

FlatMagic: Improving Flat Colorization through AI-driven Design for Digital Comic Professionals

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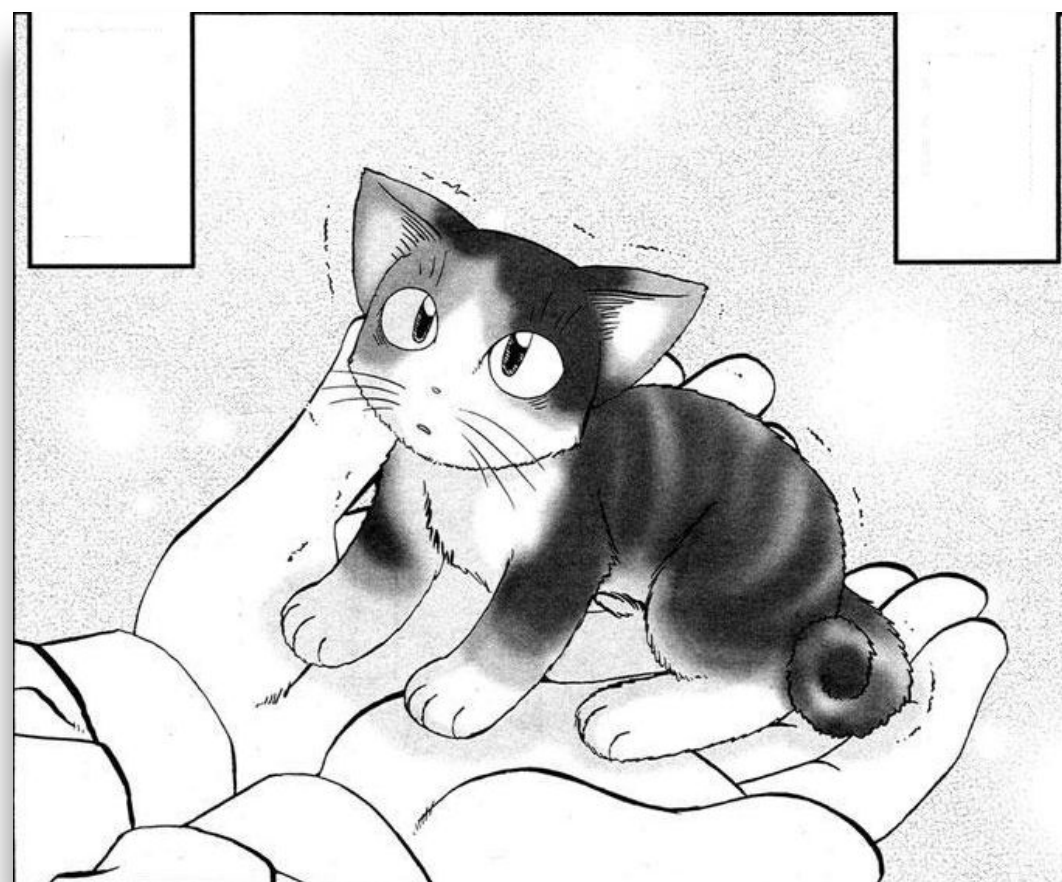
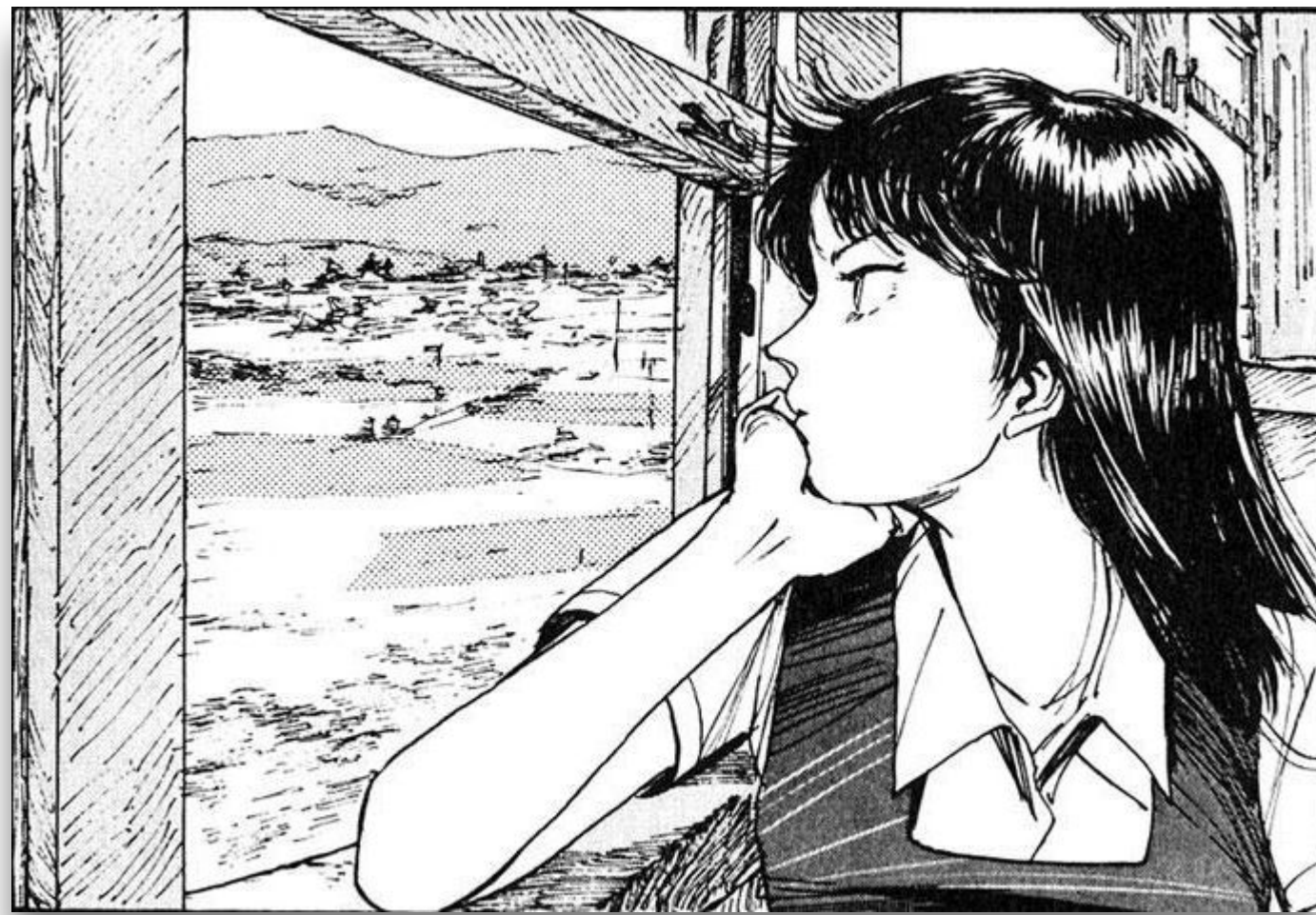
²University of Michigan,

³Pusan National University

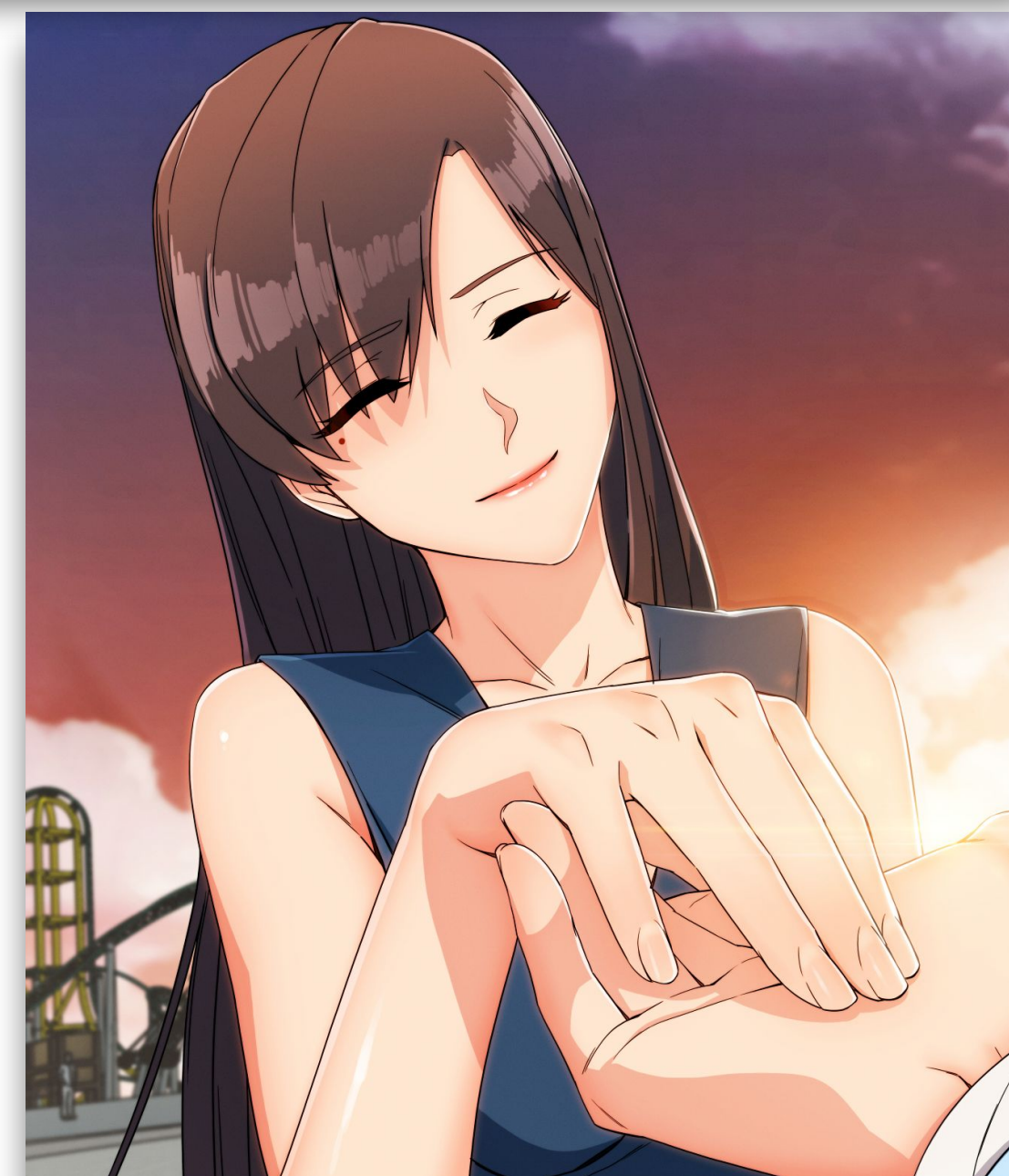
https://github.com/Nauhcnay/flat_magic_backend



Comic Industry shifting from Paper to Digital



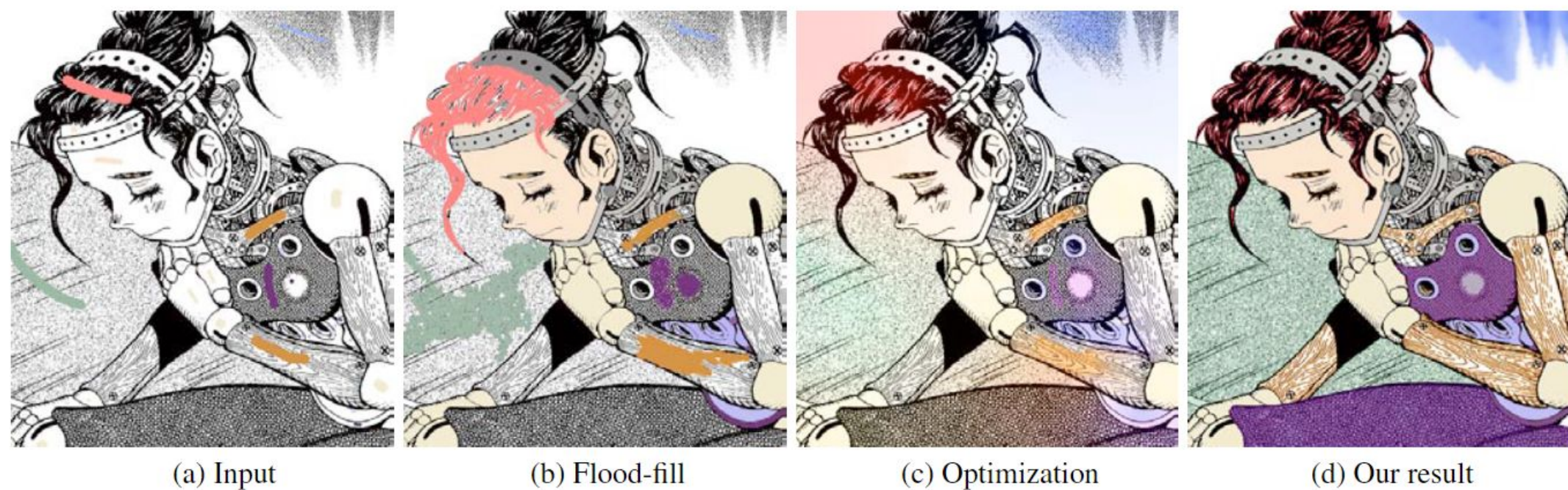
[Image source:
Manga109 Dataset]



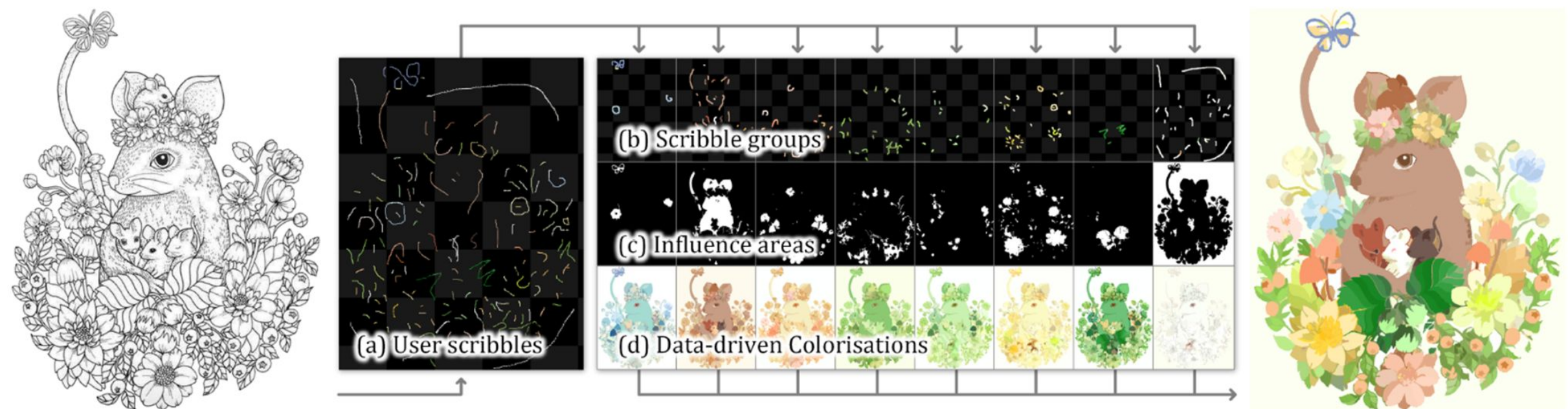
[Image source:
Studio Zilpung]

Problems in AI-assistant Drawing

[Qu et al. 2005]



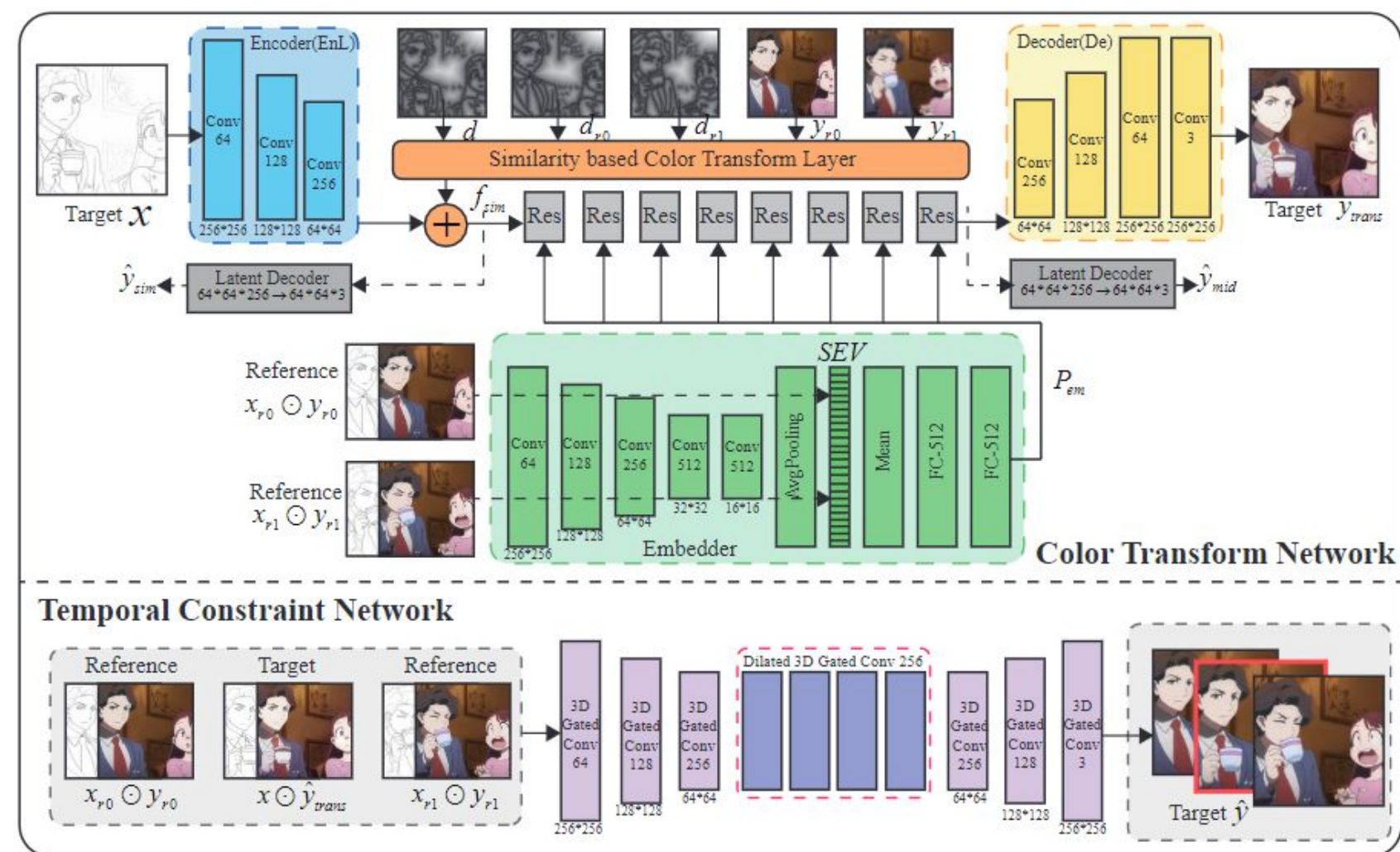
[Zhang et al. 2020]



[Furusawa et al. 2017]



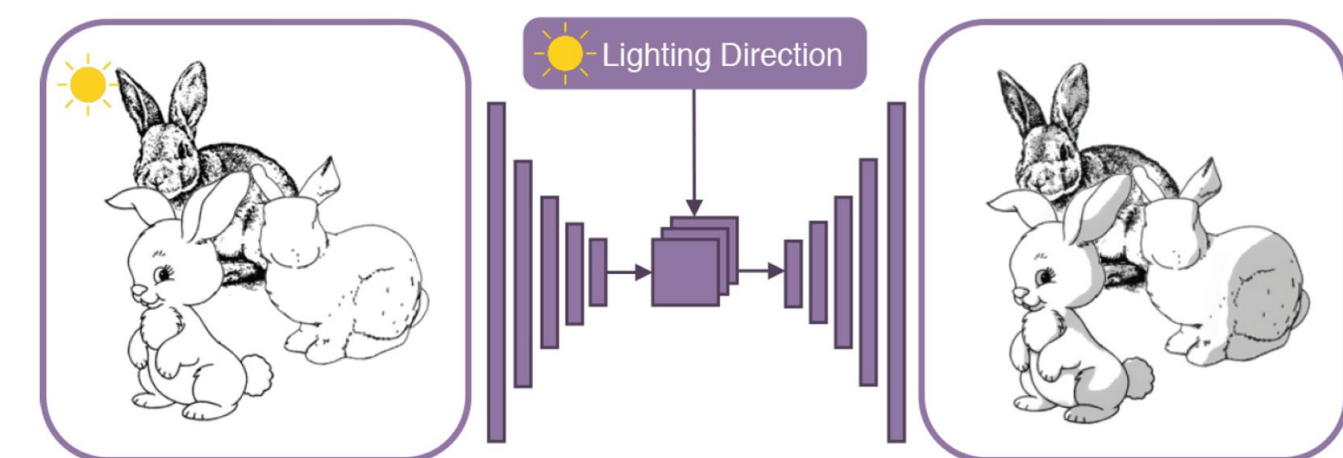
[Shi et al. 2020]



[Zhang et al. 2018]



[Zheng et al. 2020]



Formative Study: Interviews about Colorization

5 Professional Cartoon Artists

1 hour each

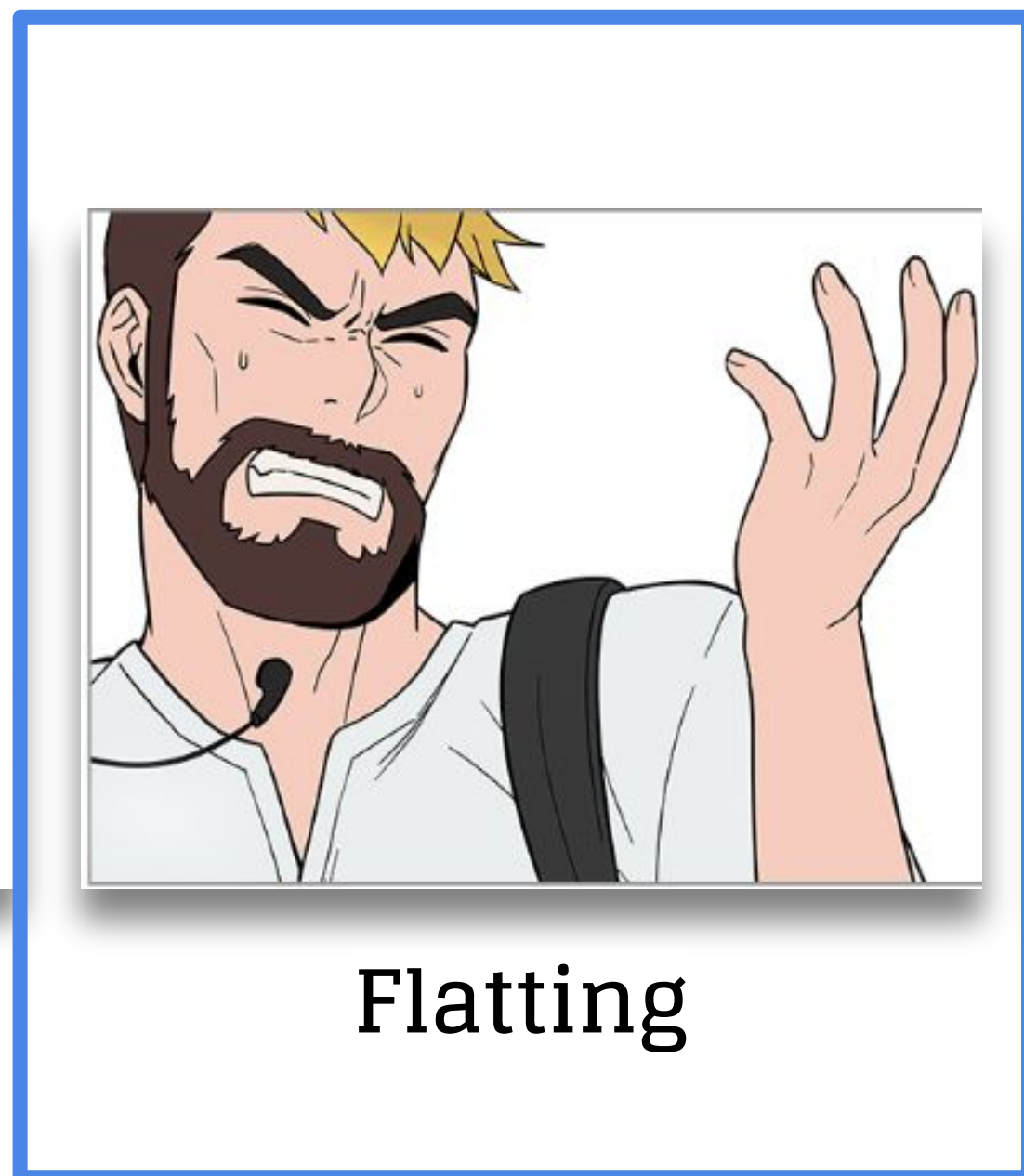
Understand

- Workflow
- Challenges
- Perception of AI tools
- Feature wish list
- Factors behind intention to adopt

Common Workflow in Comic Colorization



Line Drawing



Flatting



Shading



Lighting

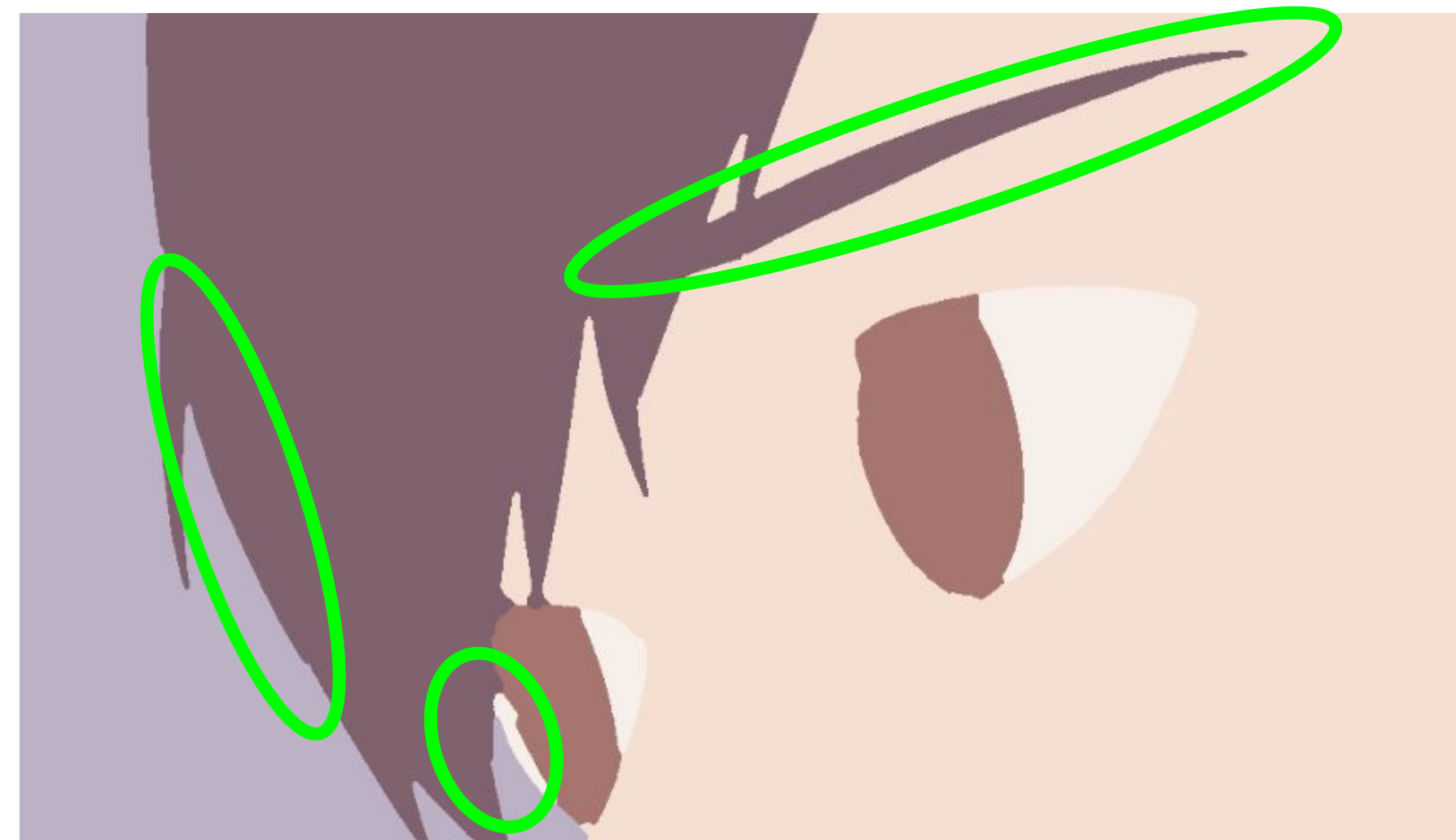
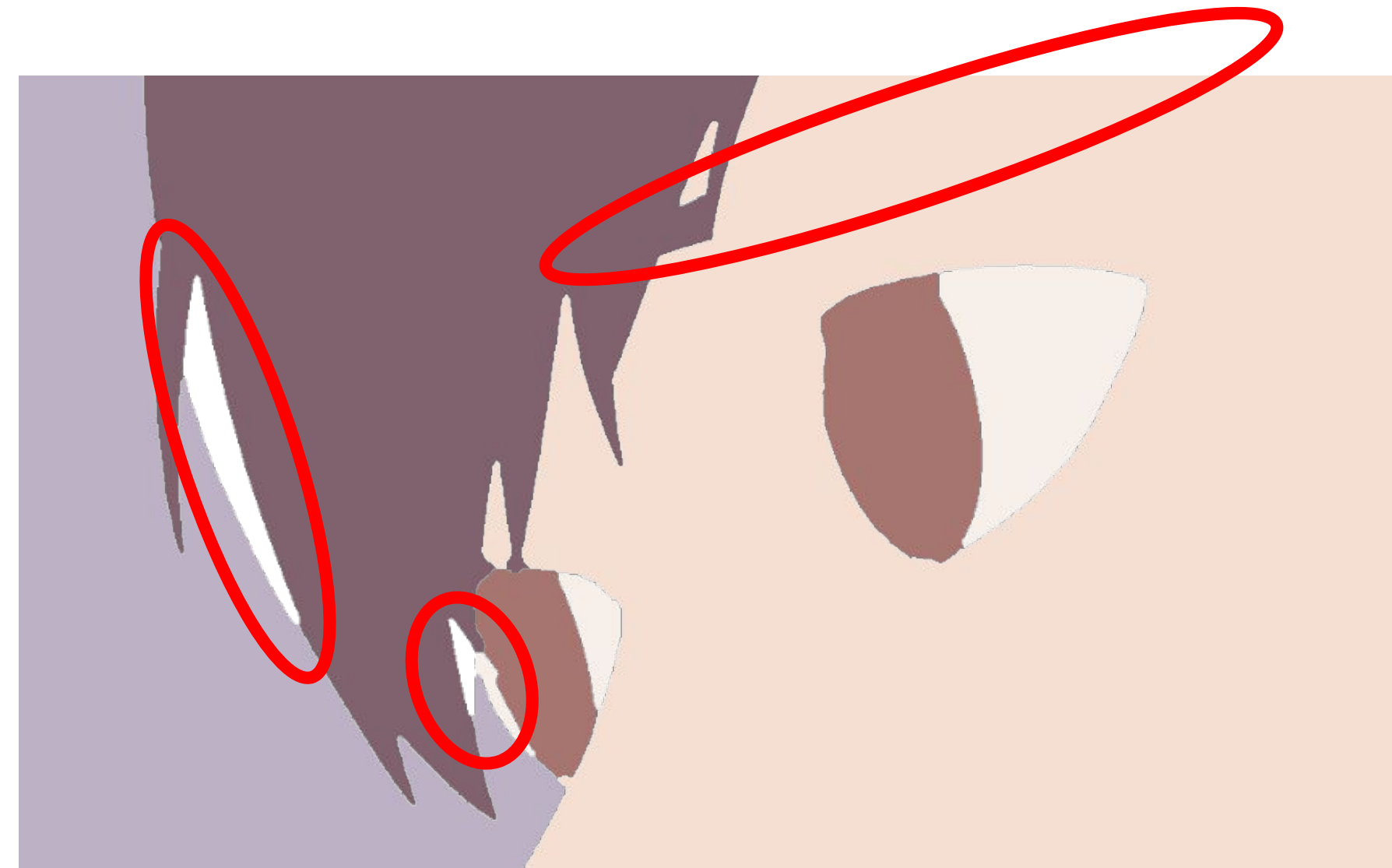
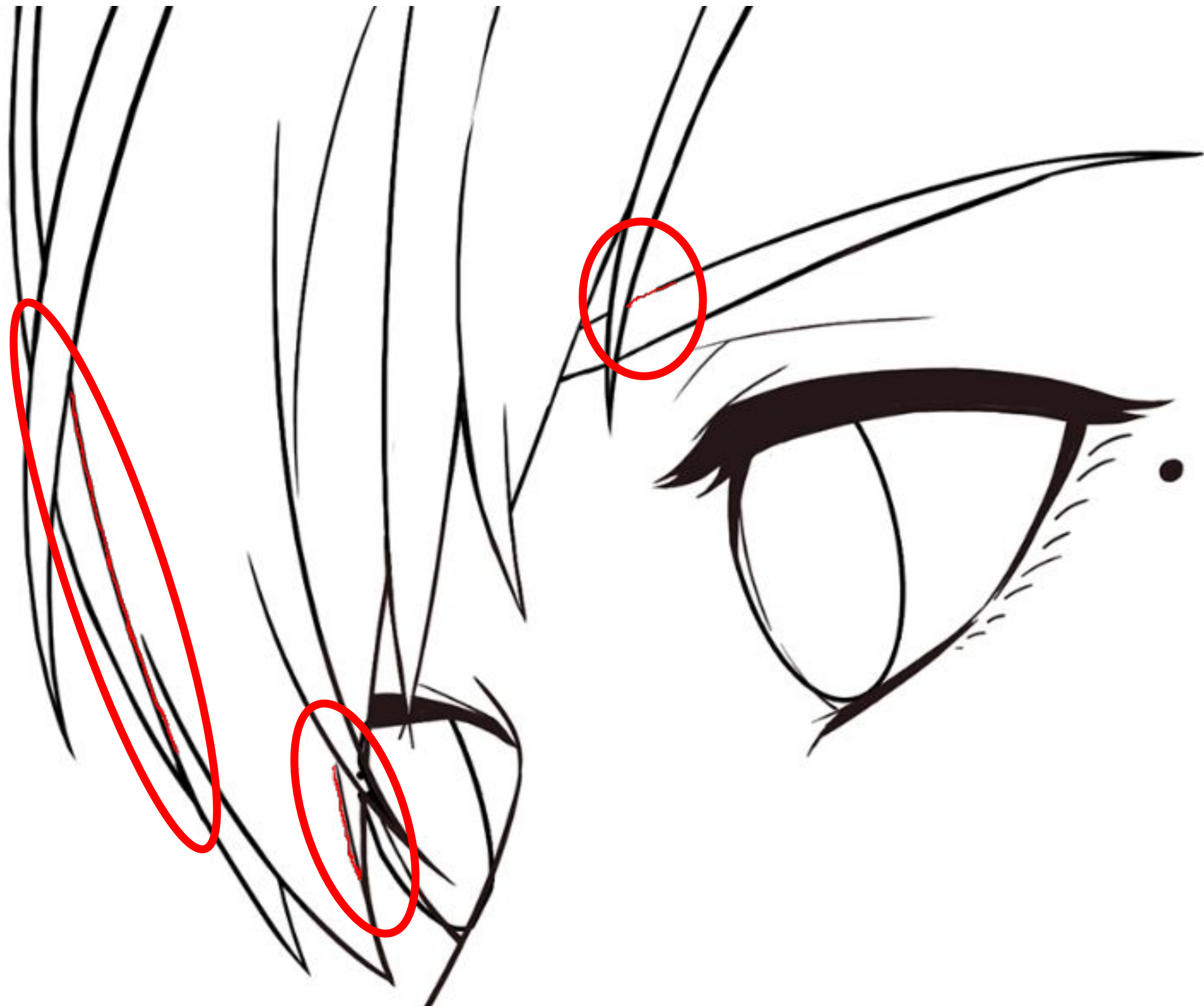


Special Effects

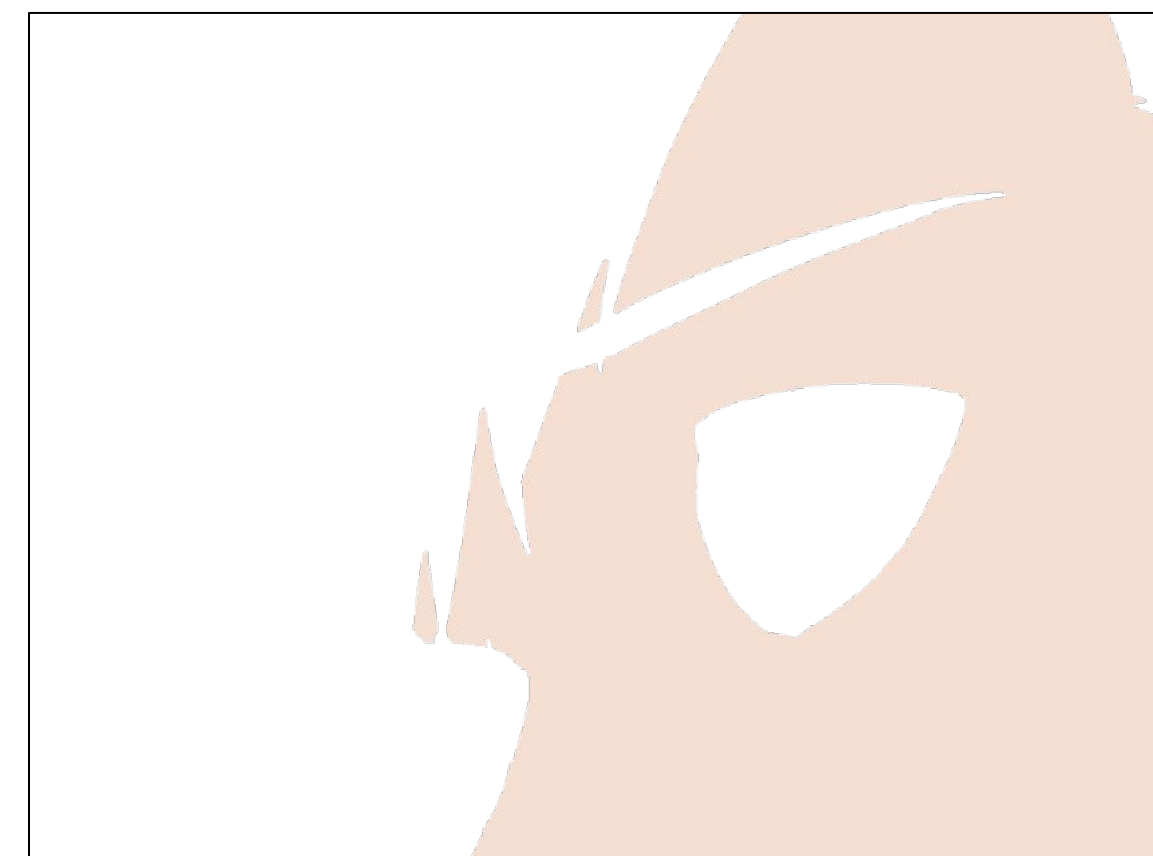
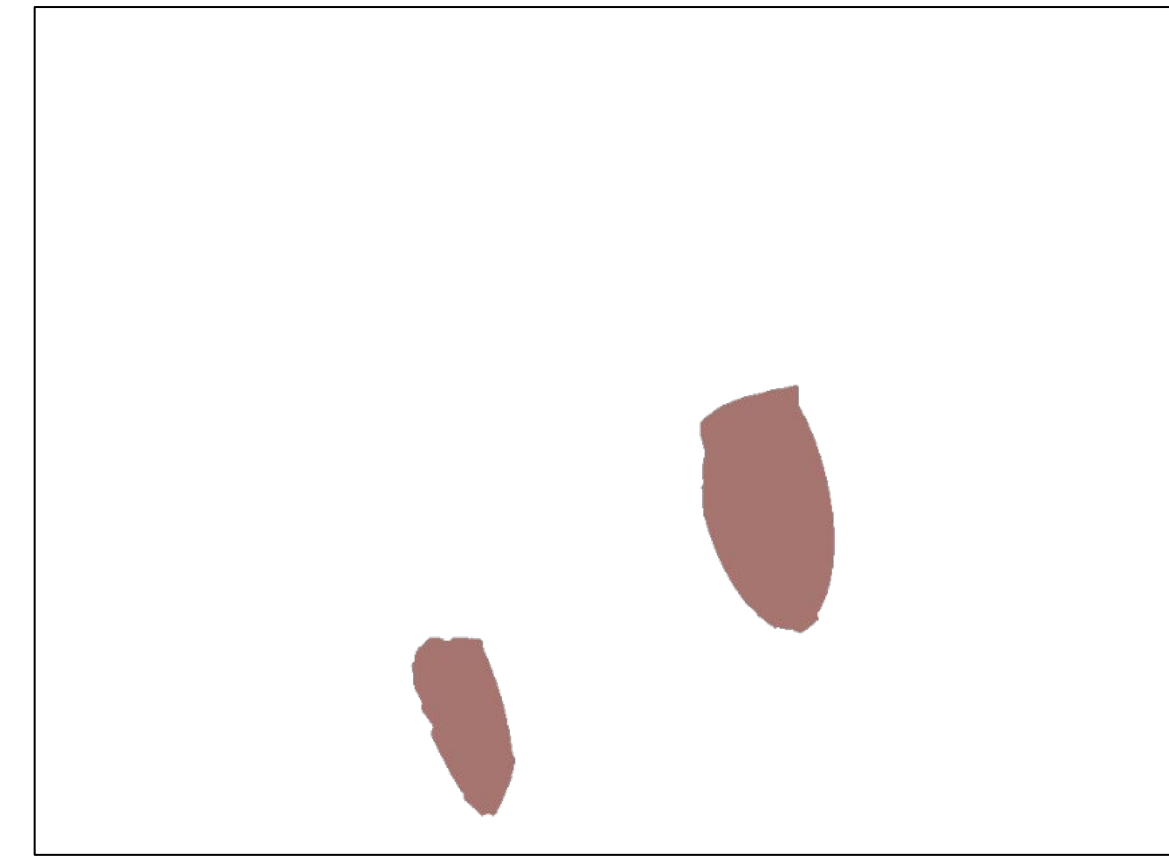
What is Flattening / Flat coloring?



Flat Consistency

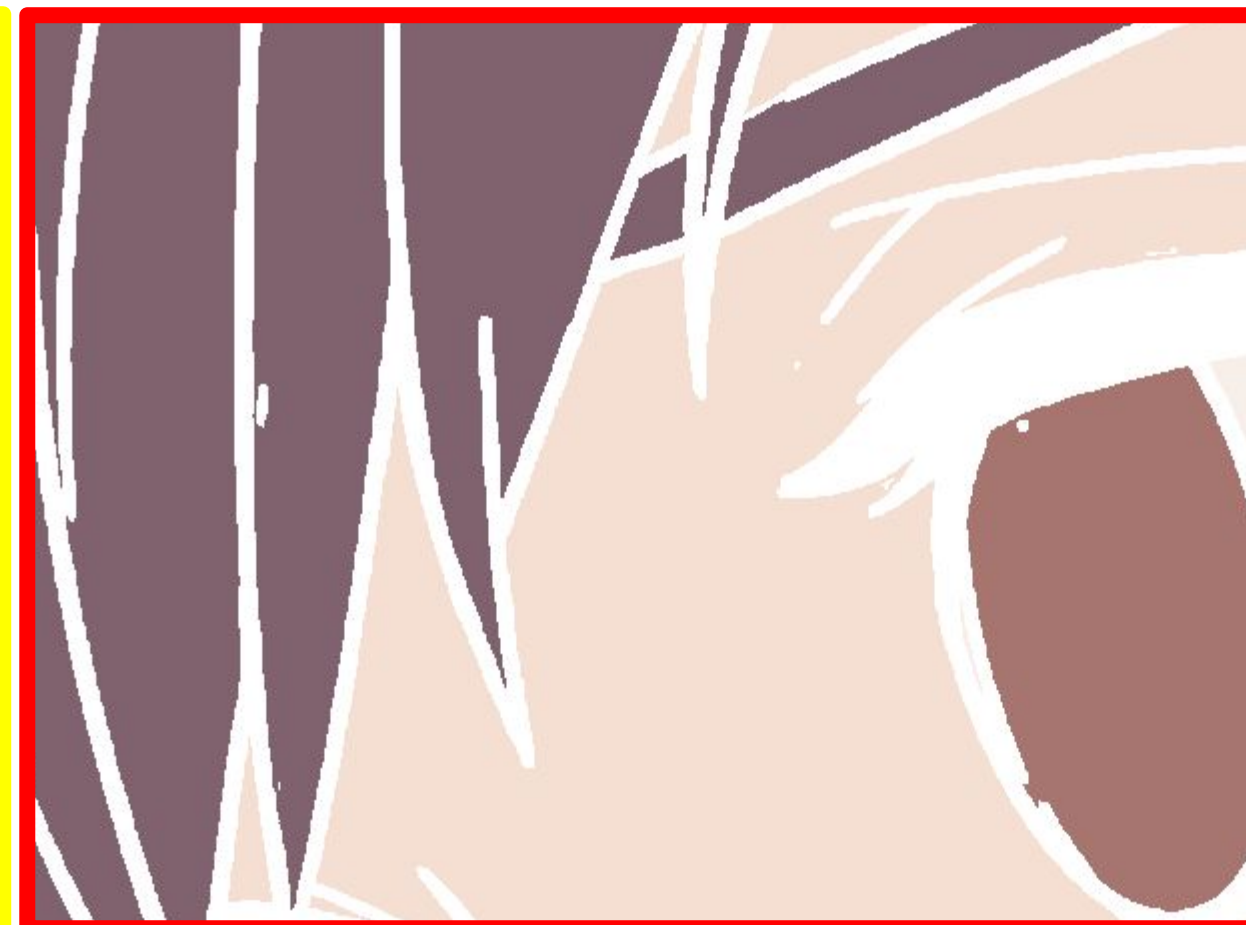
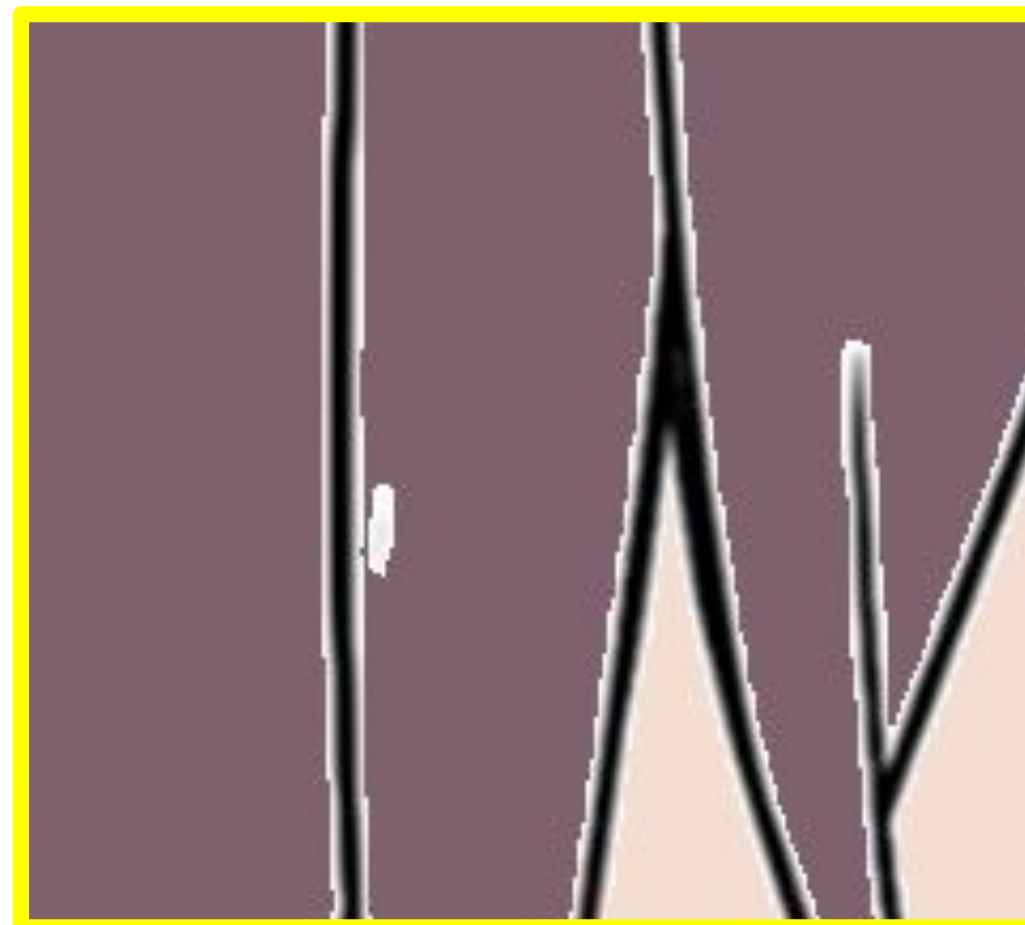
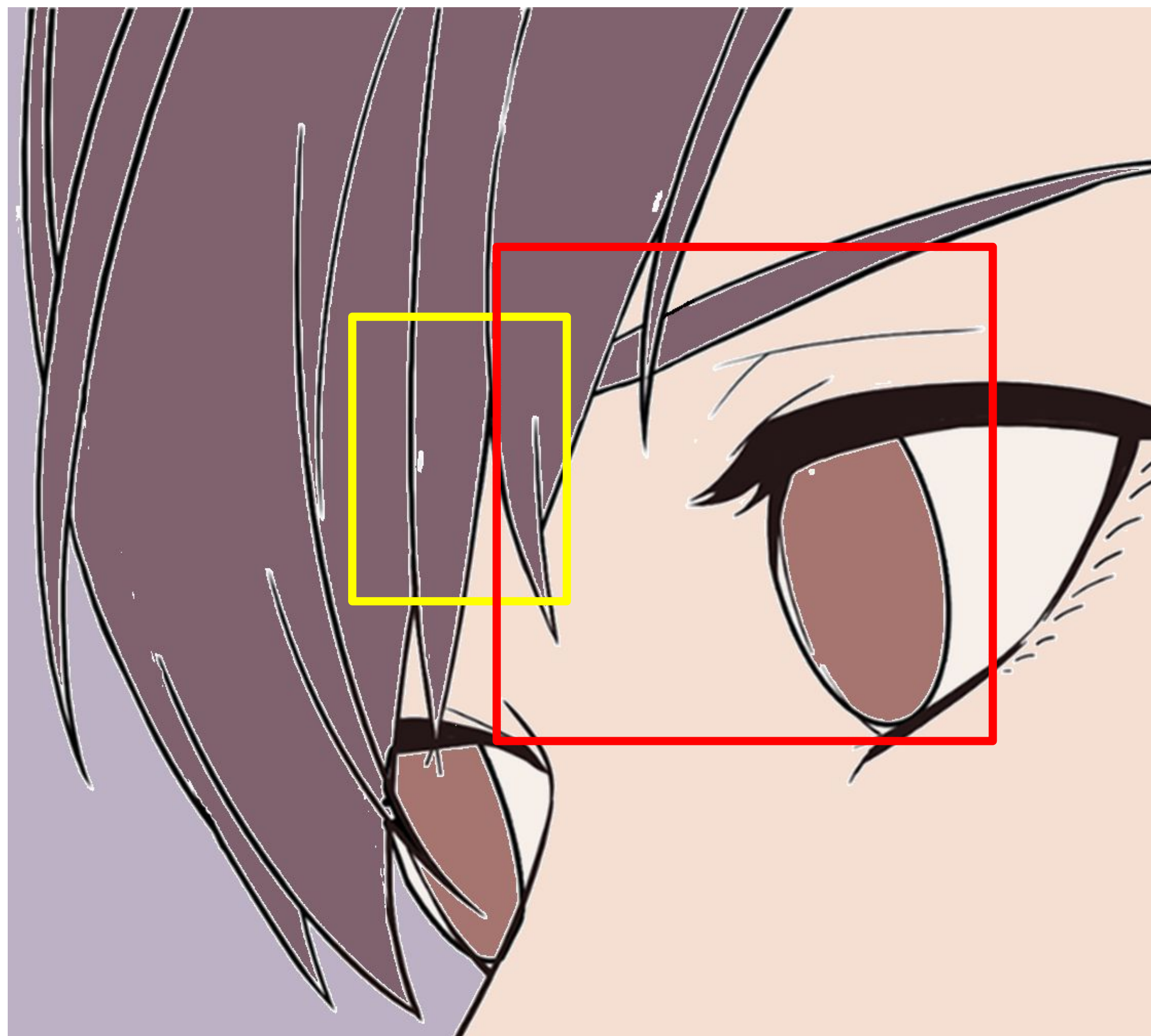


Flat Completeness

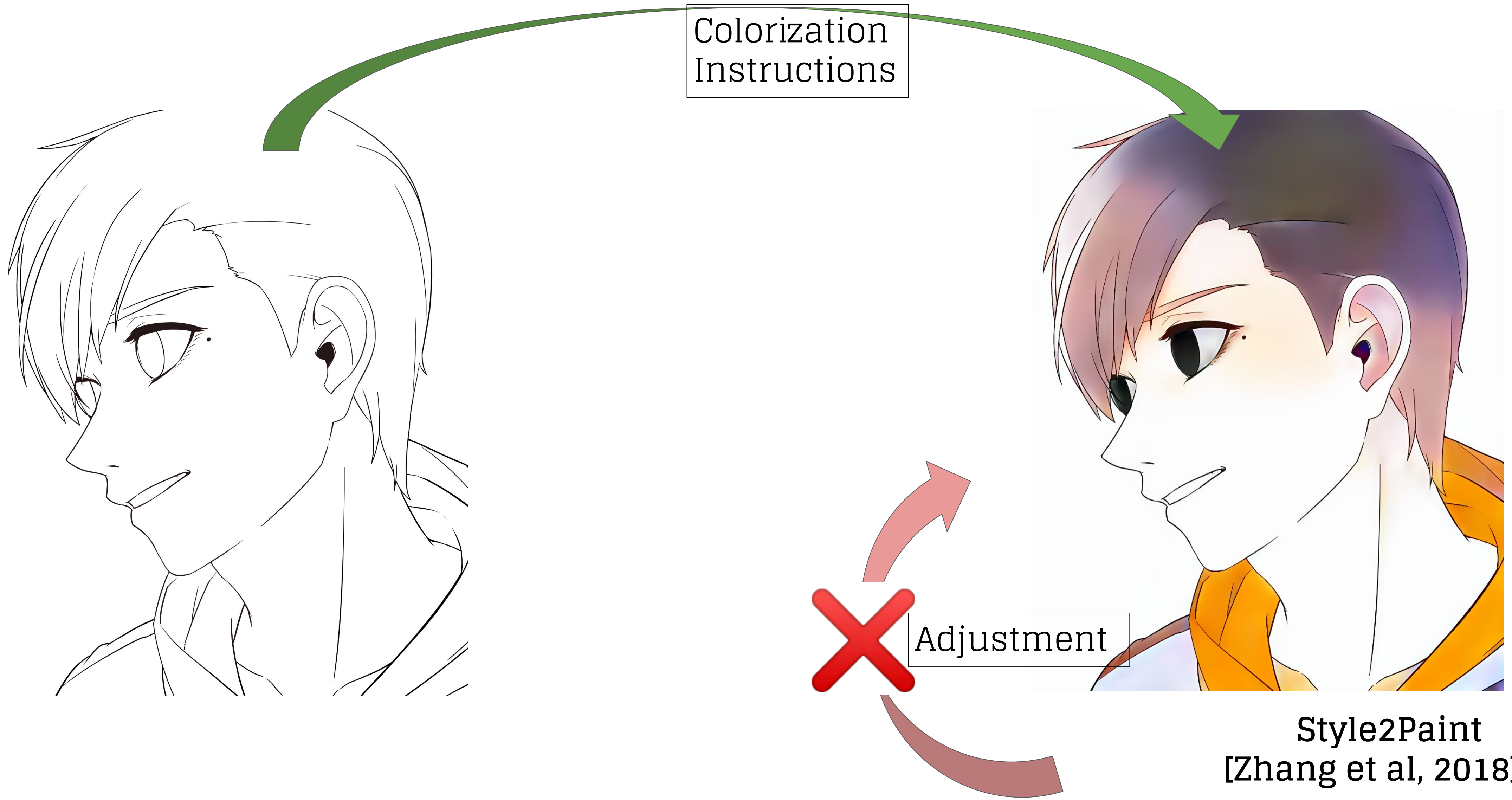


Complete
Segmentation

Flat Completeness



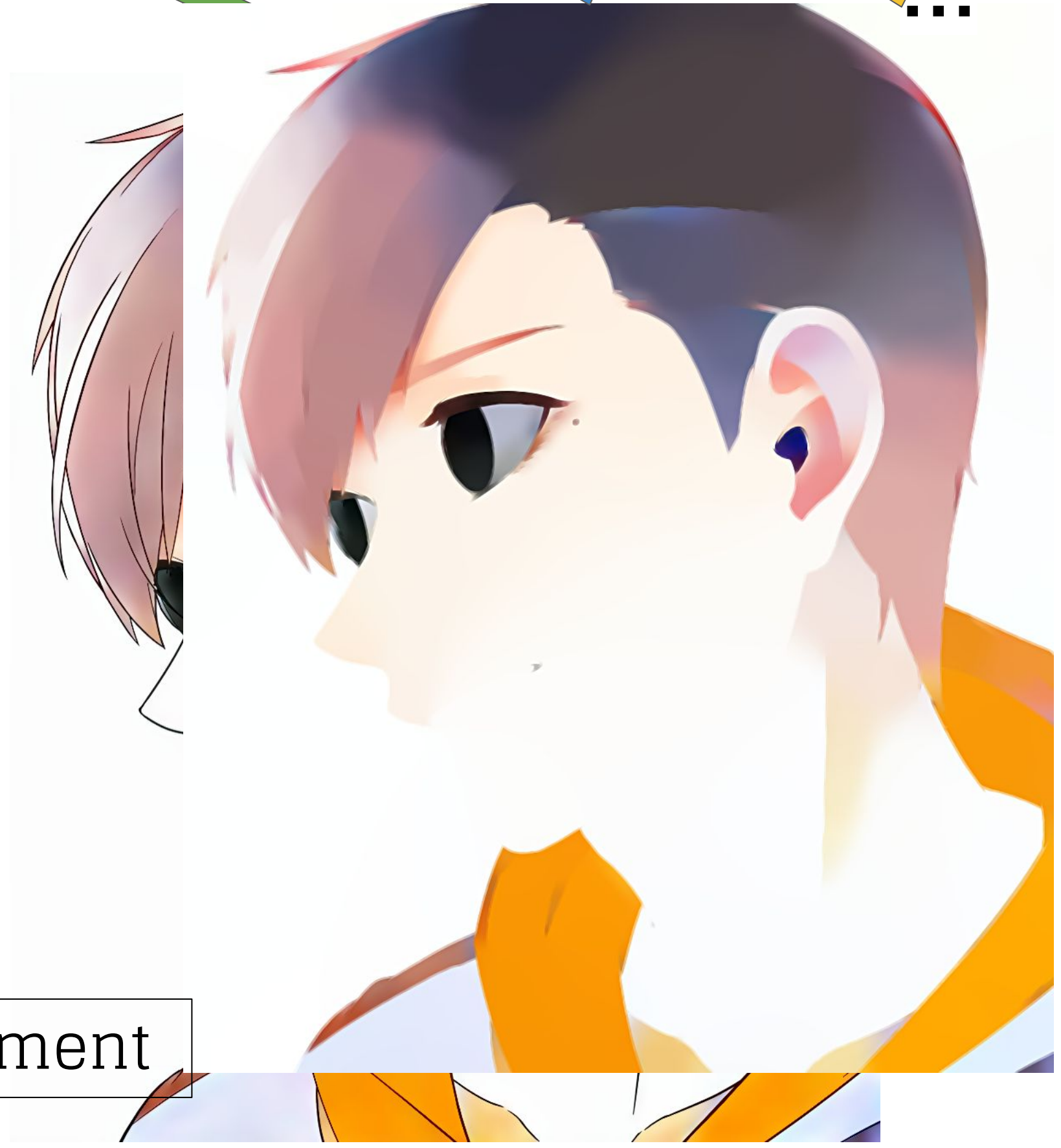
Why AI-driven Tools Don't Help?



Why AI-driven Tools Don't Help?



Colorization Instructions



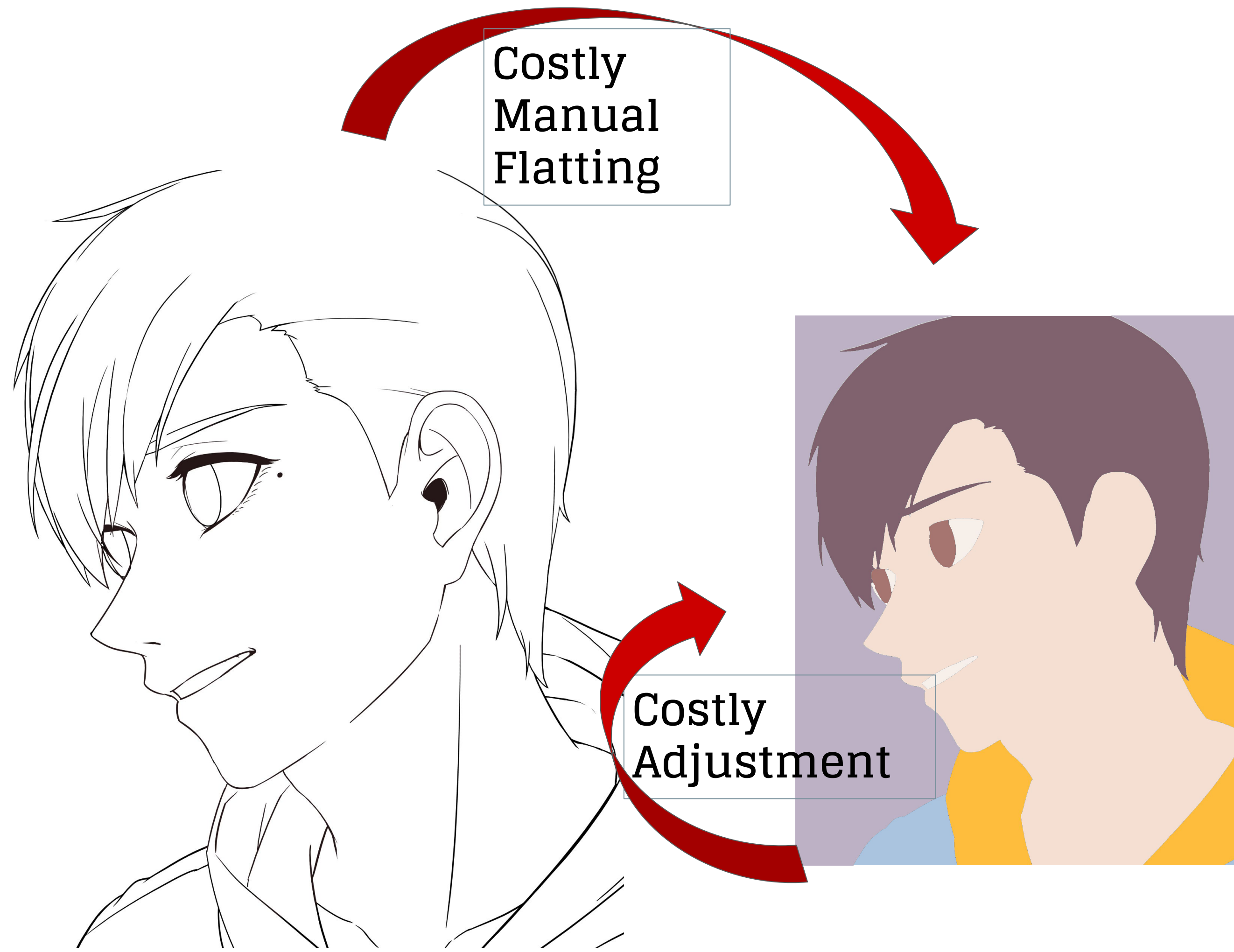
Adjustment

Style2Paint
[Zhang et al, 2018]

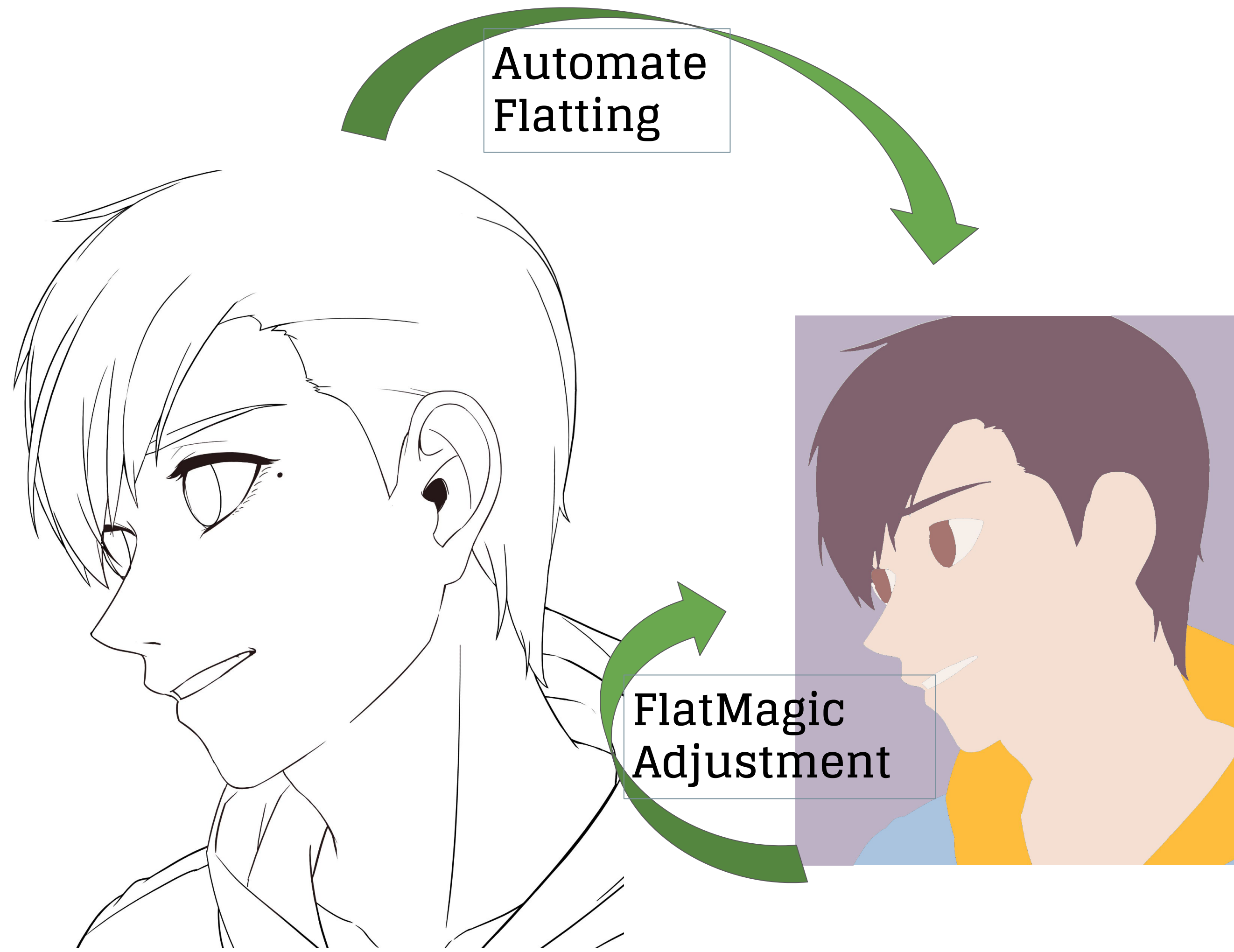
Formative Study (S1) - Conclusion



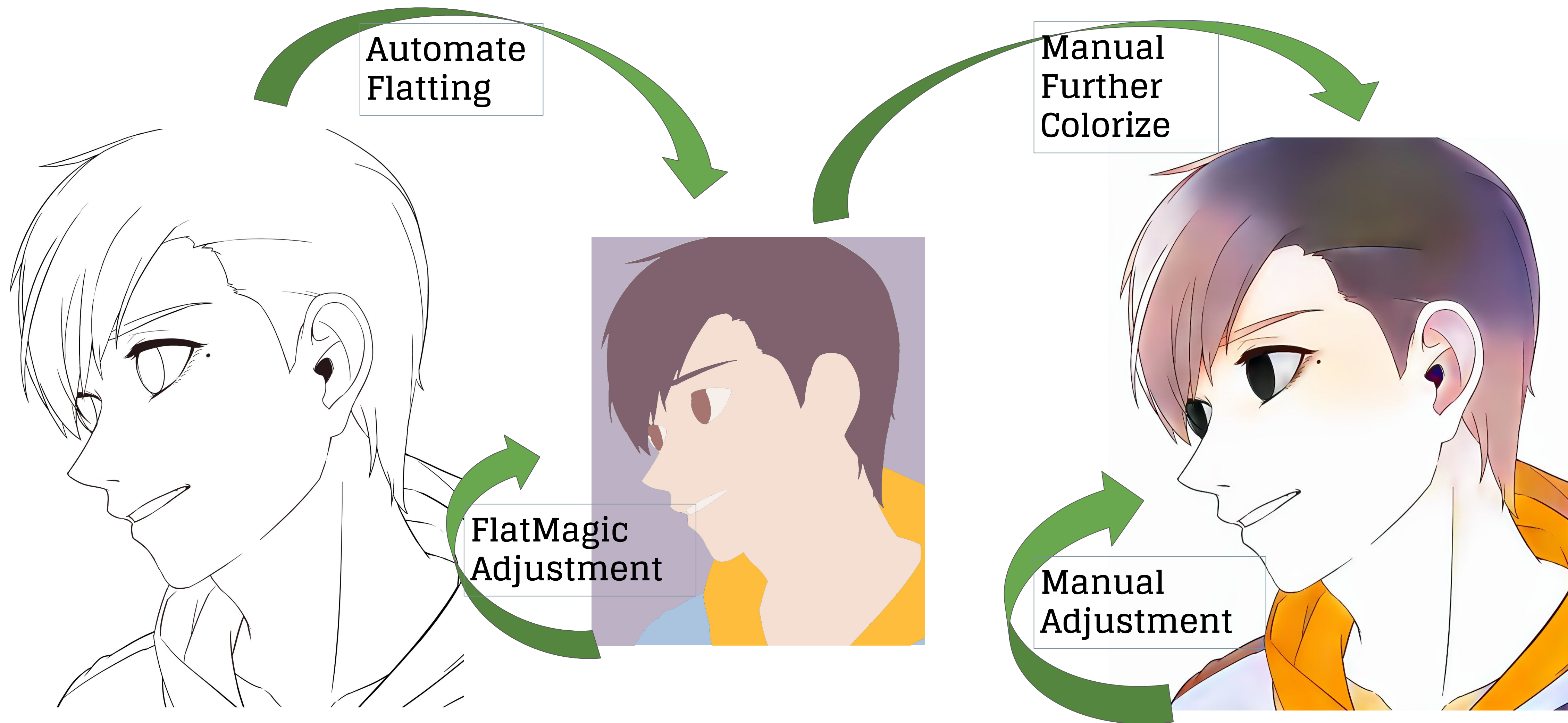
Formative Study (S1) - Conclusion



Formative Study (S1) - Conclusion

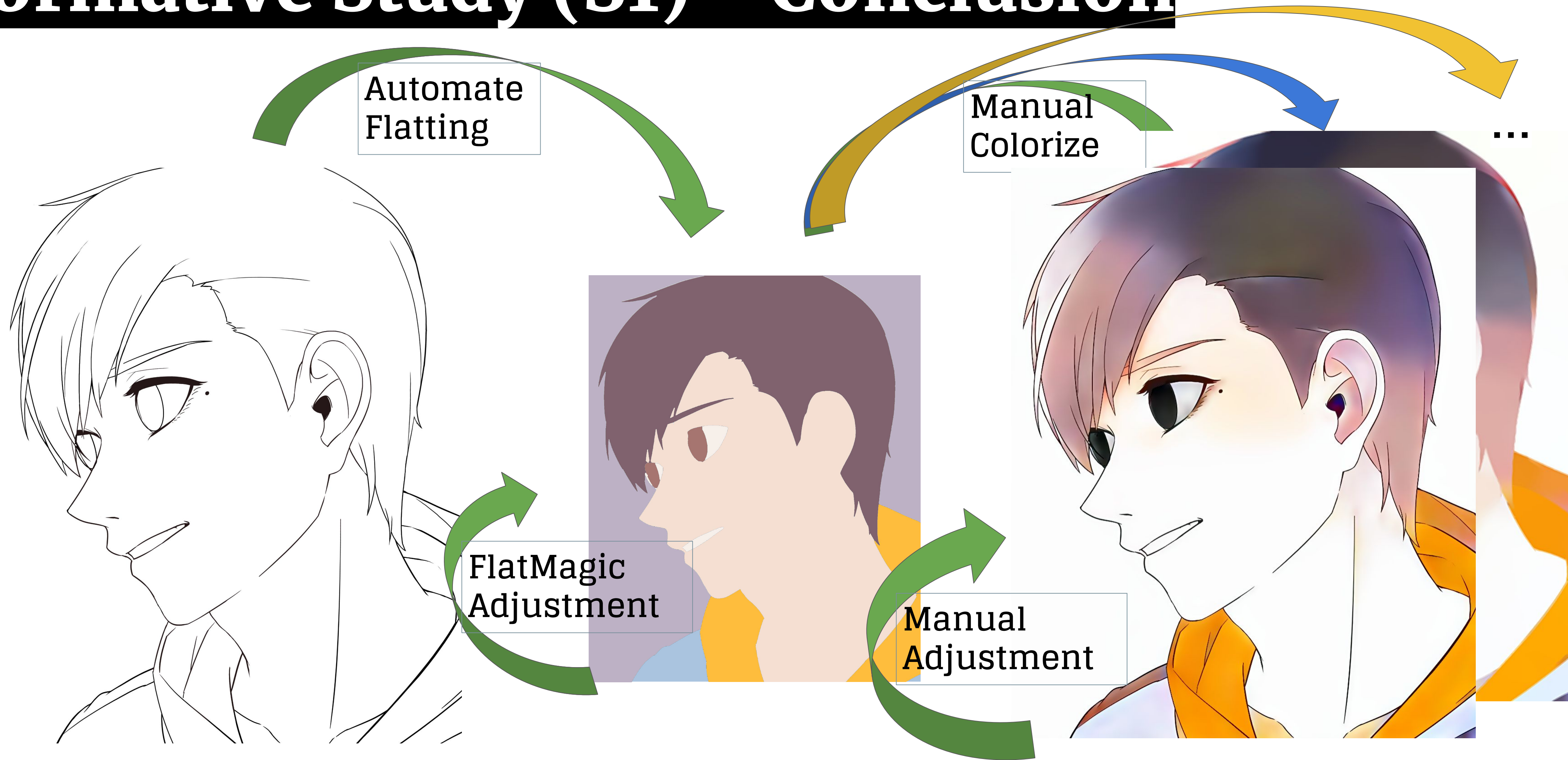


Formative Study (S1) - Conclusion



Style2Paint
[Zhang et al, 2018]

Formative Study (S1) - Conclusion



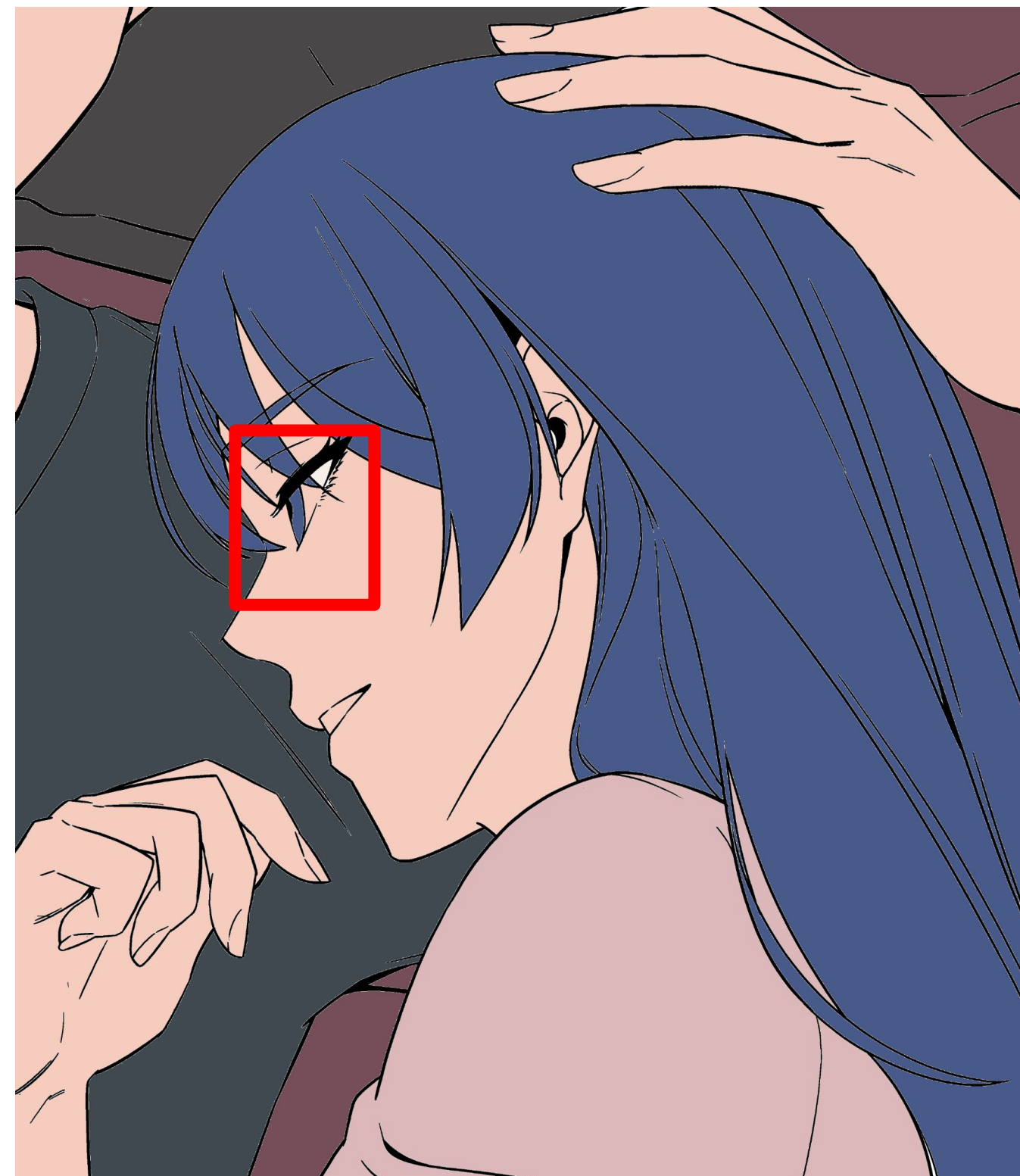
Style2Paint
[Zhang et al, 2018]

Flat Magic - Neural "re" drawing

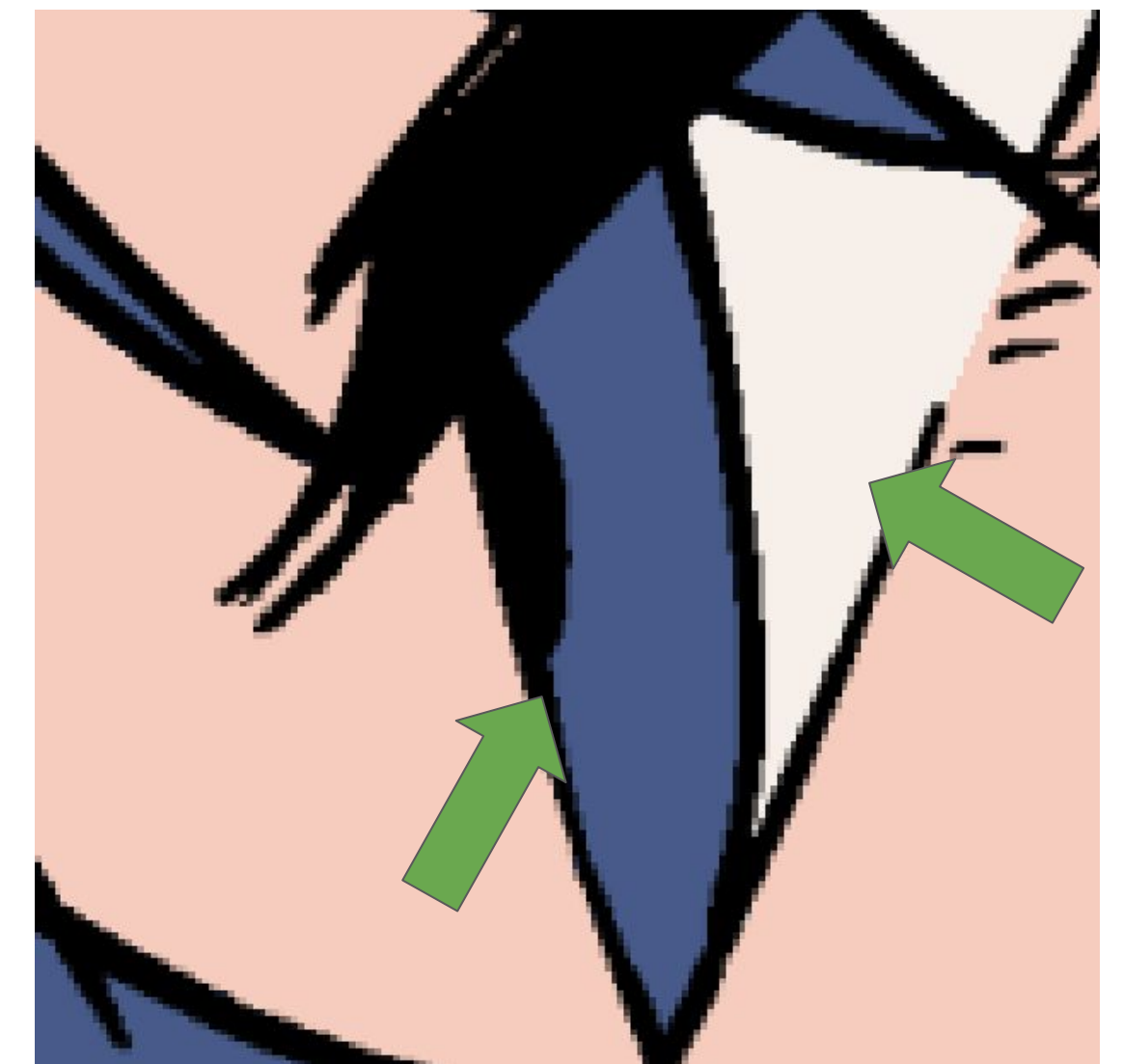
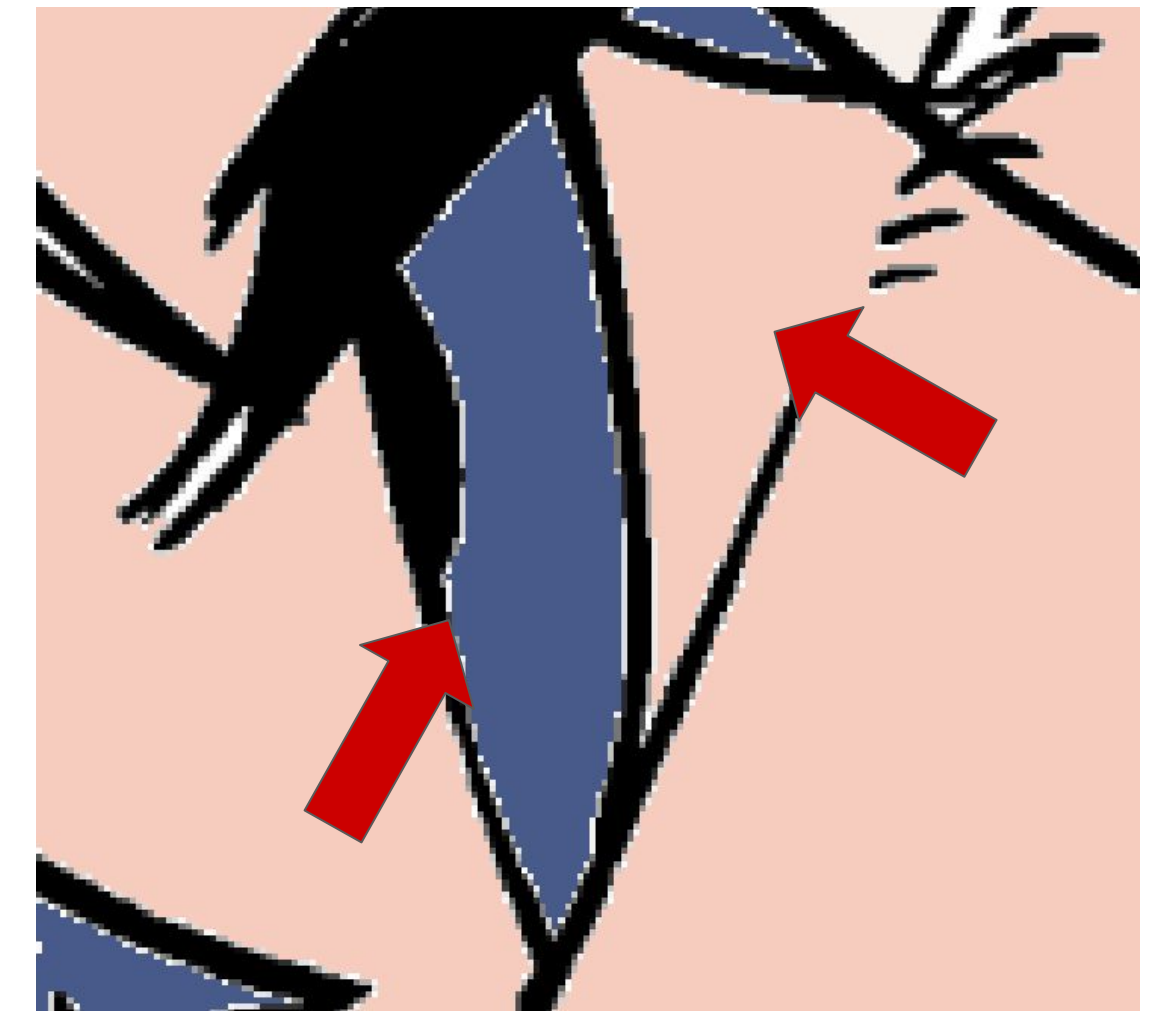


Input

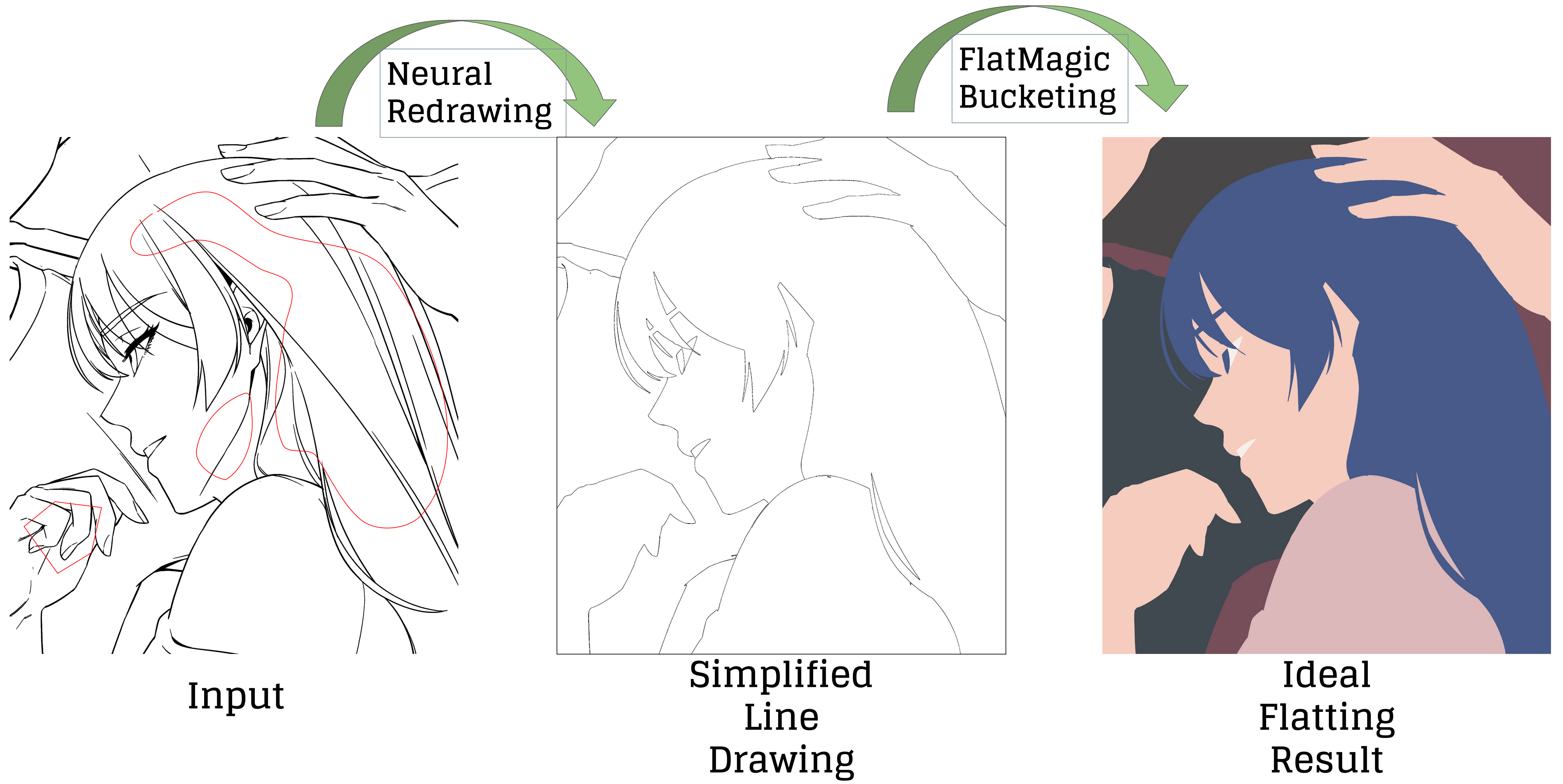
Naive Bucketing



Flatting Result



Flat Magic - Neural "re" drawing



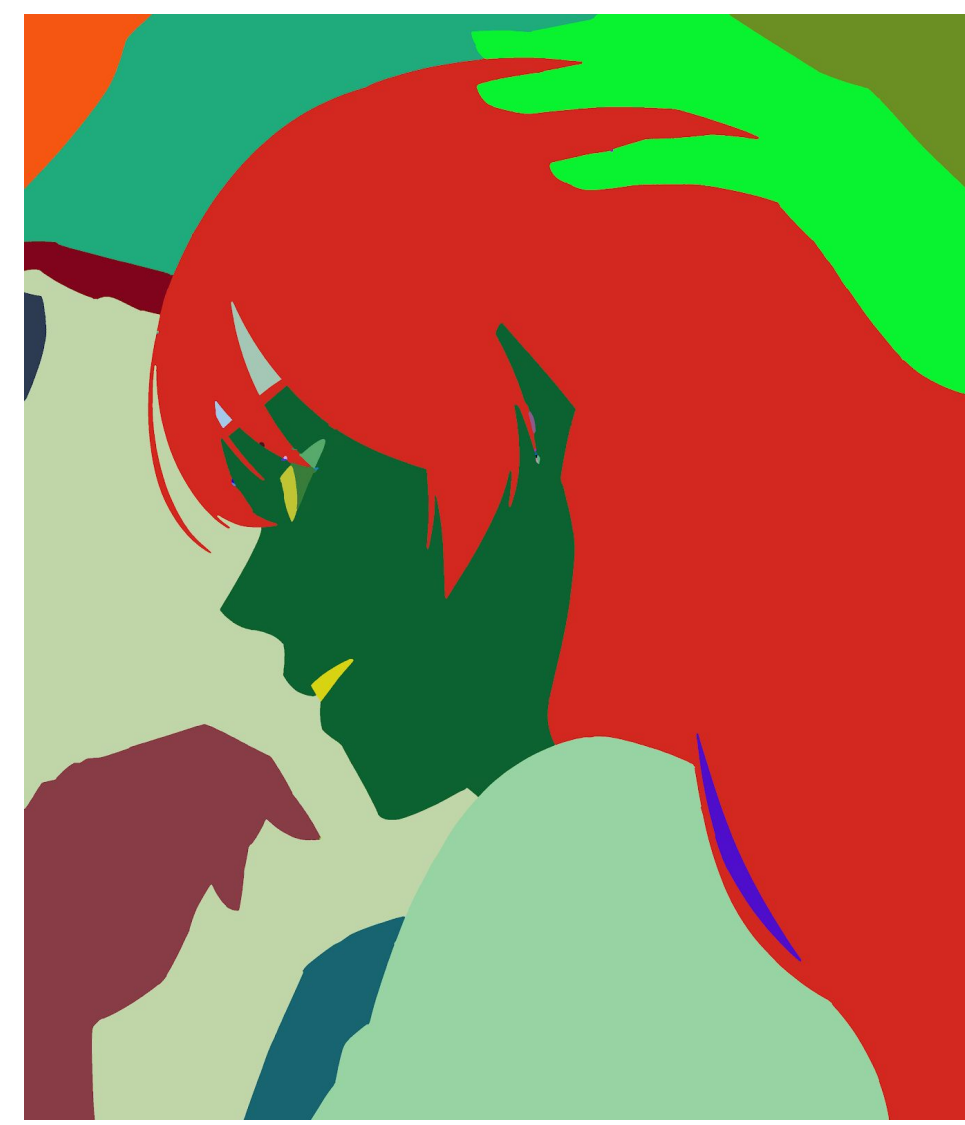
Flat Magic - Automate Initial Flattening



Input



Neural
redrawing

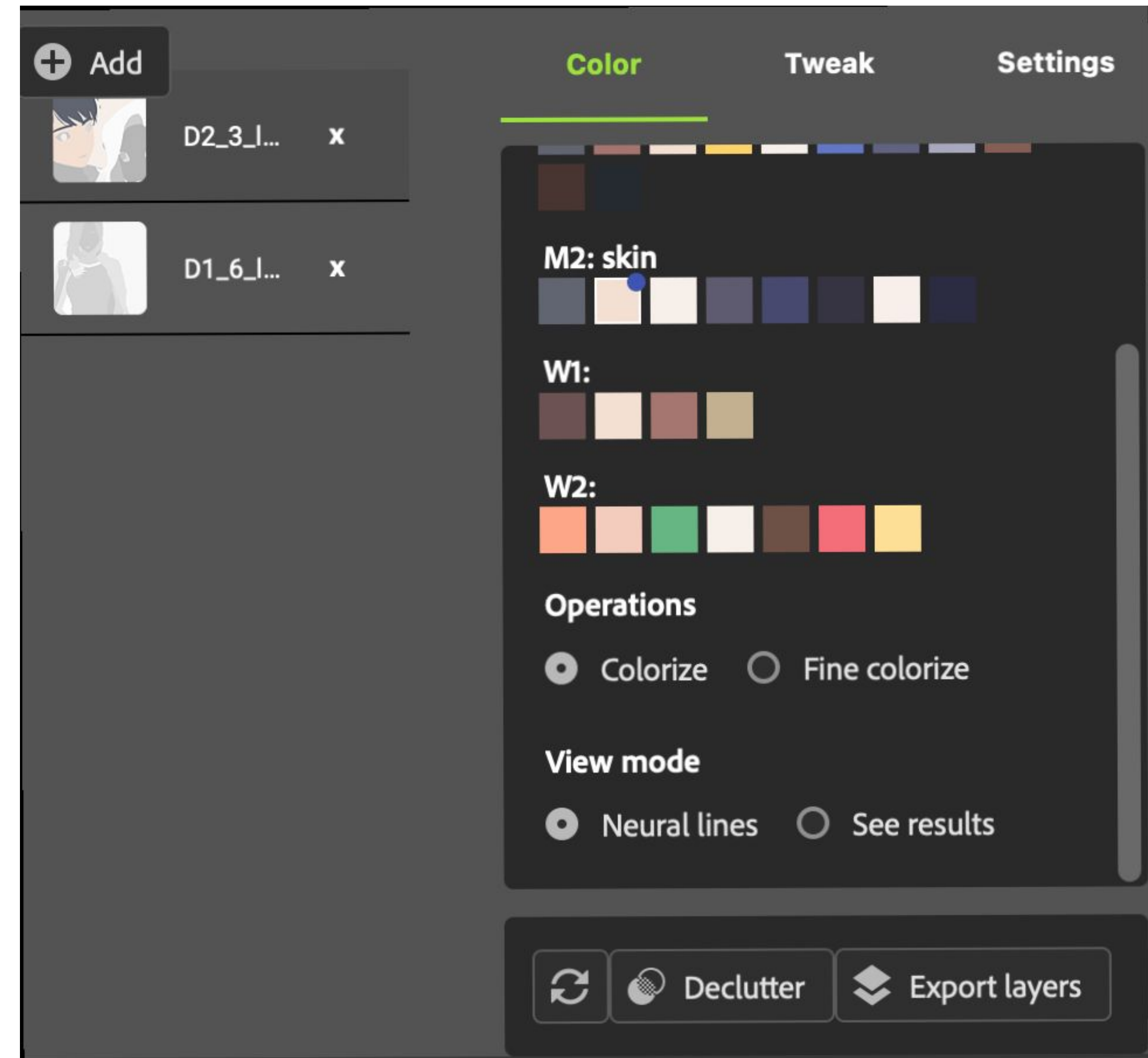
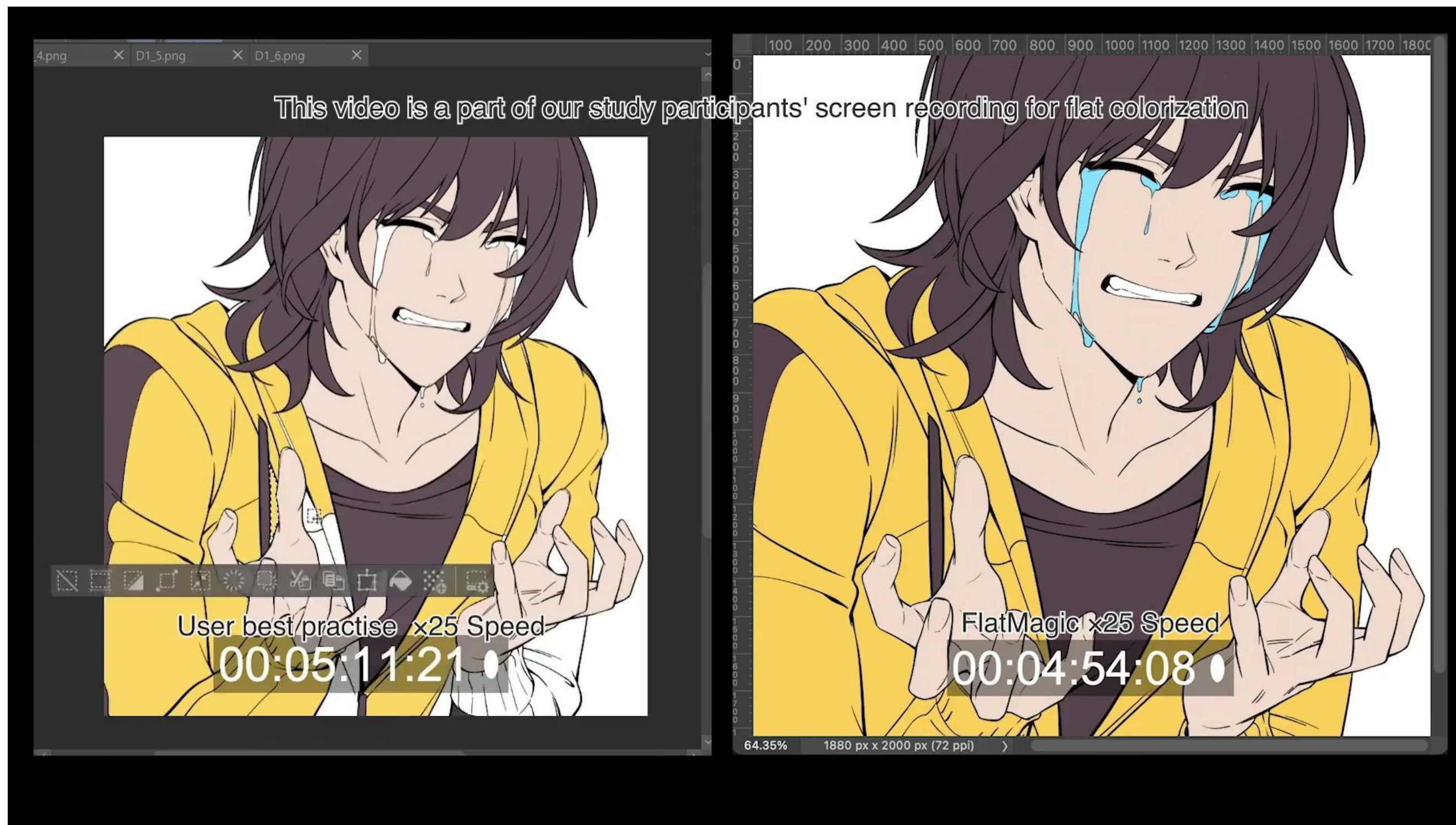


Trapped
ball Filling



Post
processing

Flat Magic - User Interface



Experimental Study - Flattening Time



Experimental Study - Flattening Quality

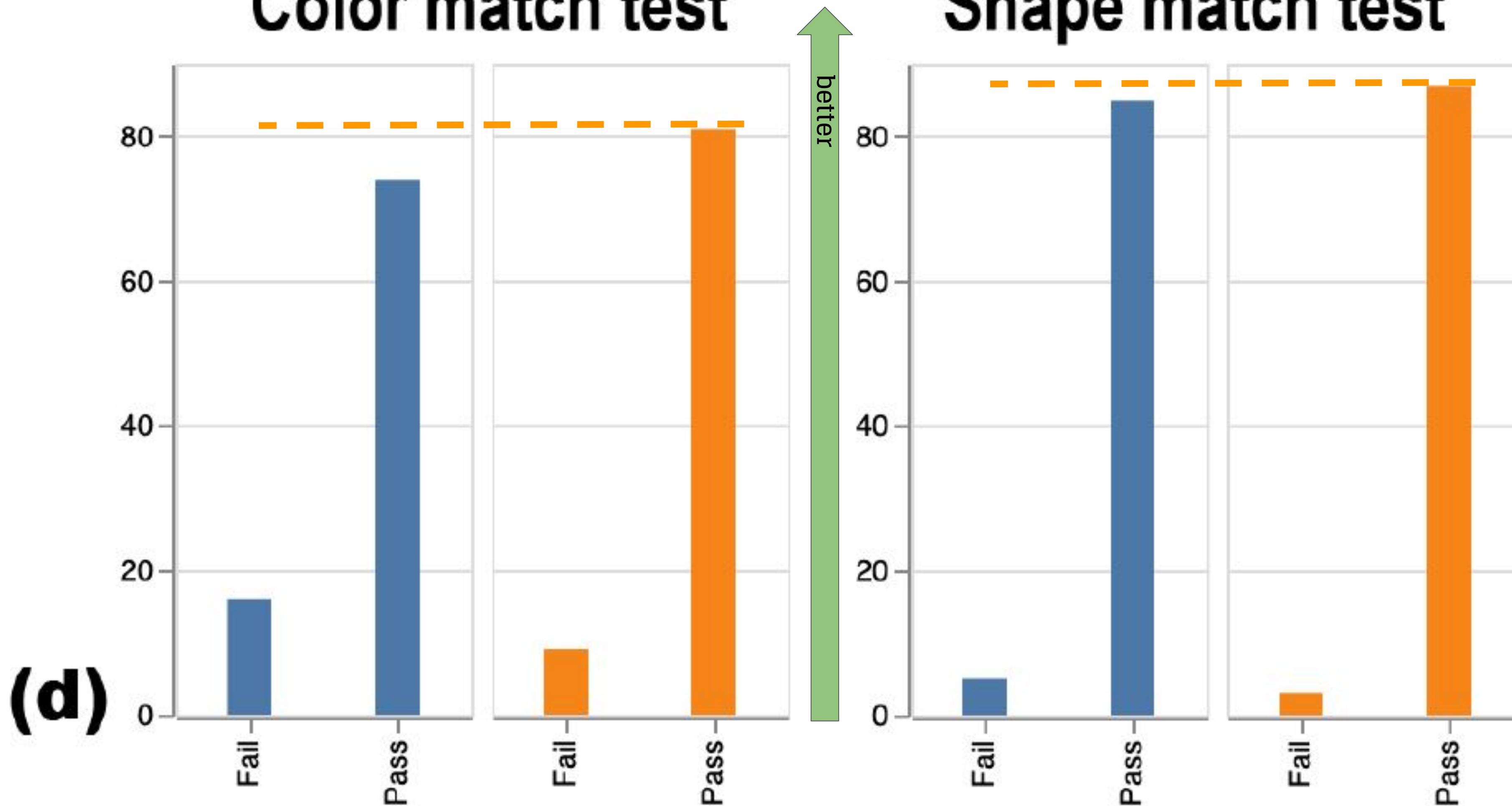
■ Baseline

More pass result is better

■ FlatMagic

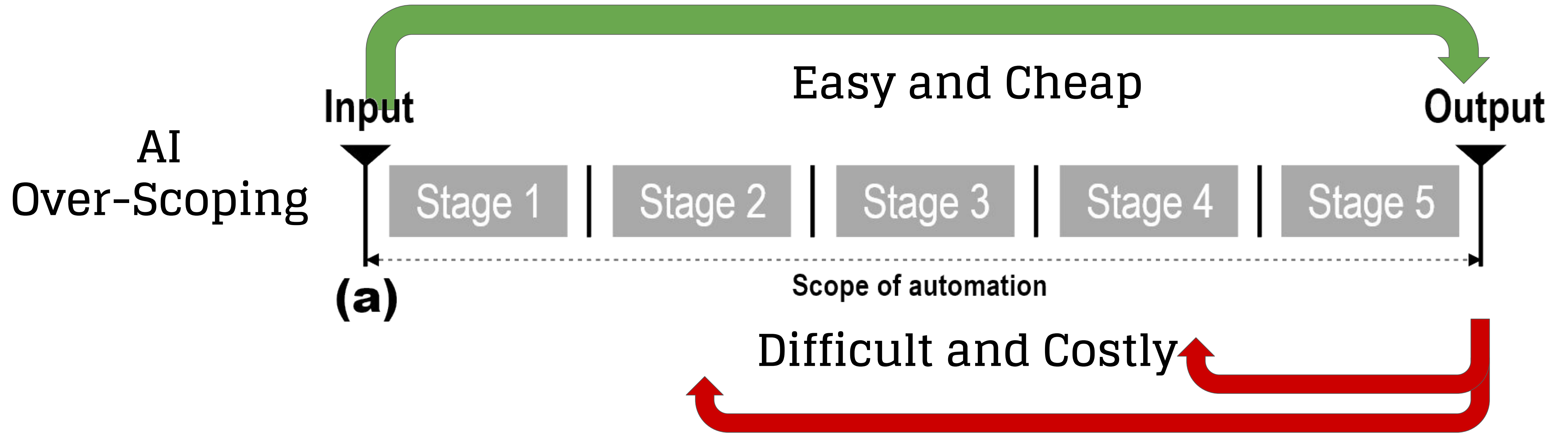
Color match test

Shape match test

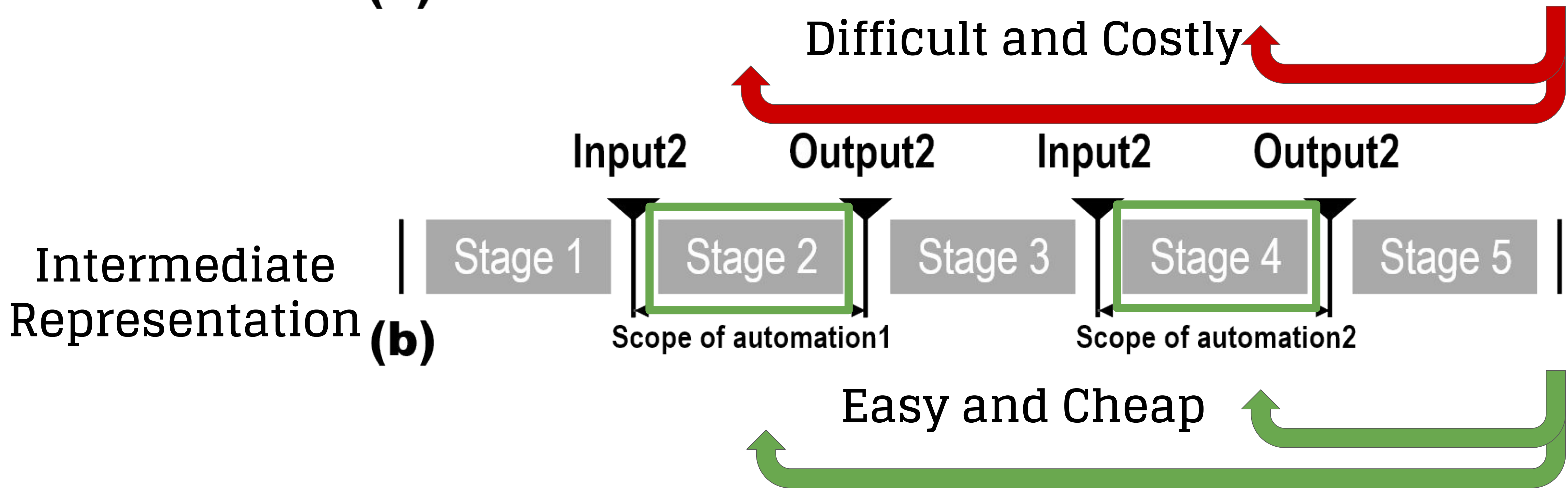
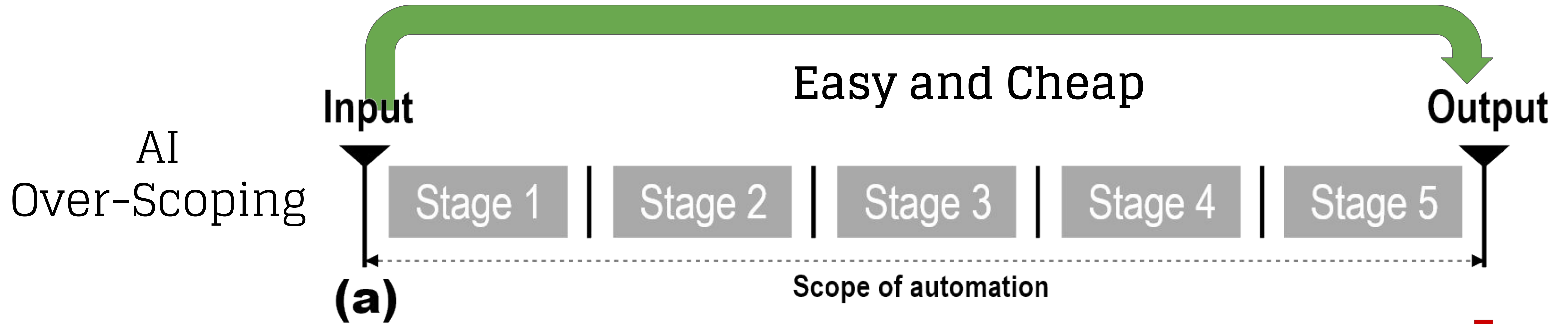


(d)

Intermediate Representation



Intermediate Representation



Intermediate Representation

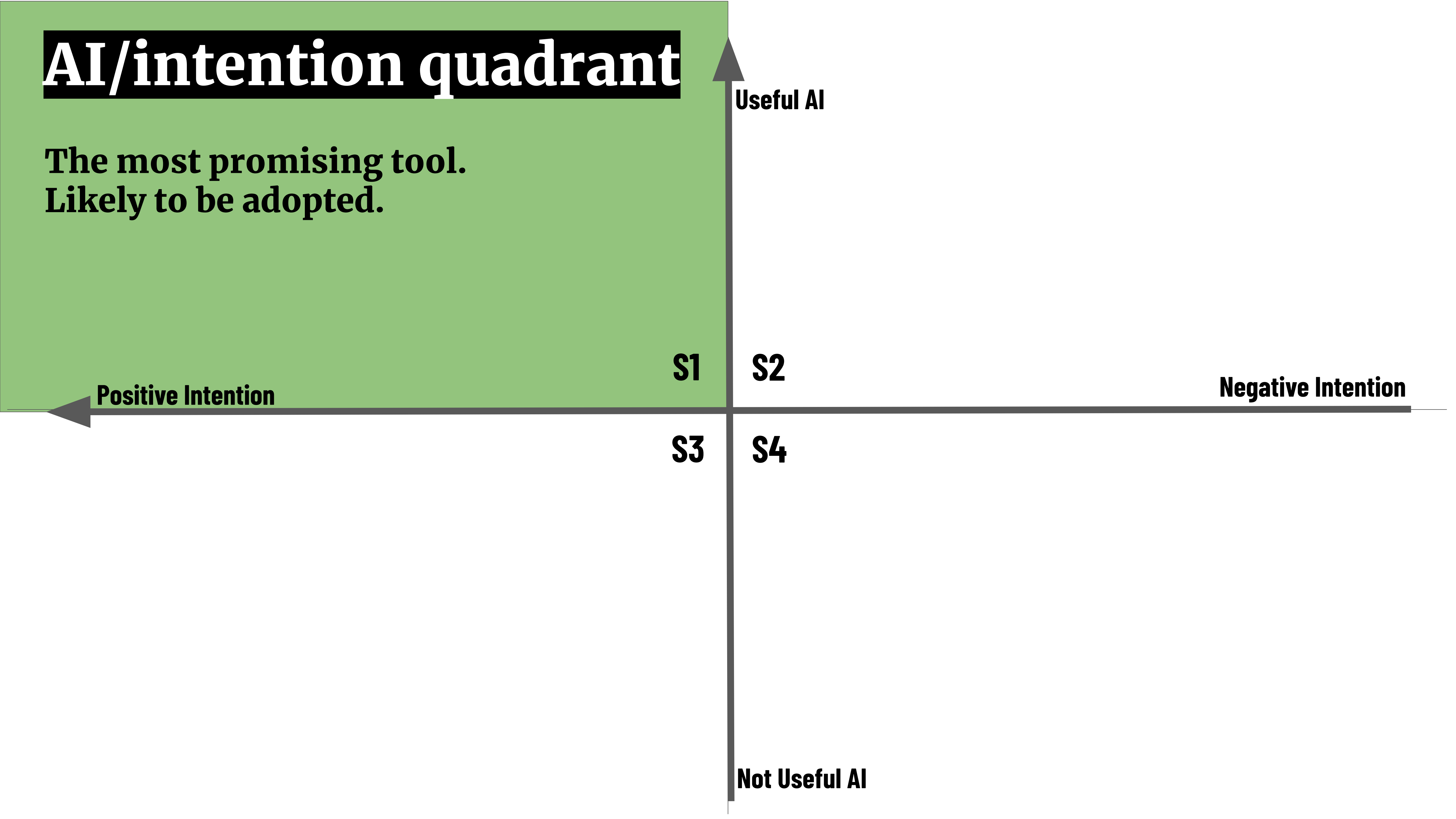
#1. Understand a detailed, stage-by-stage workflow

Intermediate Representation

#2. Then consider the AI usefulness and the User intention for a given AI tool

AI/intention quadrant

The most promising tool.
Likely to be adopted.



AI/intention quadrant

The most promising tool.
Likely to be adopted.

**Find a better strategy to
convince a user to adopt.**

Useful AI

Not Useful AI

Positive Intention

Negative Intention

S1

S2

S3

S4

AI/intention quadrant

The most promising tool.
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Find a better strategy to
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Positive Intention

Negative Intention

S1

S2

S3

S4

**Find a more reasonable
automation scope for AIs
first.**

Useful AI

Not Useful AI

AI/intention quadrant

The most promising tool.
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Find a better strategy to
convince a user to adopt.

Positive Intention

Negative Intention

S1

S2

S3

S4

Find a more reasonable
automation scope for AIs
first.

“Back to the drawing board.”

Useful AI

Not Useful AI

Intermediate Representation

#3. Be careful of merging the automation scope when building the tool.

Collaborators

John Joon

Young Chung



Kiheon Yoon



Yotam Gingold



Eytan Adar



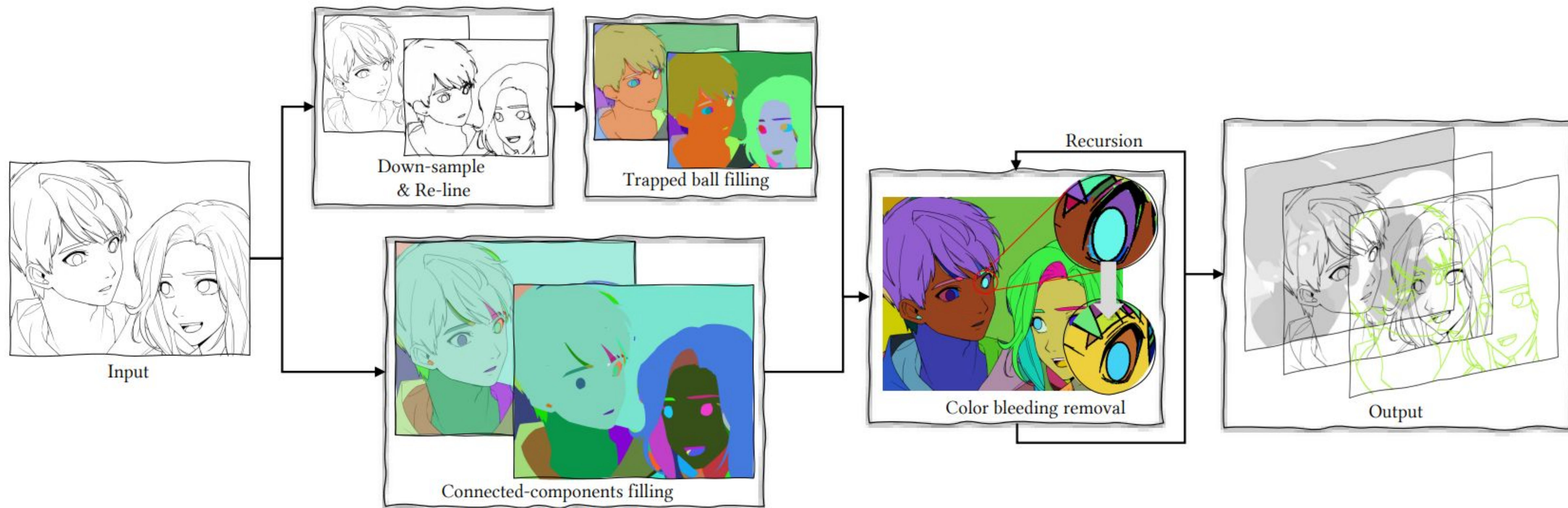
Sungsoo Ray Hong



cyan3@gmu.edu

Thanks for listening

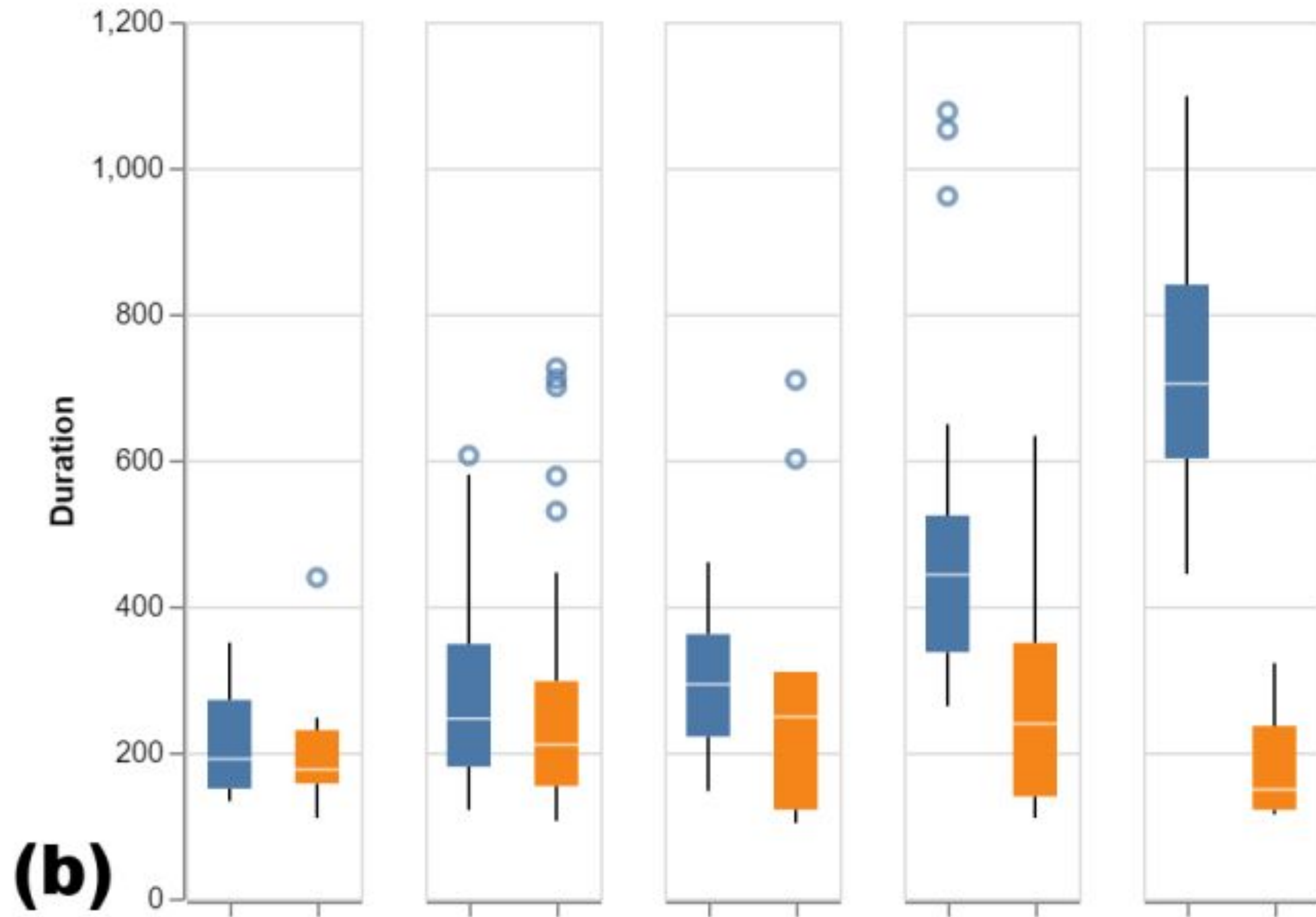
Flat Magic - Automate Initial Flattening



Experimental Study - Flattening Time Improvement

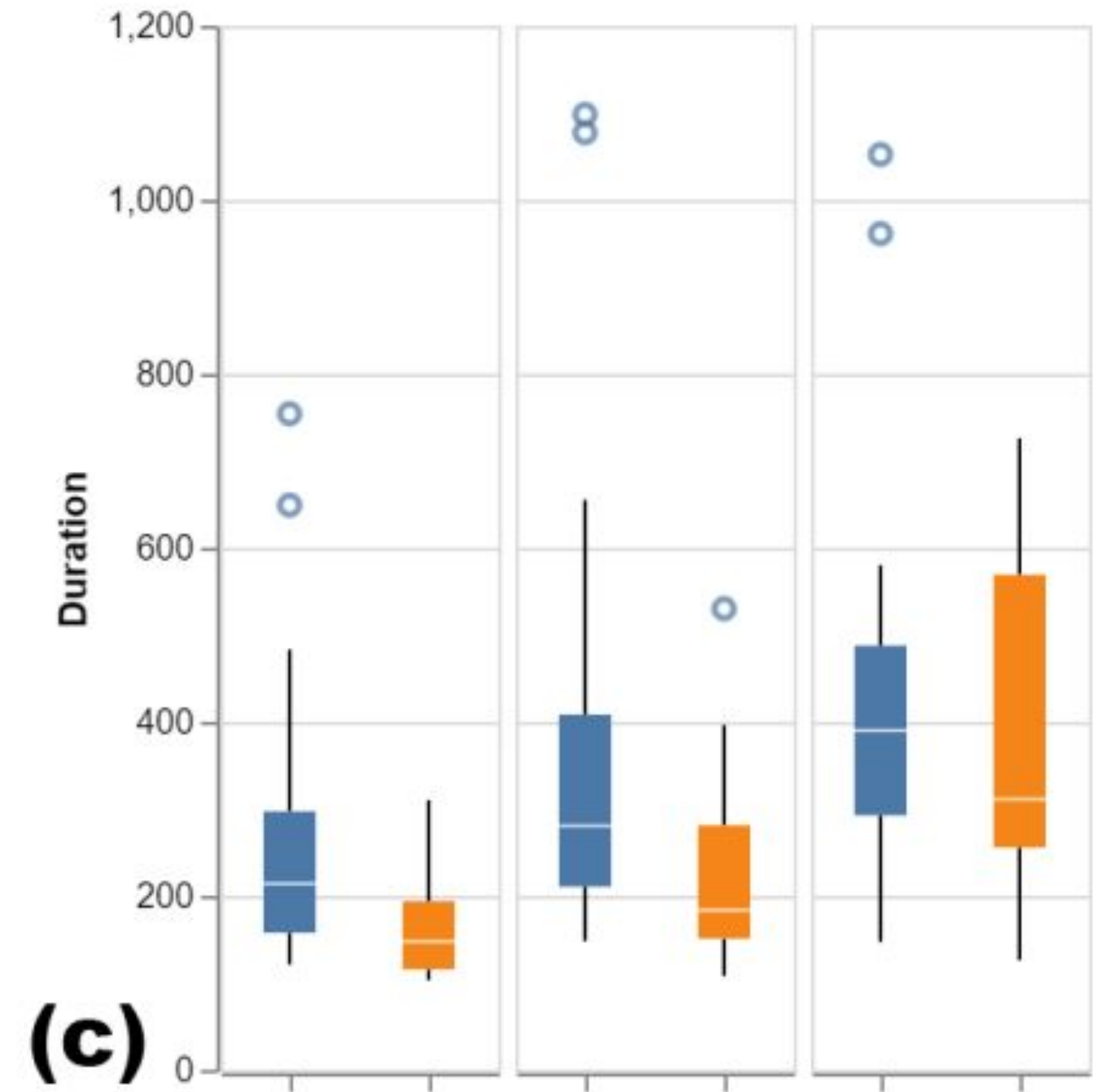
People Groups with different skills

Very fast Fast Average Slow Very slow

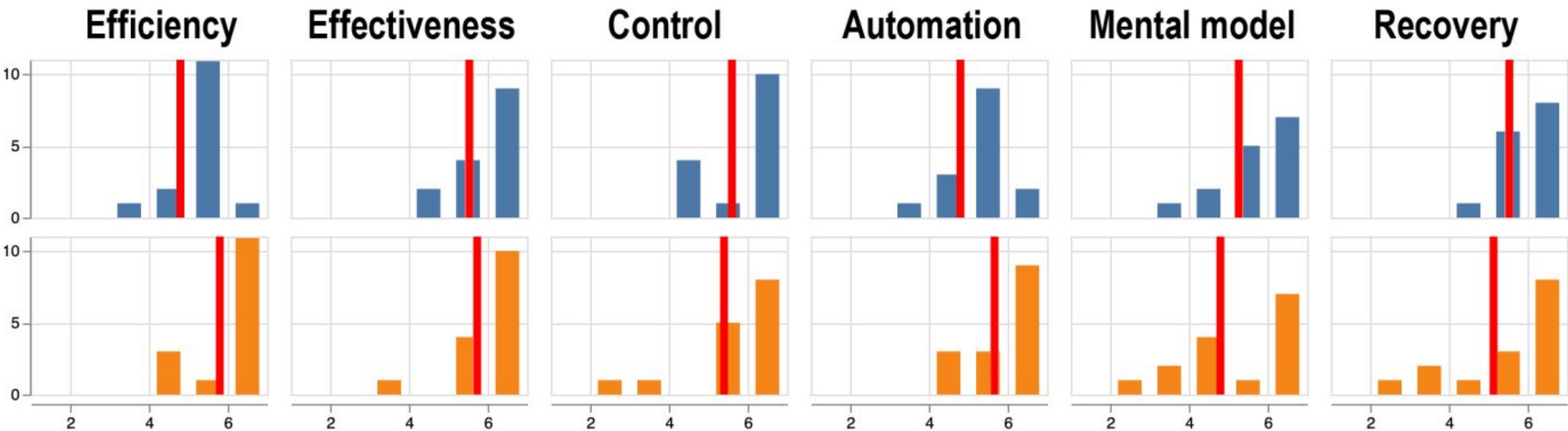


Line Drawing Groups with different complexities

Simple Normal Complex



Experimental Study - User Feedback



Future Work

- **Stage-Focused Design**
 - More accurate initial Flattening result
 - Interactive Shadowing
 - Inter-color harmony
- **Working on Multiple Panels**
 - Semantic-based batch flat
 - Headless and batch processing

Possible Questions

- **How long did the FlatMagic to process one image?**
- **Why the gap under the lines in native bucket-fill result matters?**
- **More details of the backend?**
- **How did user feedback on using FlatMagic?**
-