



# Reducing Affective Responses To Surgical Images Through Color Manipulation and Stylization

Lonni Besançon, **Amir Semmo**, David Biau, Bruno Frachet, Virginie Pineau, El Hadi Sariali, Rabah Taouachi, **Tobias Isenberg** and Pierre Dragicevic

**BLACK MIRROR**

A close-up, cinematic shot of a young girl's face. She has light blue eyes and is looking directly at the camera with a serious expression. A white medical device, possibly an ultrasound probe, is held near her right eye by a hand wearing a blue nitrile glove. The background is dark and out of focus.

# ARKANGEL

NETFLIX

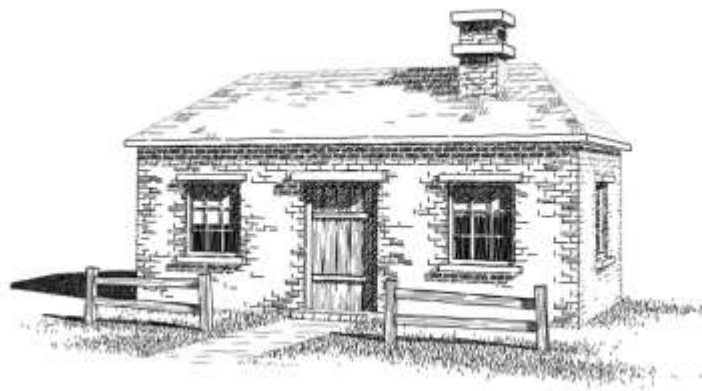








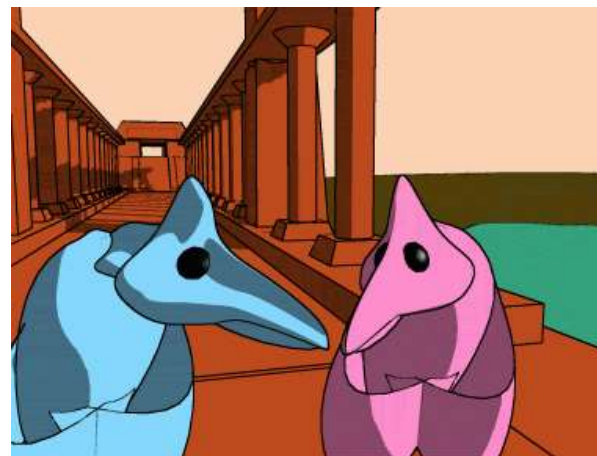
[Curtis et al., 1997]



[Winkenbach et al., 1994]

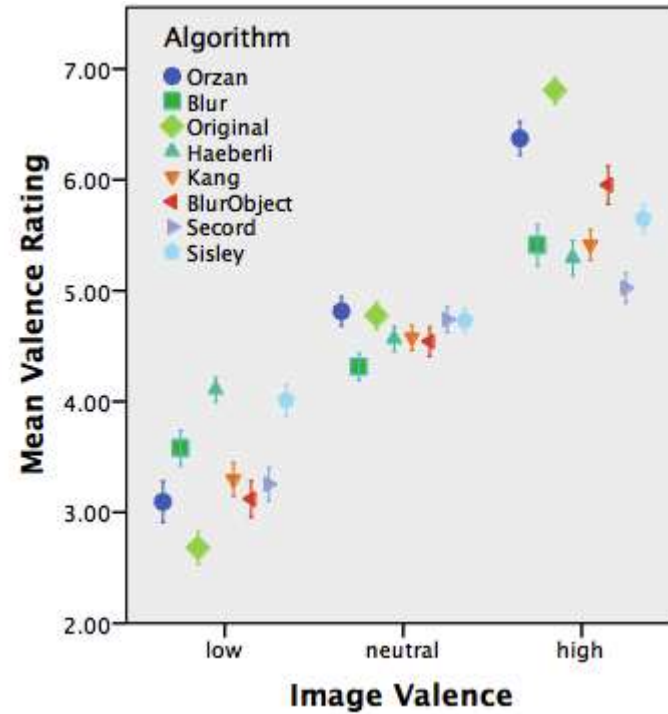
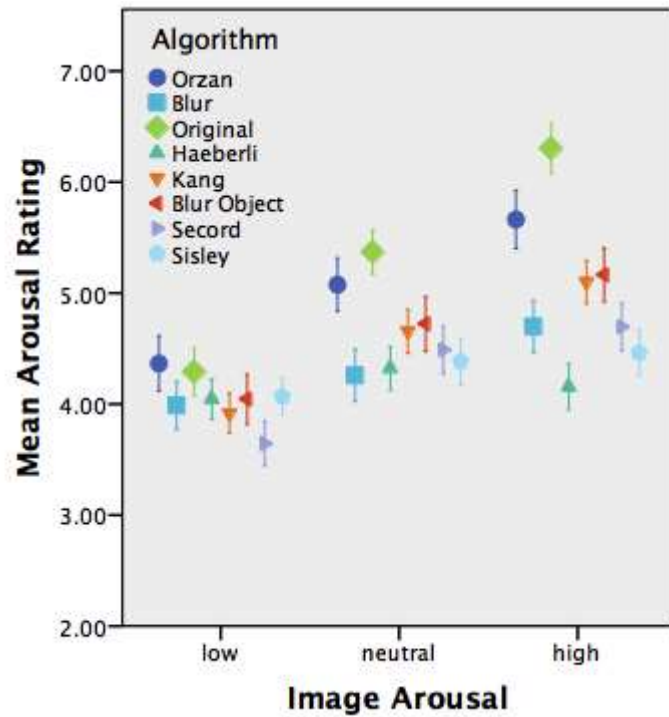


[Meier, 1996]

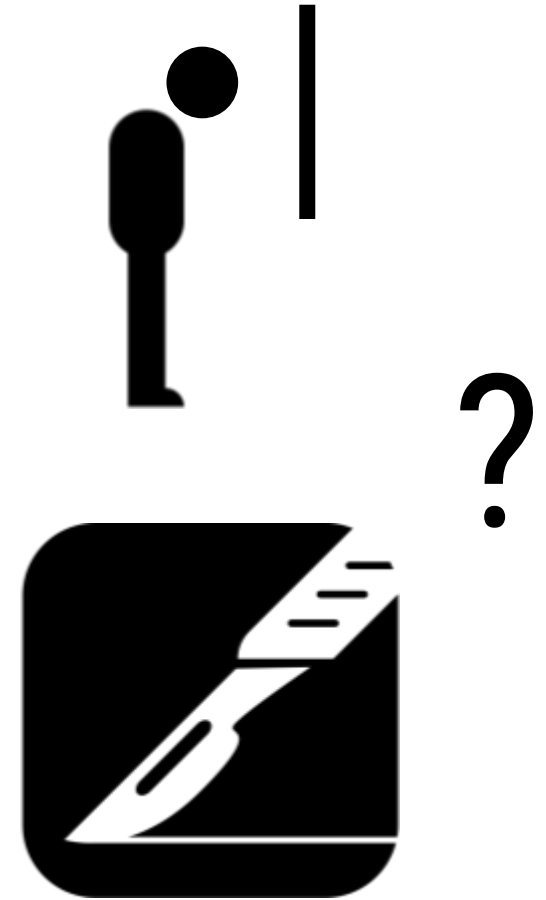


[Decaudin, 1996]

# Related Work – Evaluation



[Mandryk et al., 2011; Mould et al., 2012]









# Related Work – Processing Techniques

- Color Manipulation
- Edge-preserving Image Smoothing
- Edge Detection and Enhancement
- Image-based Artistic Rendering

Kill Bill vol. 1 (2003)







„Apparent Greyscale“ [Smith et al., 2008]



Legend of Zelda: Ocarina of Time, late 1990s









„Hue Shift“

## Image feature obfuscation by blur















„Bilateral Filter“ [Tomasi and Manduchi, 1998]







„Shape-simplifying Image Abstraction“ [Kang and Lee 2008]







„Coherence-enhancing Filtering“ [Kyprianidis and Kang 2011]







„Multi-scale Anisotropic Kuwahara Filter“ [Kyprianidis 2011]

Art by Frank Miller for the Comic Book Legal Defense Fund

GOOD GIRL.  
JUST ONE *MORE*  
--AND YOU'LL  
BE *SAFE*.









„Extended difference-of-Gaussians“ [Winnemöller et al. 2012]



Deadpool Wallpaper [marvel.com]









„Structure-adaptive Filtering“ [Kyprianidis and Döllner, 2008]



"Bird's Hell" [Max Beckmann, 1938]











„Painterly Rendering“ [Hertzmann, 1998]









„Watercolor Rendering“ [Bousseau et al. 2006, Wang et al. 2014]





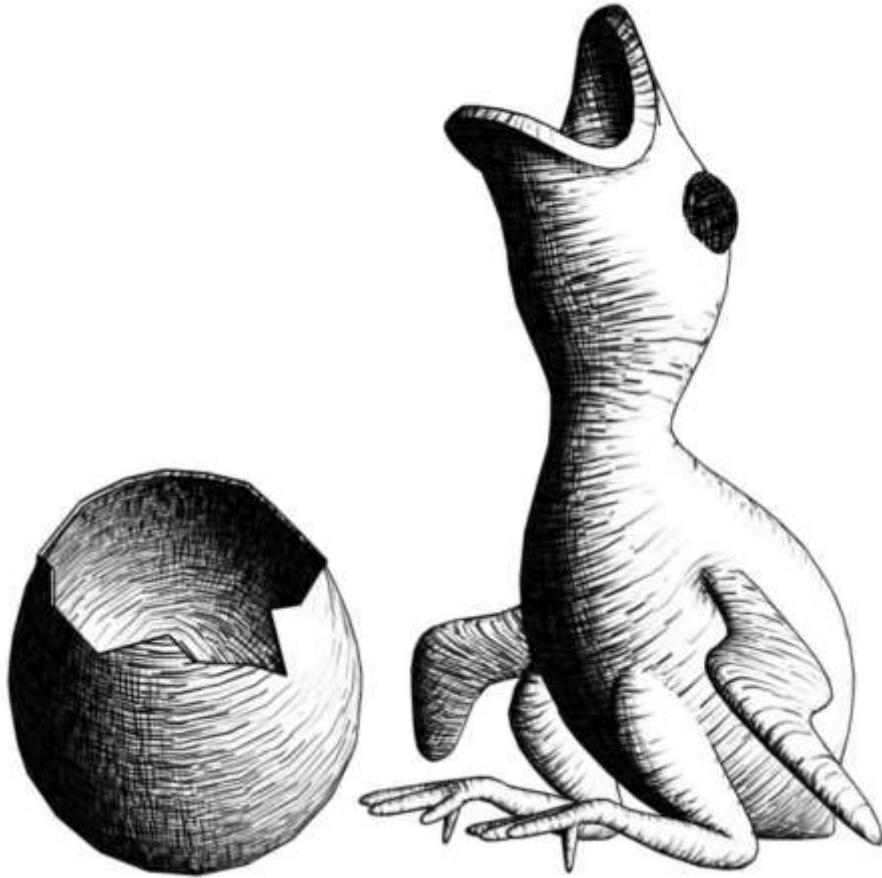




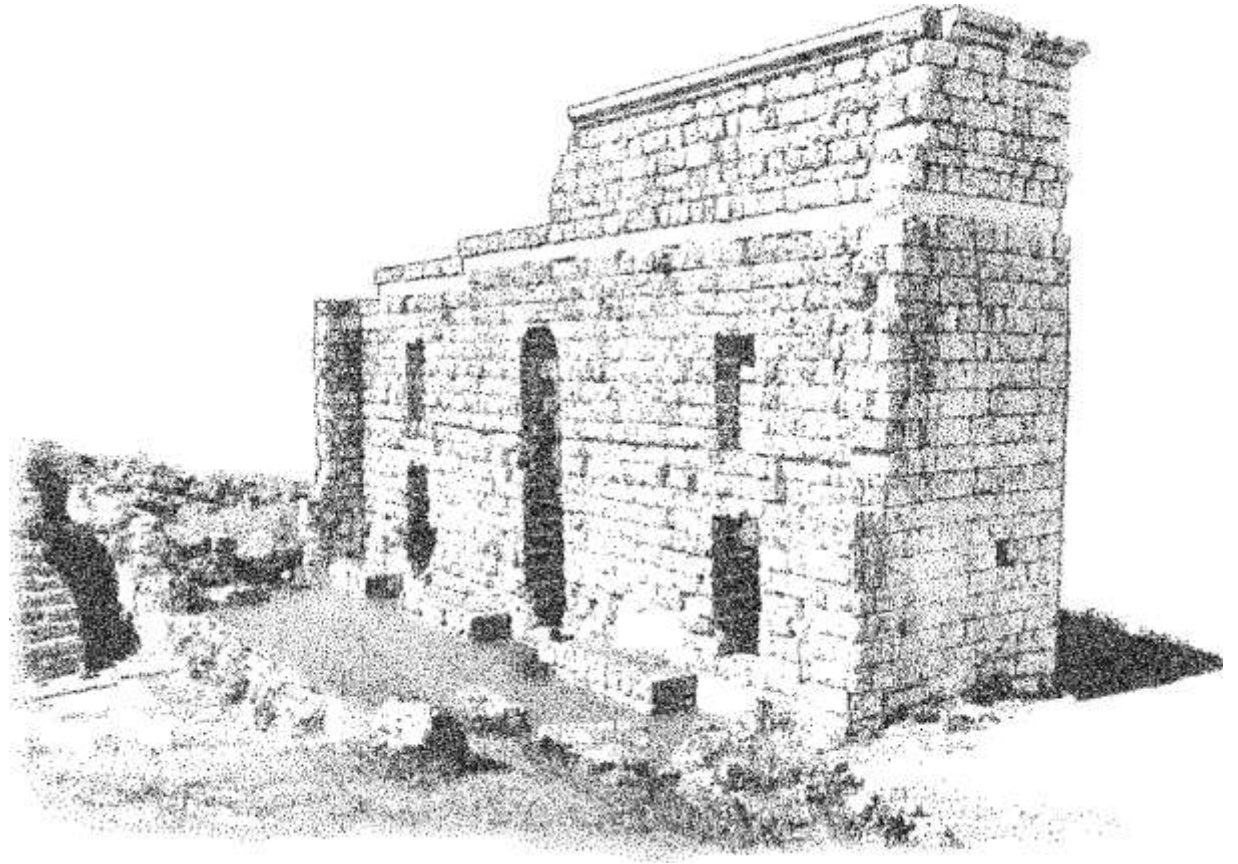
„Oil Paint Filtering“ [Semmo et al., 2016]



# Black and White Illustrations – Hatching and Stippling



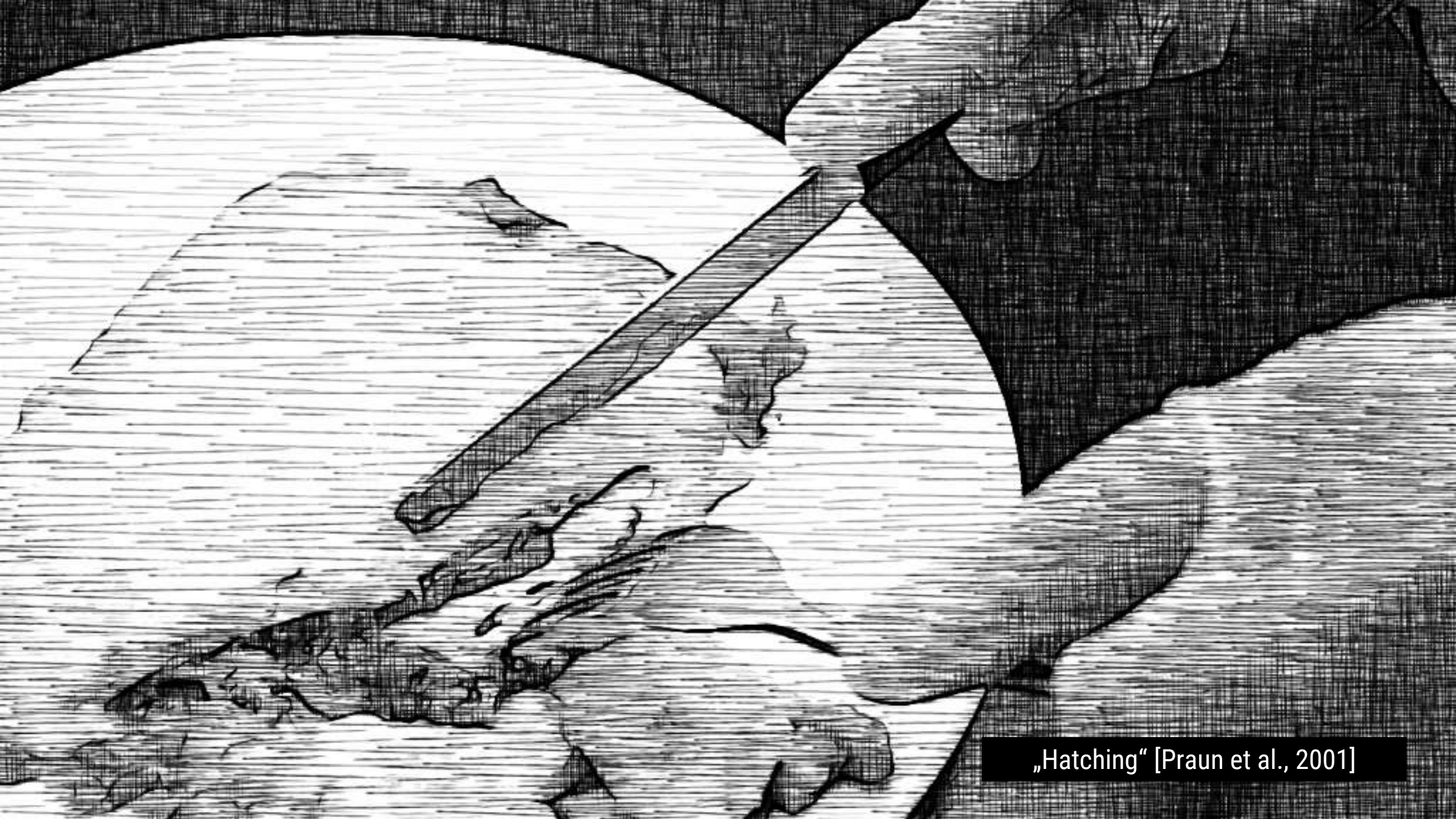
[Praun et al., 2001]



[Martín et al., 2010/2011]





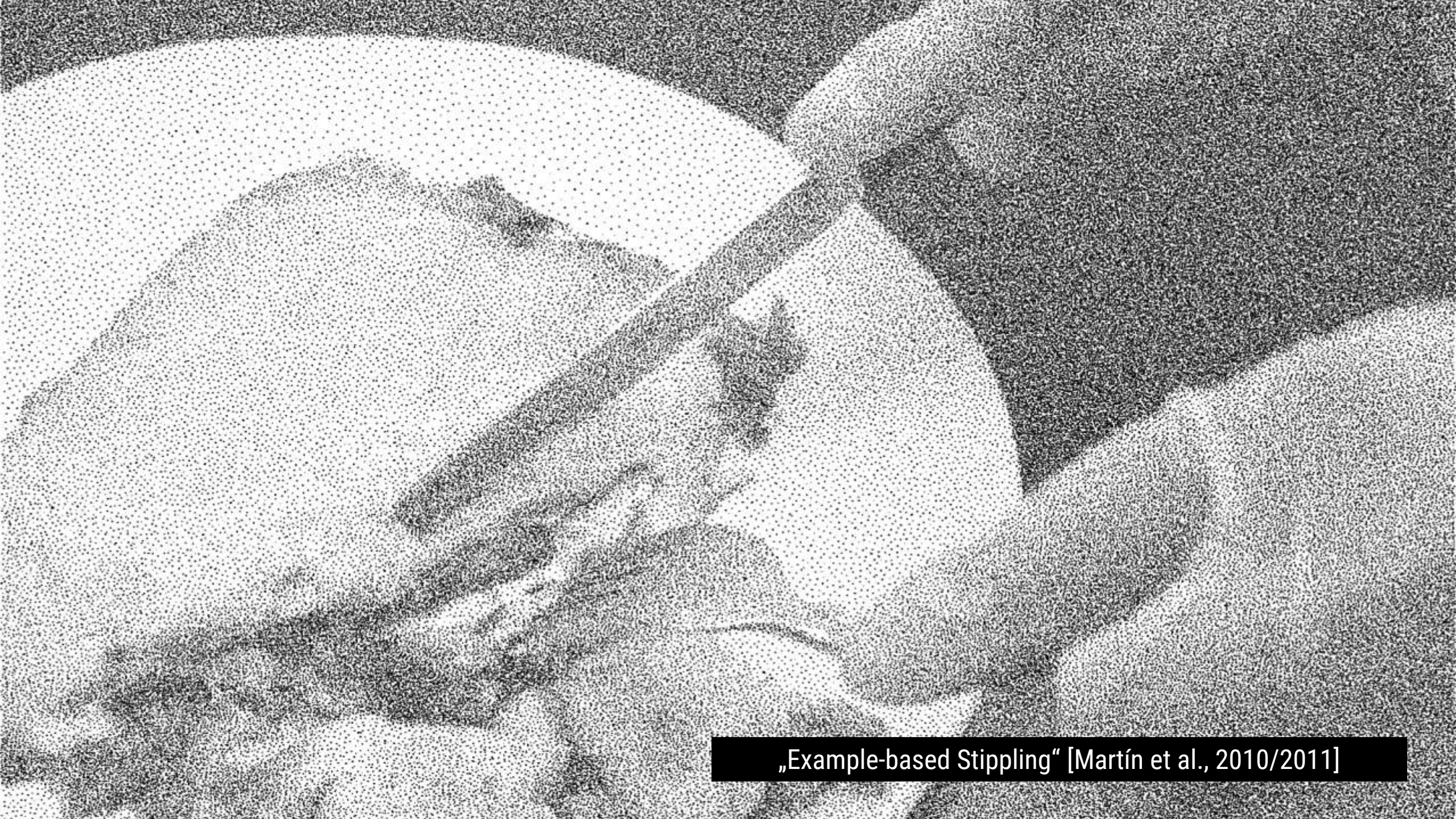


„Hatching“ [Praun et al., 2001]





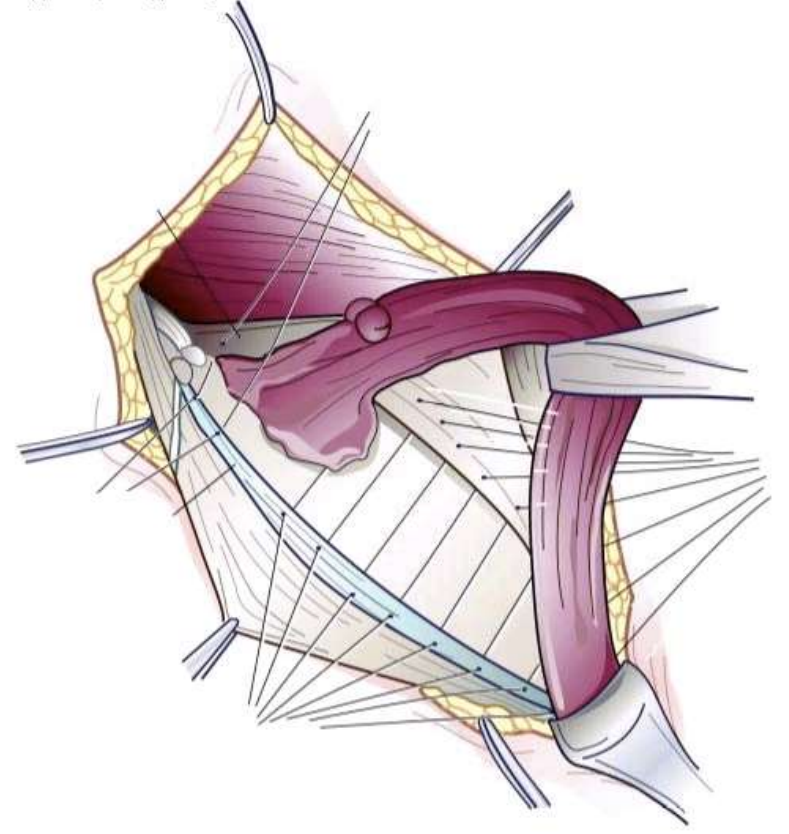
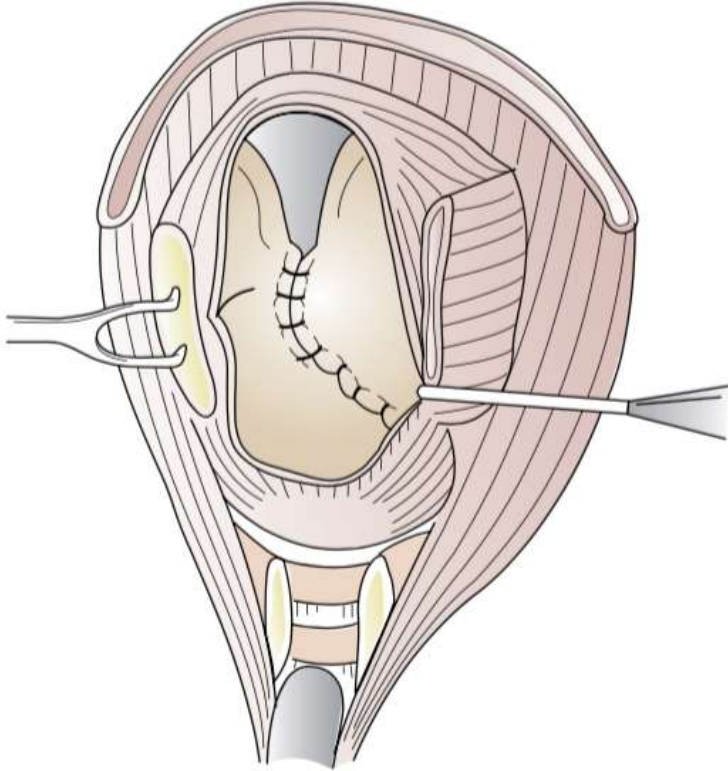




„Example-based Stippling“ [Martín et al., 2010/2011]



# Neural Style Transfer from Illustrations



- Norman S Williams, Christopher J.K. Bulstrode, P Ronan O'Connell - Bailey and Love's Short Practice of Surgery - Oxford University Press, USA (2008)
- Courtney M. Townsend - Sabiston Textbook of Surgery - Saunders (2004)

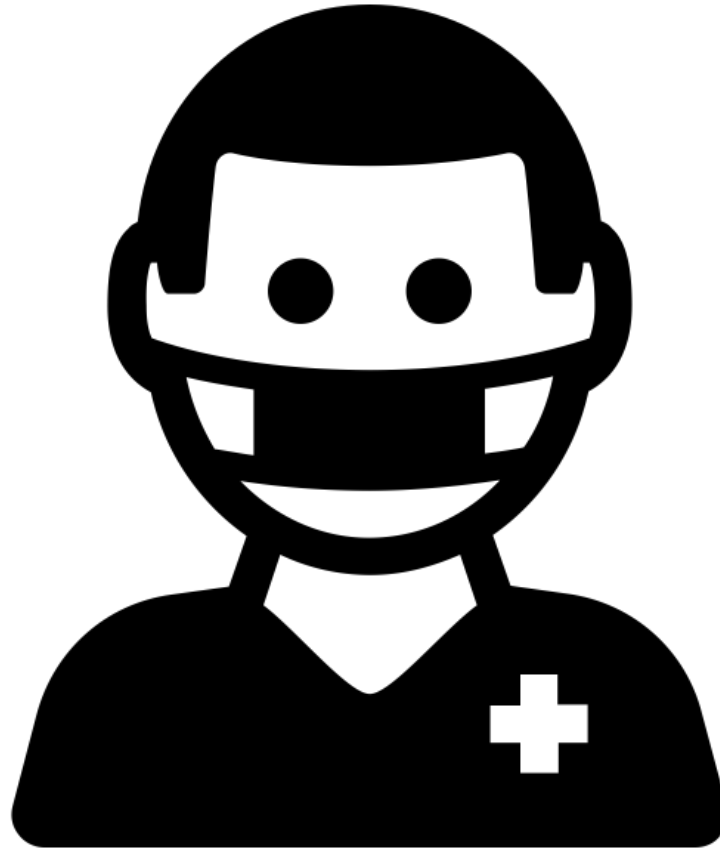






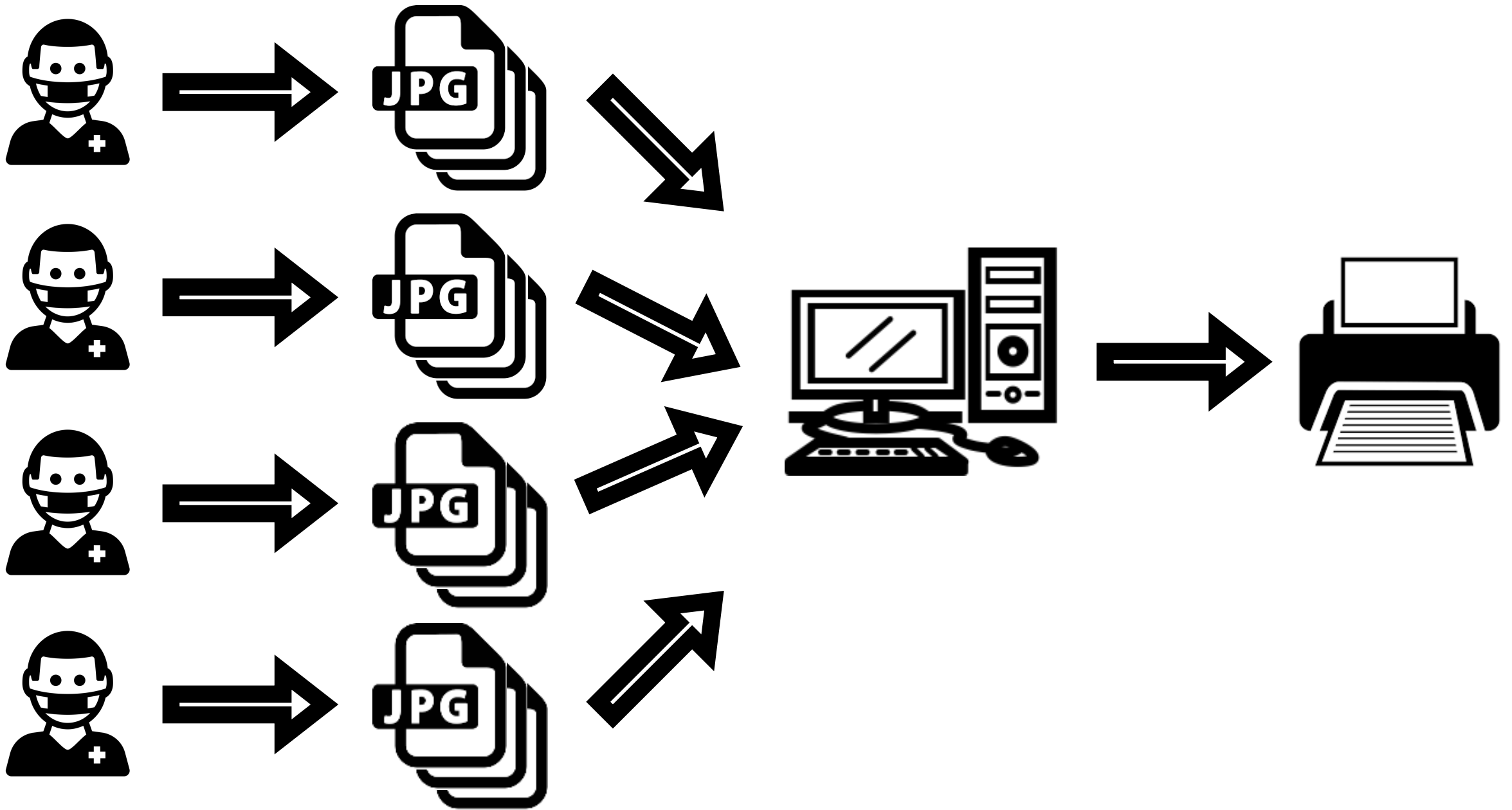
„Real-time Style Transfer“ [Johnson et al., 2016]

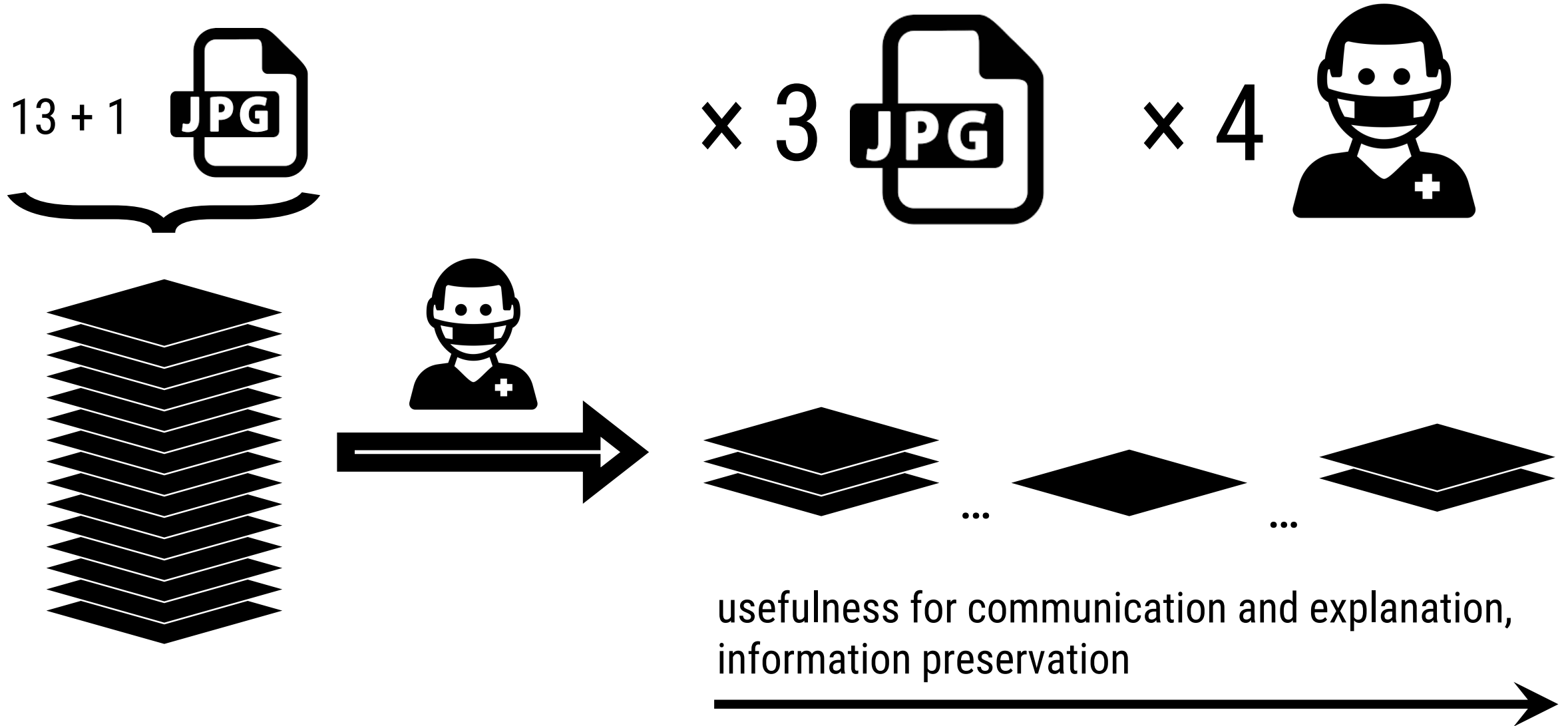
# Study with surgeons



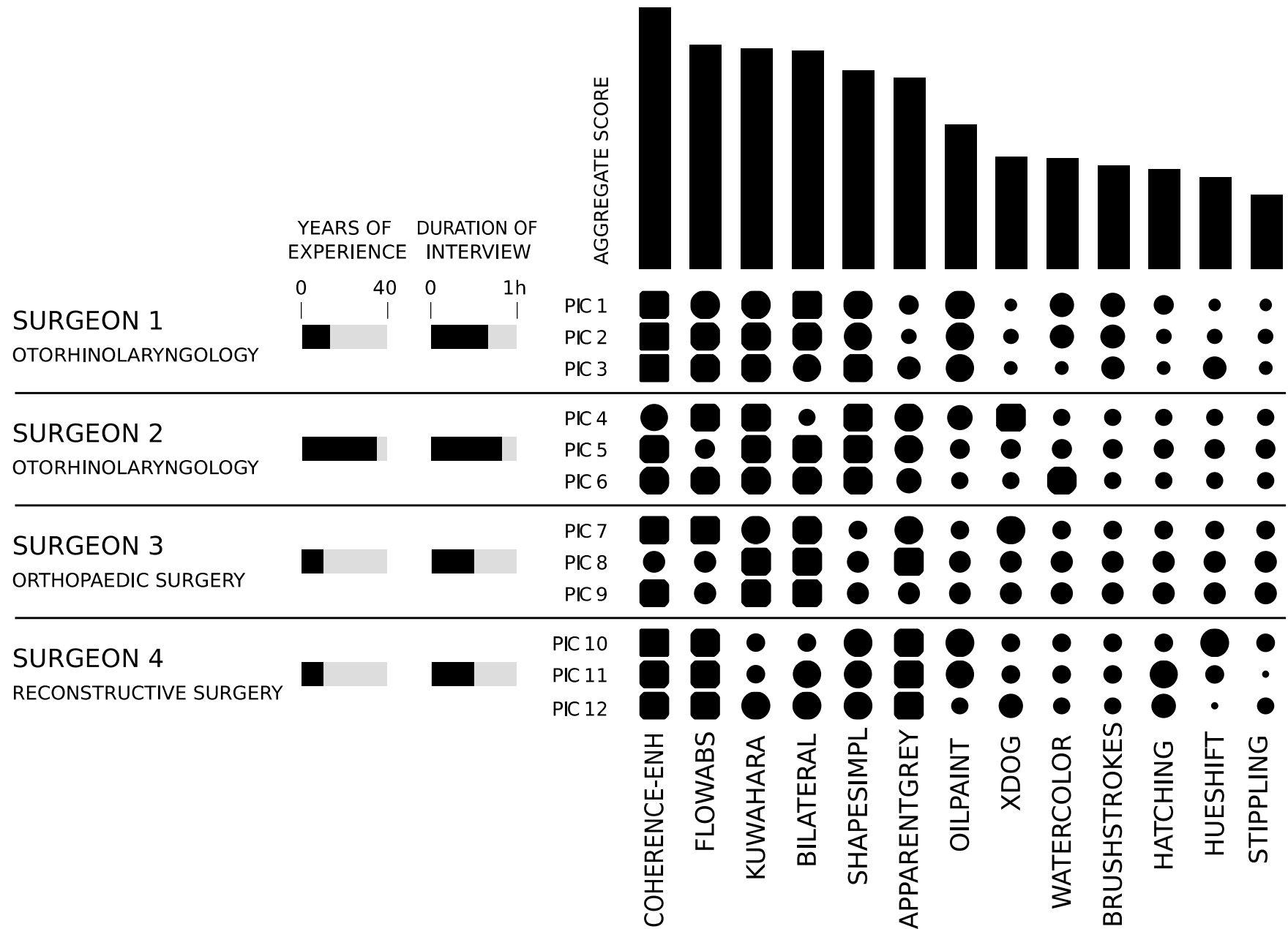
× 4

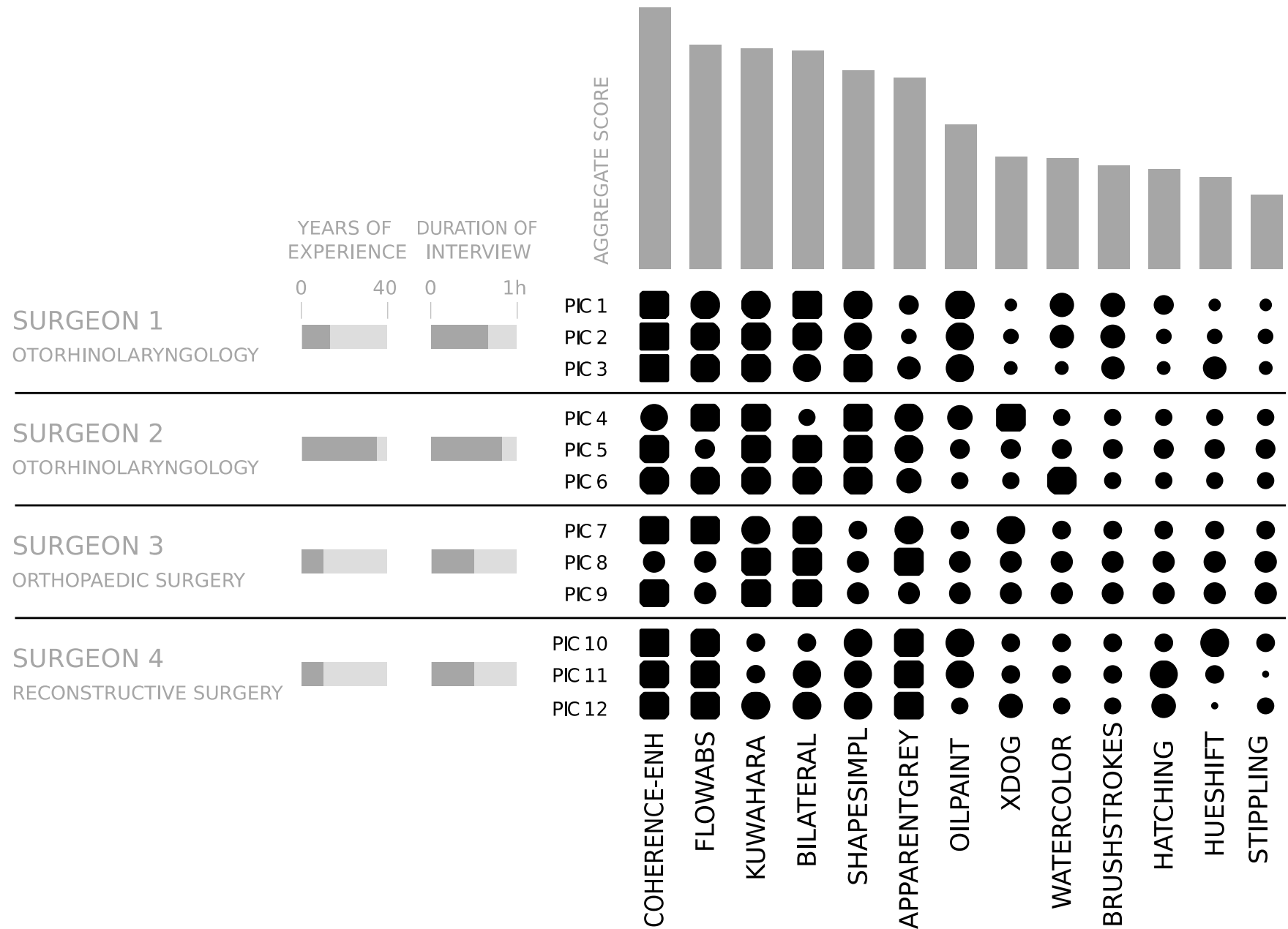




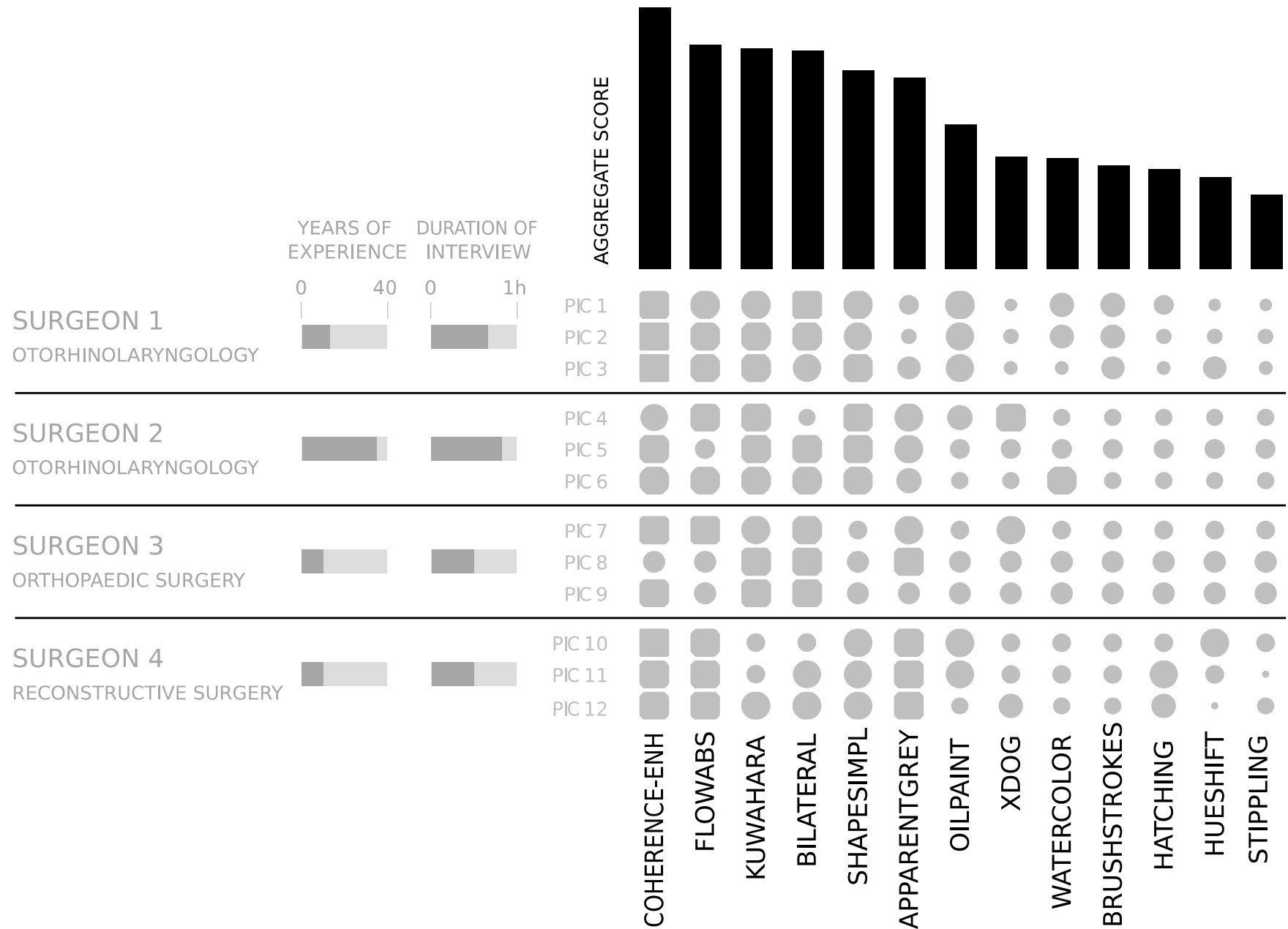


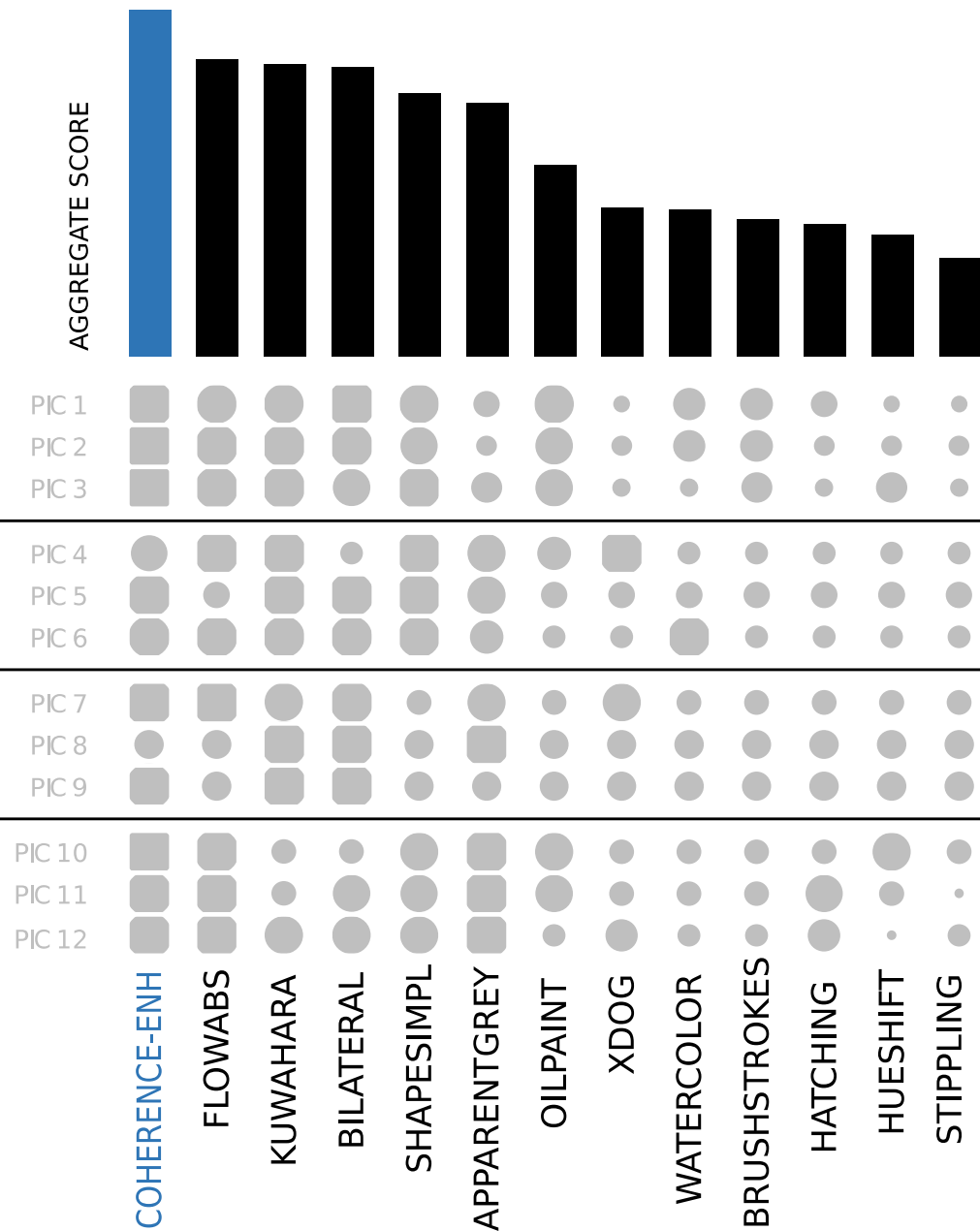




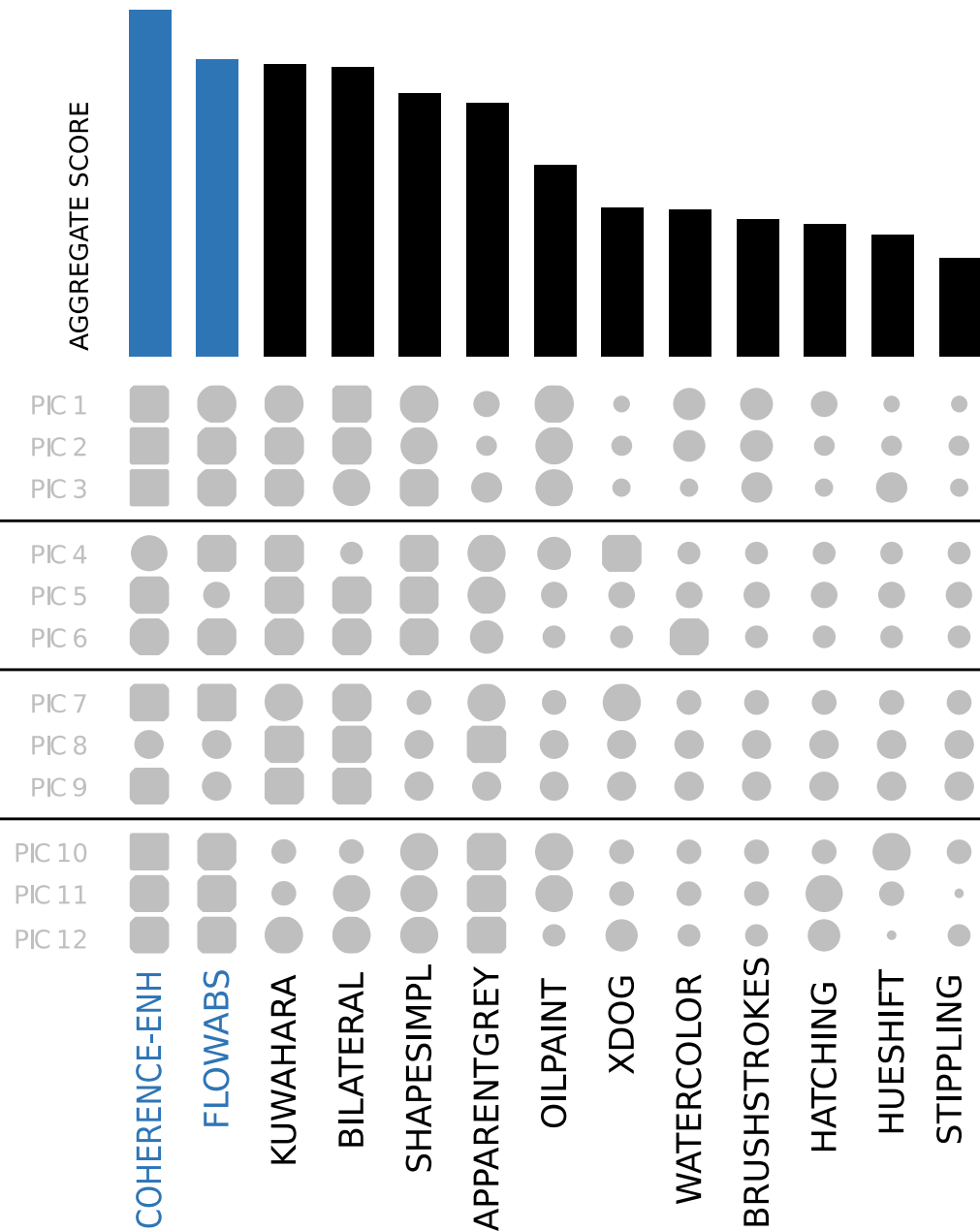


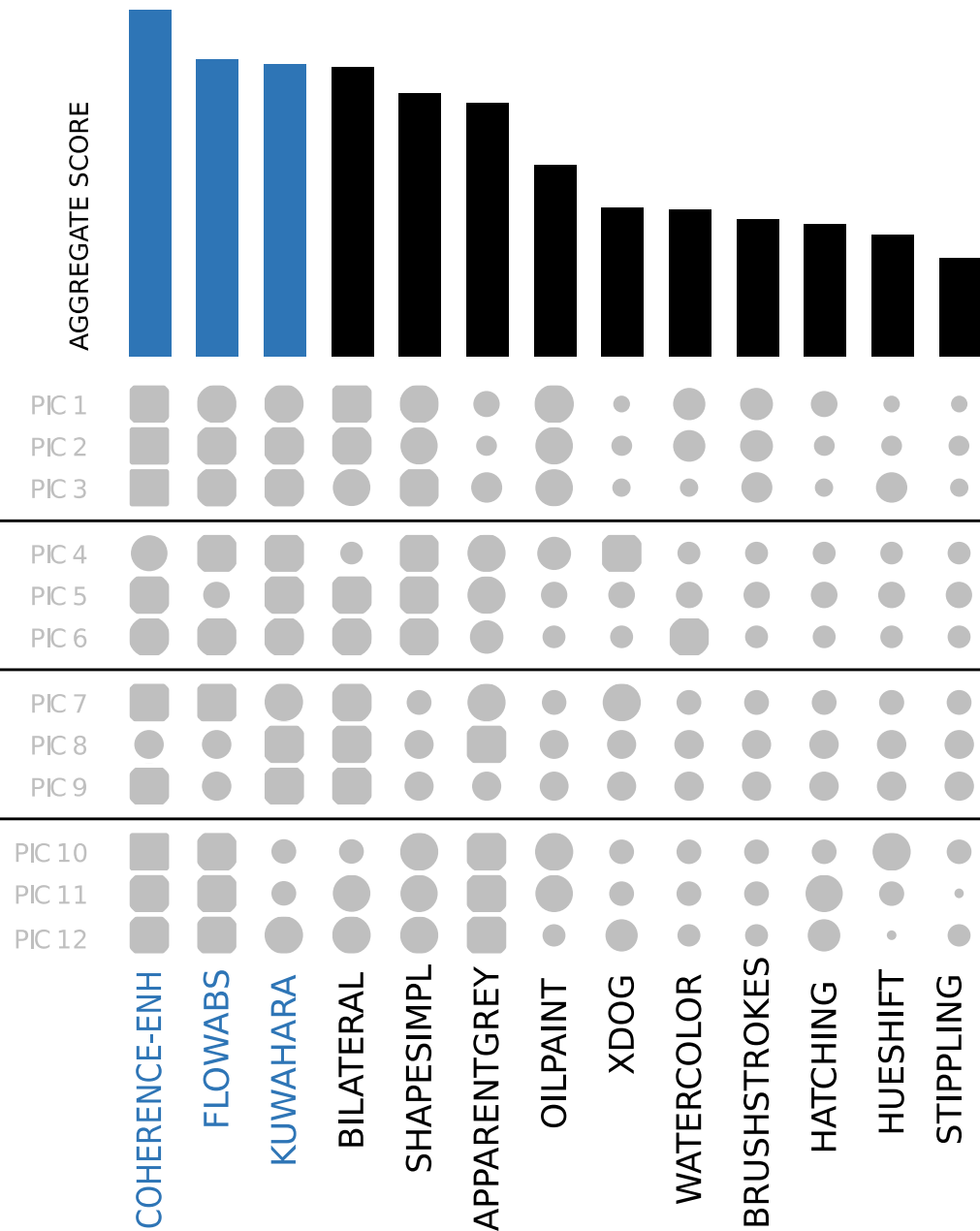




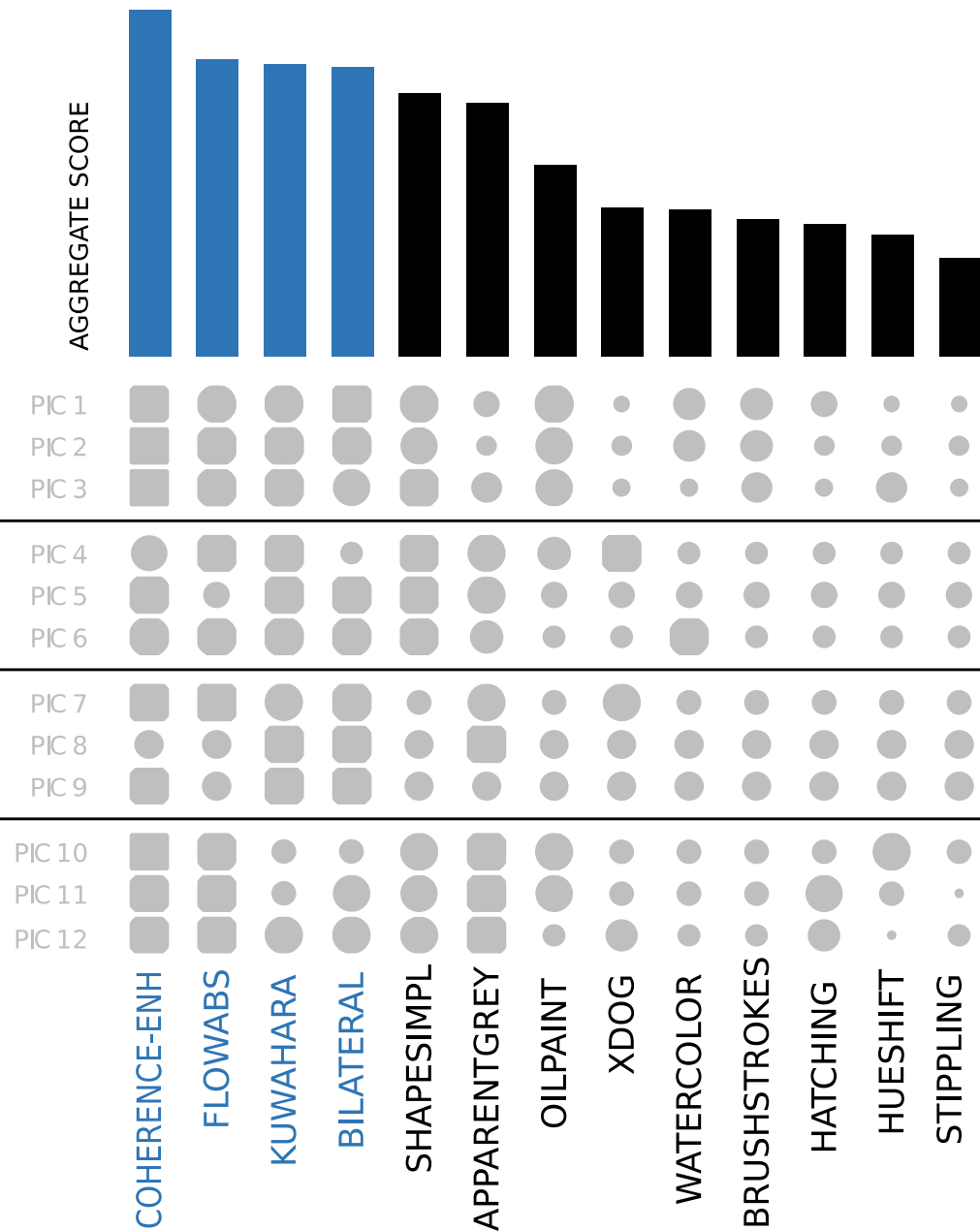


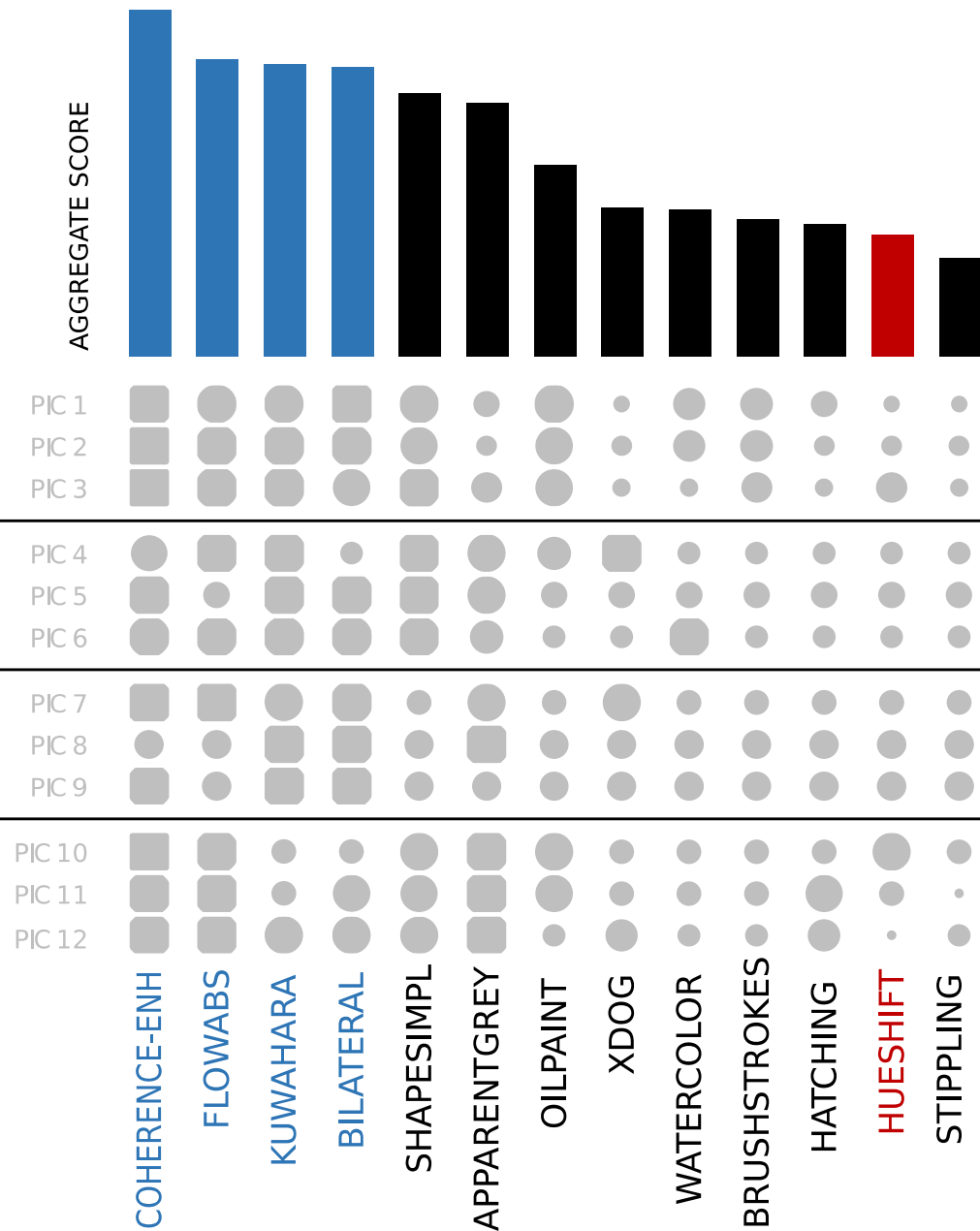






















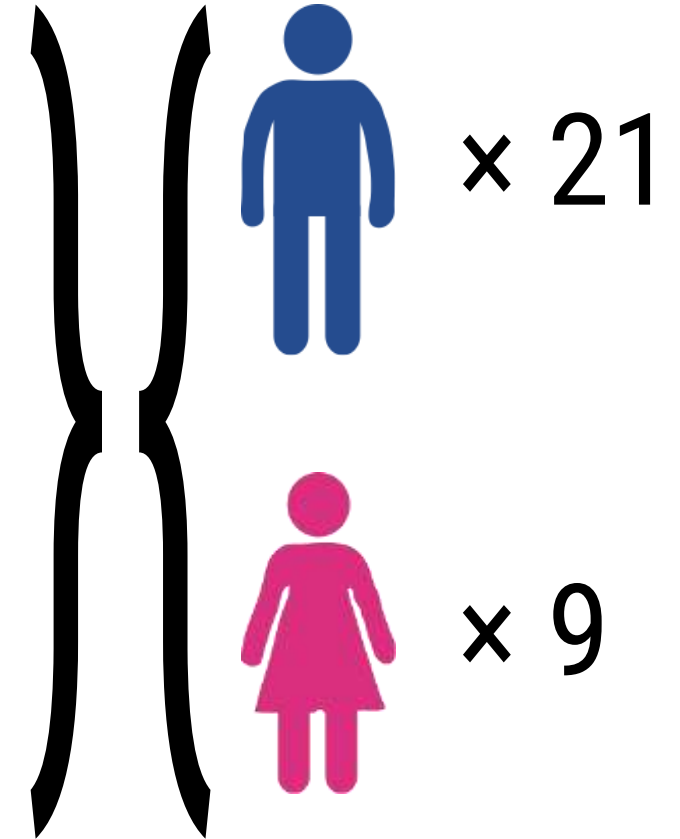


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# Experiment with lay people

- Nencki Affective Picture System (NAPS)
  - picture of leg surgery
  - picture of leg surgery (possibly autopsy)
  - picture of surgery in the eye area
- International Affective Picture System (IAPS)
  - picture of surgery performed on a dog
  - picture of thumb surgery







Hue Shift  
(*HueShift2*)



Apparent Greyscale  
(*ApparentGrey*)



Shape-simplifying Image  
Abstraction (*ShapeSimpl2*)



Coherence-enhancing Filtering  
(*CoherenceEnh*)



Multi-scale Anisotropic Kuwahara  
Filtering (*Kuwahara*)



Structure-adaptive Filtering  
(*FlowAbs*)



How difficult was it for you to look at this image?

Very easy    1   2   3   4   5   6   7   8   9    Very difficult  
☐   ☒   ☐   ☐   ☐   ☐   ☐   ☐   ☐

How difficult was it to recognize the image's content?

Very easy    1   2   3   4   5   6   7   8   9    Very difficult  
☐   ☐   ☐   ☐   ☒   ☐   ☐   ☐   ☐

Next

19%



after 2 seconds



How difficult was it for you to look at this image?

Very easy    1   2   3   4   5   6   7   8   9    Very difficult

☐   ☒   ☐   ☐   ☐   ☐   ☐   ☐   ☐

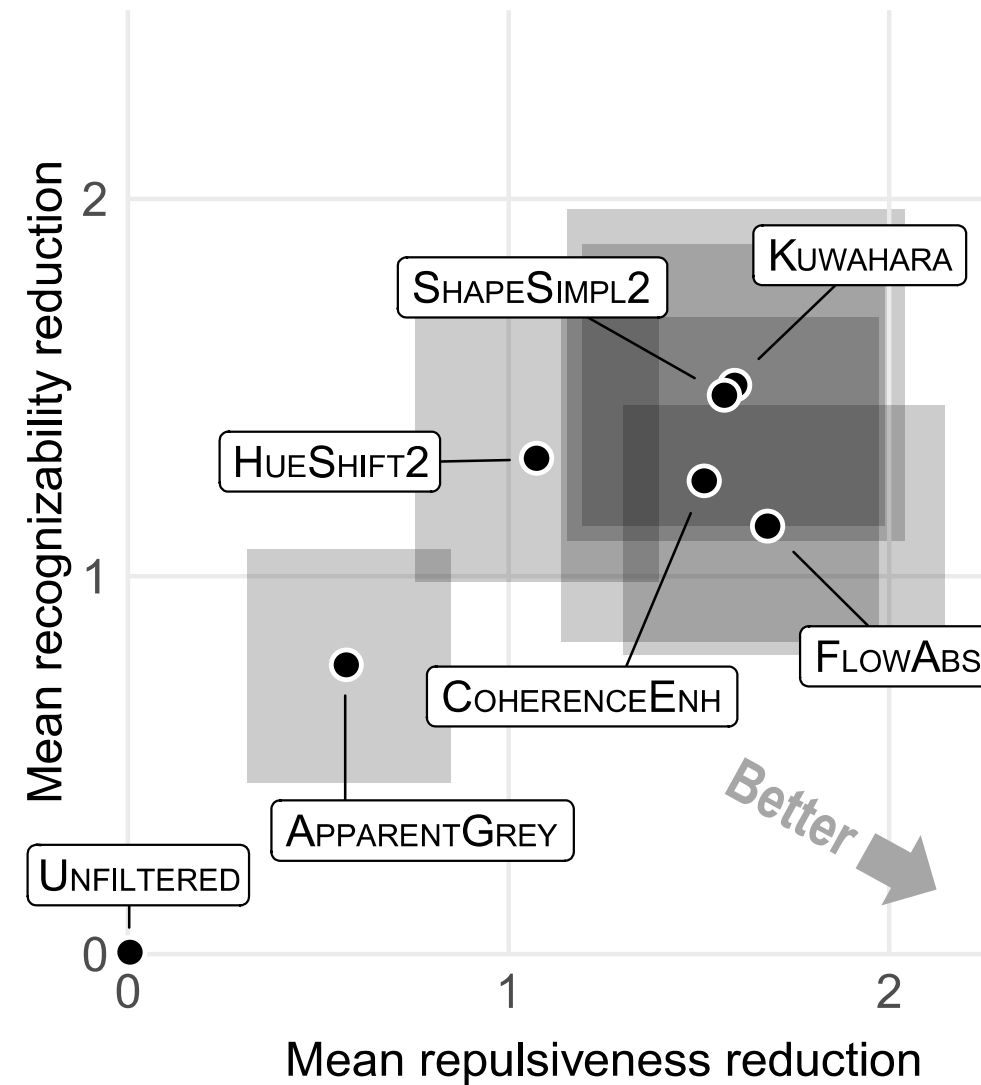
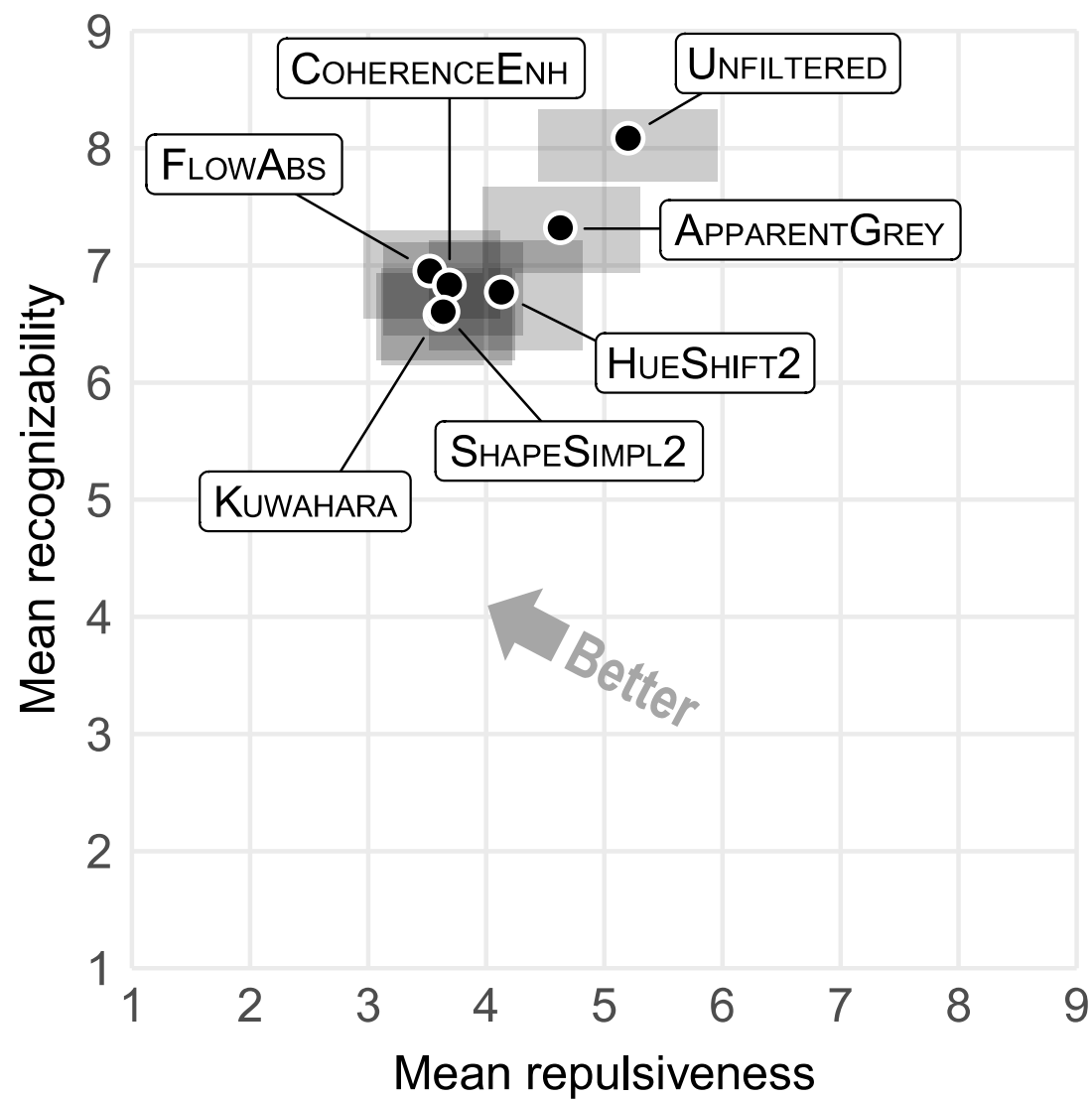
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Very easy    1   2   3   4   5   6   7   8   9    Very difficult

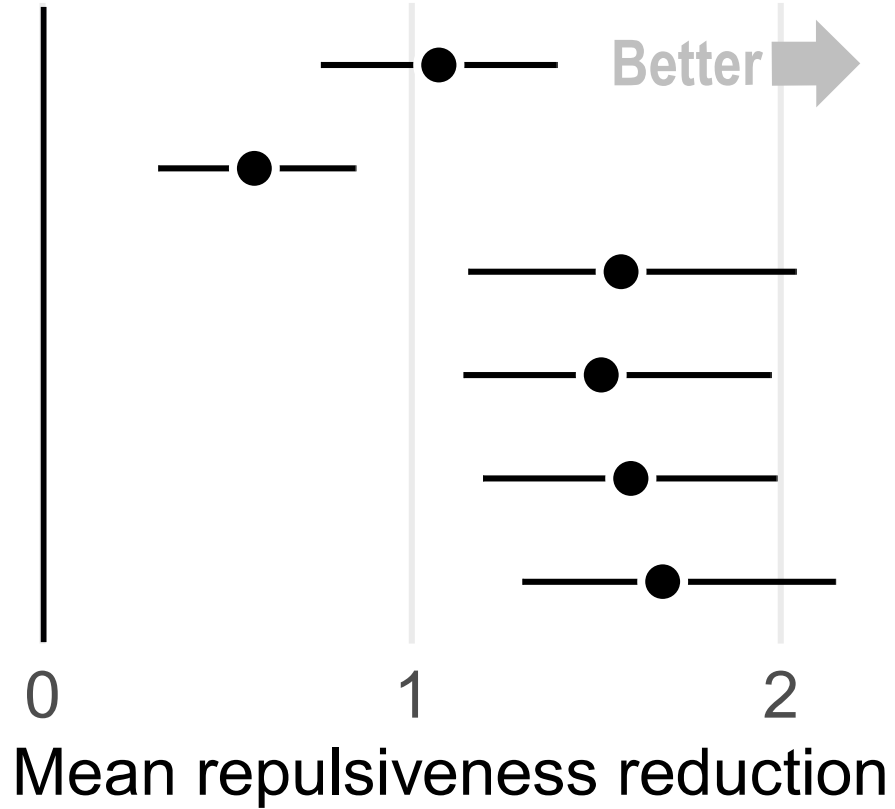
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Next

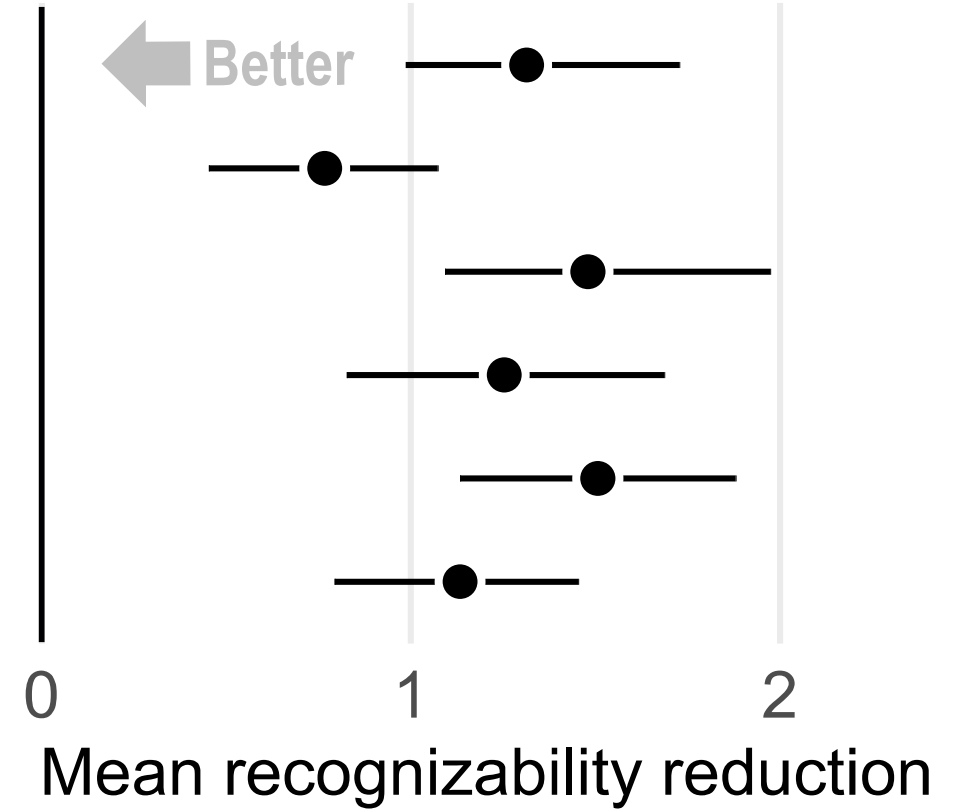
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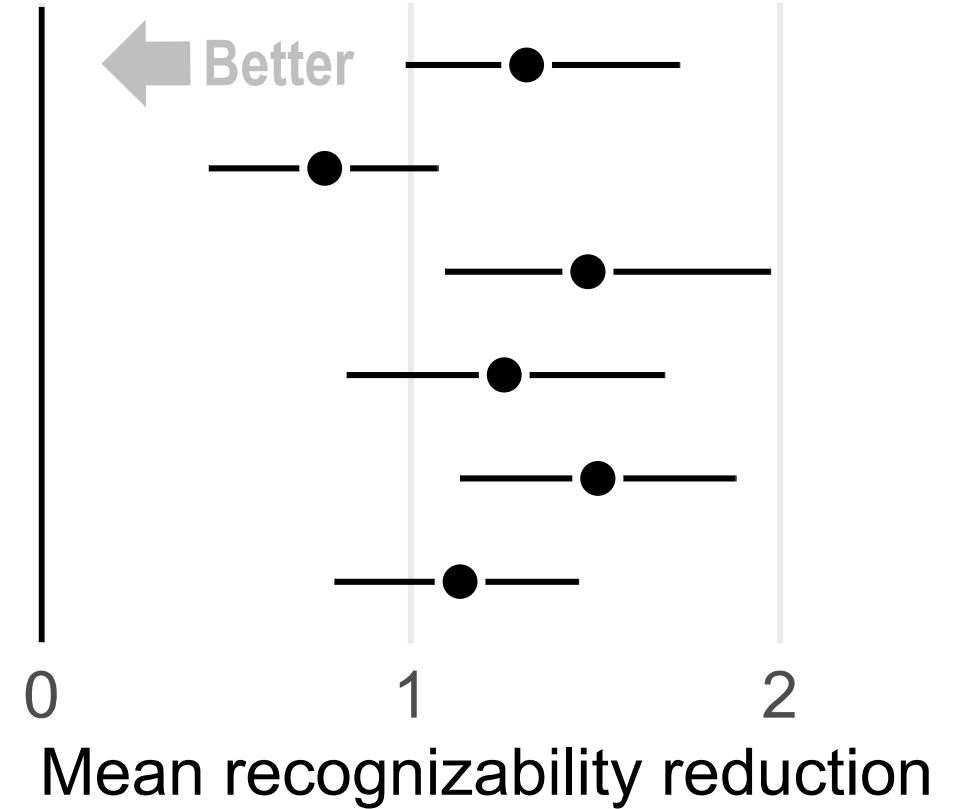
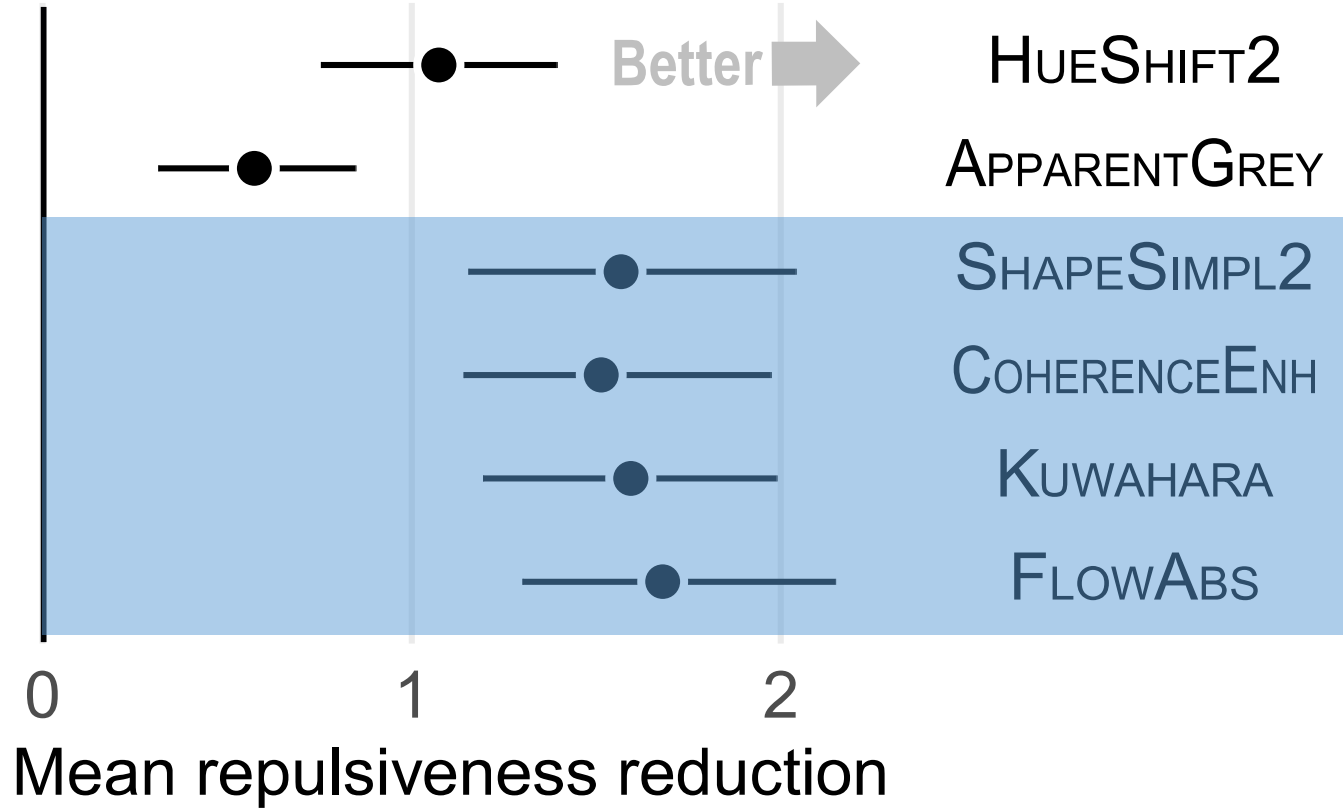




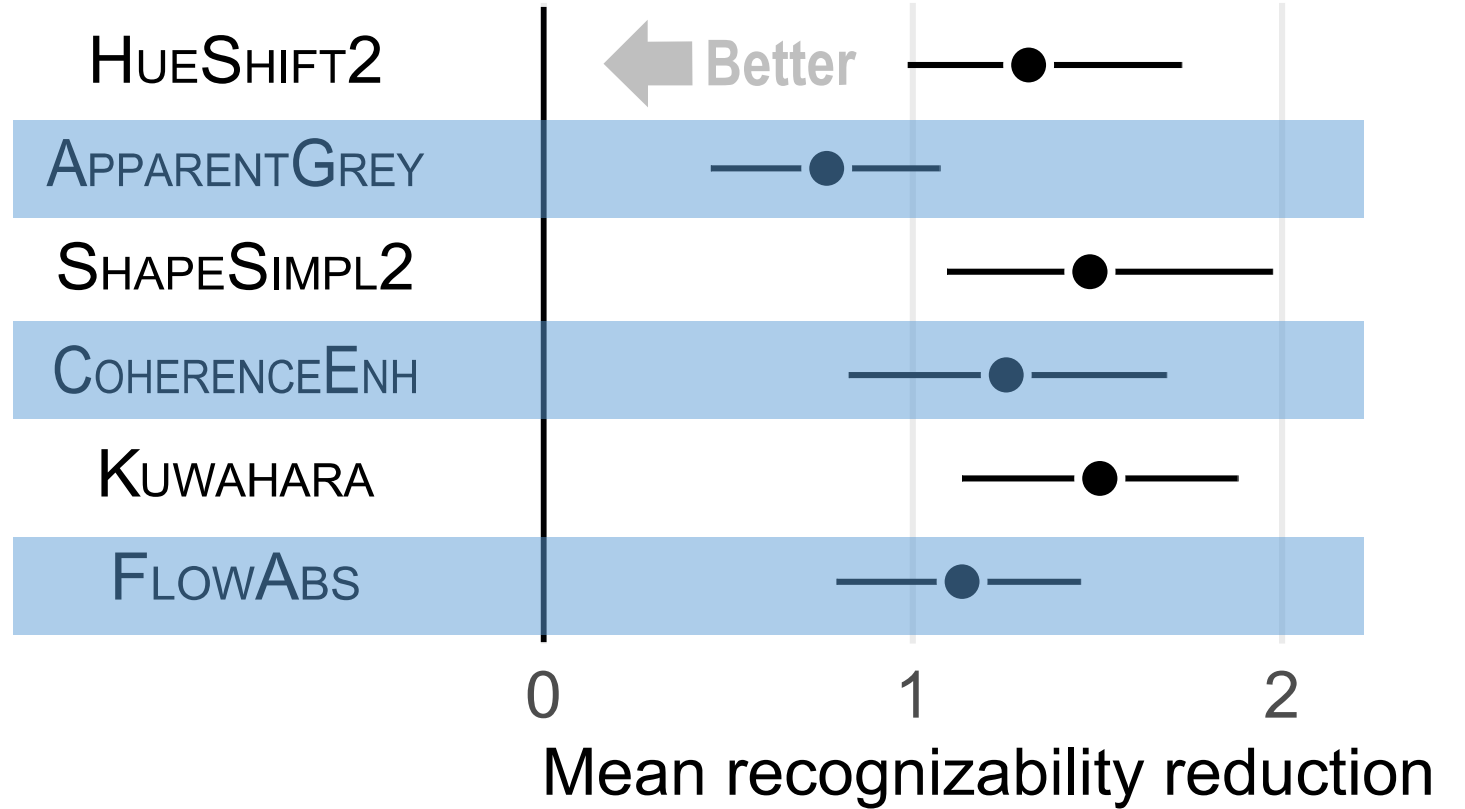
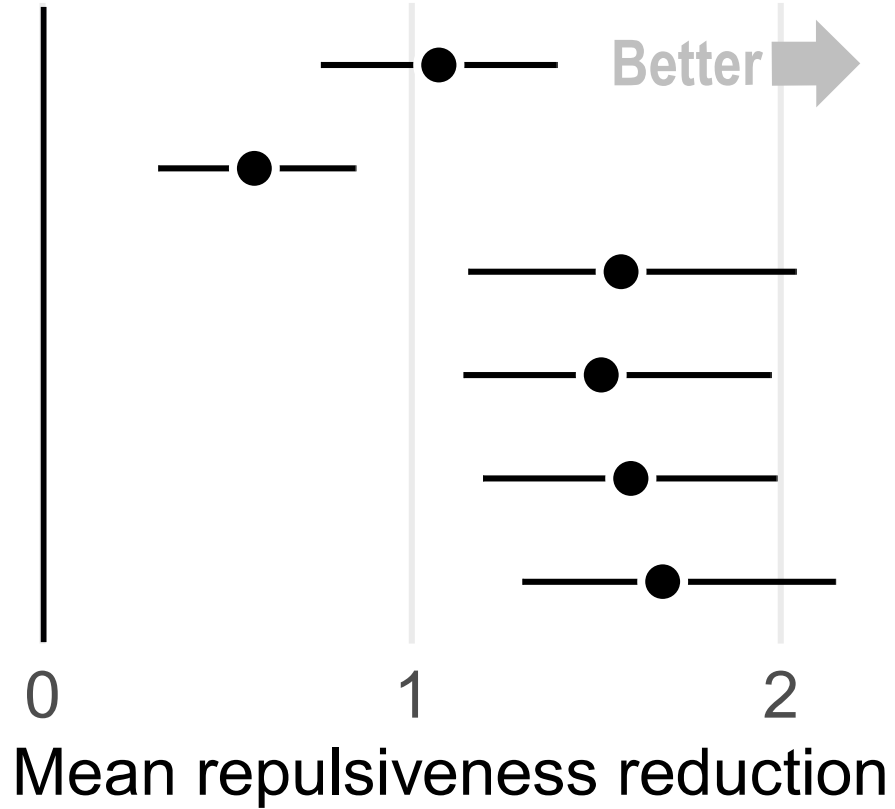


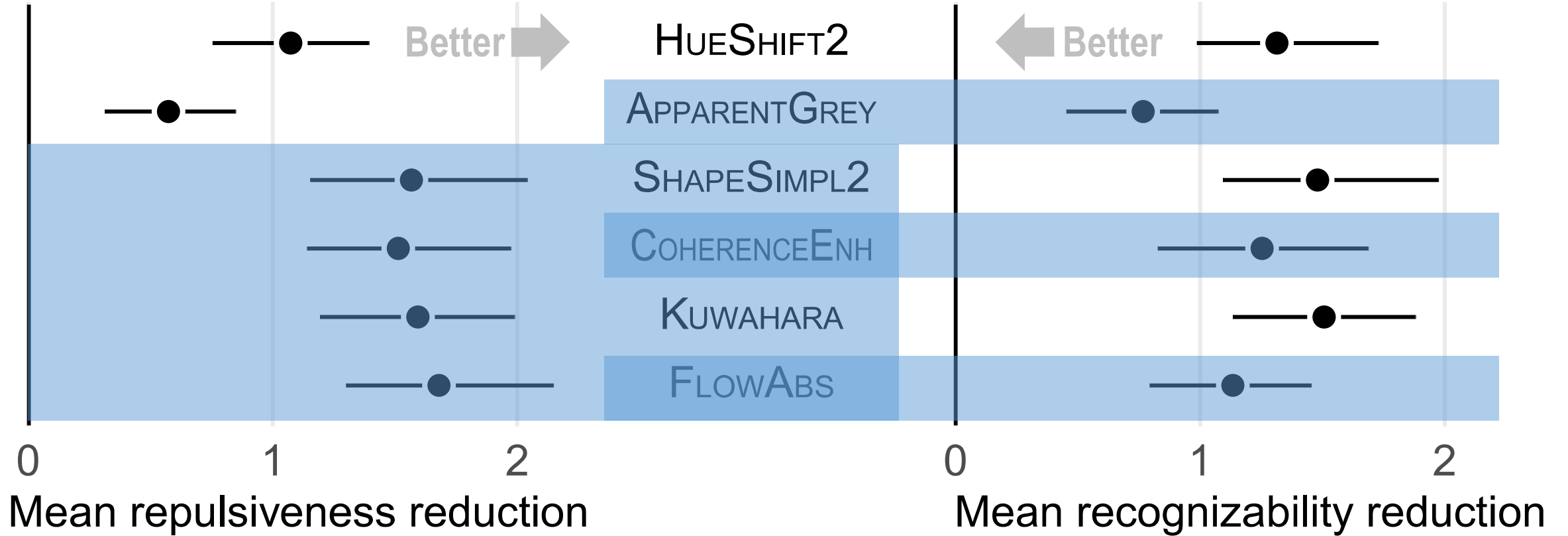
HUESHIFT2  
APPARENTGREY  
SHAPESIMPL2  
COHERENCEENH  
KUWAHARA  
FLOWABS



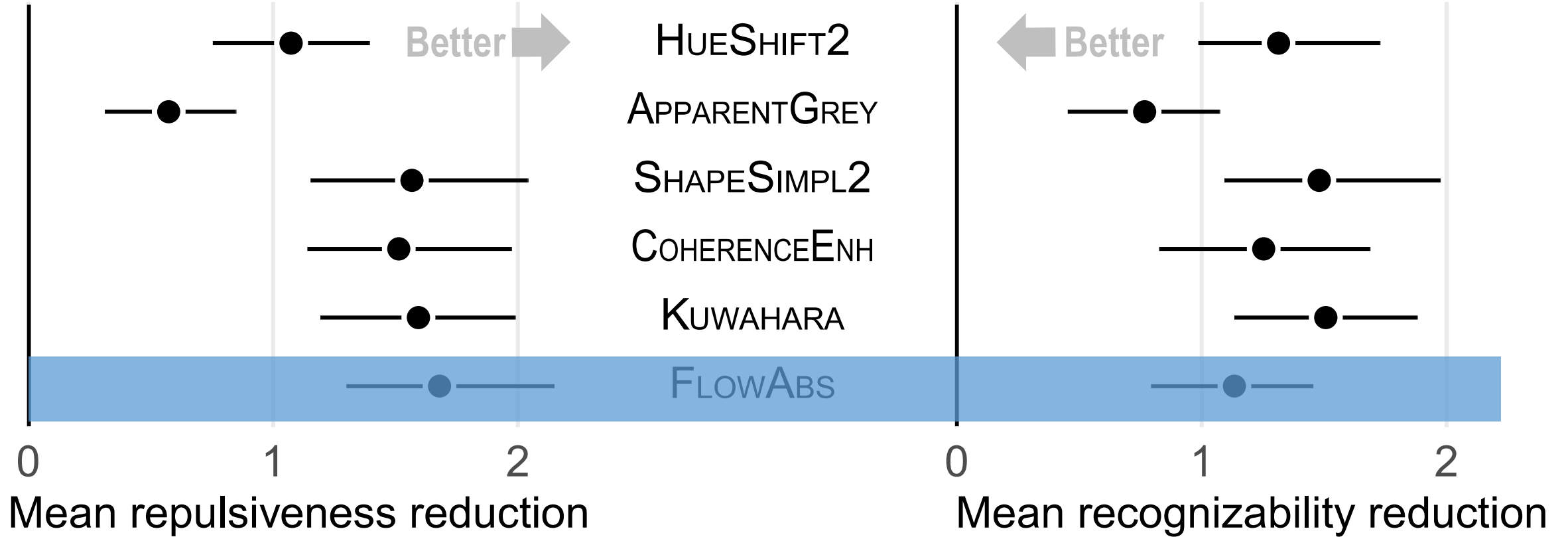








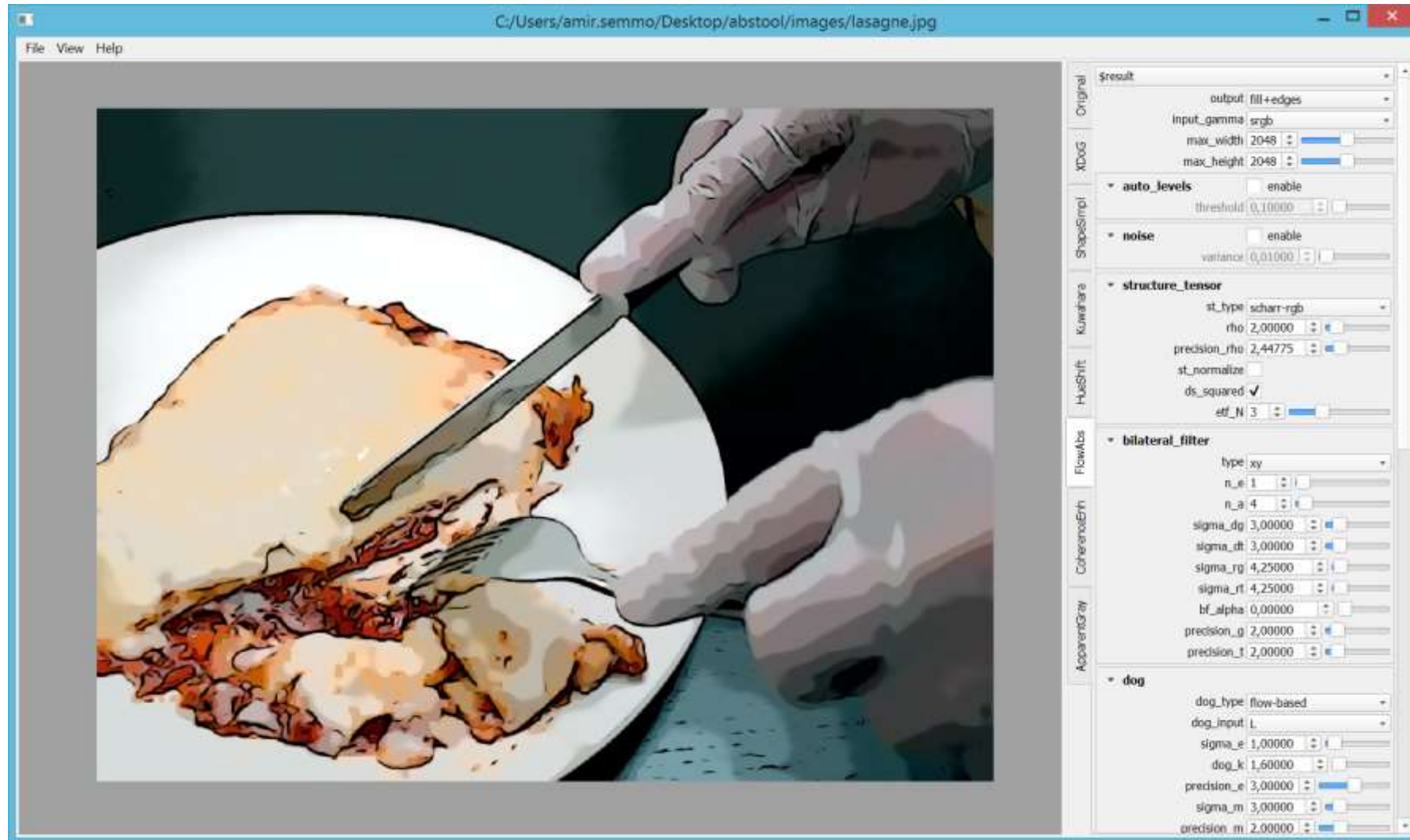








# Limitations/Future Work



# Future Work



domains with  
sensitive data



WIKIPEDIA





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