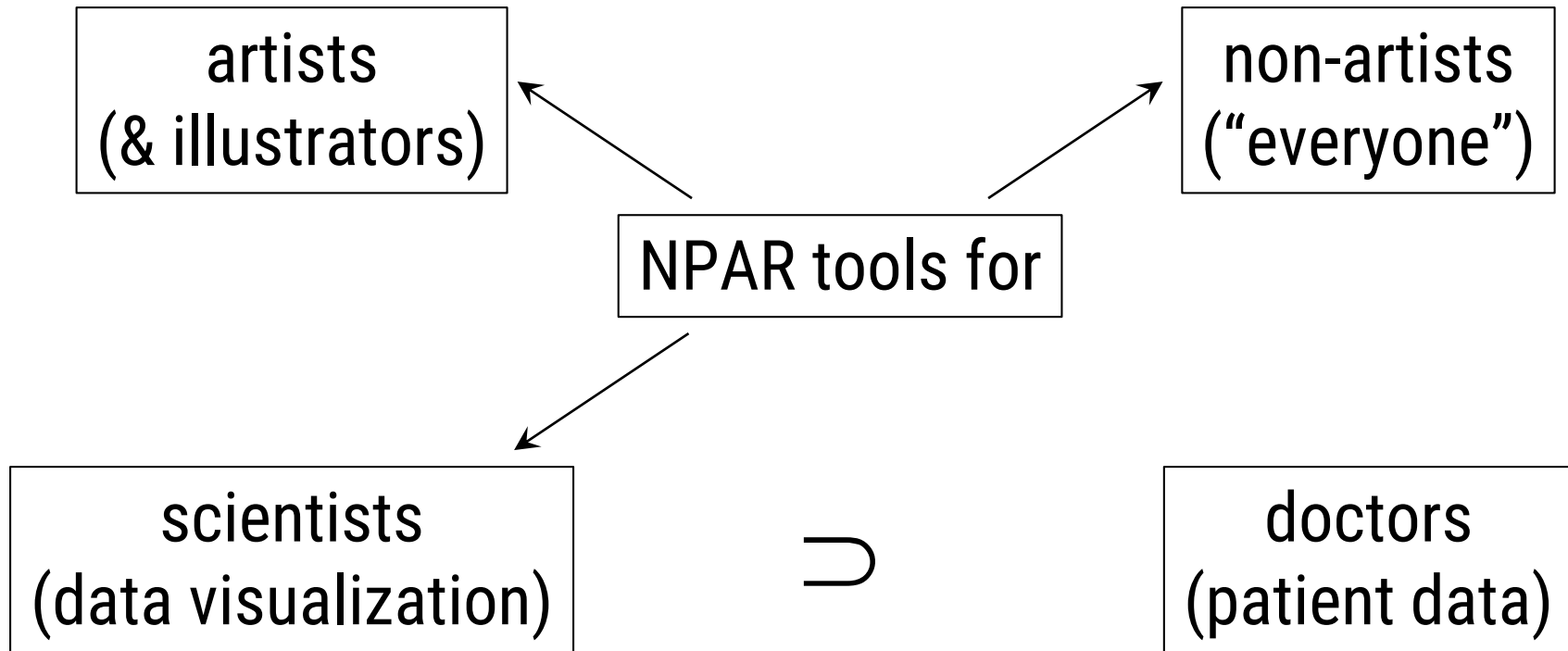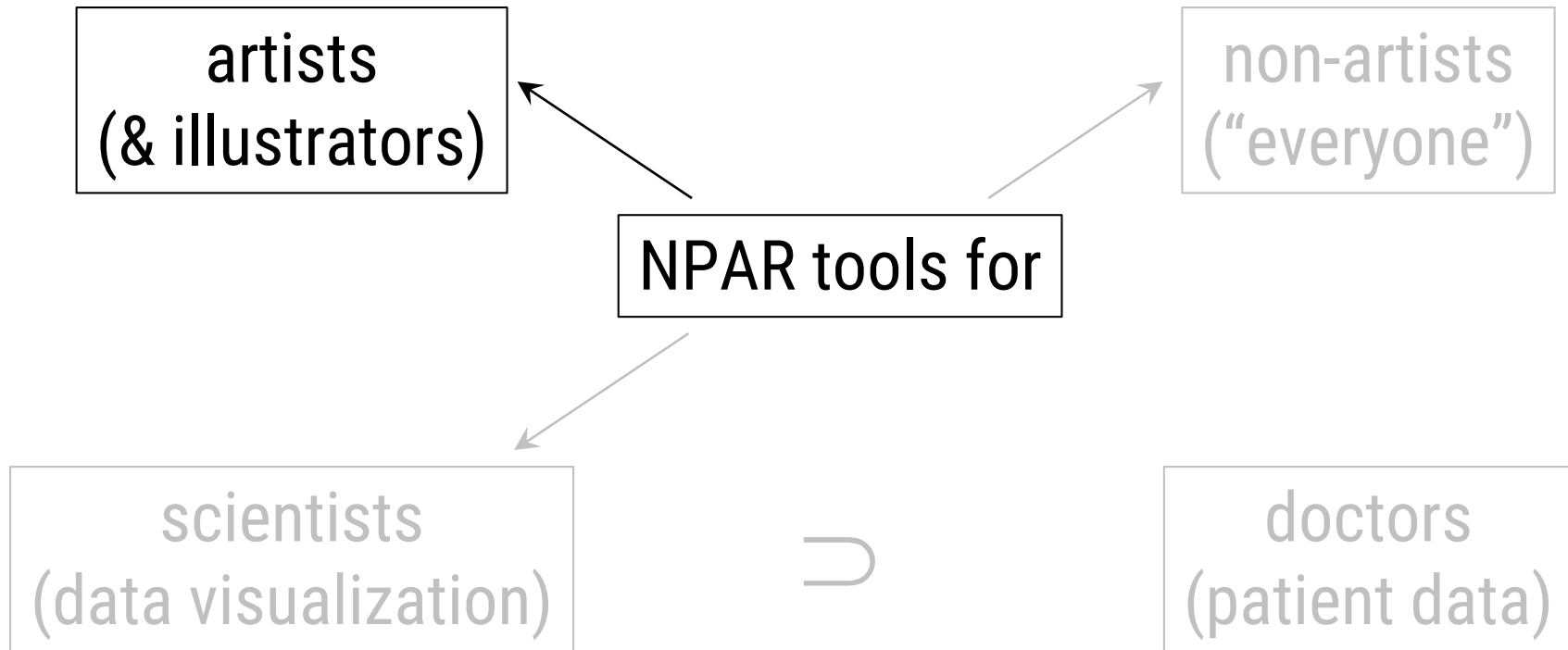
NPAR for Artists: In-Betweening
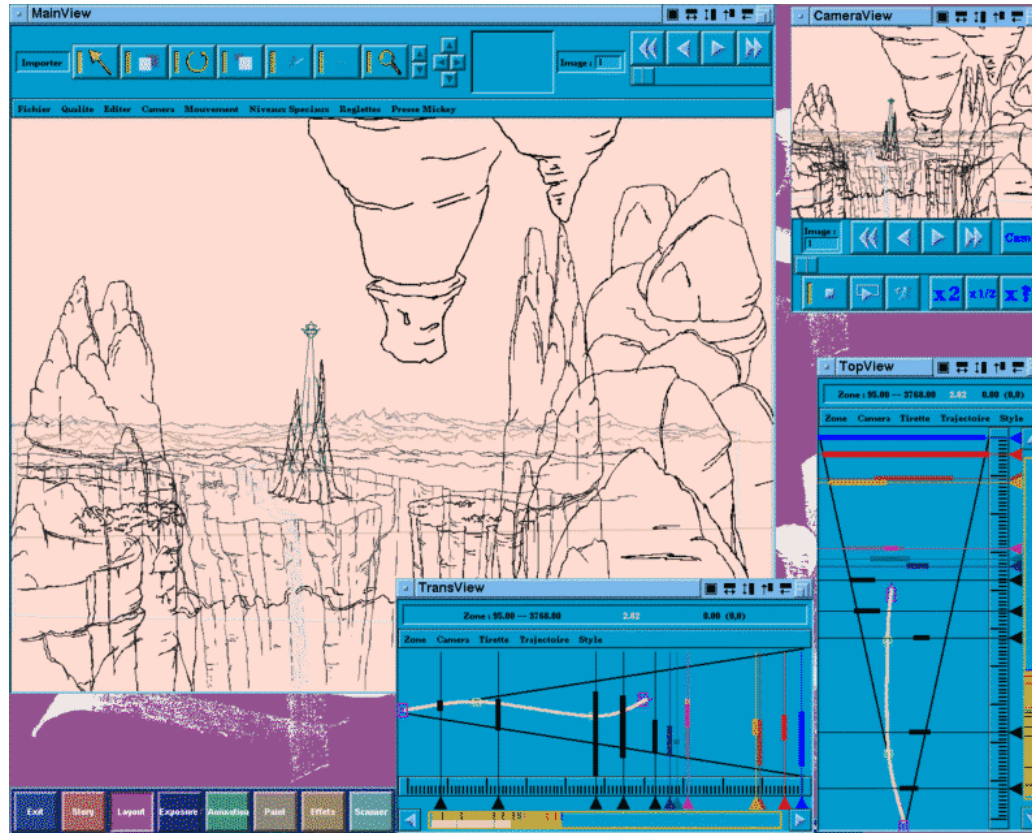
TicTacToon
[Fekete et al., 1995]

NPAR for Artists: In-Betweening

source   target   our approach   [Papenberg et al. 2007]   [Glocker et al. 2008]

[Sýkora et al., 2009a]

NPAR for Artists: In-Betweening

© Disney

[Whited et al., 2010]

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

Expressive 2016, May 8, 2016
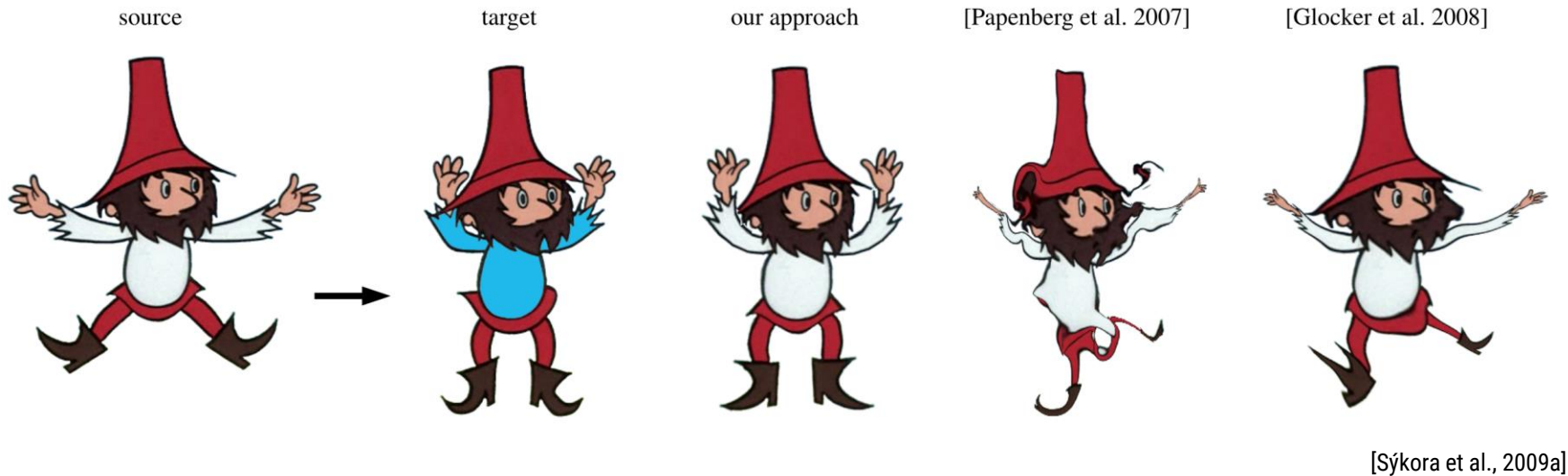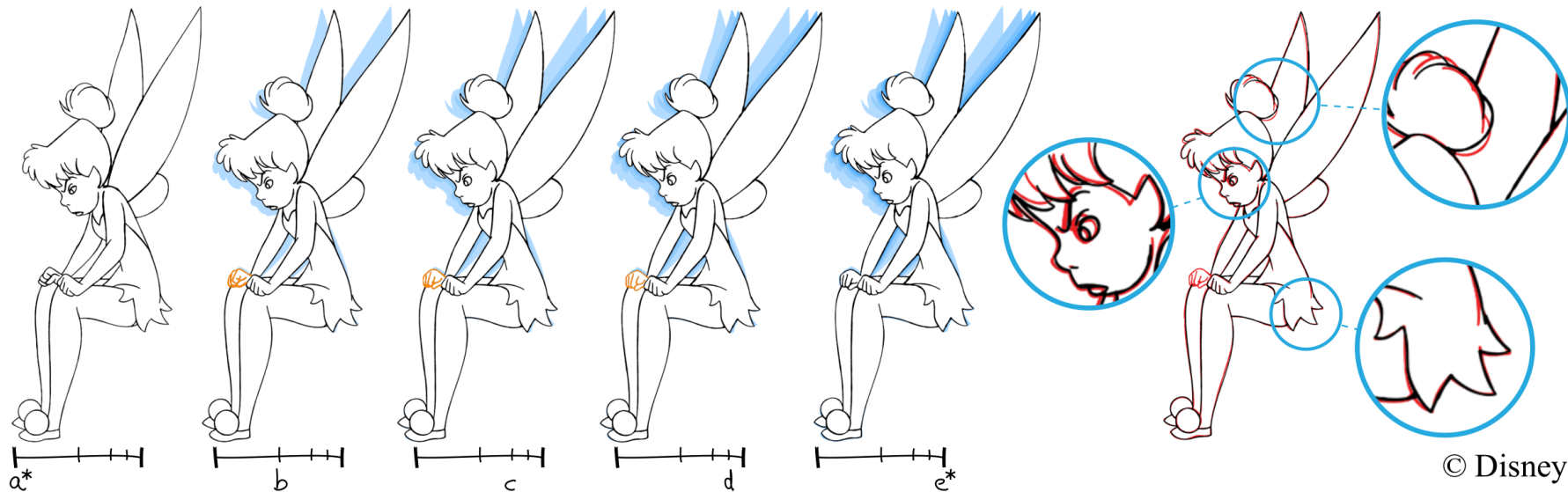
NPAR for Artists: Interactive Cartoon Colorization
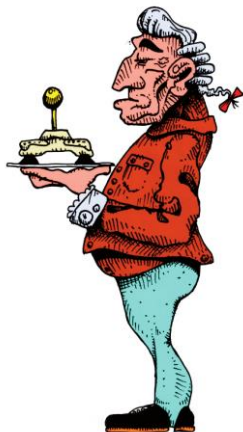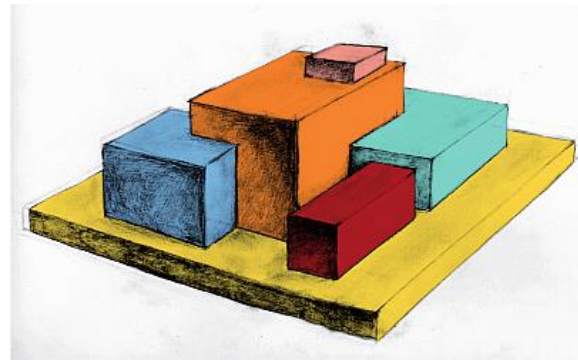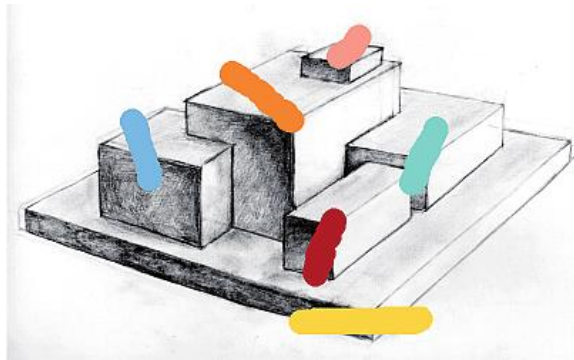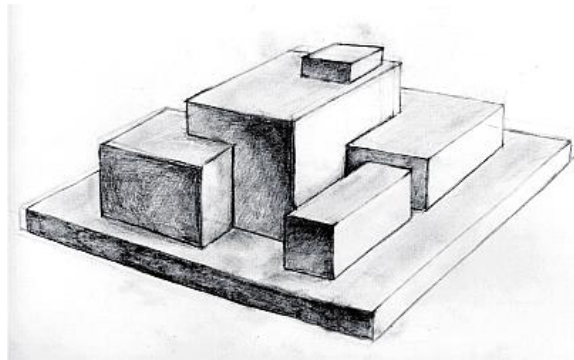
[Sýkora et al., 2009b]

NPAR for Art.: (Photo-)Realistic [sic!] Media Simulation

[Curtis et al., 1997]

[Bousseau et al., 2006]
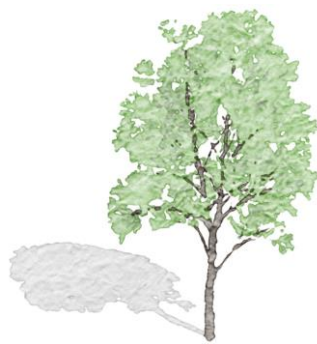
[Luft & Deussen, 2006]

[DiVerdi et al., 2013]

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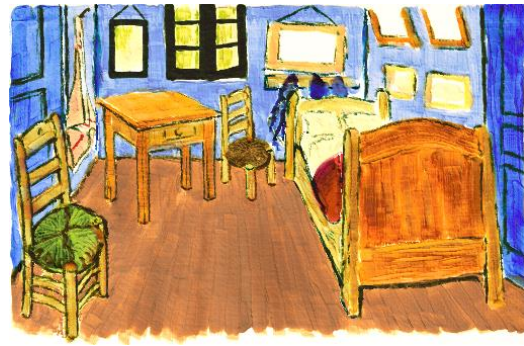
IMPaSTo [Baxter et al., 2004]

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"
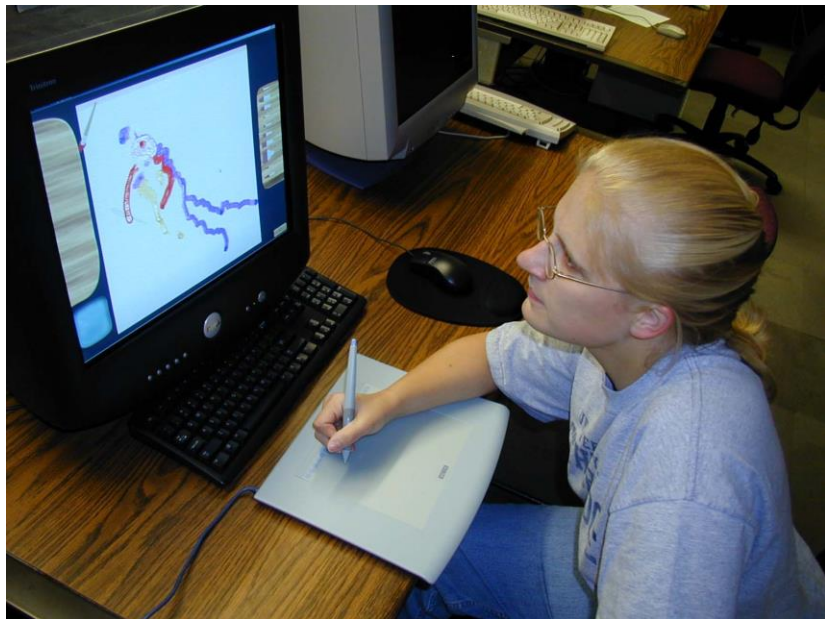
IMPaSTo [Baxter et al., 2004]

IntuPaint [Vandoren et al., 2008]

Low-level vs. High-level Tasks and Control
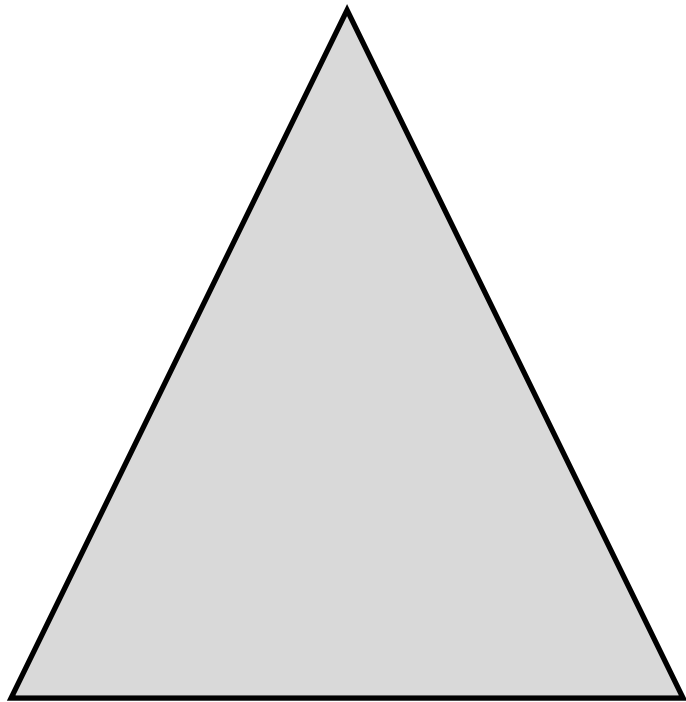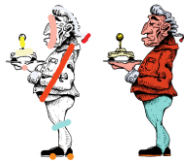
workload/control over result

influence of input

[Semmo et al., 2015/16]

[Sykora et al., 2009b]

[Curtis et al., 1997]

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

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

Expressive 2016, May 8, 2016

Low-level vs. High-level Tasks and Control

workload/control over result

high-level control

influence of input

[Semmo et al., 2015/16]

[Sýkora et al., 2009b]

[Curtis et al., 1997]

[http://two-n.com/pi/]
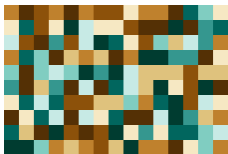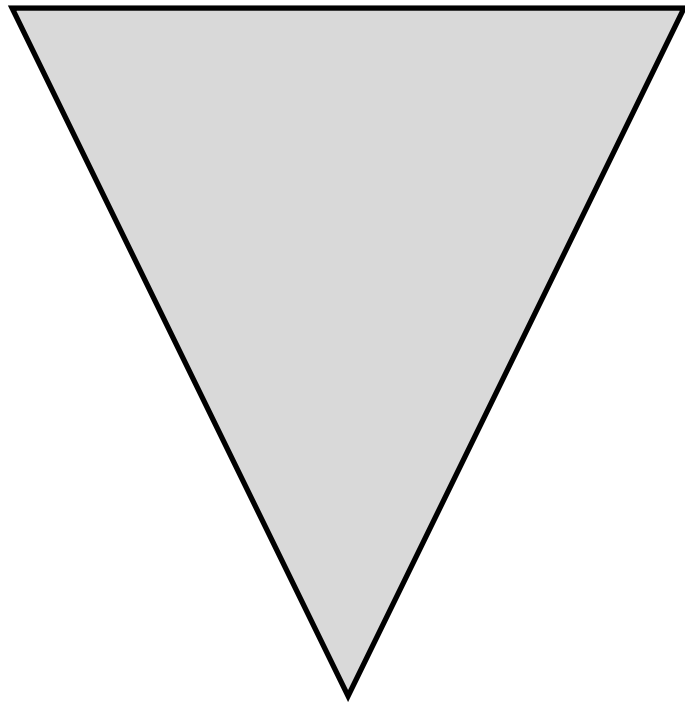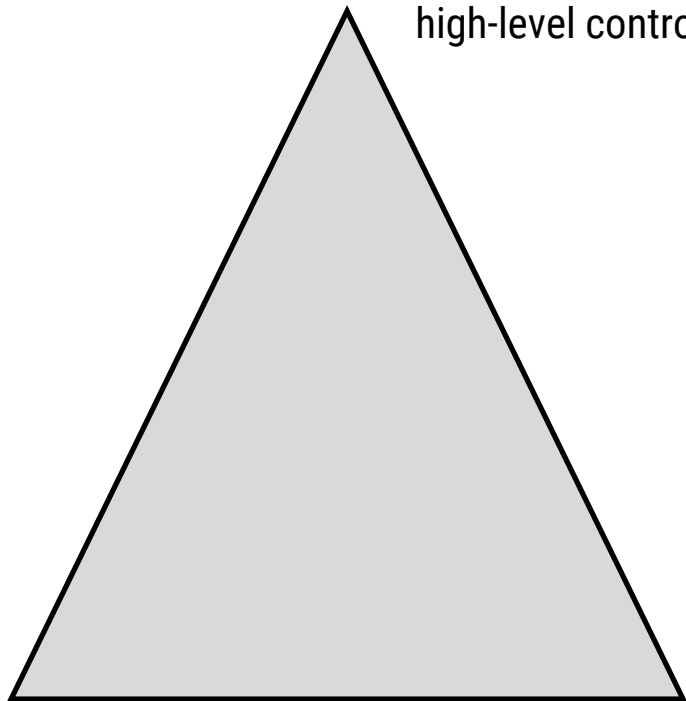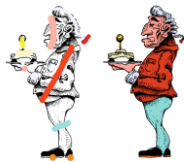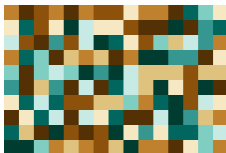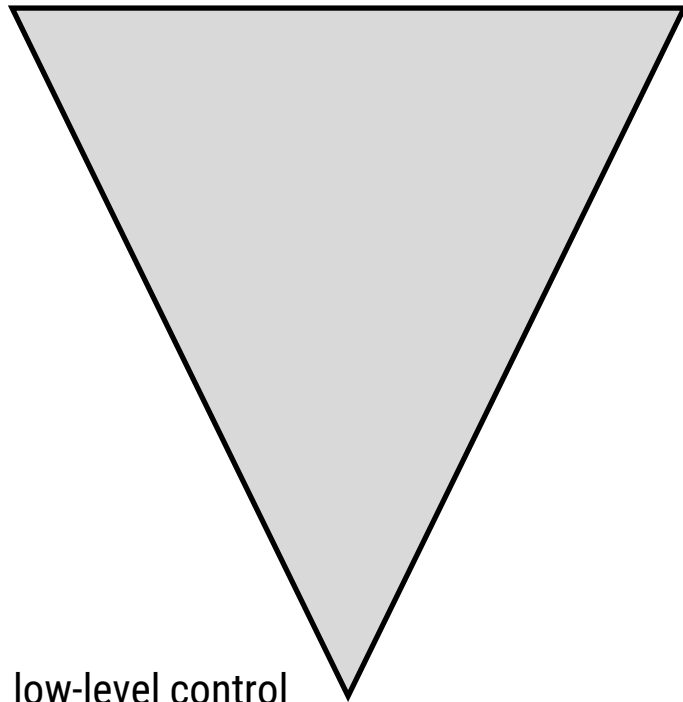
low-level control

Goals & Application Domains of NPAR

artists
(& illustrators)

non-artists
("everyone")

NPAR tools for

scientists
(data visualization)

doctors
(patient data)
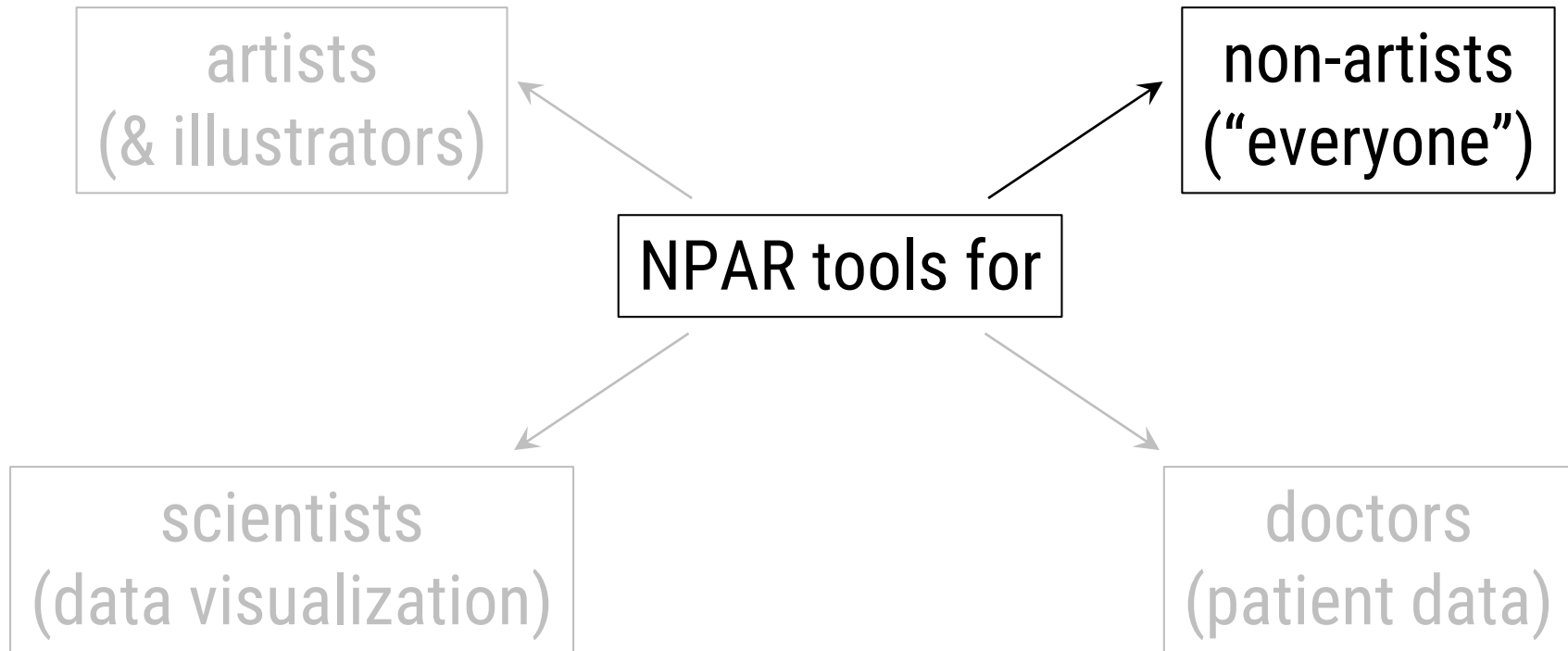
NPAR Tools for Non-Artists: Higher-Level Control

1. Color Palette Extraction

2. Seed Placement and Propagation
Seed Placement
Color Seeds

3. Colorization and Luminance Quantization
(Re-)colorized
Quantized

7. Image Smoothing
Smoothed

4. Edge Detection
Contours (DoG)
Signed FLoG

5. Flow Extraction
Flow Field

6. Paint Texture Computation
Brush Texture
Varnish Texture

Input

Output
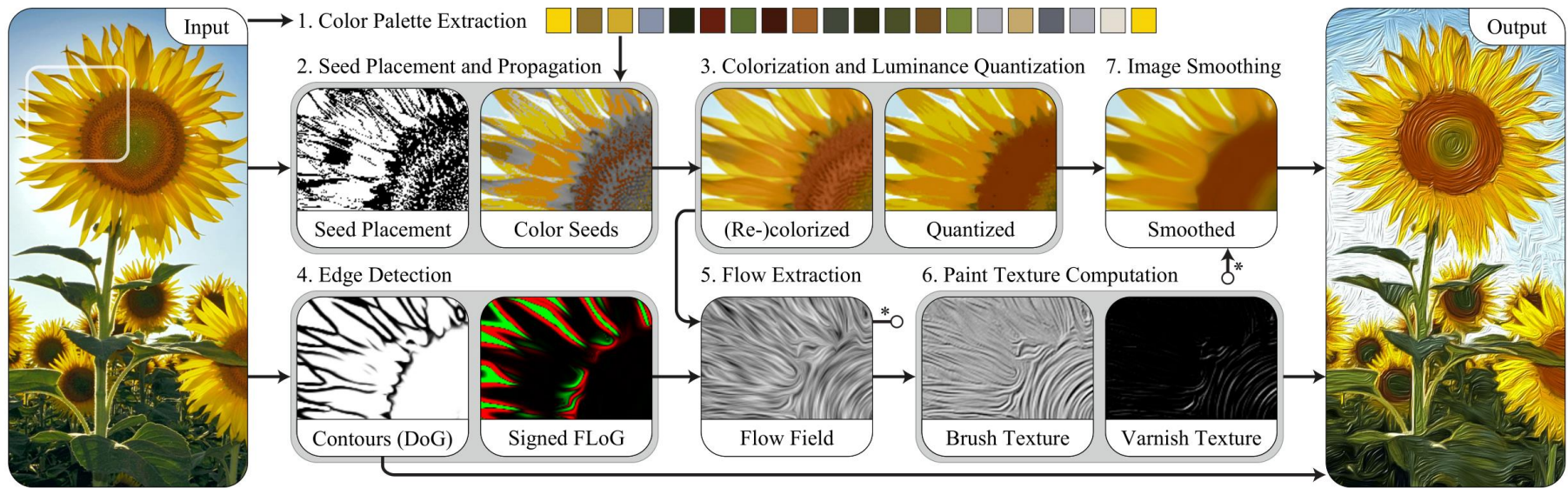
[Semmo et al., 2015/16]

NPAR Tools for Non-Artists: Filters (w/ Interaction)
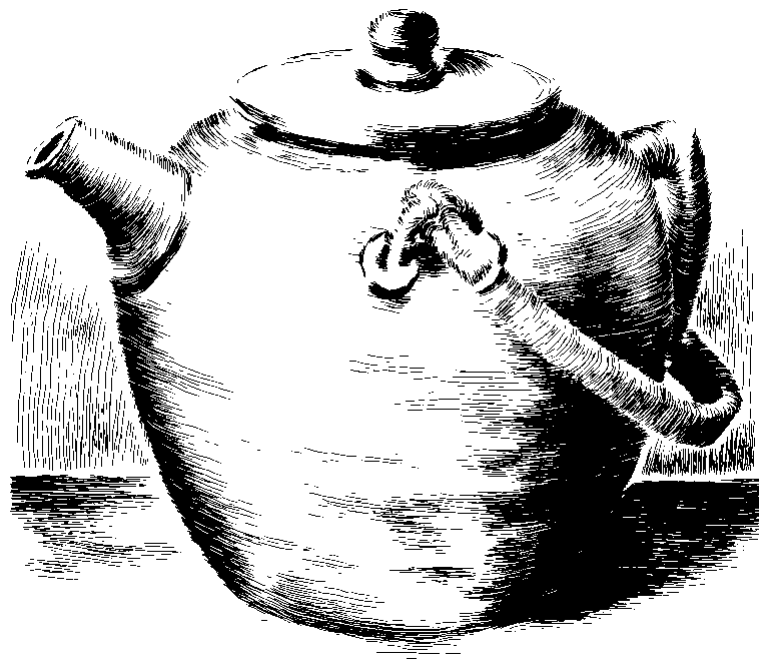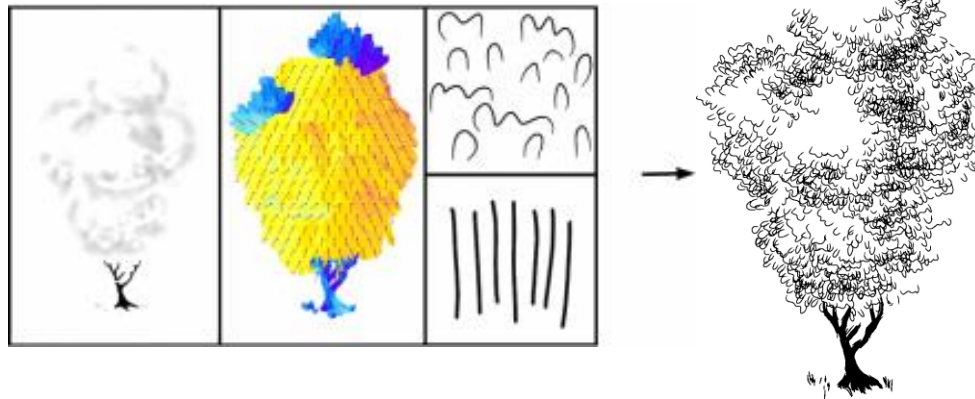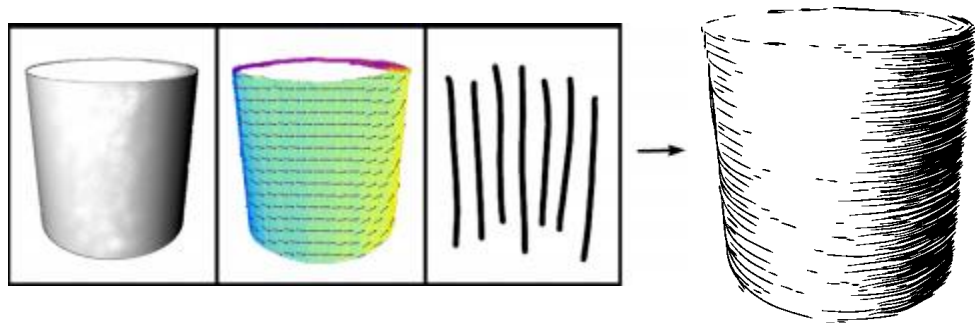
[Salisbury et al., 1997]

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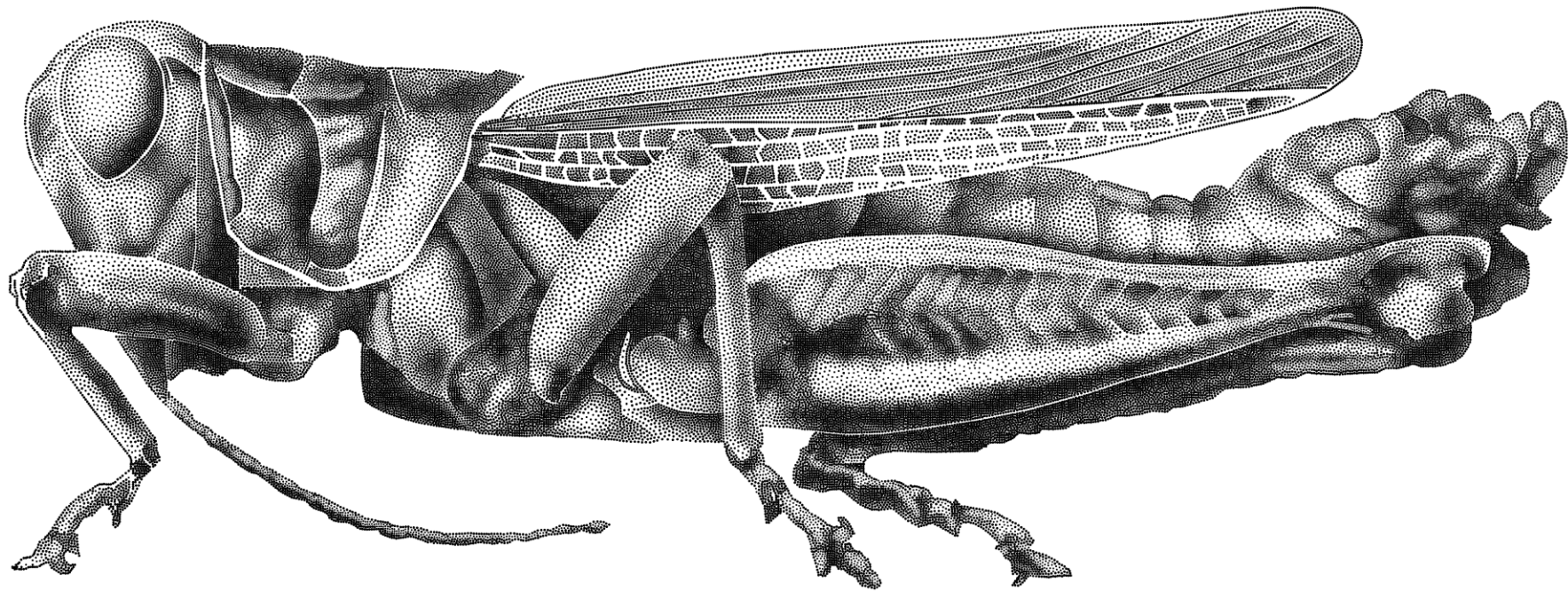
[Deussen et al., 2000]

NPAR Tools for Non-Artists: Filters (w/ Interaction)
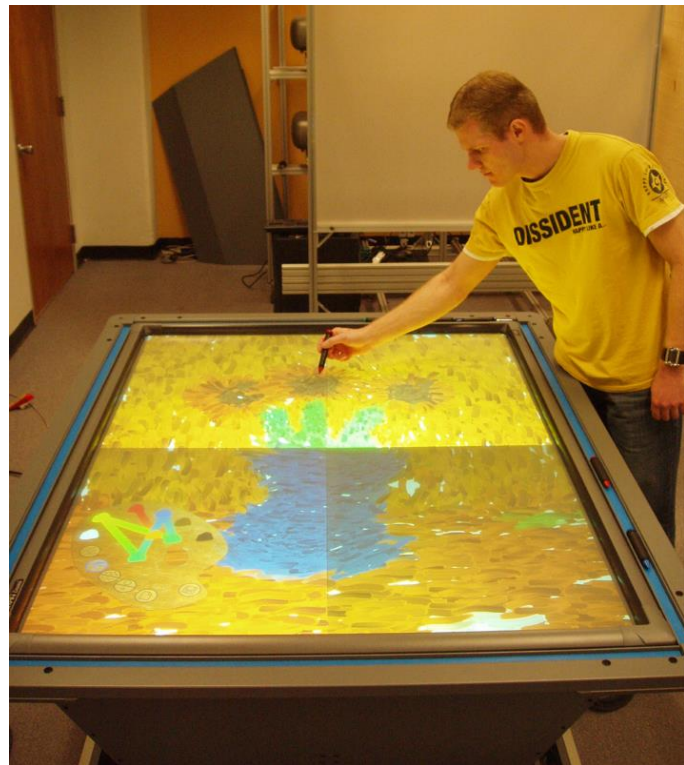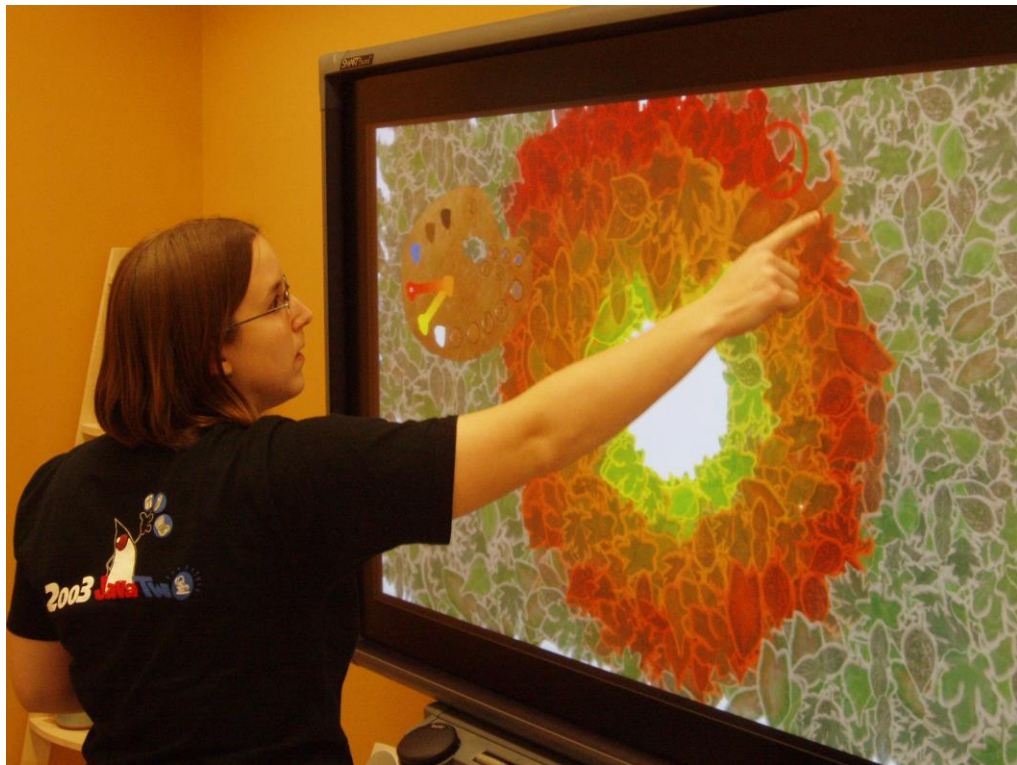
[Schwarz et al., 2007]

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
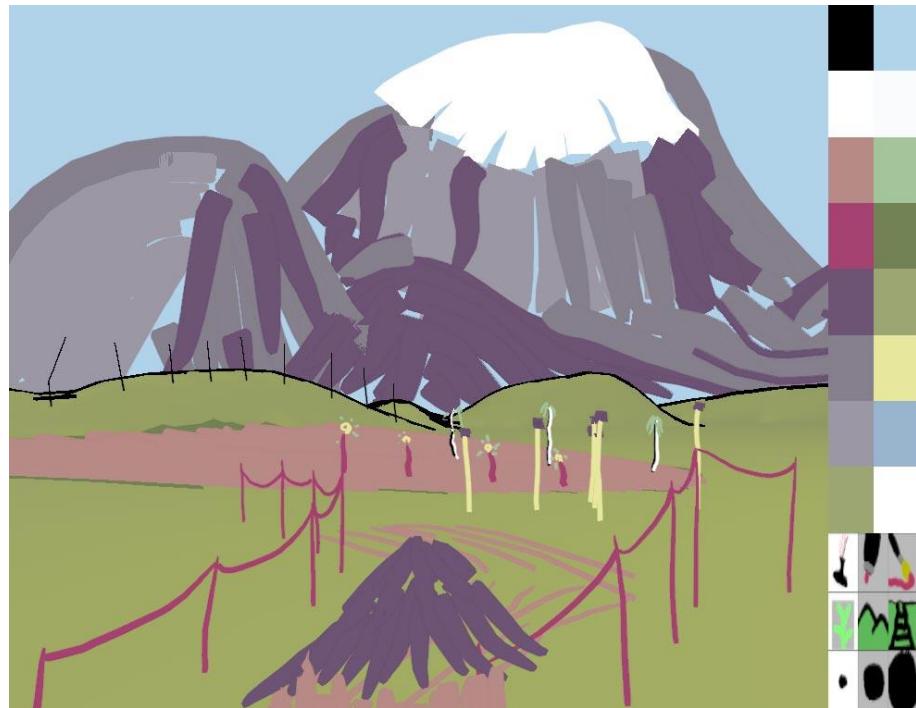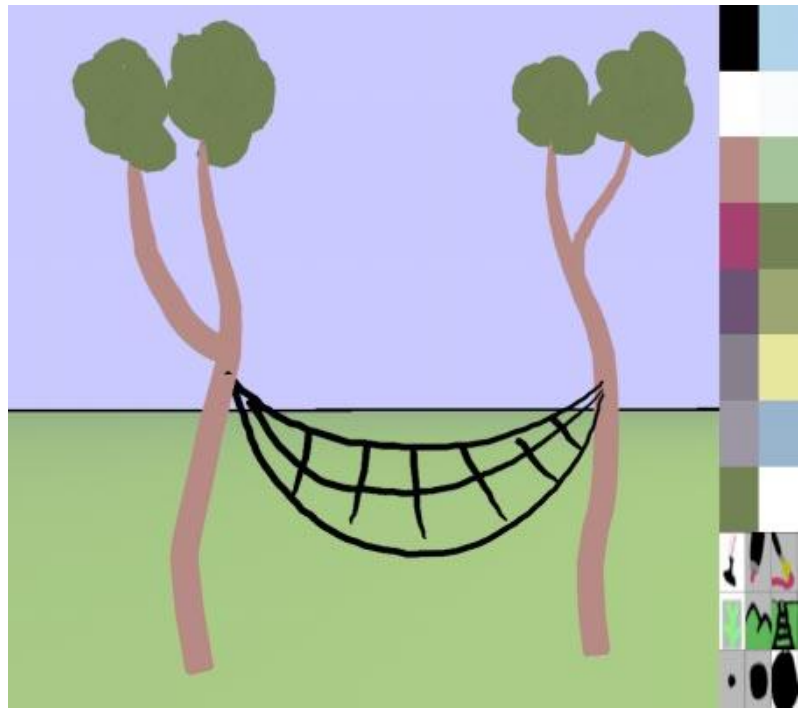
Harold [Cohen et al., 2000]

NPAR Tools f. Non-Artists: Simple Drawing/Painting
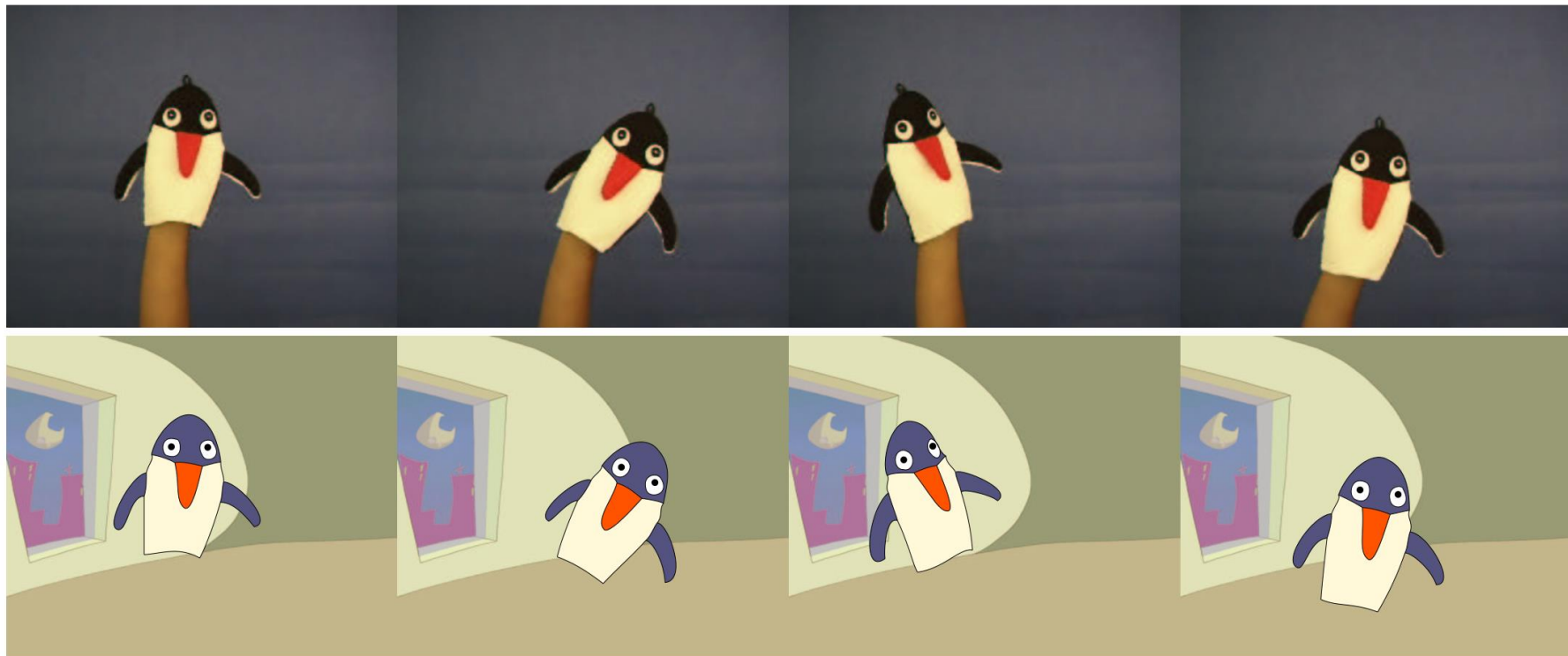
SnakeToonz [Agarwala, 2002]
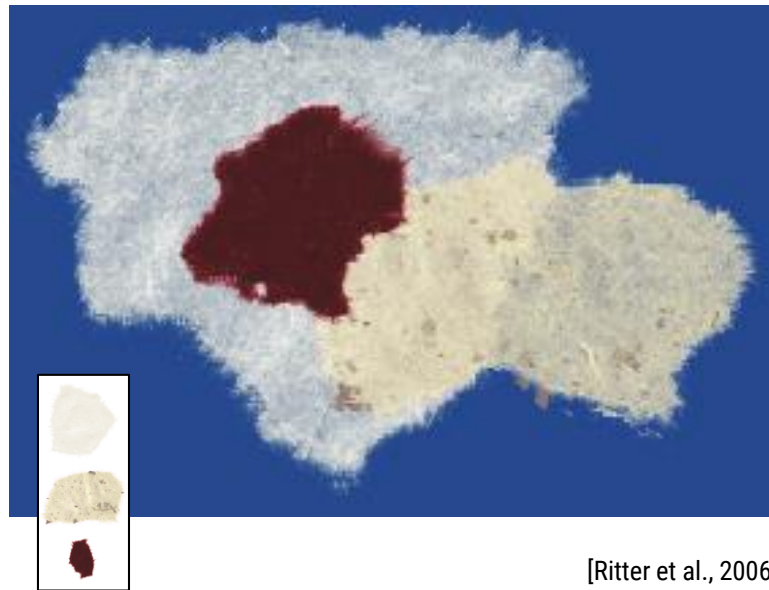
[Ritter et al., 2006]

NPAR Tools for Non-Artists: Mobile Apps

[PaintCan by Winnemöller et al.]

[PencilFX by Gooch et al.]
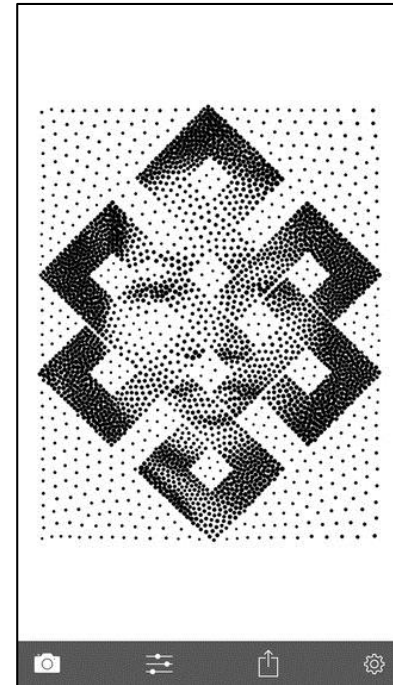
SnapDot based on [Secord 2002]

Goals & Application Domains of NPAR

artists
(& illustrators)

non-artists
("everyone")

NPAR tools for

scientists
(data visualization)

doctors
(patient data)
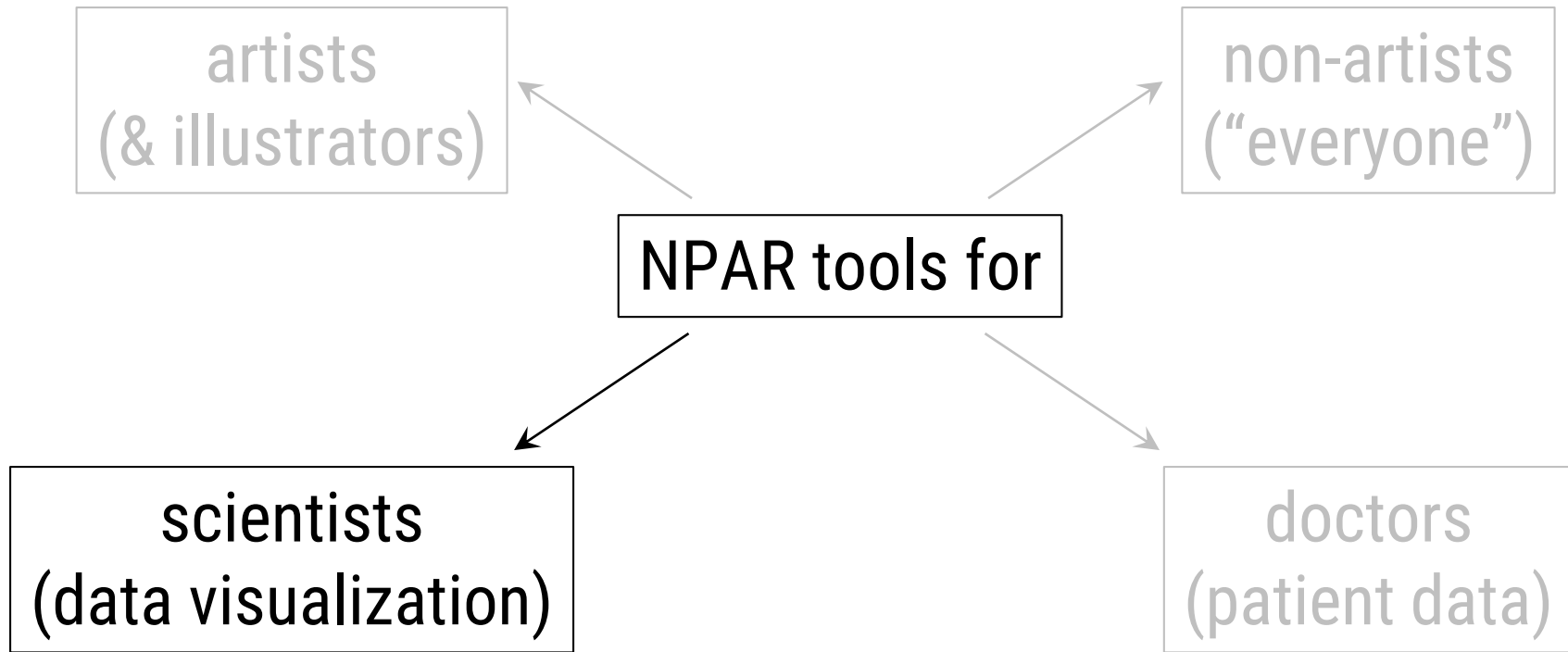
Expressive/Illustrative Visualization

[Lum & Ma, 2002]

NPAR Tools for Scientists (& Science Illustrators)

[Bruckner & Gröller, 2007a]
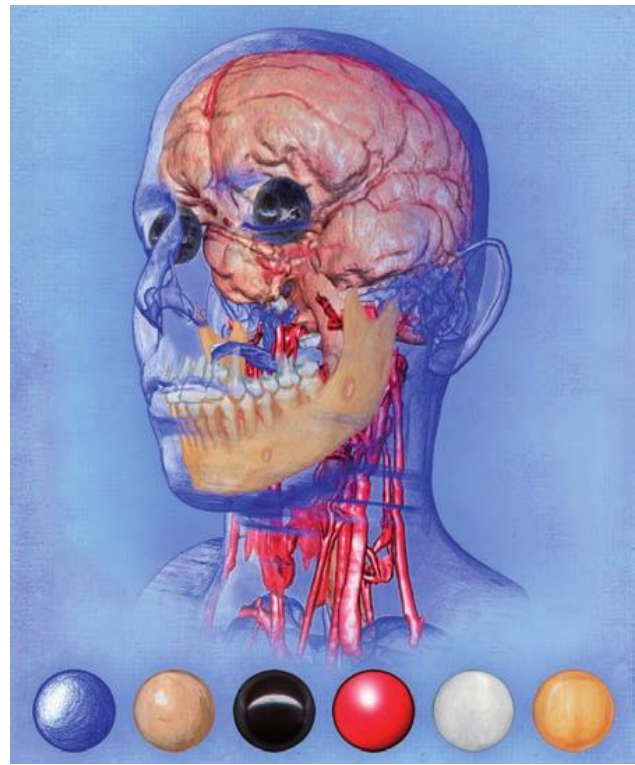
[Bruckner & Gröller, 2007b]

NPAR Tools for Scientists (& Science Illustrators)
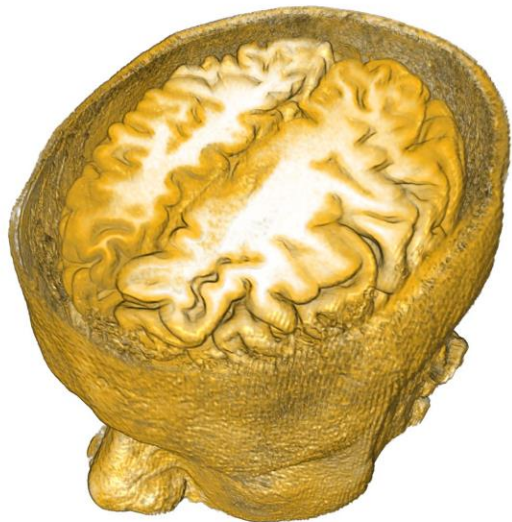
[Gerl & Isenberg, 2012]
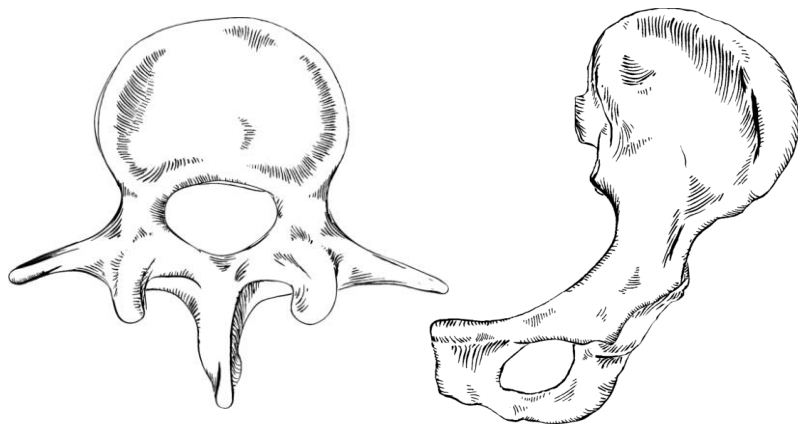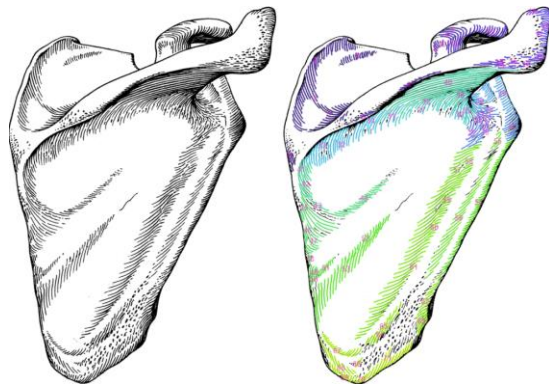
[Gerl & Isenberg, 2013]

NPAR Tools for Scientists (& Science Illustrators)

Crossover tube
Piston (4)
Caliper stud (2)
Brakepad (1)
Piston (5)
Caliper stud (4)
Knuckle bracket
Hub
R. caliper
Caliper stud (1)
Dust cover
Caliper stud (3)

L. caliper
Rim
Brakepad (2)
Rotor
Tire

Epidermis
L. thyrohyoid
Thyroid gland

L. sternocleidomastoid
L. splenius capitis
Trapezius
L. levator scapulae
Seventh cervical vertebra
L. scalenus anterior
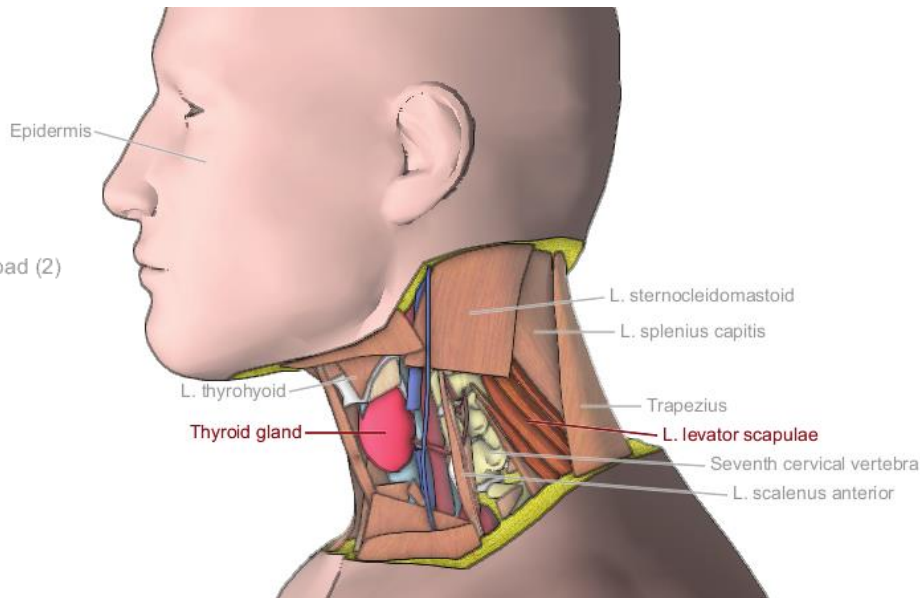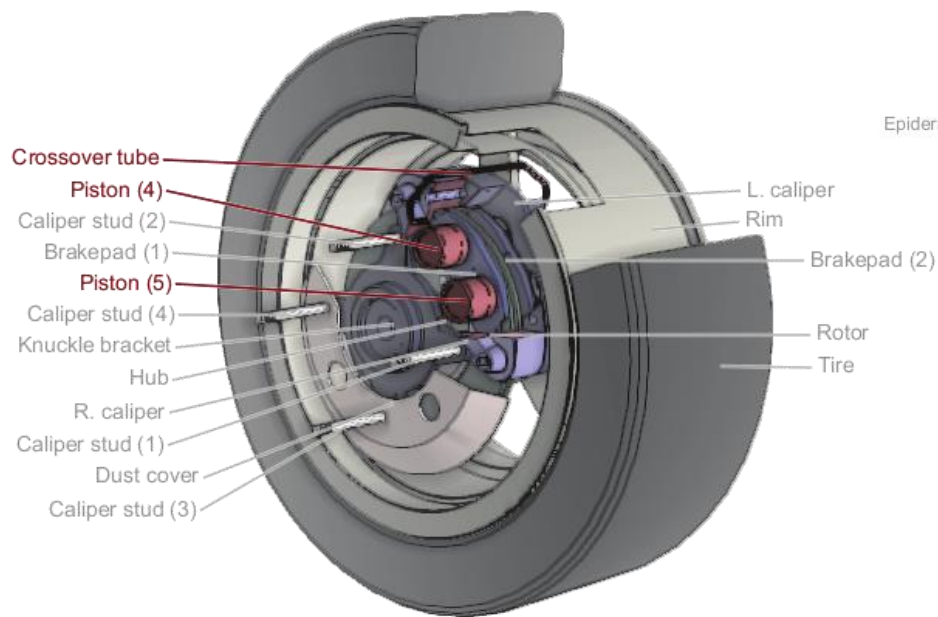
[Li et al., 2007]

NPAR Tools for Scientists (& Science Illustrators)

[van der Zwan et al., 2011]
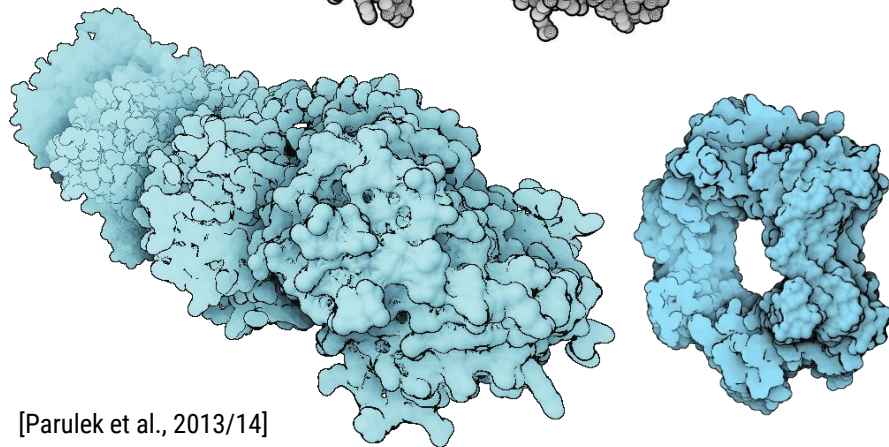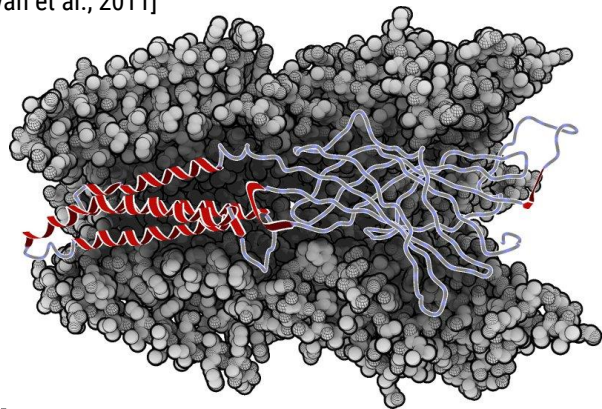
[Parulek et al., 2013/14]
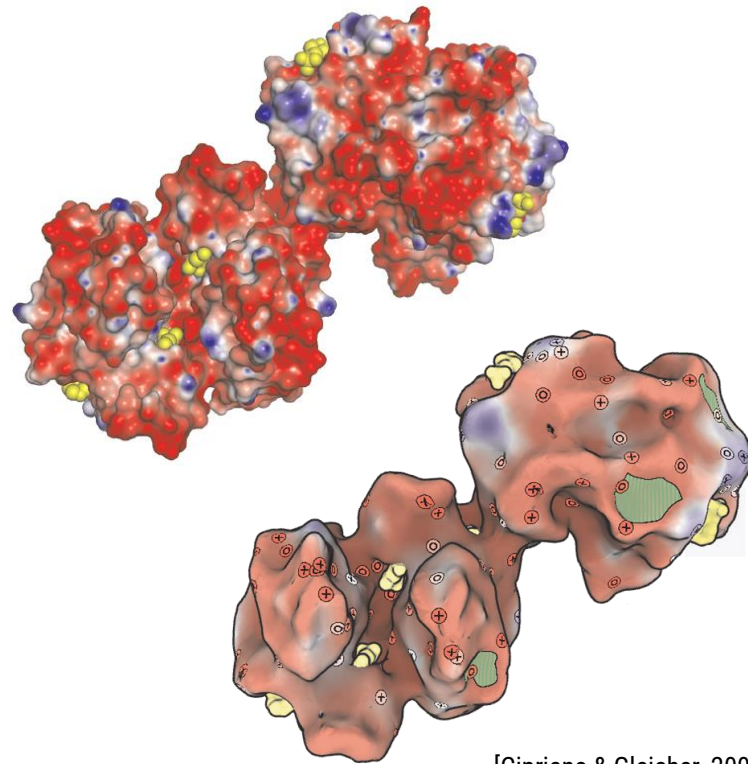
[Cipriano & Gleicher, 2007]

NPAR Tools for Scientists (& Science Illustrators)

[Everts et al., 2009]
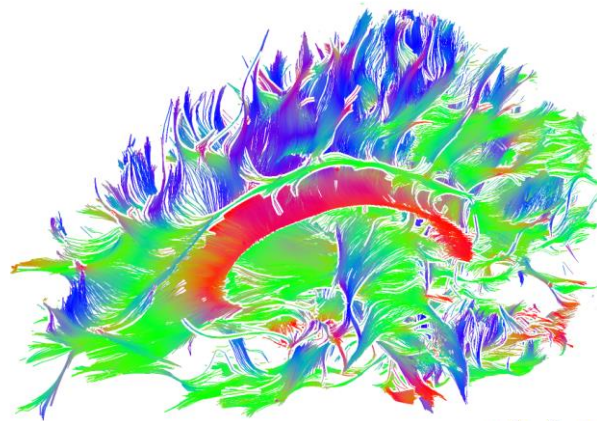
[Everts et al., 2015]

[Svetachov et al., 2010]

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non-artists
("everyone")

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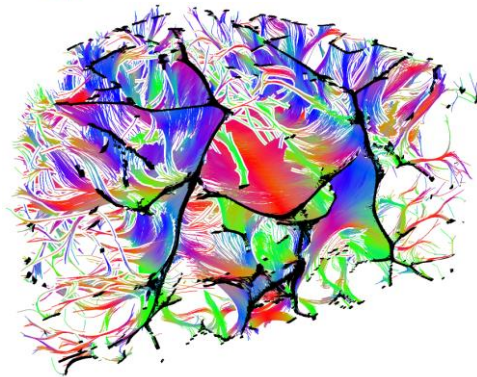
doctors
(patient data)
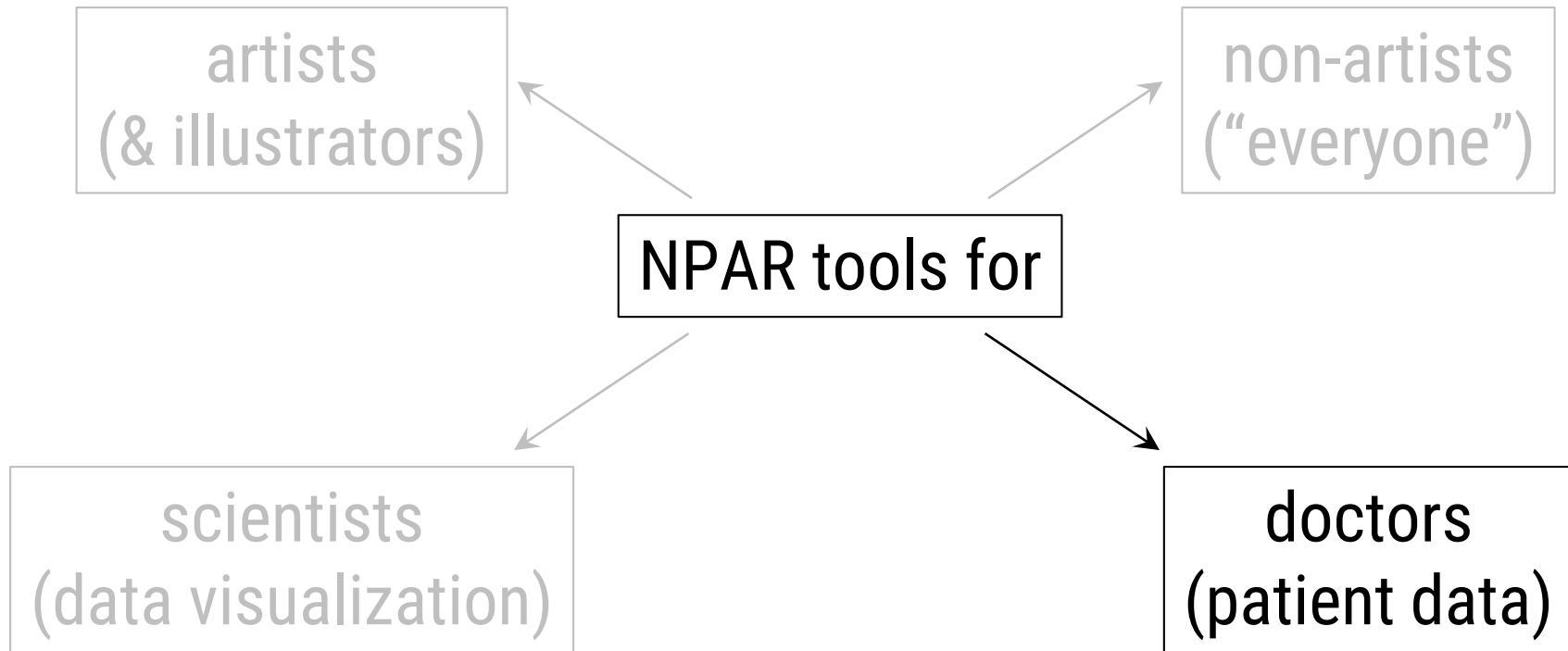
NPAR Tools for Doctors (and Patients)
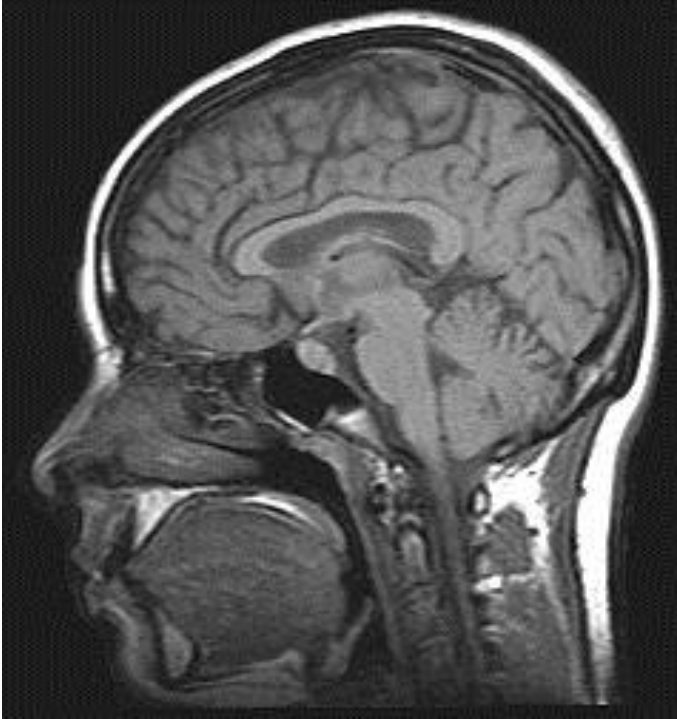
NPAR Tools for Doctors (and Patients)
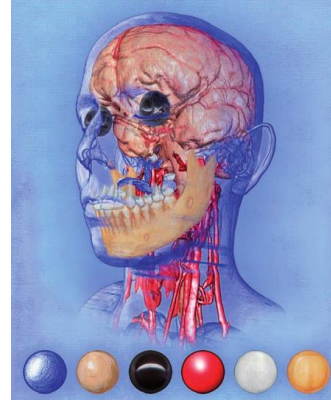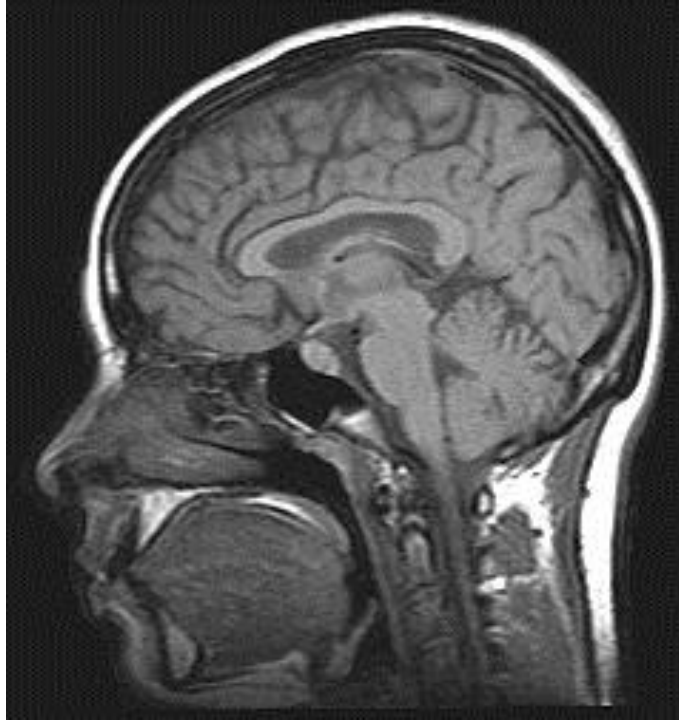
[Bruckner & Gröller, 2007b]
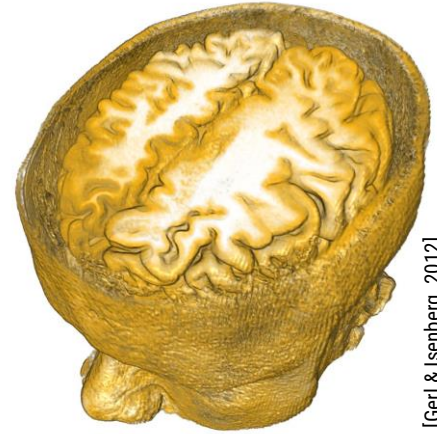
[Gerl & Isenberg, 2012]
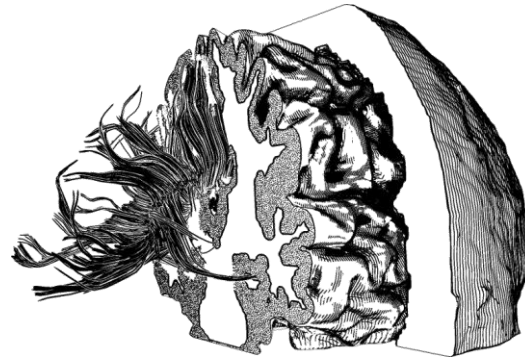
[Svetachov et al., 2010]

Low-level vs. High-level Tasks and Control

workload/control over result

high-level control

influence of input

low-level control

[Semmo et al., 2015/16]

[Sýkora et al., 2009b]

[Curtis et al., 1997]

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

An Interaction Spectrum

RealBrush [Lu et al., 2013]

Sisley the abstract Painter [Zhao & Zhu, 2010]

Low-level control

High-level control

An Interaction Spectrum

RealBrush [Lu et al., 2013]

artists
(& illustrators)

Sisley the abstract Painter
[Zhao & Zhu, 2010]
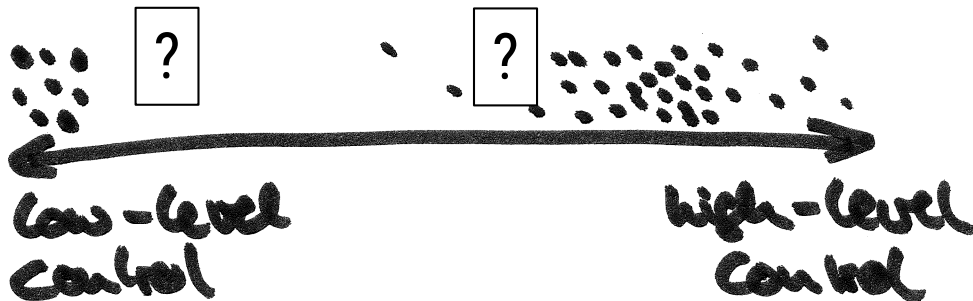
low-level
control

high-level
control

An Interaction Spectrum

artists
(& illustrators)

RealBrush [Lu et al., 2013]

Sisley the abstract Painter [Zhao & Zhu, 2010]

?

?

low-level control

high-level control

An Interaction Spectrum

RealBrush [Lu et al., 2013]

artists
(& illustrators)

non-artists
("everyone")

Sisley the abstract Painter
[Zhao & Zhu, 2010]
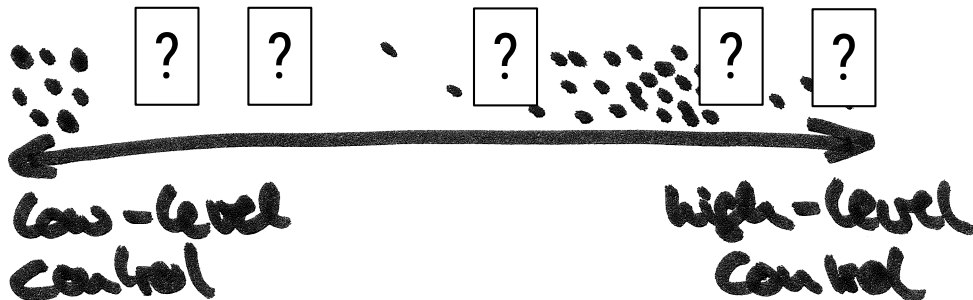
? ? · ? ? ?

Low-level
Control

high-level
Control

An Interaction Spectrum

RealBrush [Lu et al., 2013]

artists
(& illustrators)

non-artists
("everyone")

scientists
(data visualization)

Sisley the abstract Painter
[Zhao & Zhu, 2010]

? ? ? ? ? ? ?

low-level control

high-level control

An Interaction Spectrum

RealBrush [Lu et al., 2013]

artists
(& illustrators)

non-artists
("everyone")

scientists
(data visualization)

Sisley the abstract Painter
[Zhao & Zhu, 2010]

? ? ? ? ? ? ? ?

low-level
control

high-level
control
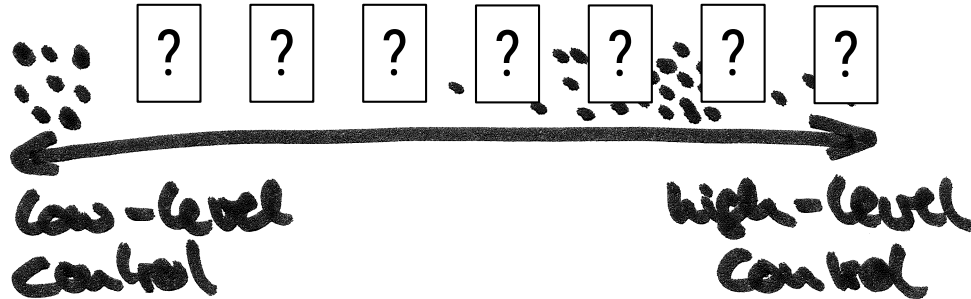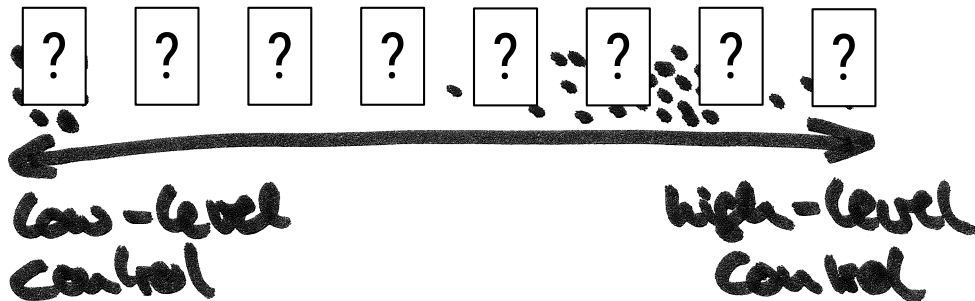
Mapping the Interaction Spectrum

Mapping the Interaction Spectrum

high-skilled

little skill

low-level control

high-level control

artists?

artists in training?

non-artists?

scientists?
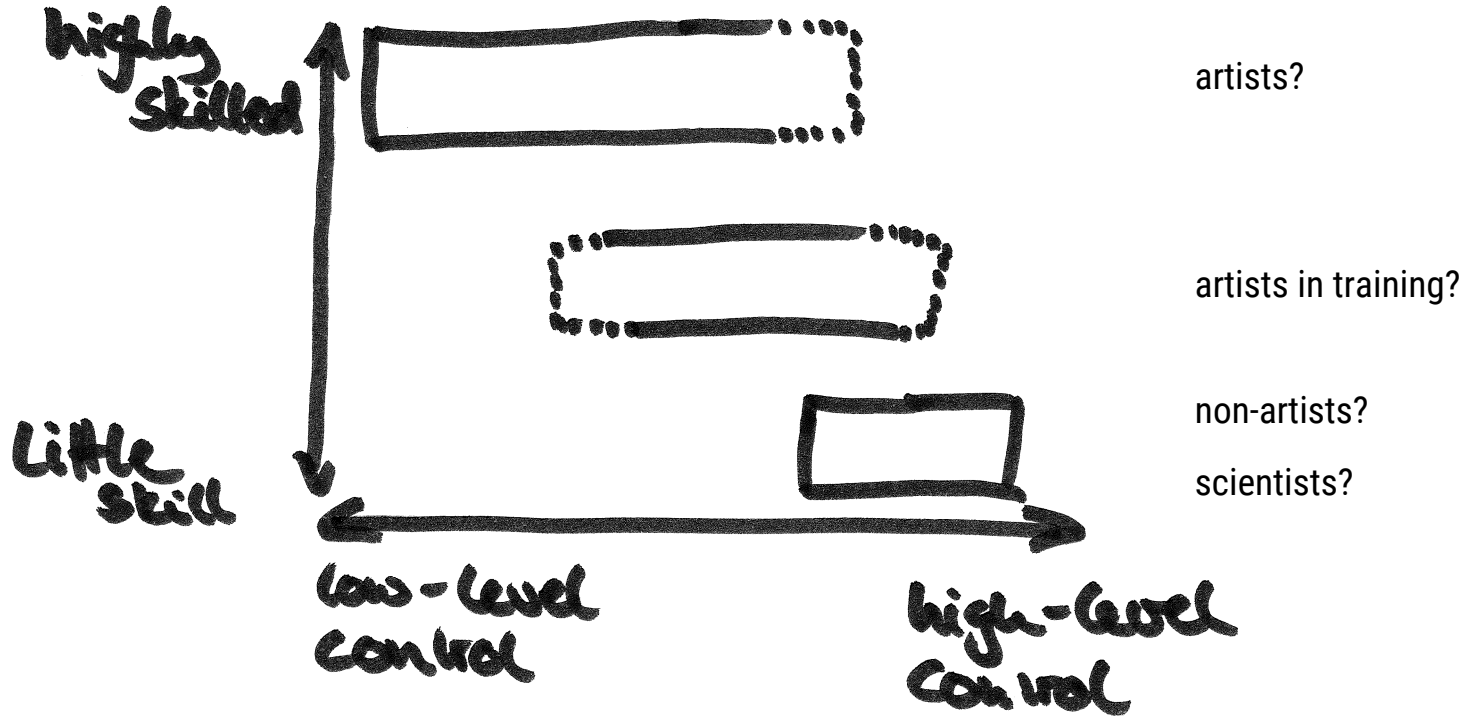
Challenges of Providing Appropriate Control

- How to cope with system complexity?
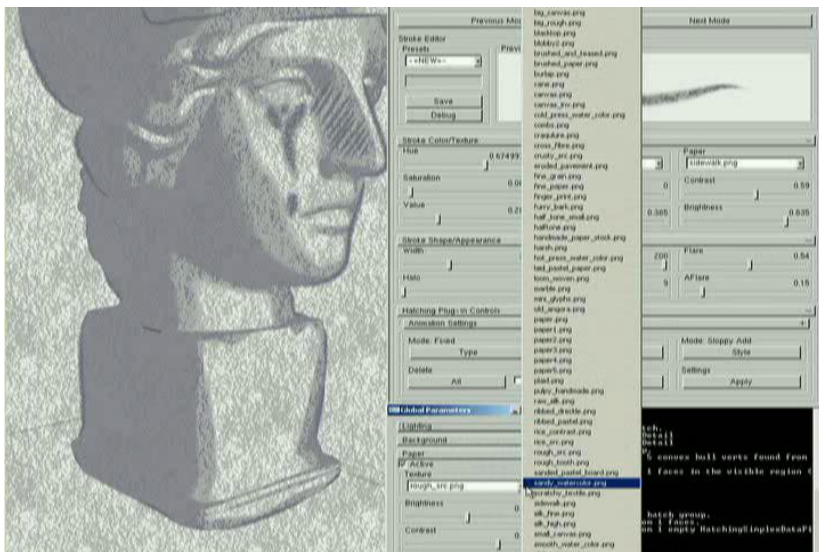
WYSIWYG-NPR [Kalnins et al., 2003]
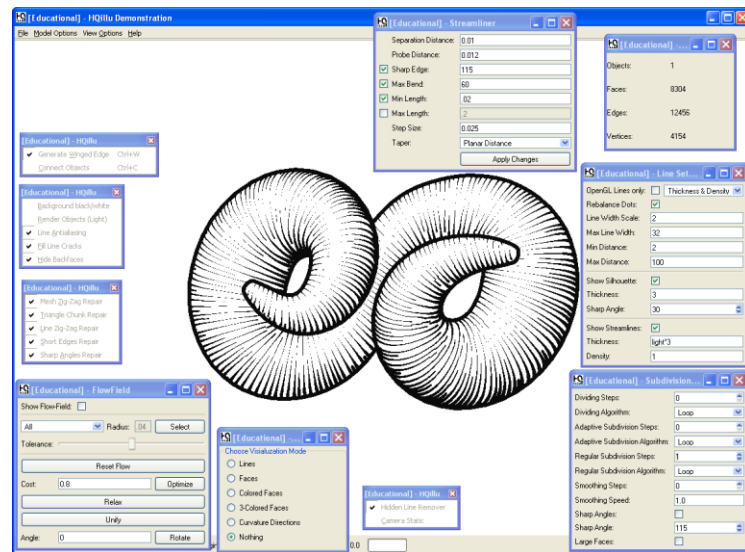
[Zander et al., 2004]

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

Challenges of Providing Appropriate Control

- How to cope with system complexity?

Paint by Relaxation [Hertzmann, 2001]

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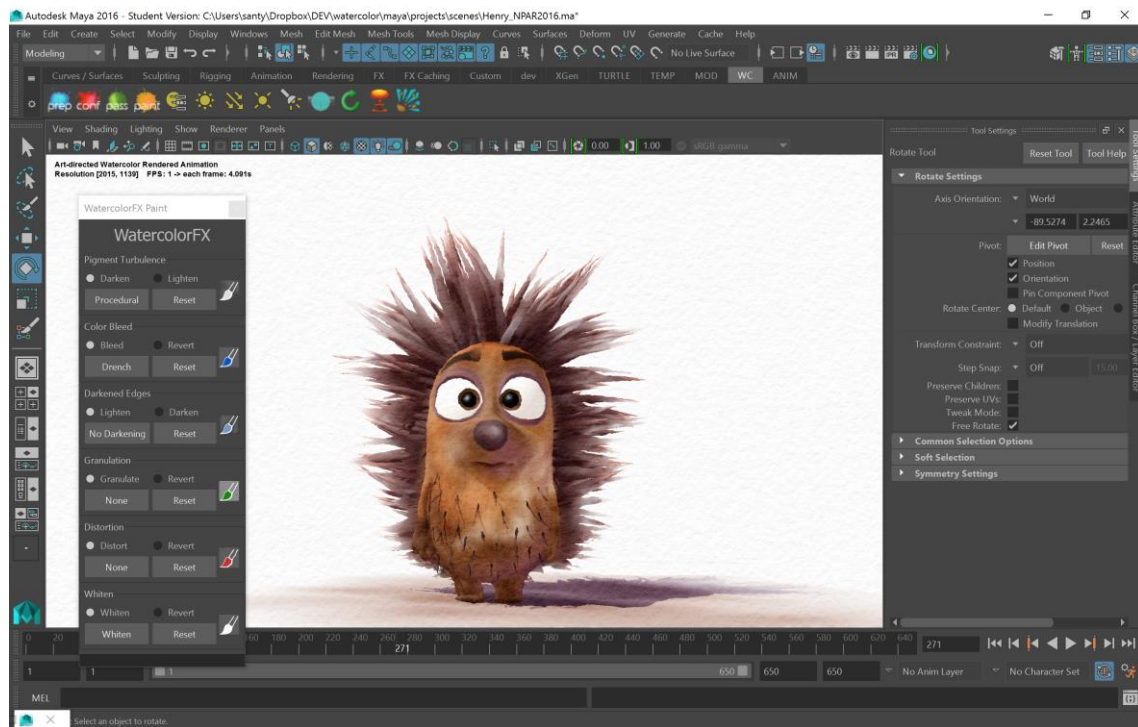
- How to cope with system complexity?

[Montesdeoca et al., 2016]

Challenges of Providing Appropriate Control

- How to cope with system complexity?

[Collomosse, 2006]
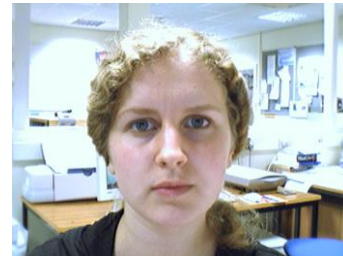
[Shugrina et al., 2006]

Challenges of Providing Appropriate Control

- How to cope with system complexity?

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

Expressive 2016, May 8, 2016

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]

[Lukáč et al., 2013]

[Lu & Ebert, 2005]
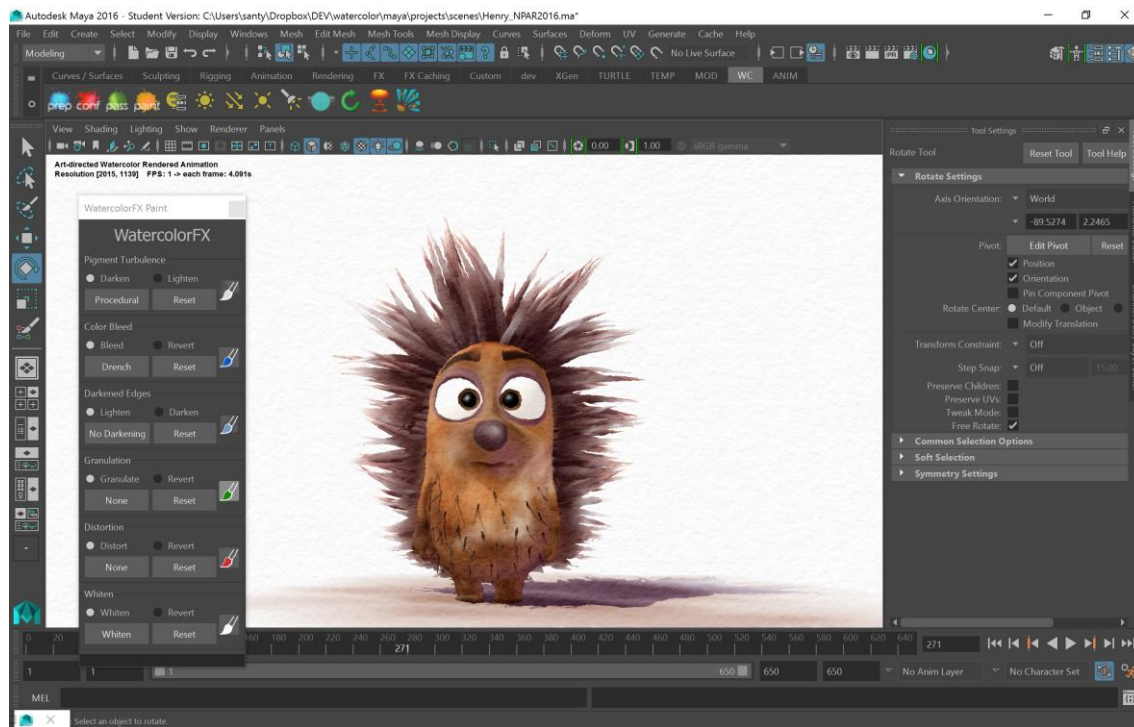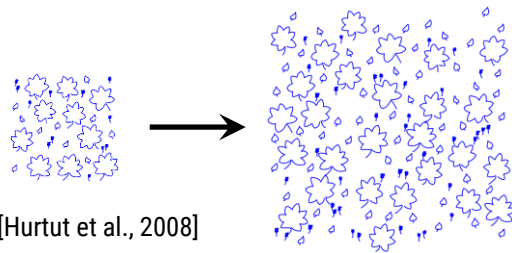
WYSIWYG-NPR [Kalnins et al., 2003]

[Martín et al., 2010/11]

[Bénard et al., 2013]

Challenges of Providing Appropriate Control

- example-based operators vs. media simulations: adjustable level of control
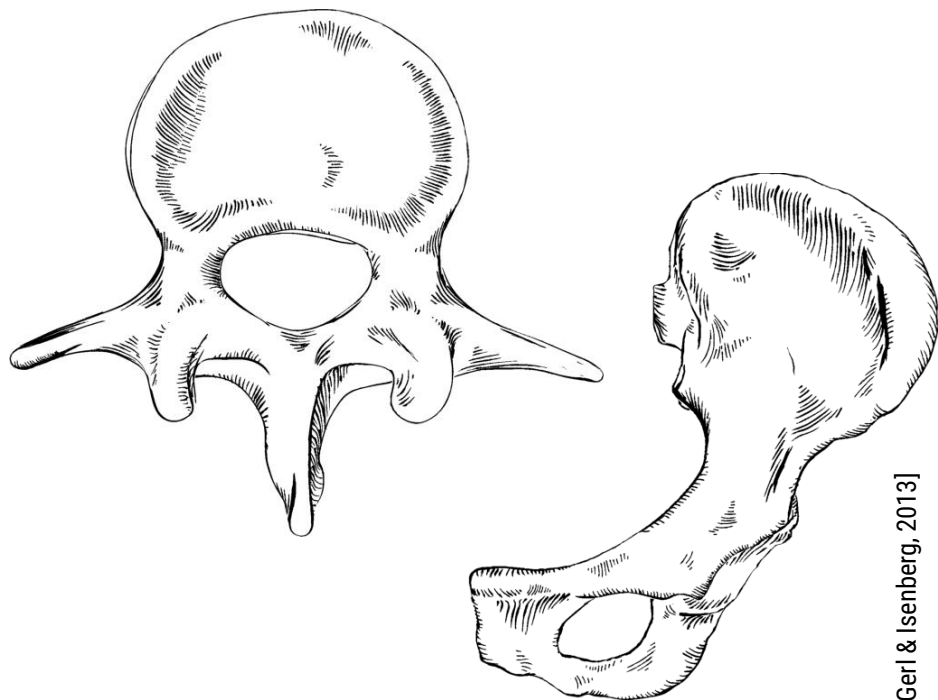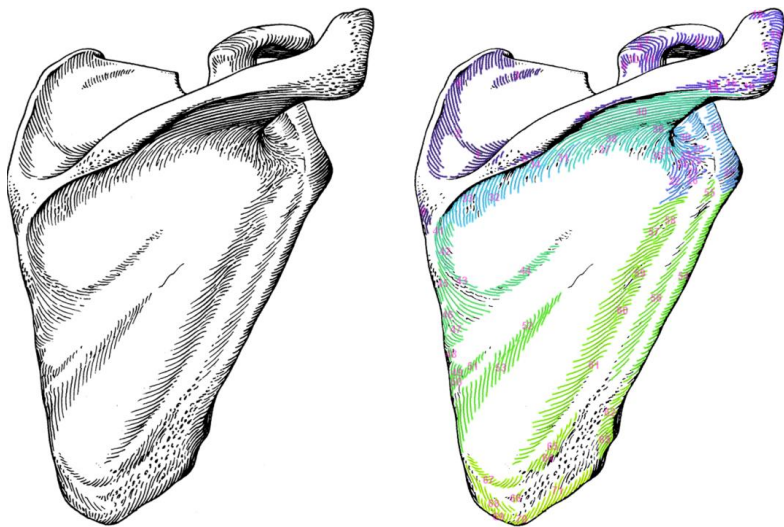
[Gerl & Isenberg, 2013]

Challenges of Providing Appropriate Control

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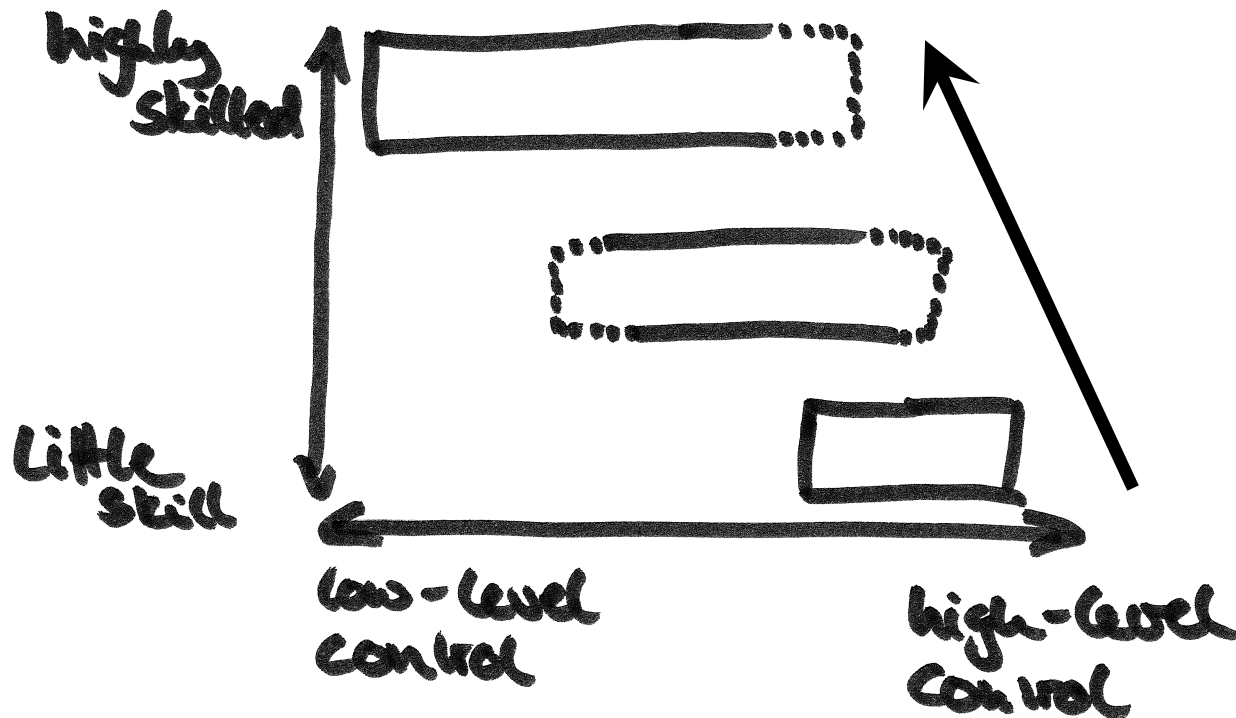
Challenges of Providing Appropriate Control

- 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]
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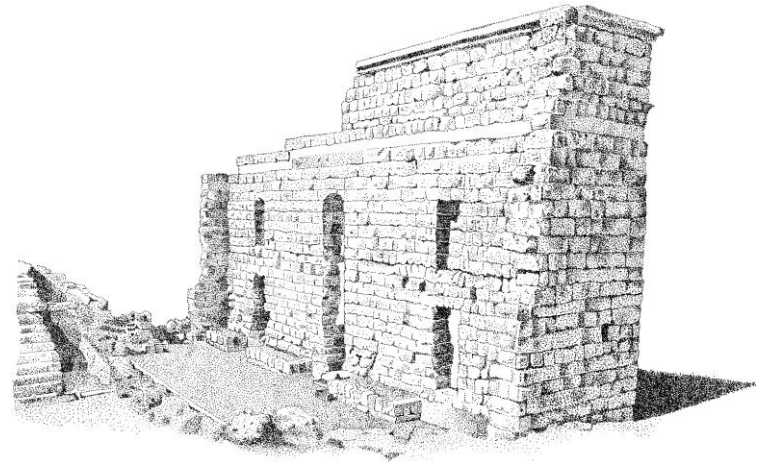

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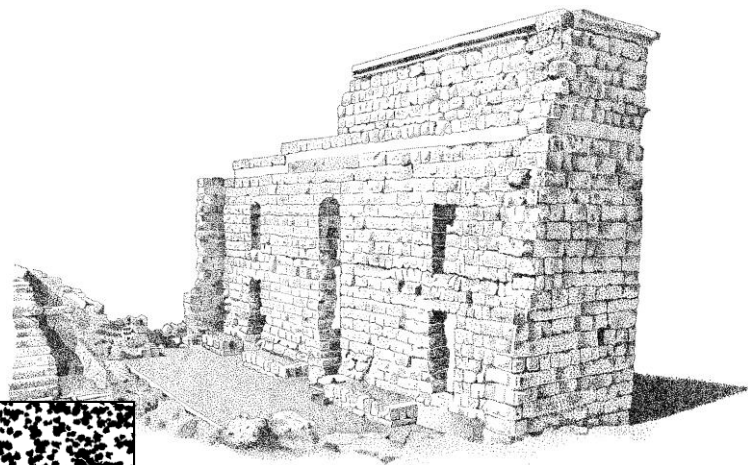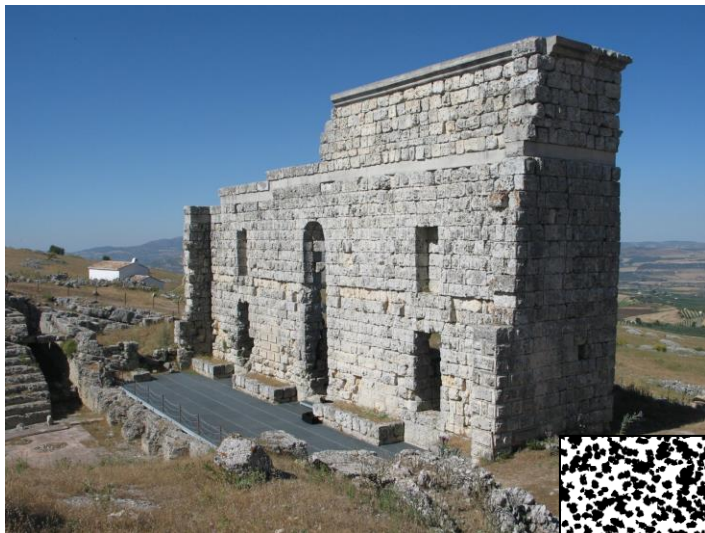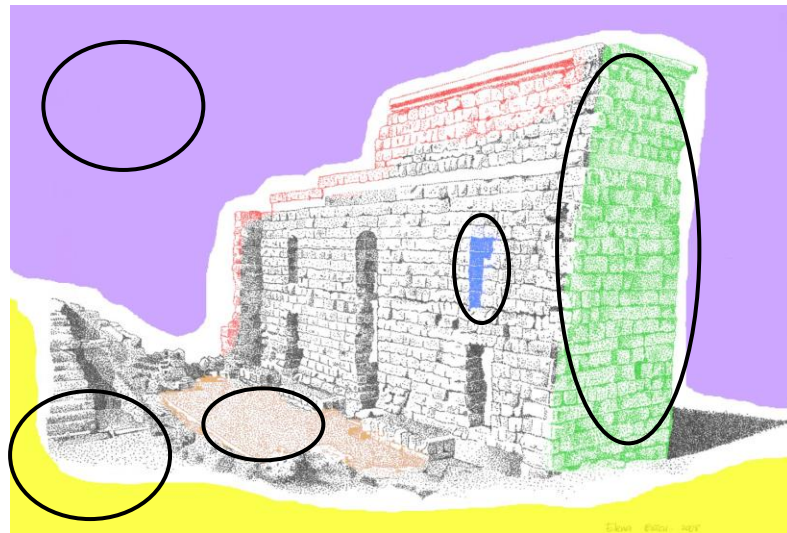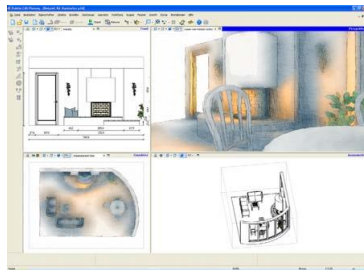
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3. NPAR success stories

[PaintCan]   [Luft et al., 2008]   [Universal Pictures/Winnemöller, 2013]   [Harvill, 2007]   [Mitchell et al., 2007]

Interactive NPAR:
What type of tools should we create?*

Tobias Isenberg

* The selection of examples is biased and many more
  excellent examples exist for the mentioned approaches.