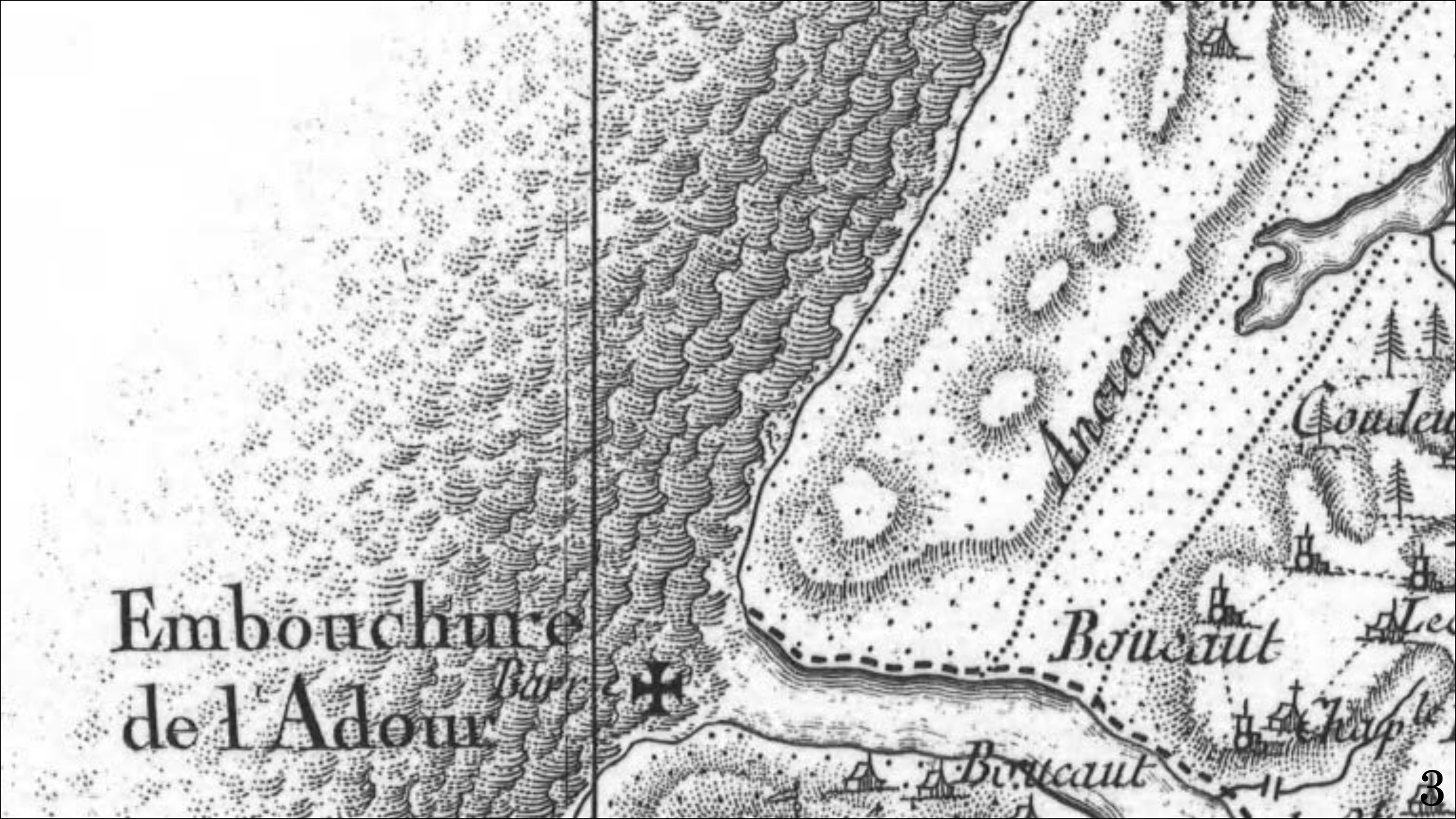
Programmable Synthesis of Element Textures and Application to Cartography

Hugo Loi

PhD supervised by Joëlle Thollot,
Thomas Hurtut and Romain Vergne


Embouchure
de l'Adour
Barre
Anglet
Boucaut
Boucaut

Texturing people for *Avatar*

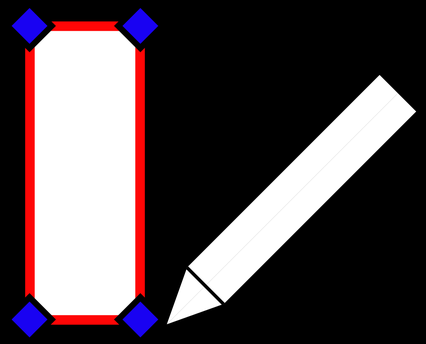
David Abbott
Raine Anderson
Hillary Yeo Tsi Ann
Jane Apthorp
Georgy Arevshatov
Elisabeth Arko
Mia Askew
Michael Bain
Robert Baldwin
Ned Barraud
Kathleen Beeler
Jennifer Bloomfield
Katreena Erin Bowell
Ron Bowman
David Brunette
Myriam Catrin
Jessica Cowley
Michael Cox

Bradford deCaussin
Virginie Degorgue
Samuel Doyle
Ryan Duncan
David Edwards
Alison Farmer
James Furlong
Christian Furr
Lauren Manuel Garcia Carro
Danny Geurtsen
Belinda Griffiths
John William Harnagel
Ngoc Heng
Richard Hopkins
Nikki Hughes
Lina Hum
Mel James
Gareth J. Jensen

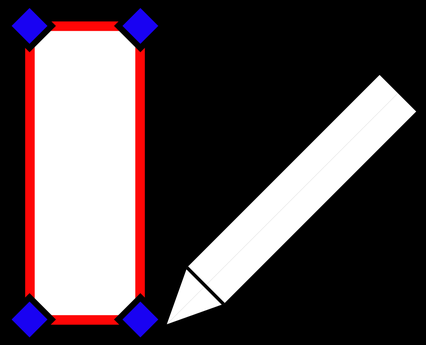
Byung Gun Jung
Laure Lacroix
Po Yuen Lam
Zoe Lord
Nigel McKissock
Tom Mikota
Ben Nightingale
Keven Norris
Tor-Bjorn Olsson
David Owen
Collin Maxfield Parrish
Ula Rademeyer
Raine Reen
Anne Ritter
Justine Sagar
Adam Shelton
Grace Stephens
Shar Stewart

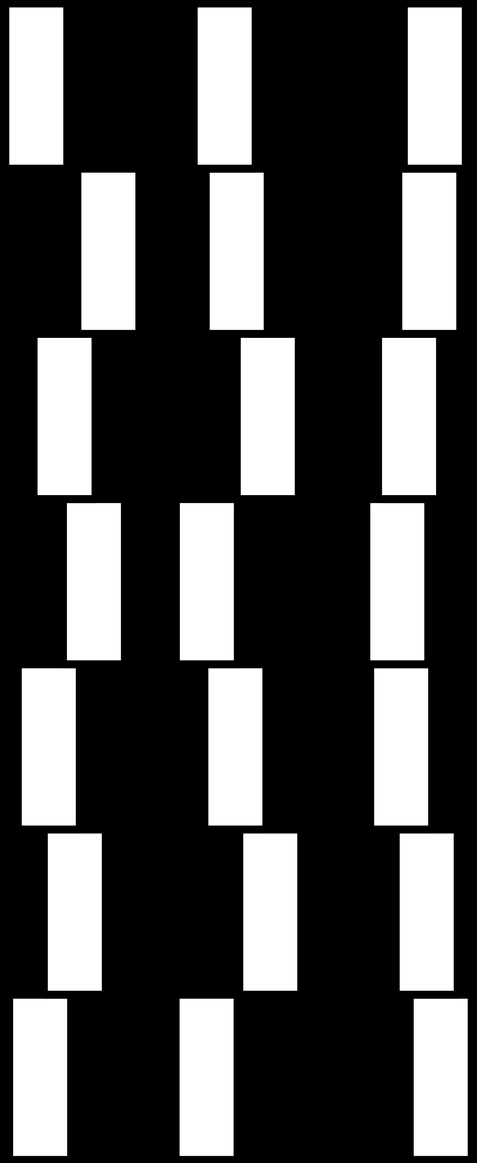
Petra Stueben
Masaya Suzuki
David Swift
Nataliya Tsyganok
Kara Vandeleur
Christopher Welch
Sarah Wilson
Jasmine Wong
Piotr Fox Wysocki
Mark Young
Melissa Almeida
Ravi Bansal
Jami Gigot
Yann Provencher
Guillaume Ruegg
Anna Silvey
Celine Velasco
Malcolm Wright

Draw

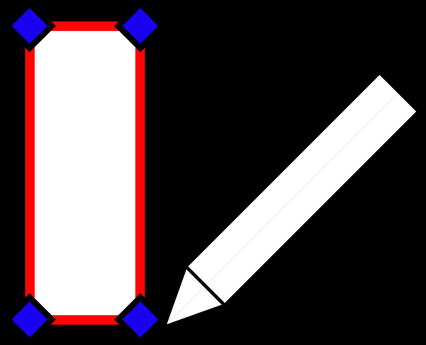


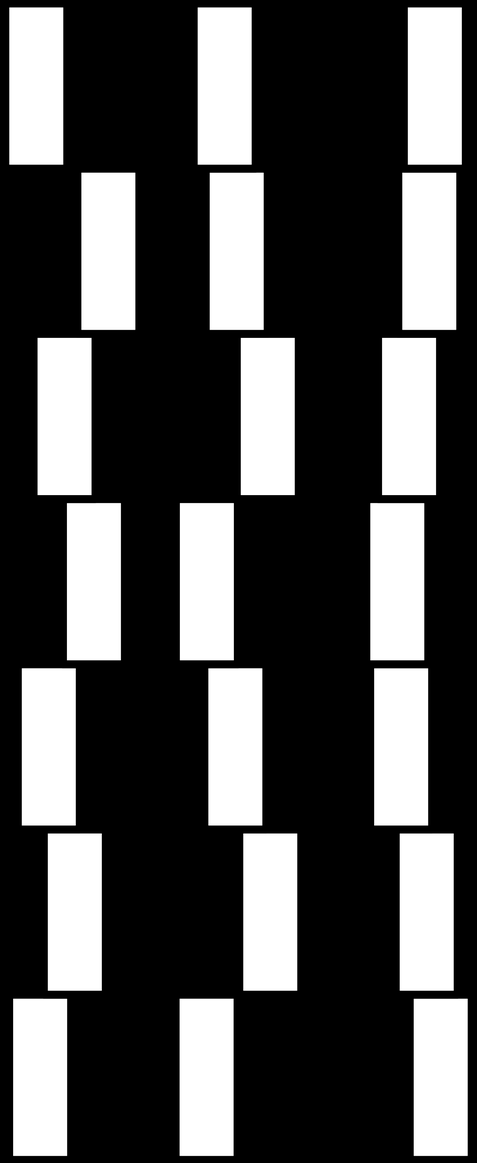
Draw + Arrange

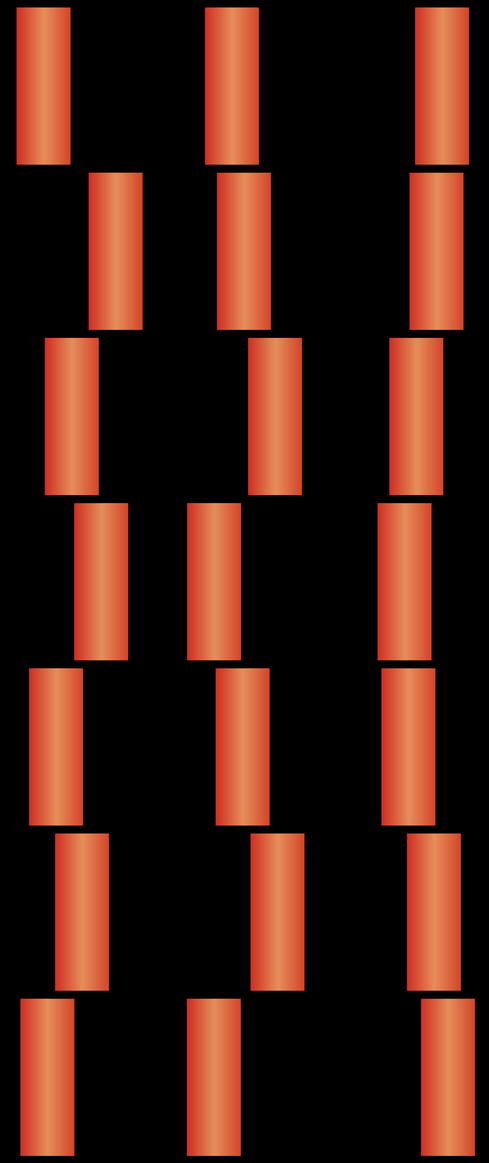




Draw + Arrange + Stylize







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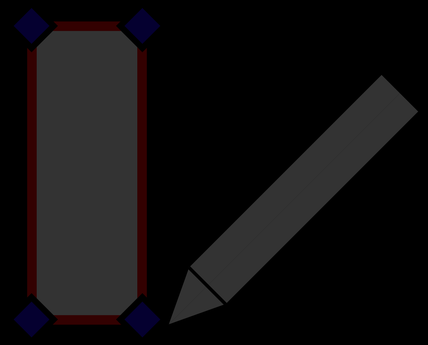
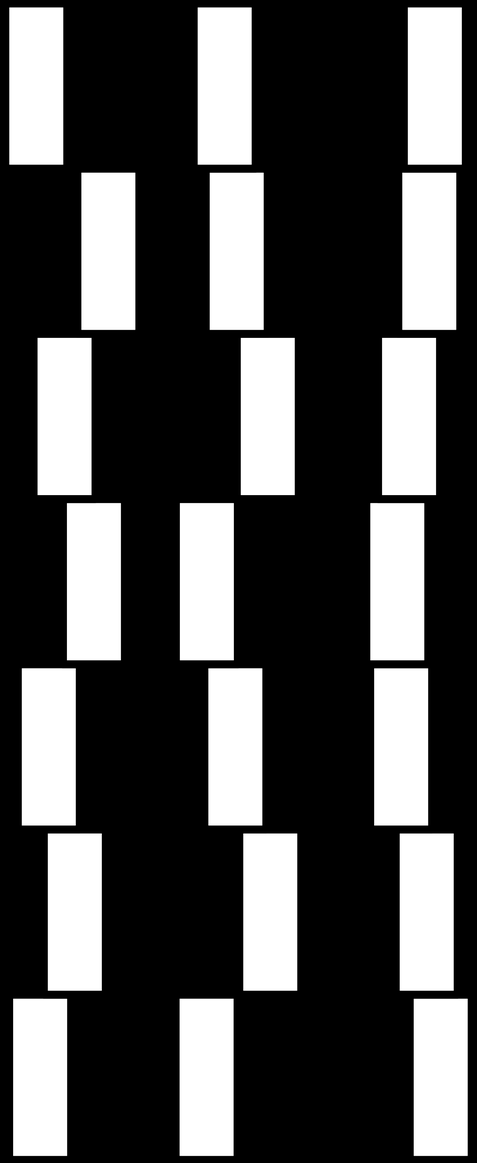
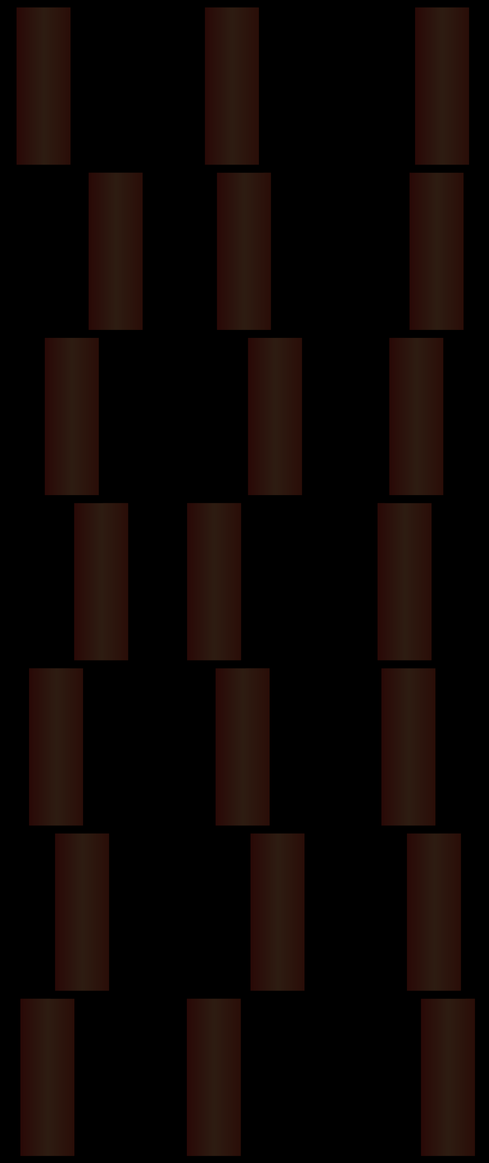
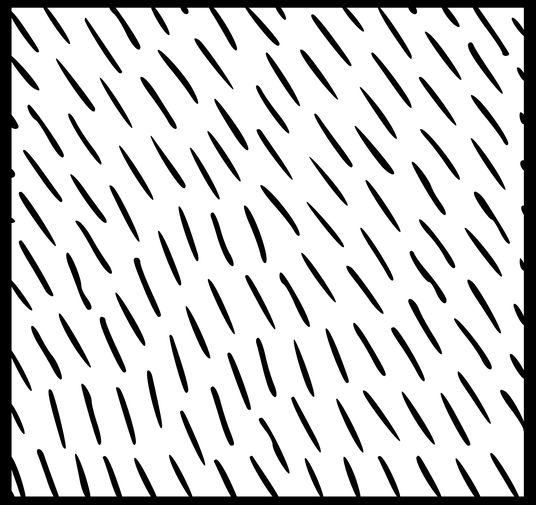


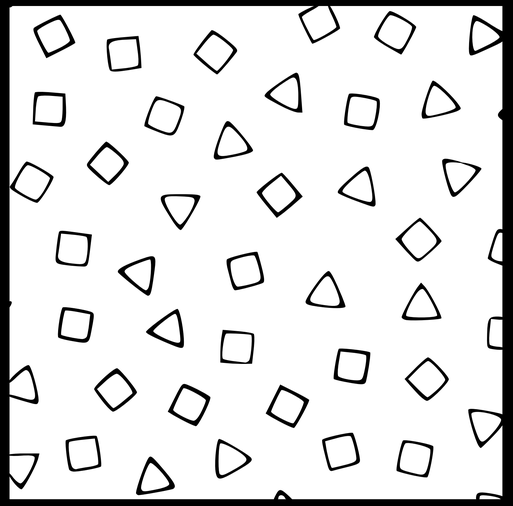




Predefined layouts



[Hiller et al 2003]



[Lagae et al 2005]

[Adobe Illustrator 2013]

Examplar-based approaches up to [Emilien et al 2015]

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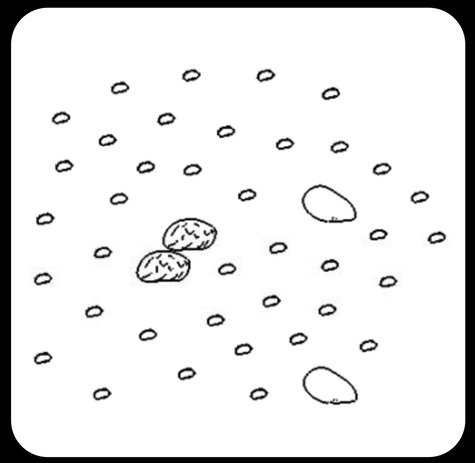
Examplar-based approaches

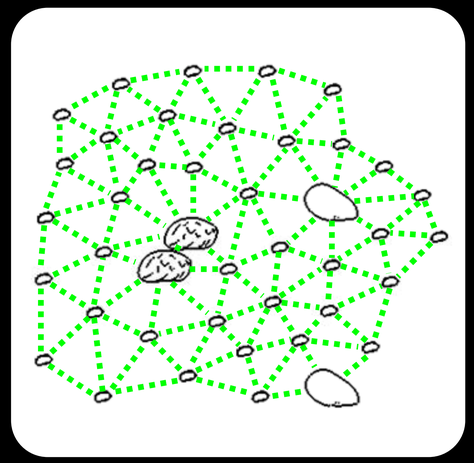
up to [Emilien et al 2015]

Examplar-based approaches

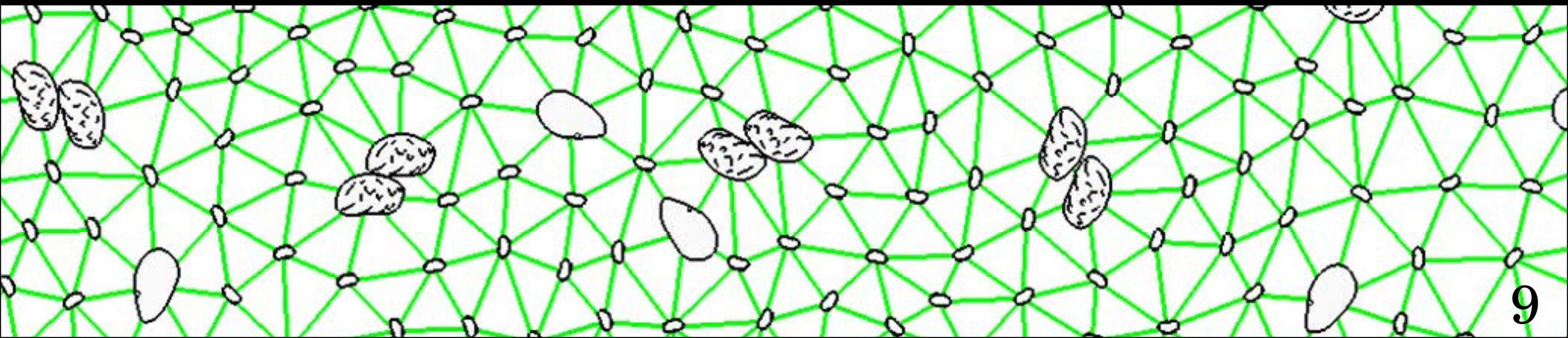
up to [Emilien et al 2015]



Analysis



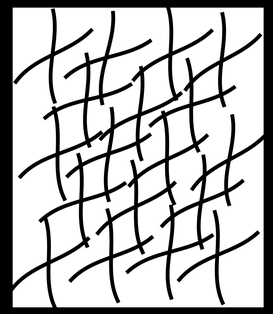
Synthesis

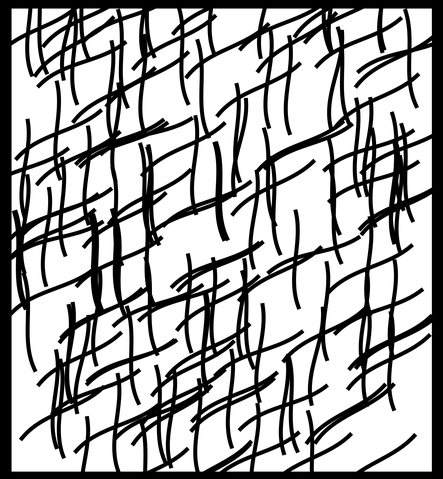


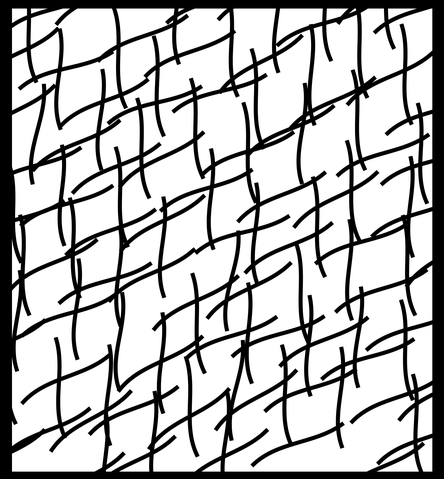
Examplar-based approaches

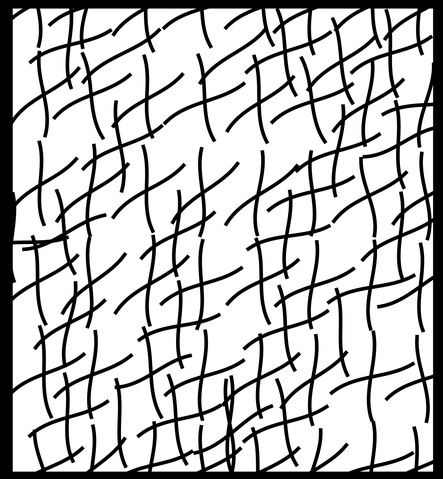
[Ijiri et al 2008] [Hurtut et al 2009] [Ma et al 2011] [Landes et al 2013]

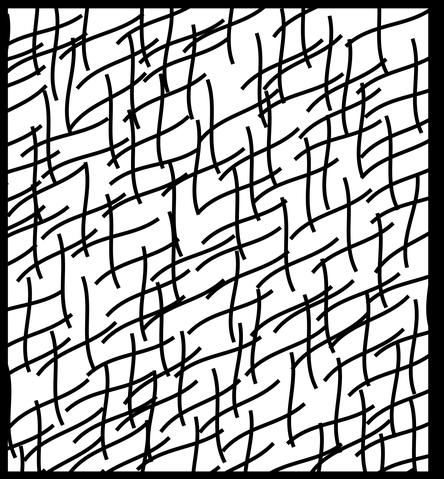
(a)



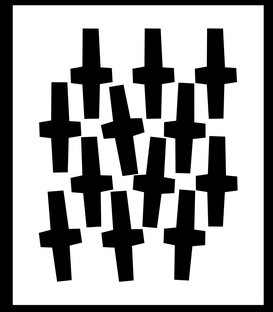


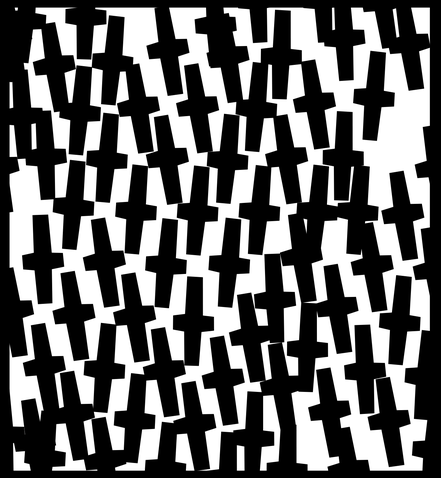


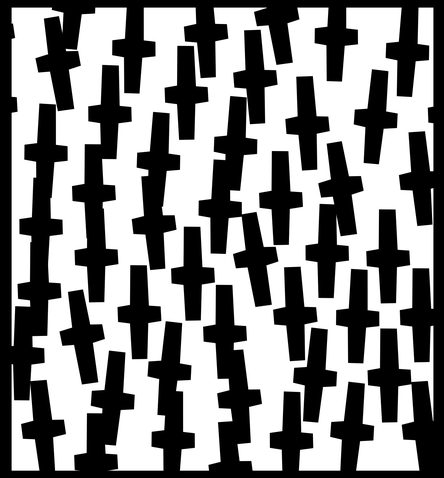


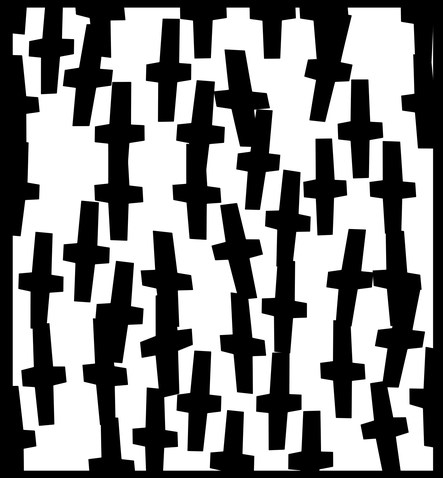


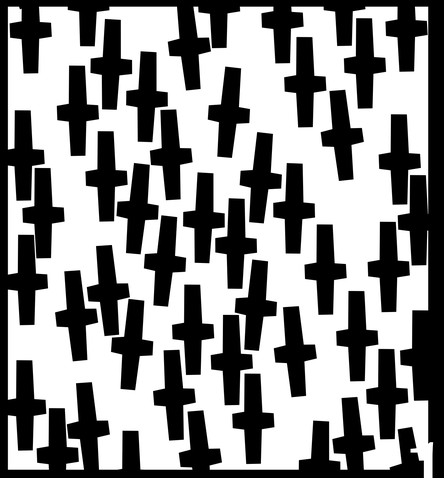
(b)





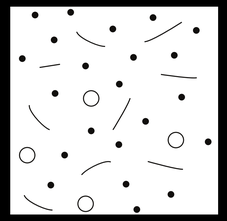
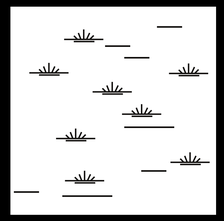
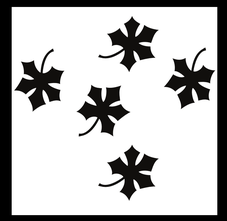
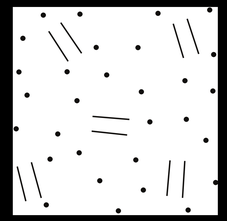




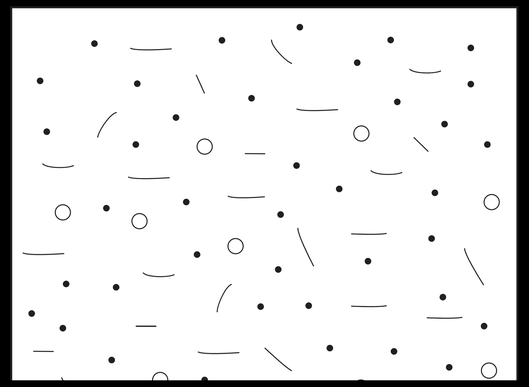
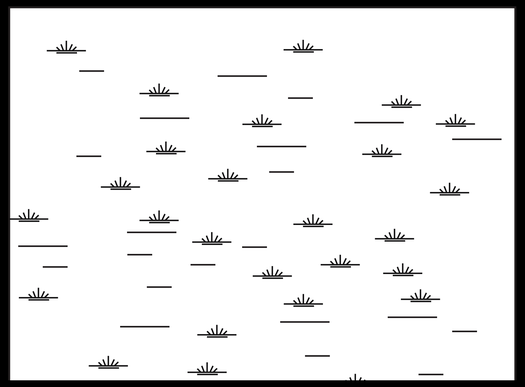


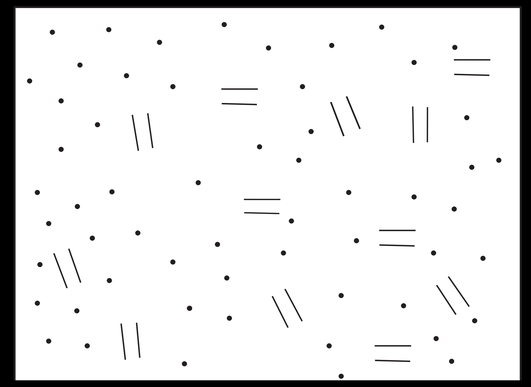
Examplar-based approaches

Exemplars

Artist 1



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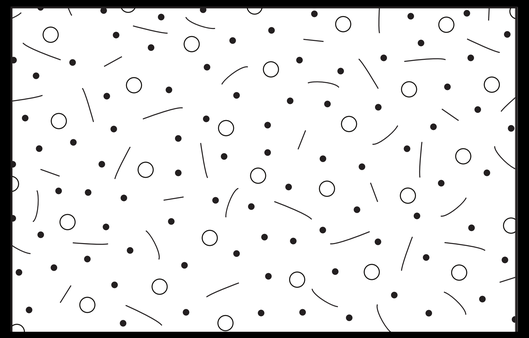
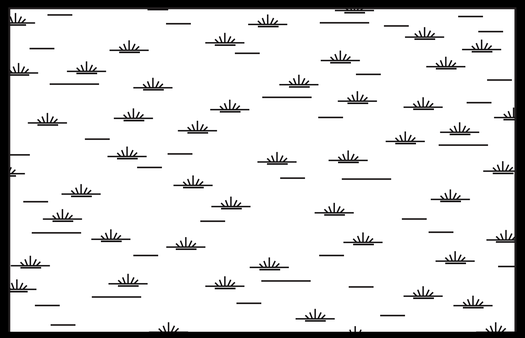
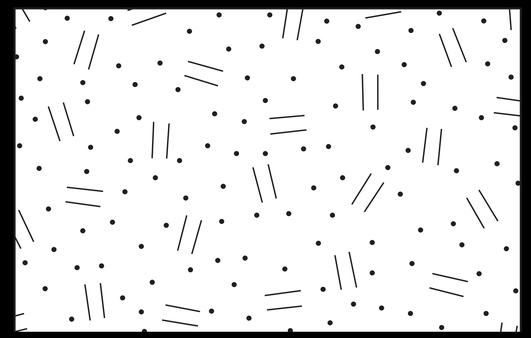



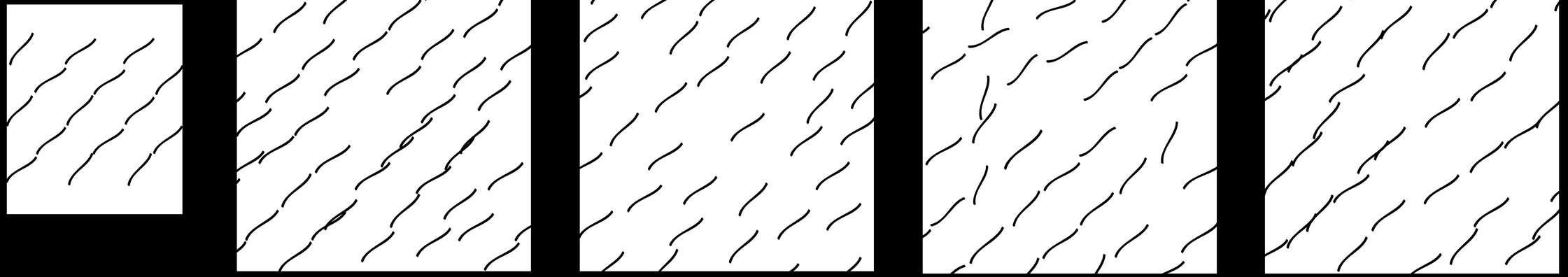


[AlMeraj et al 2013]

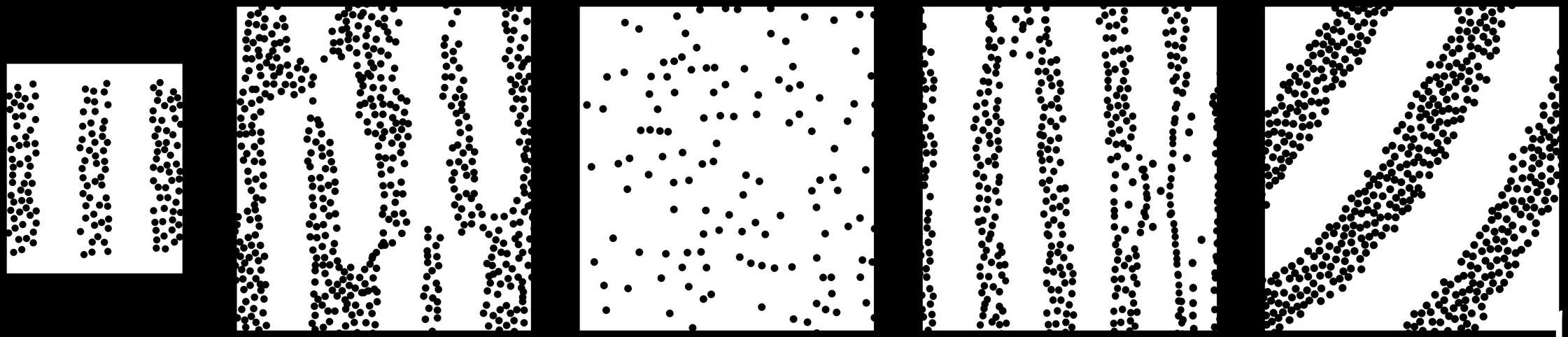
Examplar-based approaches

[Ijiri et al 2008] [Hurtut et al 2009] [Ma et al 2011] [Landes et al 2013]

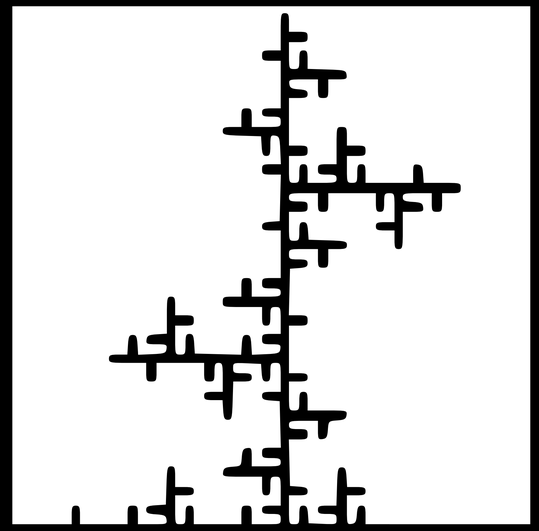
(c)



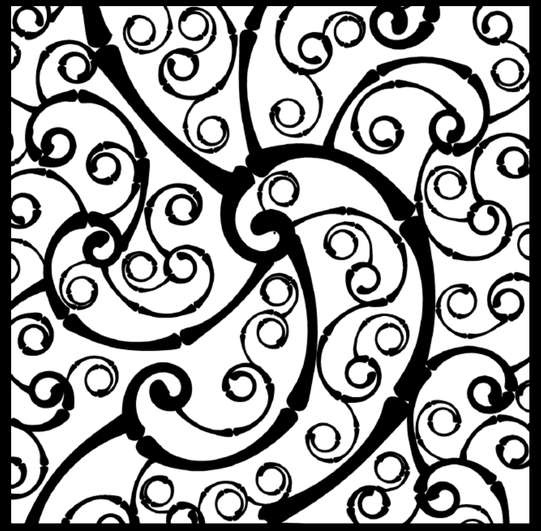
(d)



Procedural Modeling

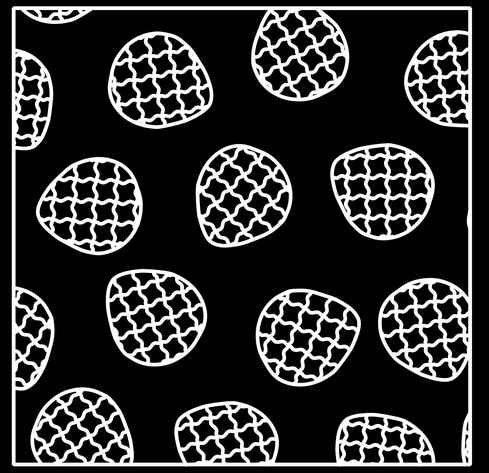


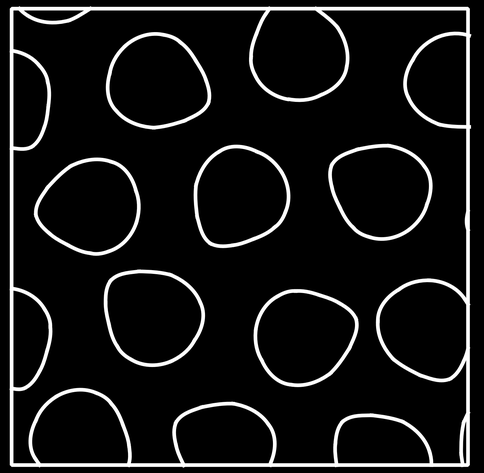
[Prusinkiewicz et al 1996]

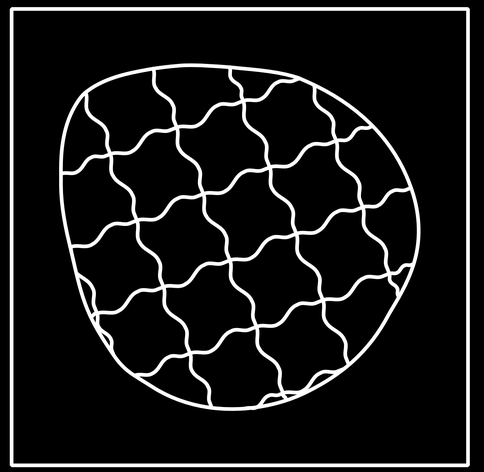


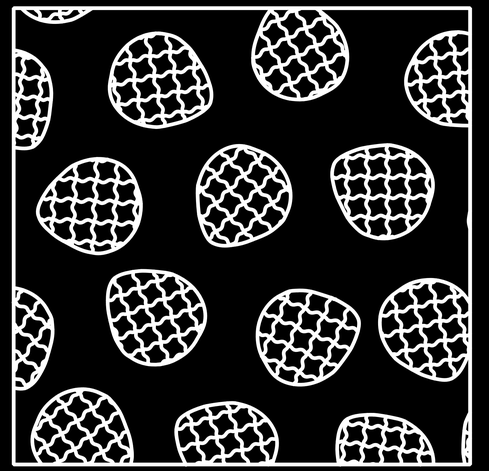
[Wong et al 1998]

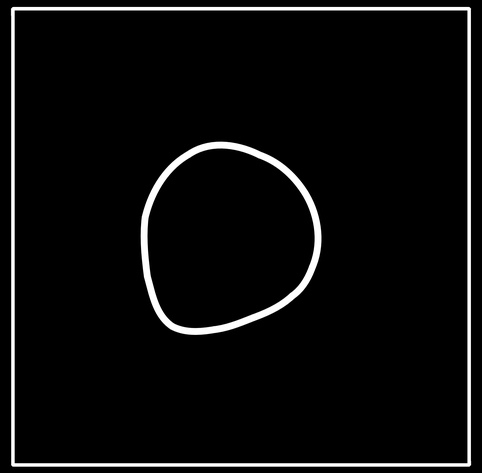
[Mech et al 2012]

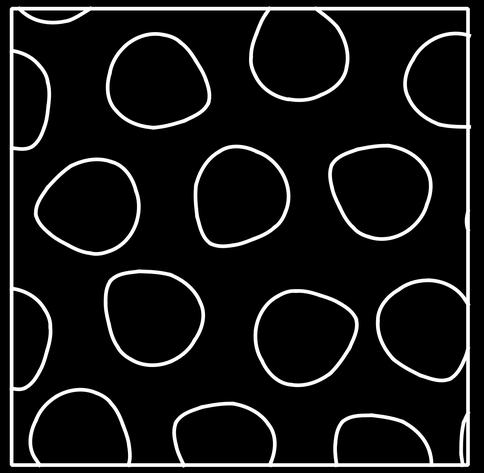


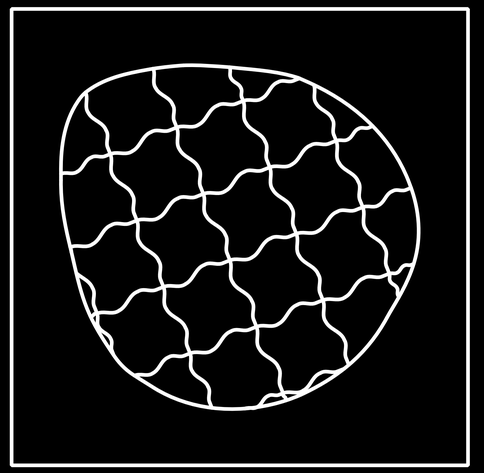


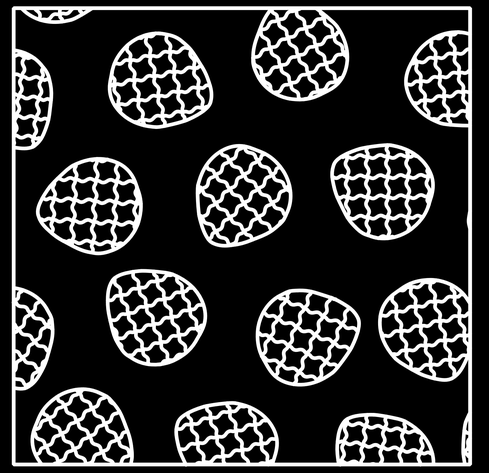


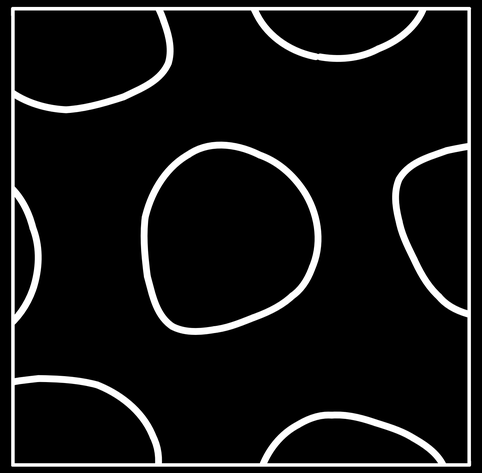


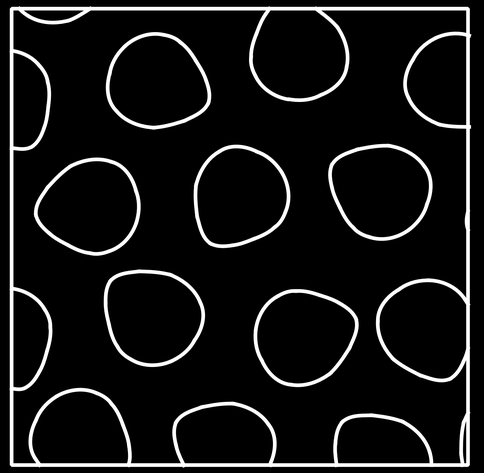


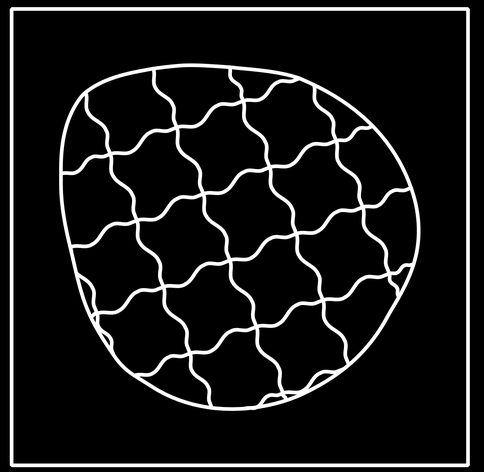


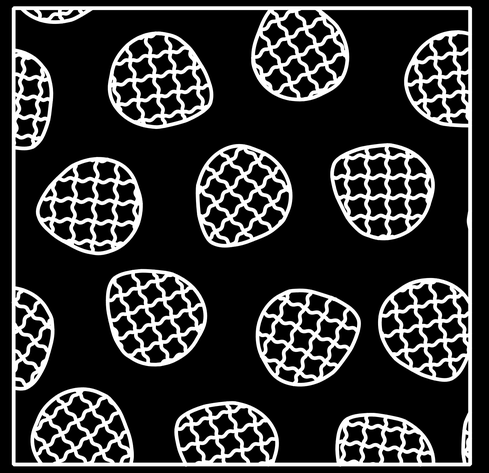


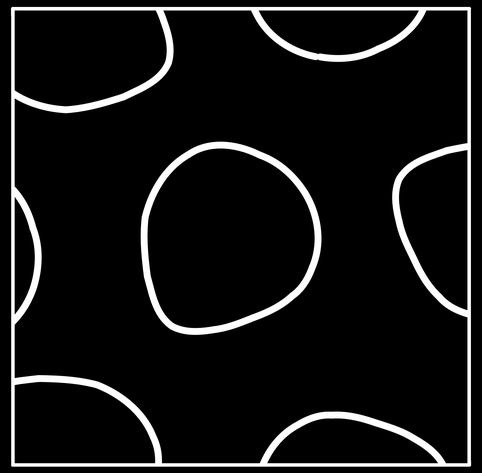


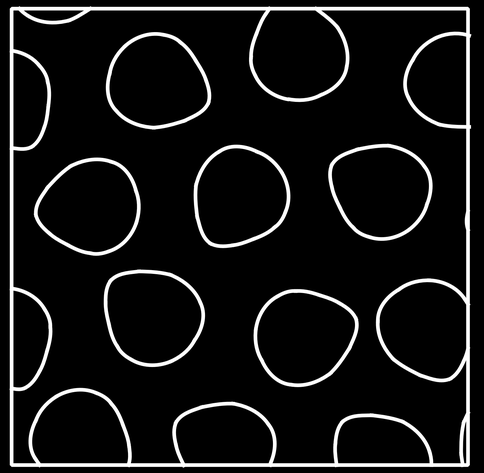


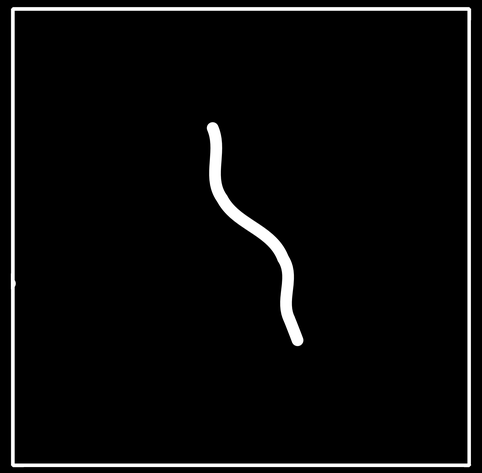


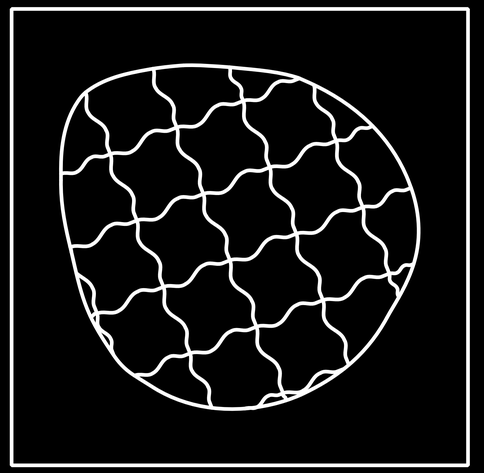


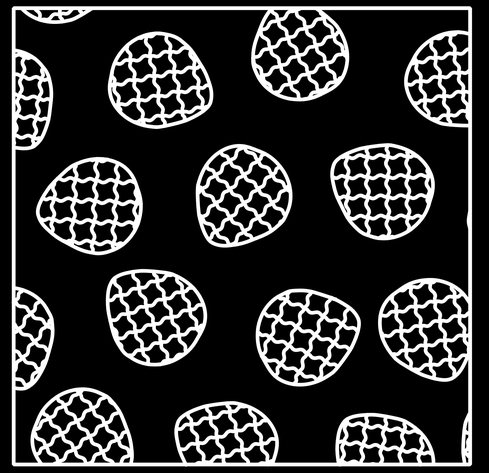


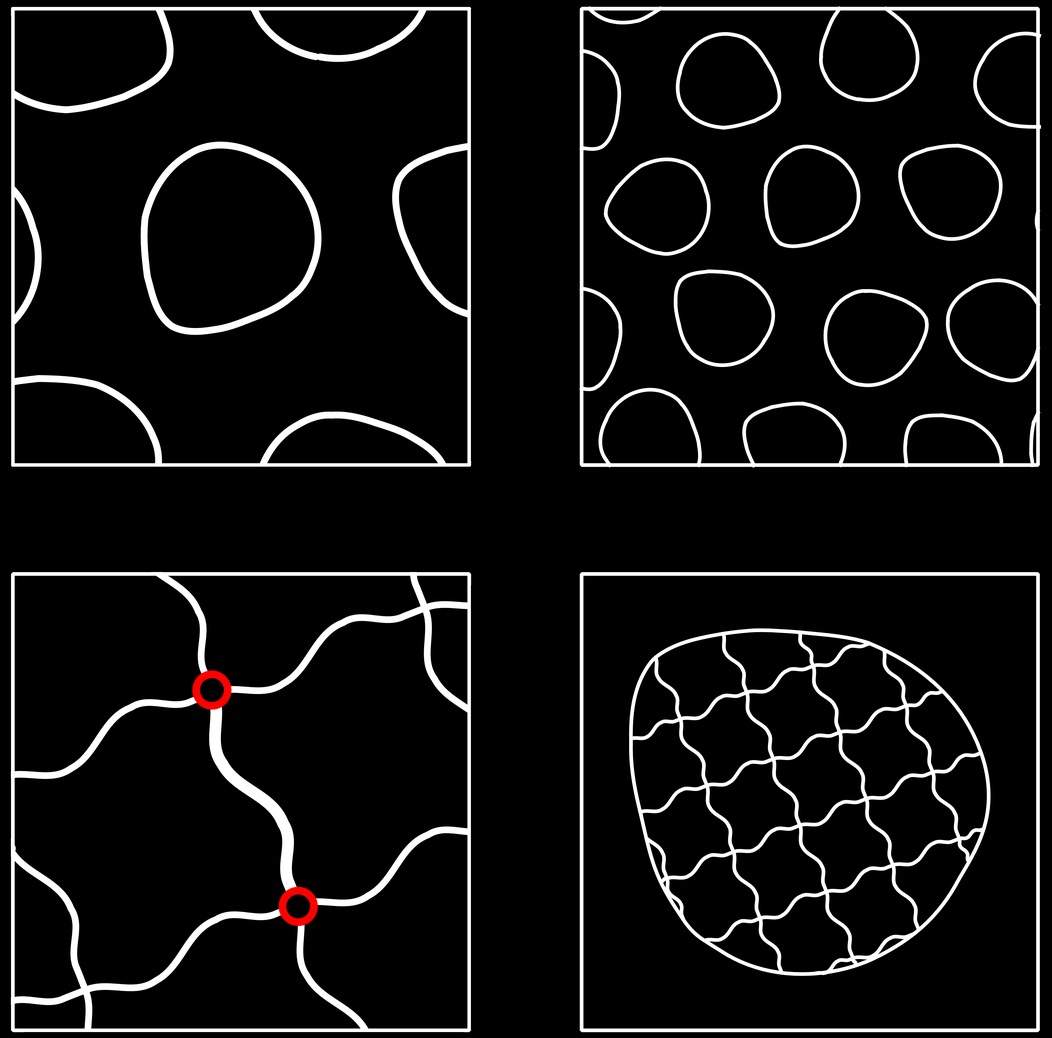




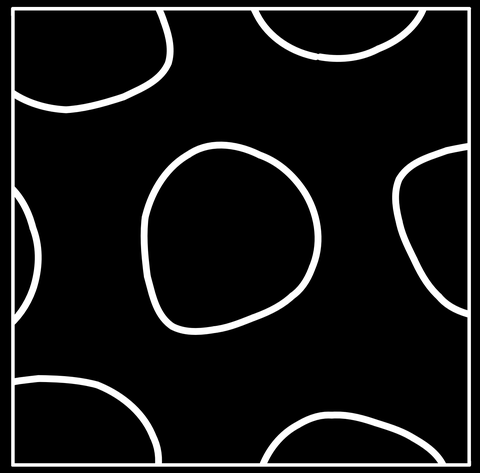


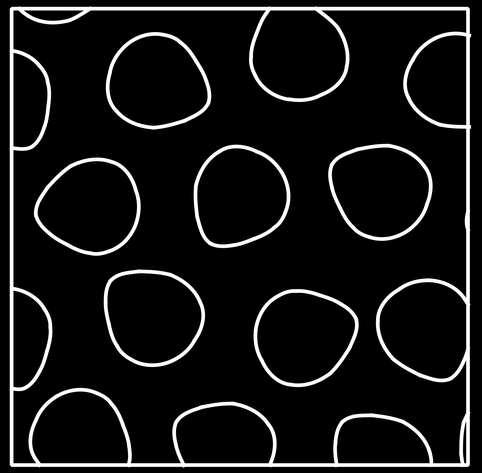


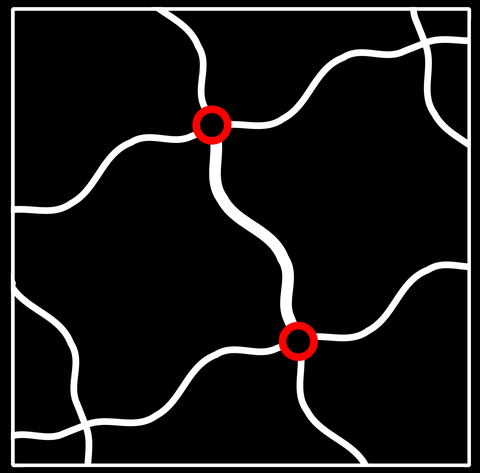


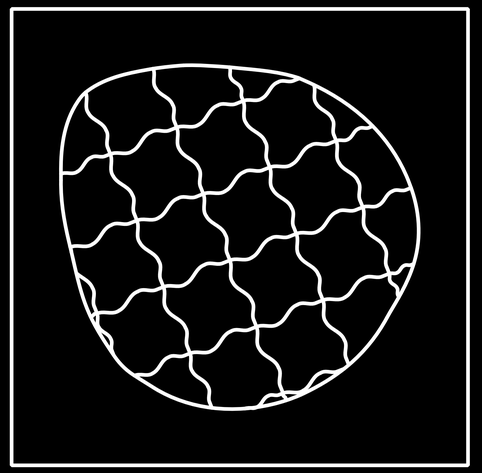


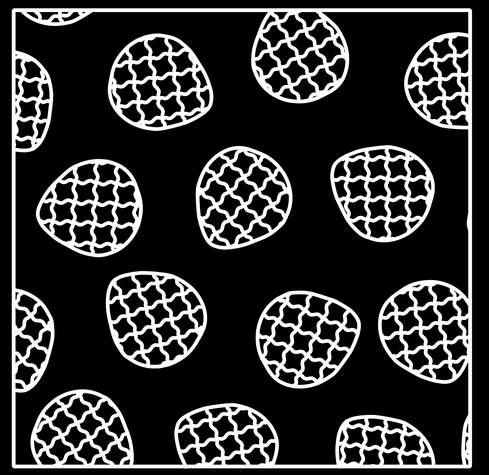
Irregular











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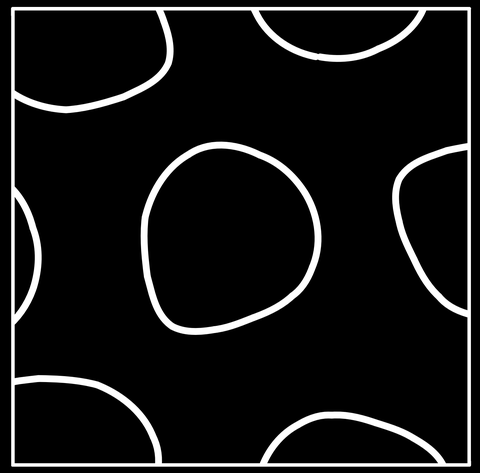
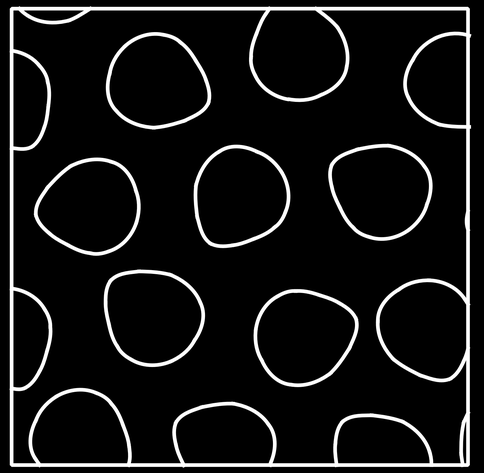
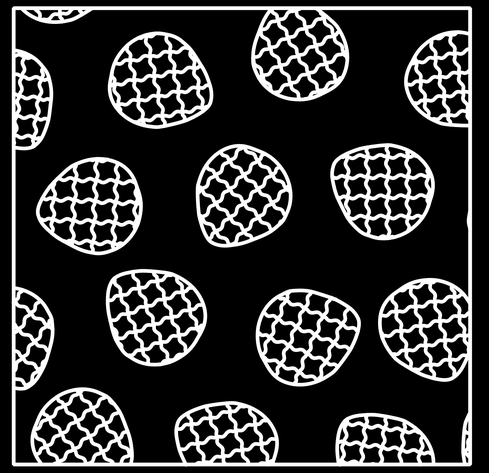
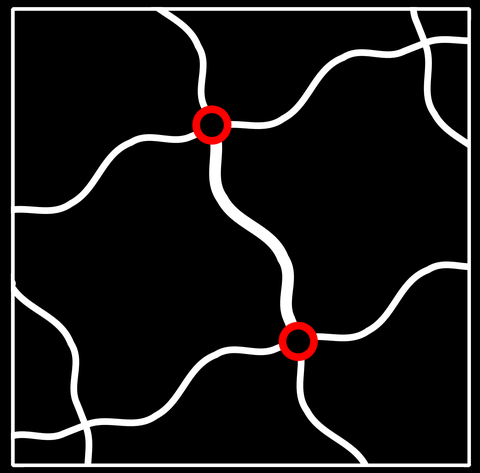
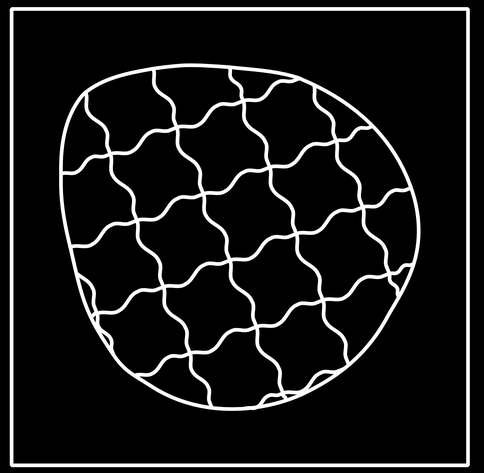






Regular





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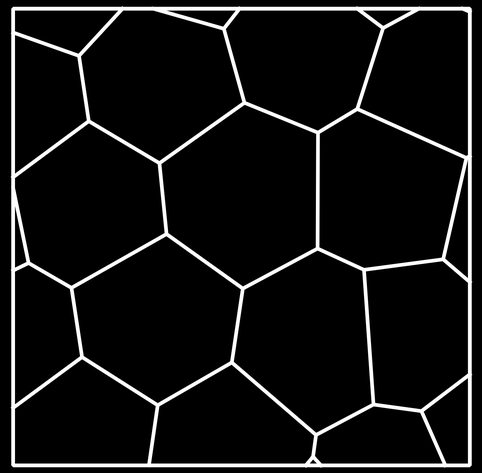
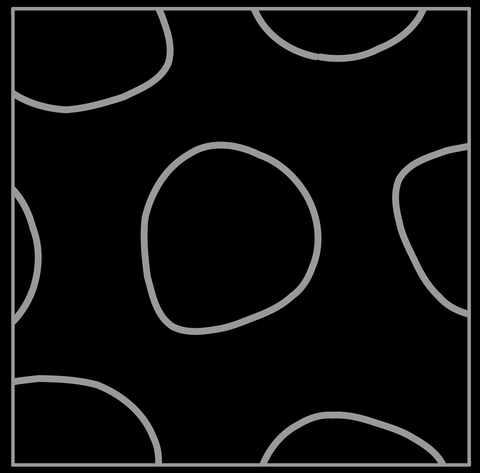
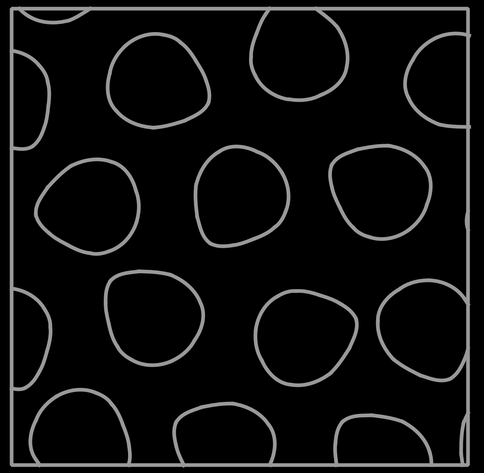
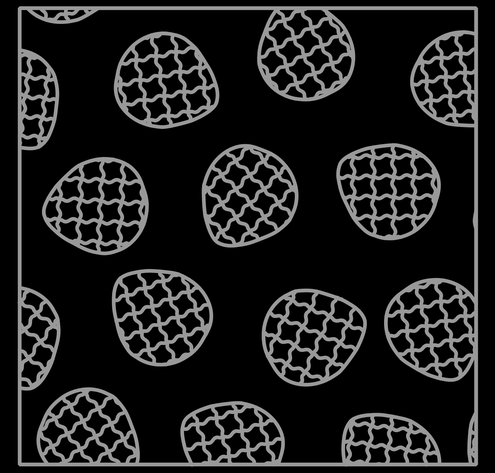
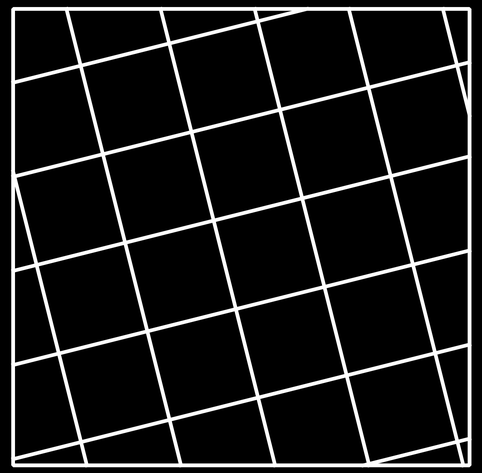
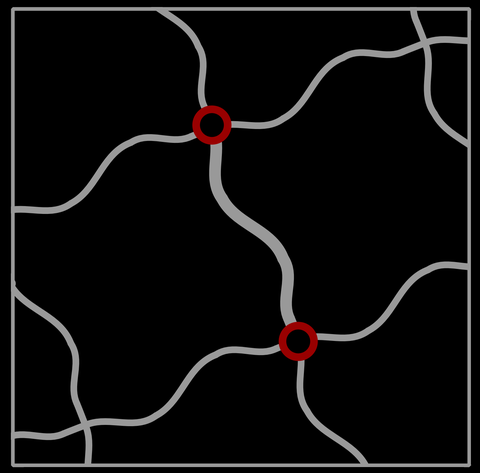


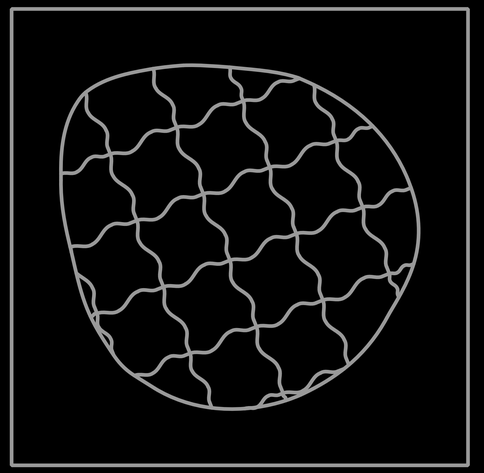




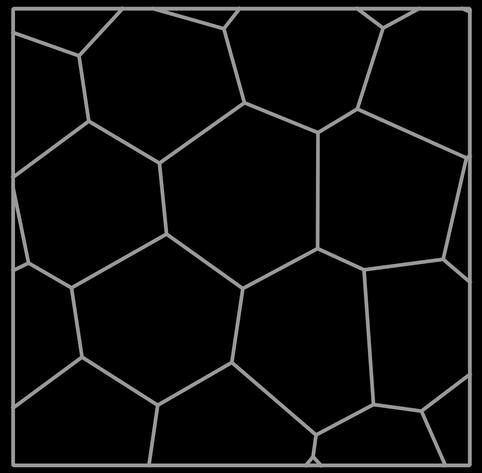
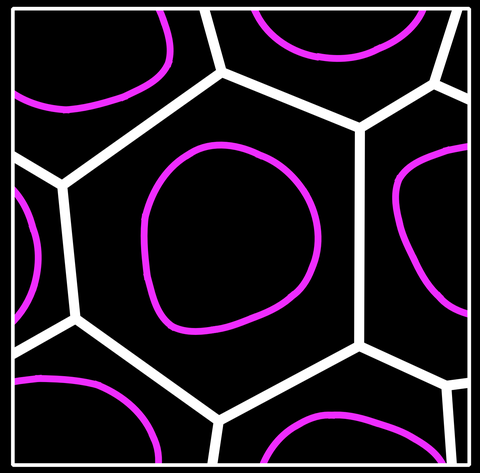
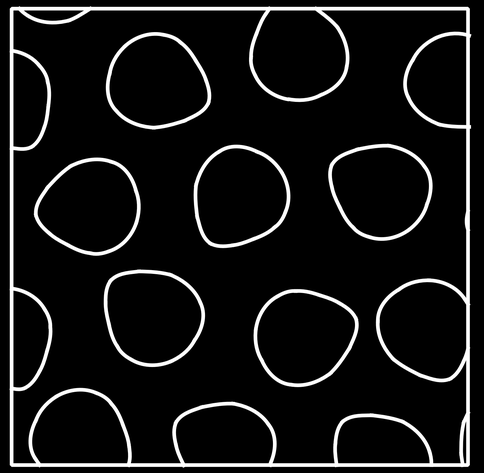
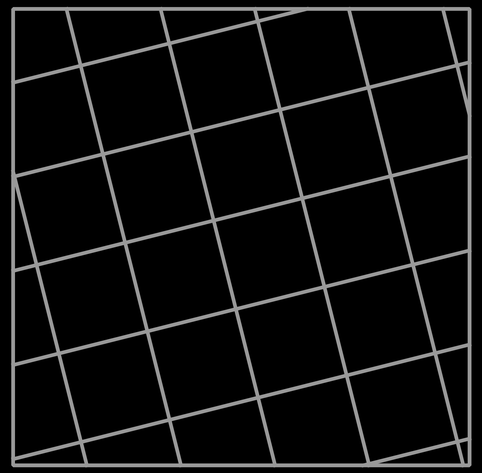
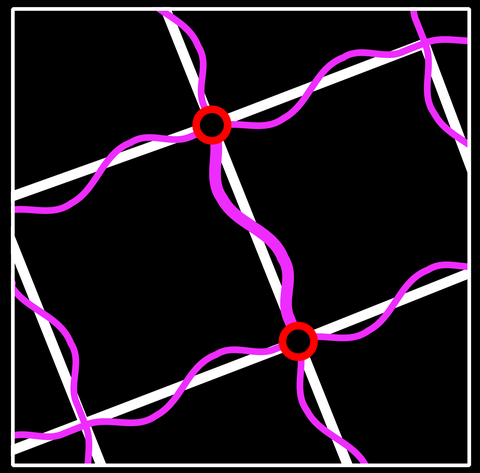
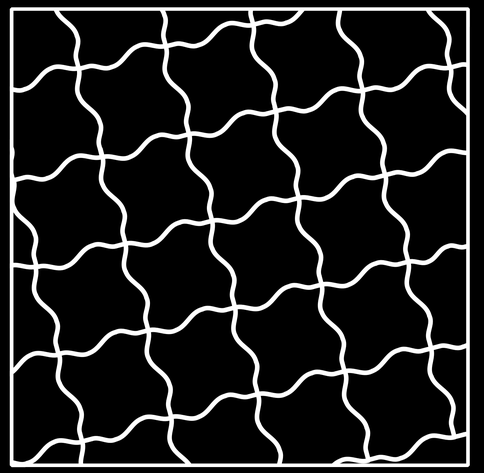
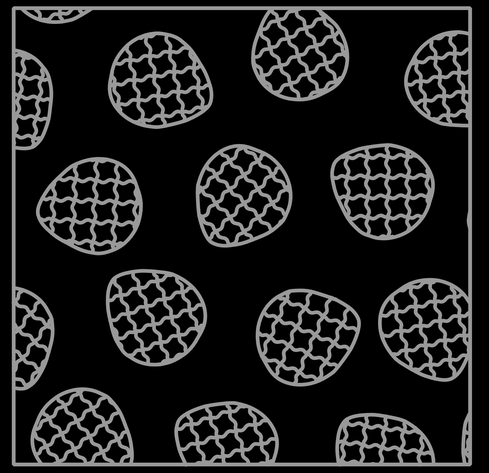




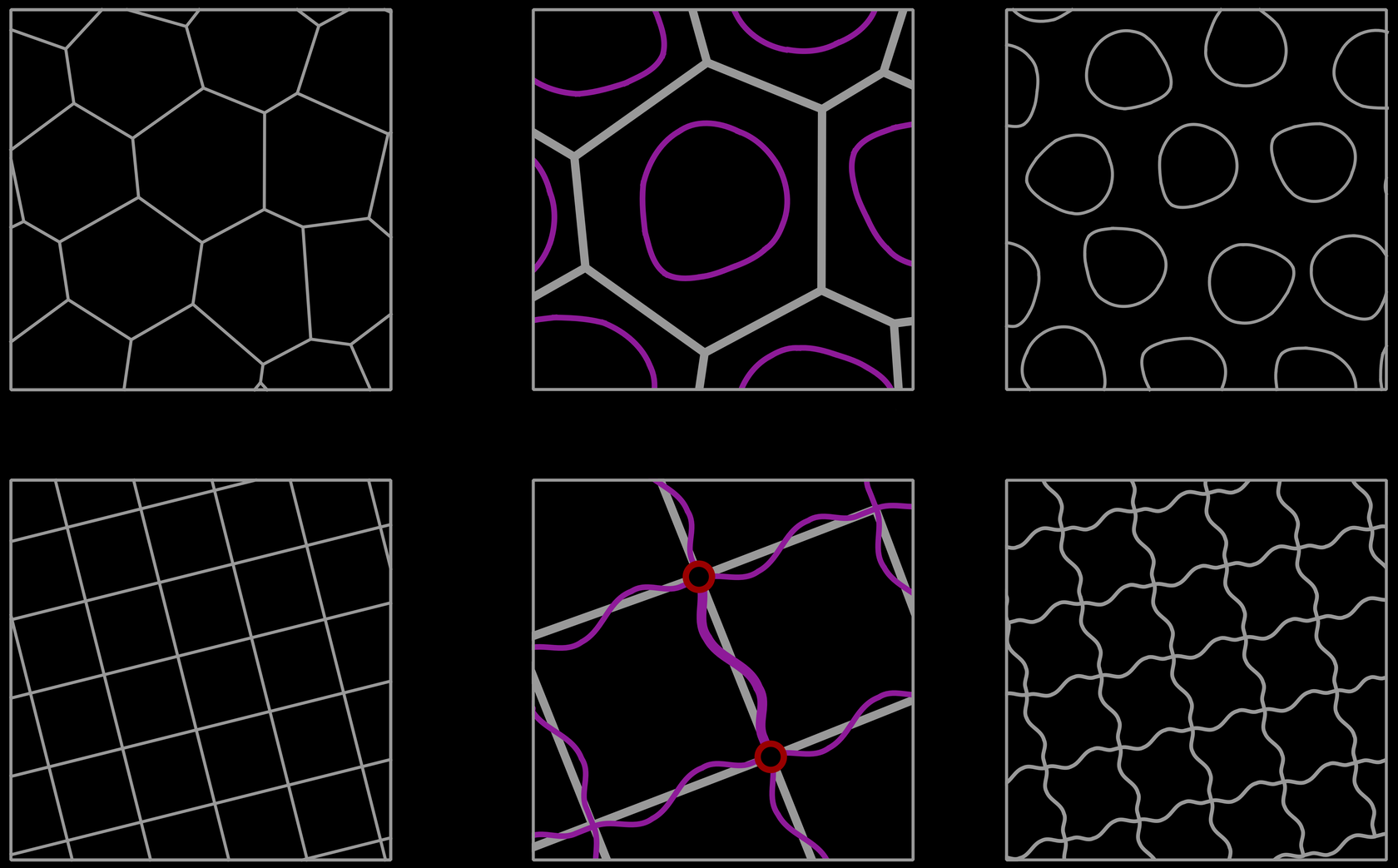




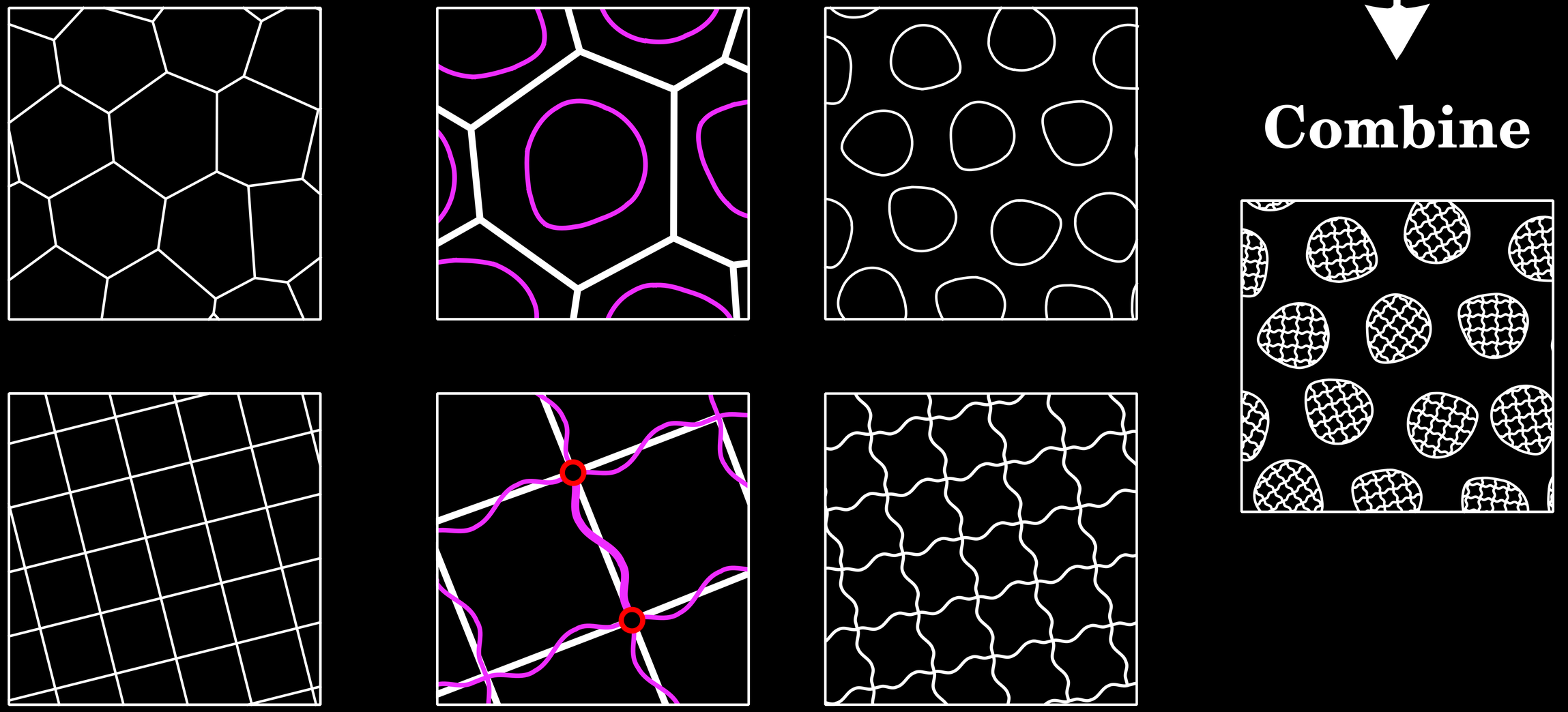
Partition → **Mapping**

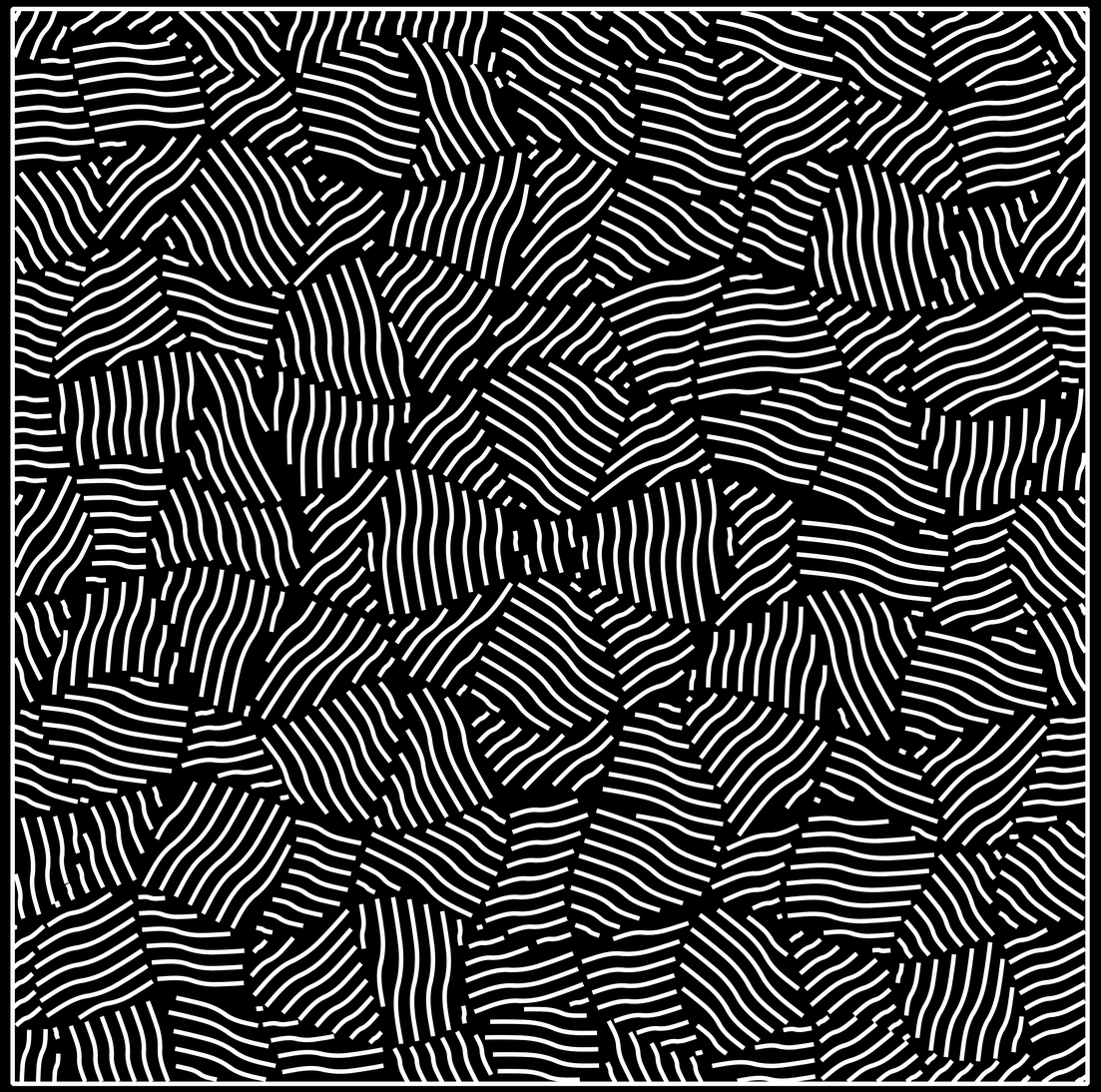
Partition → **Mapping** → **Combine**

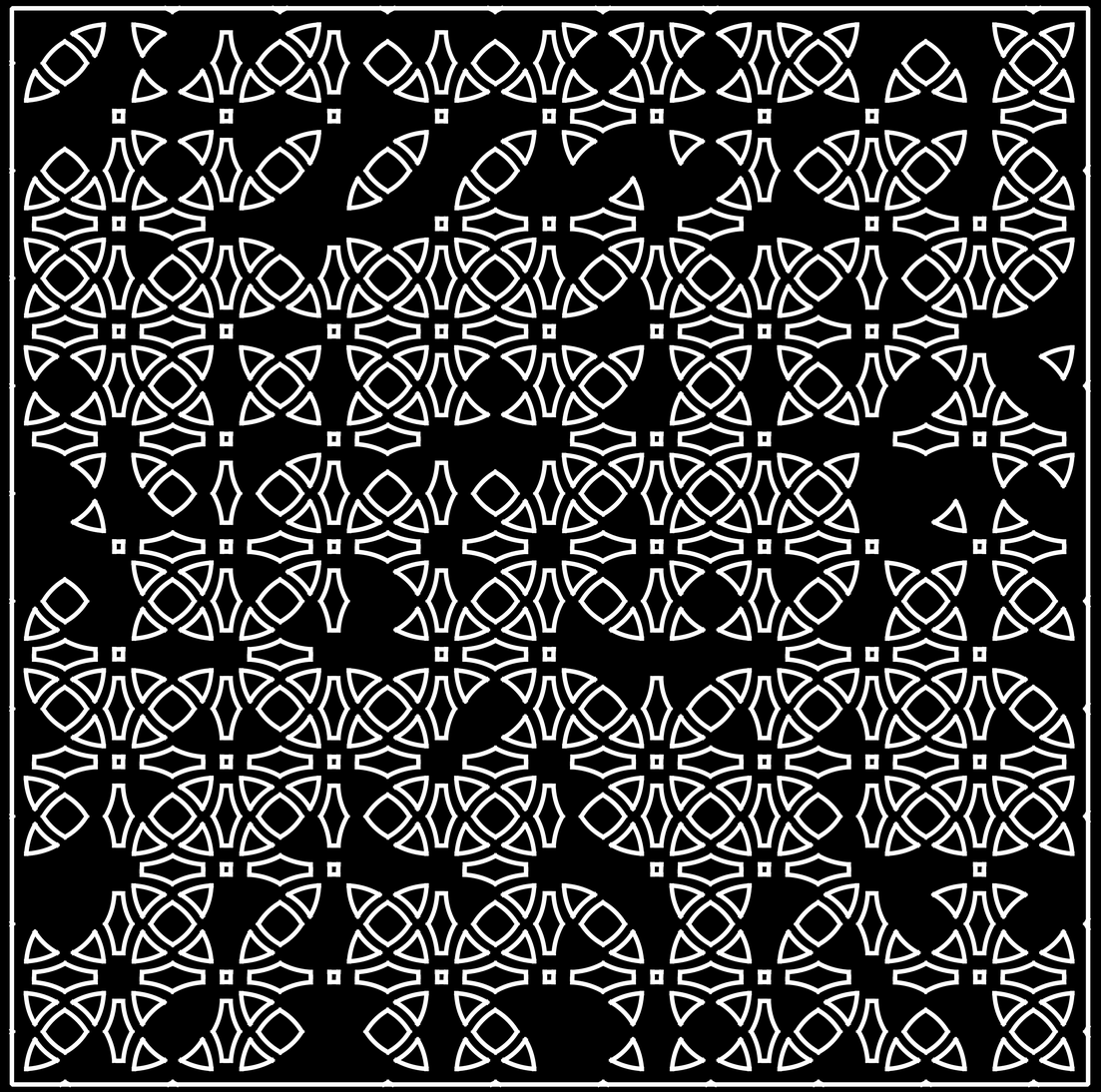


Partition → **Mapping** → **Combine**

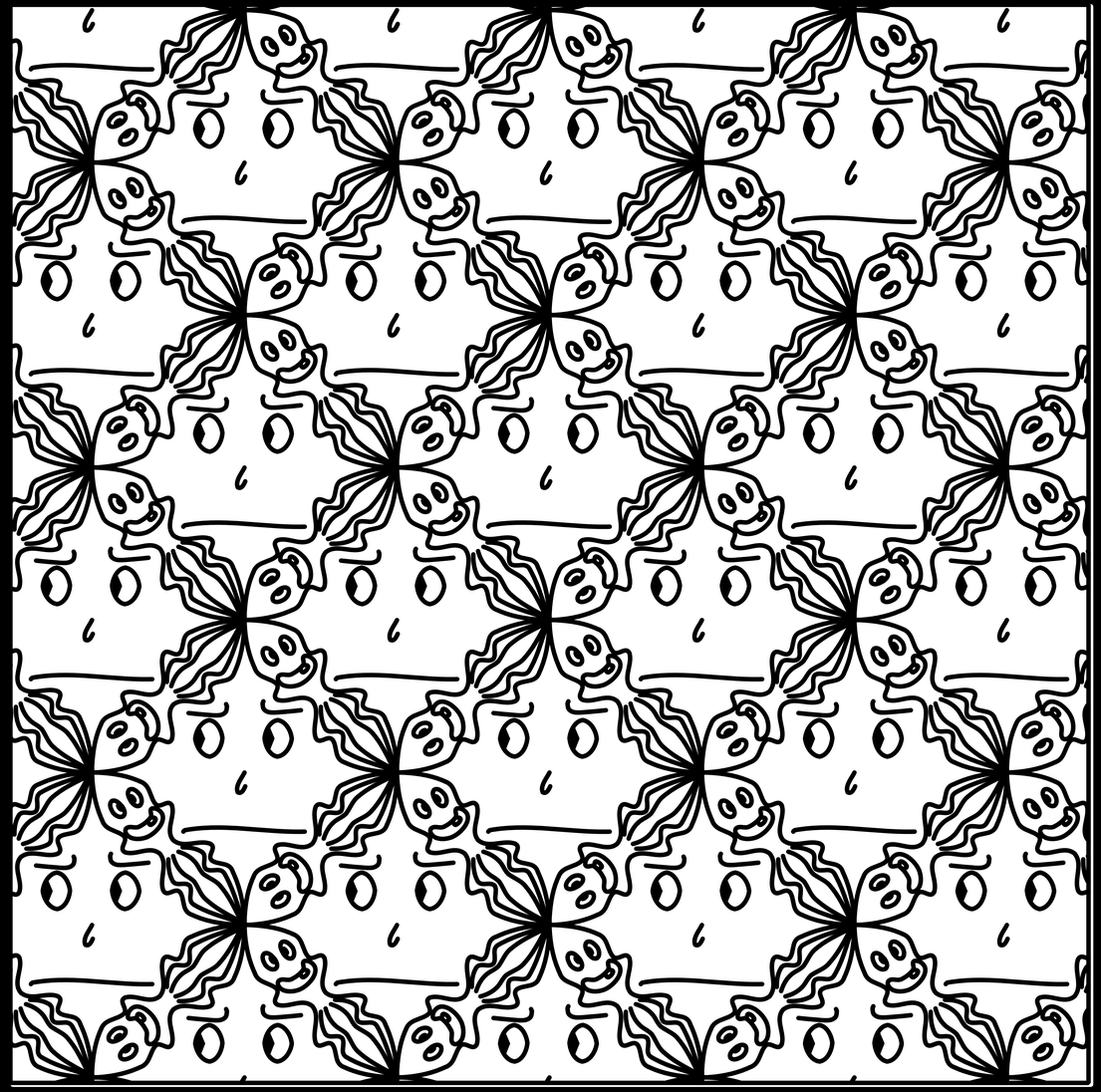


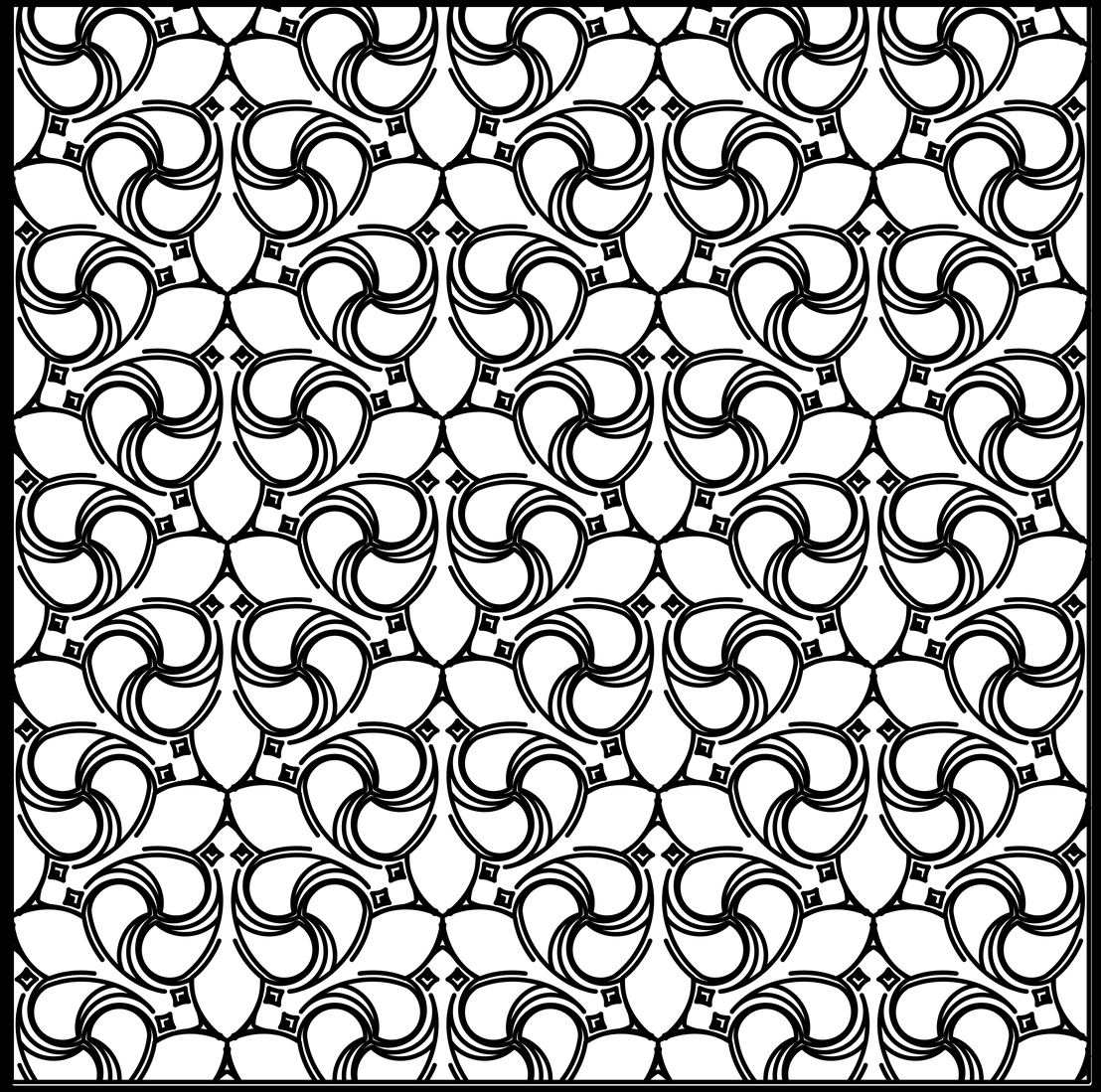
Results - expressiveness



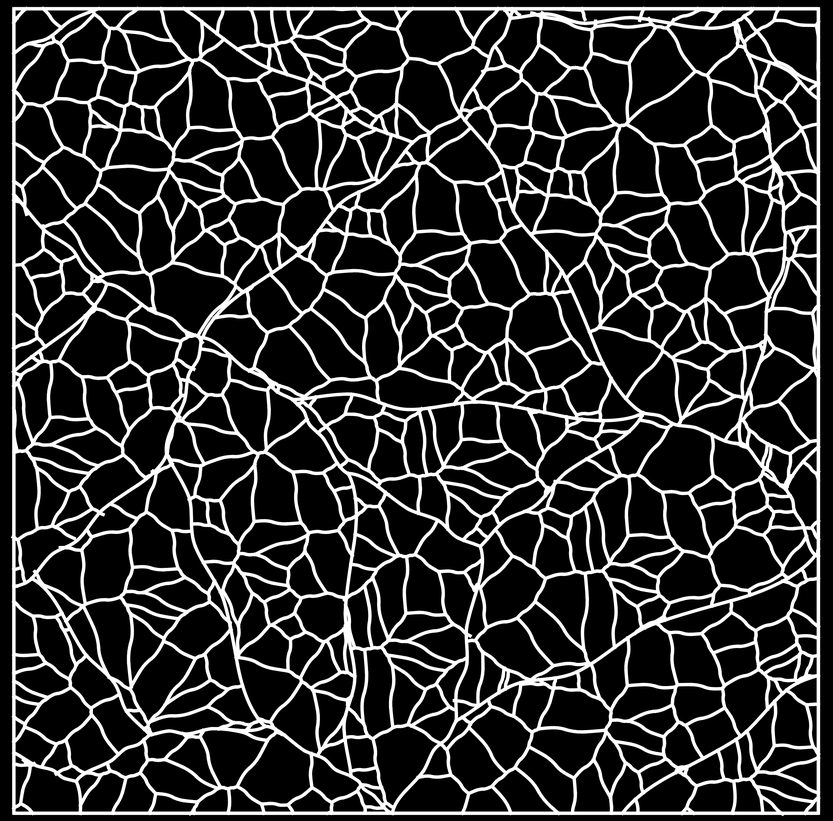


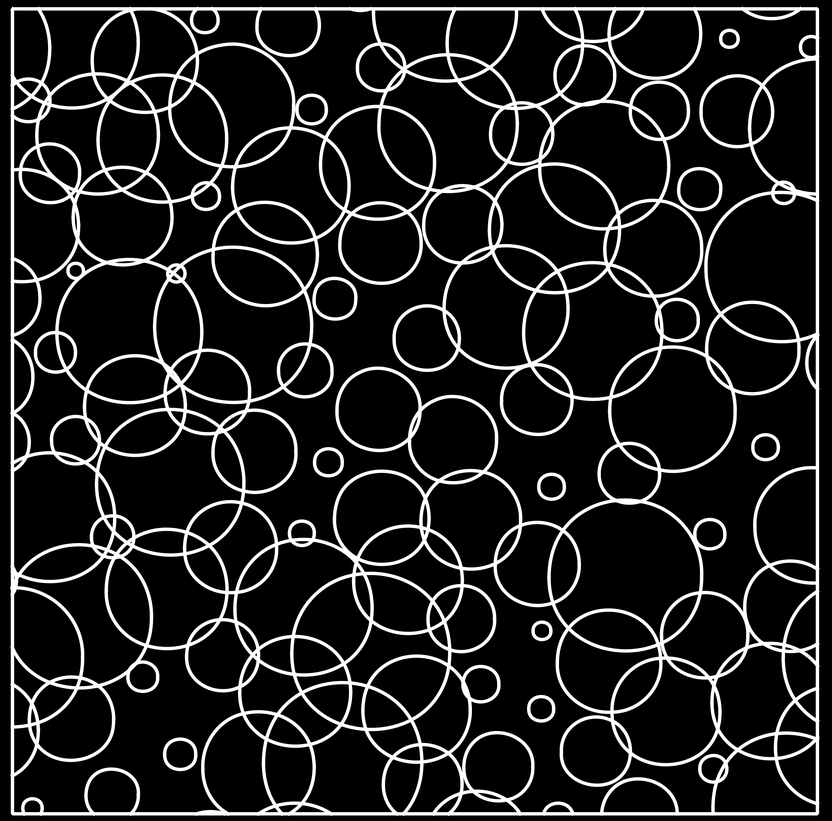
Results - expressiveness

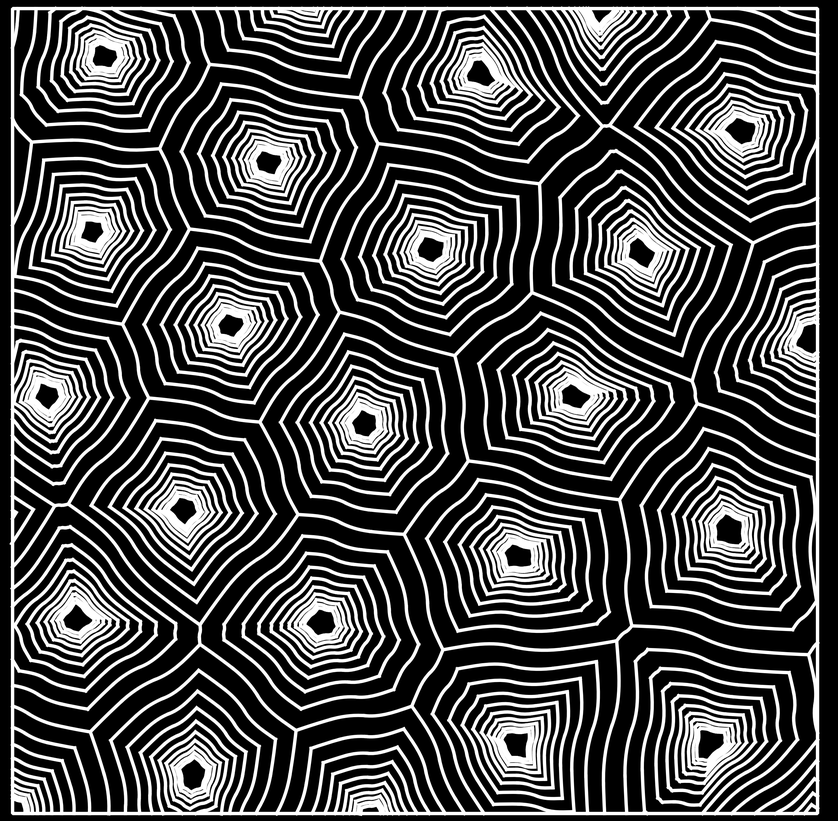




Results - expressiveness

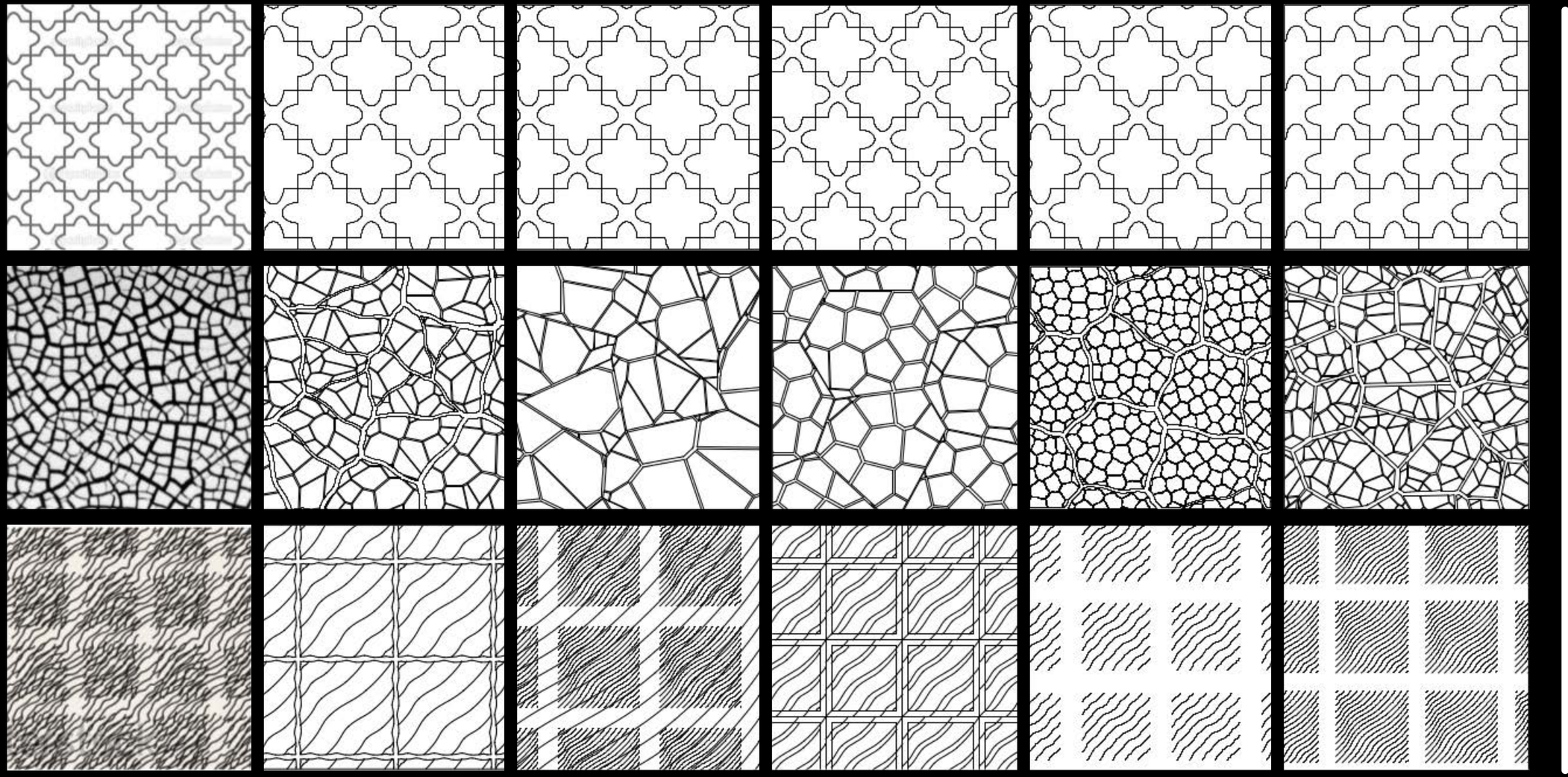


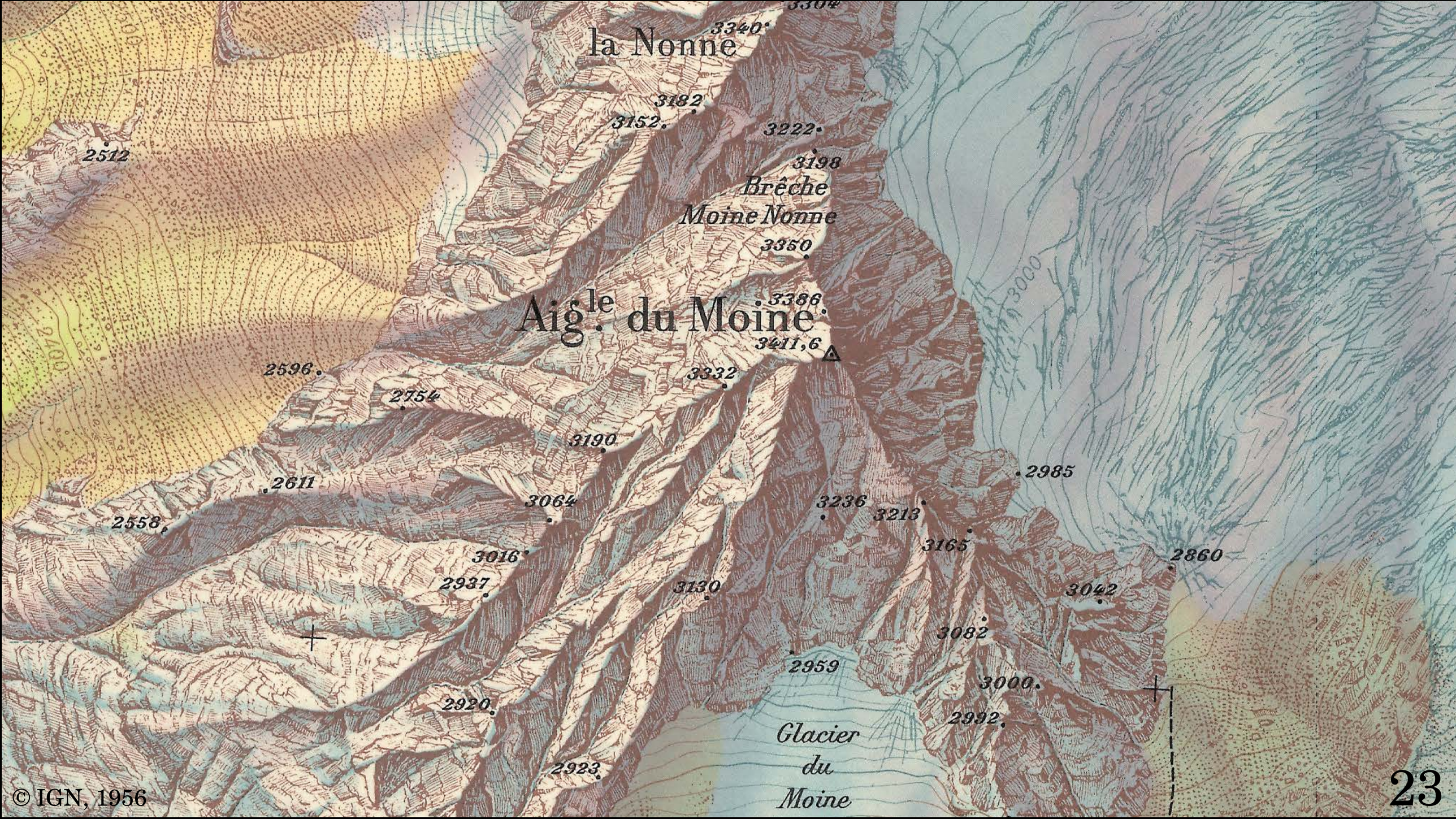




Results - expressiveness

Results - usability after 1h learning

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Moine Nonne
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Aig.le du Moine
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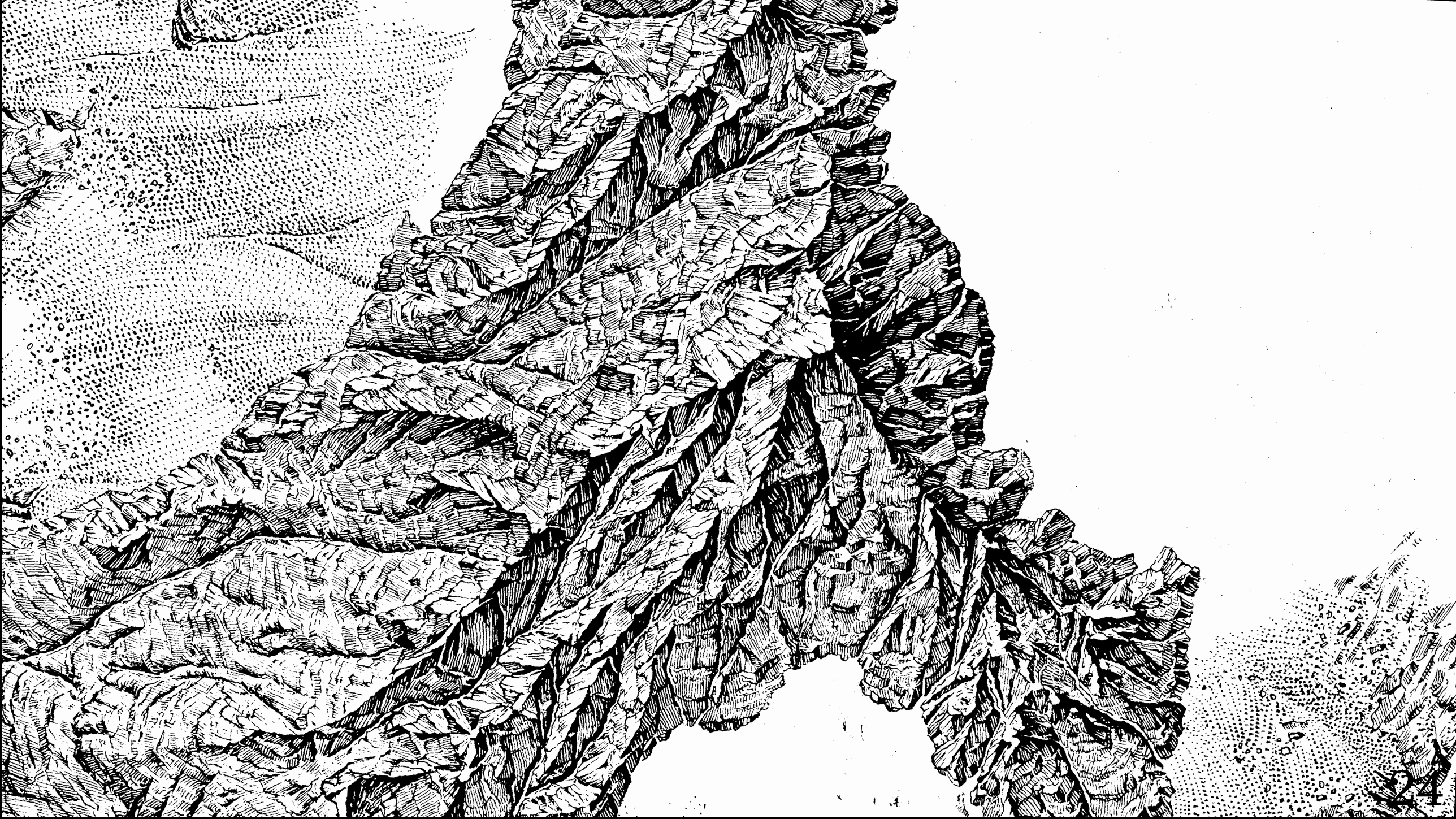
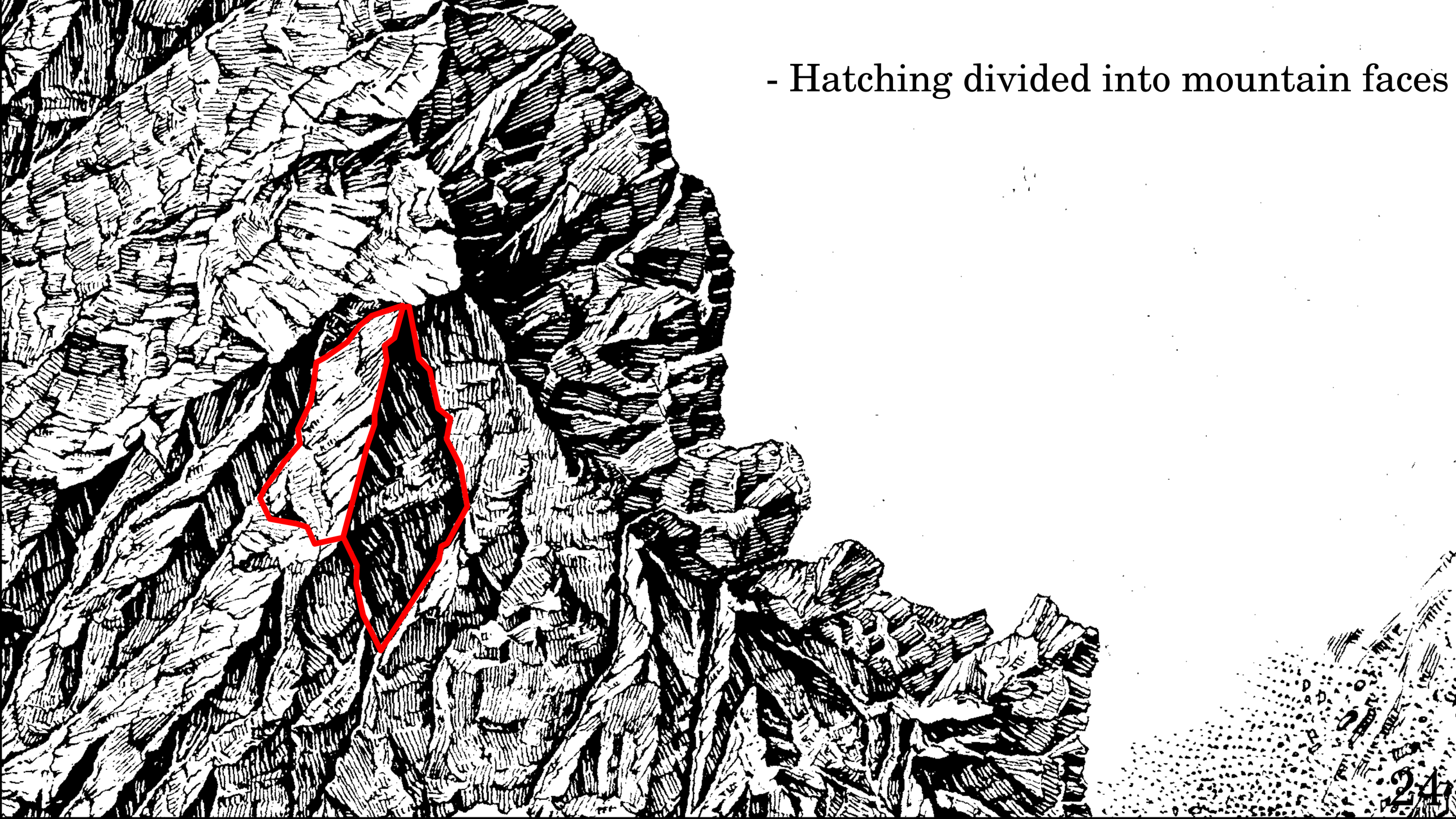
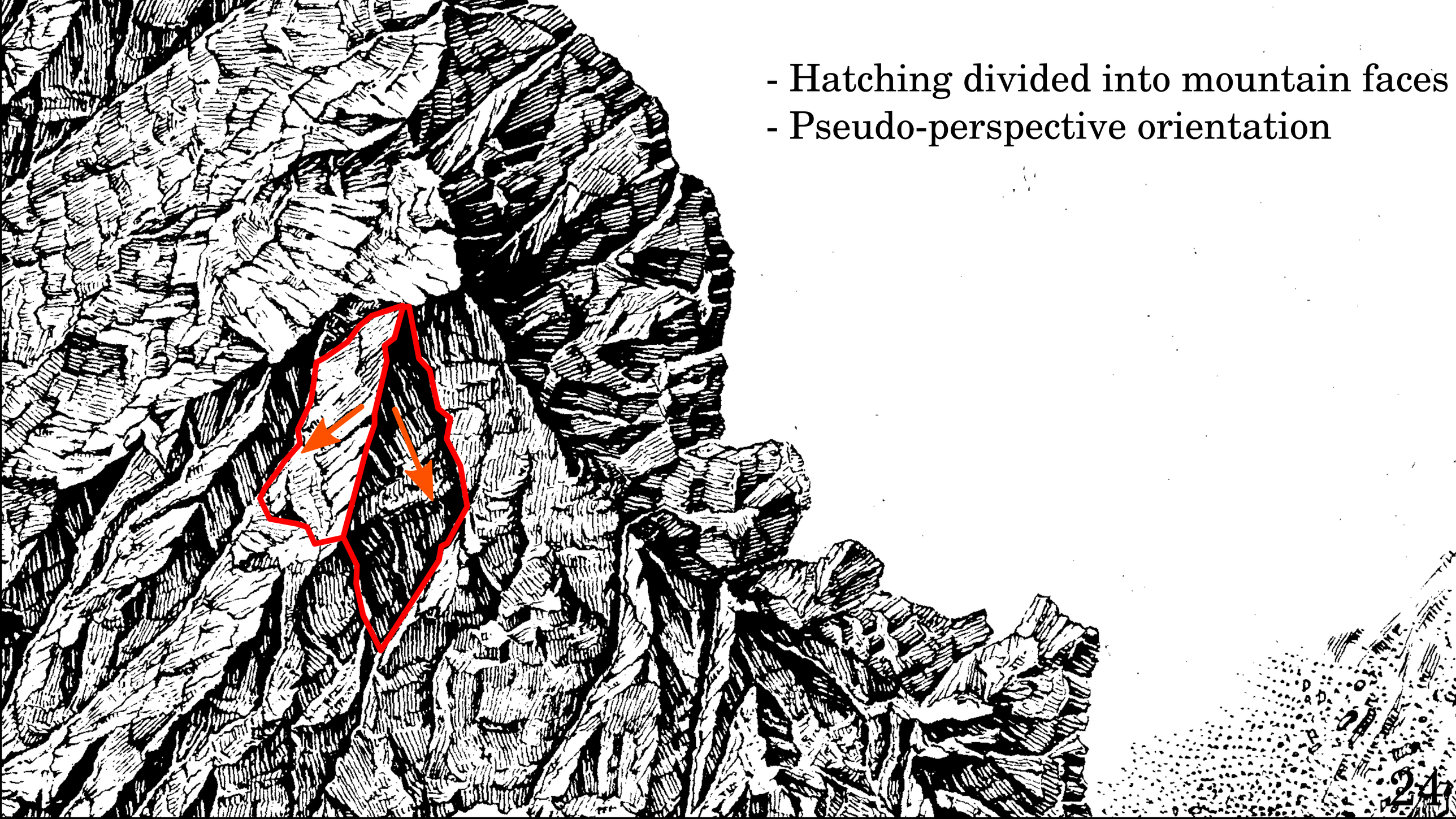
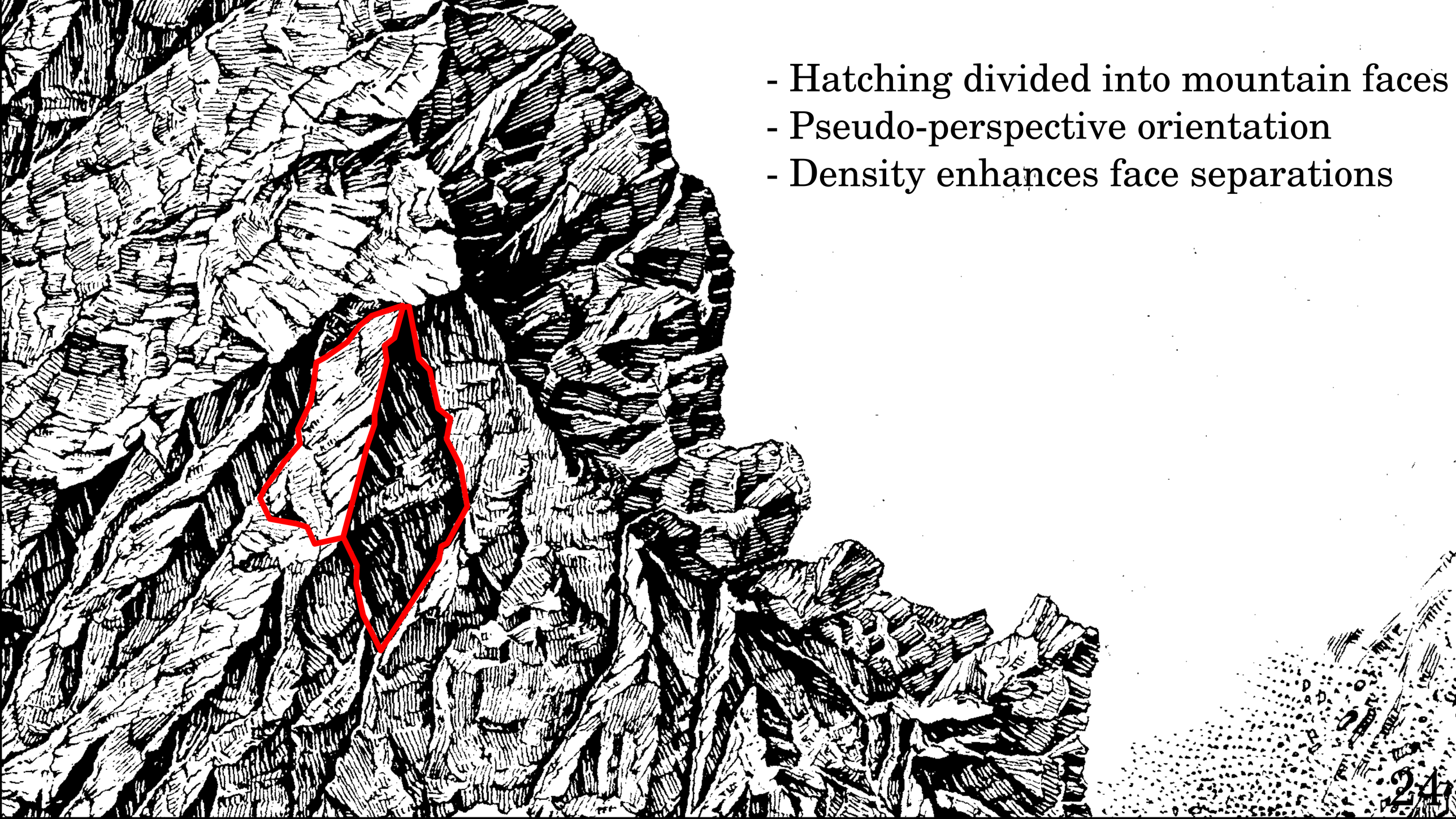




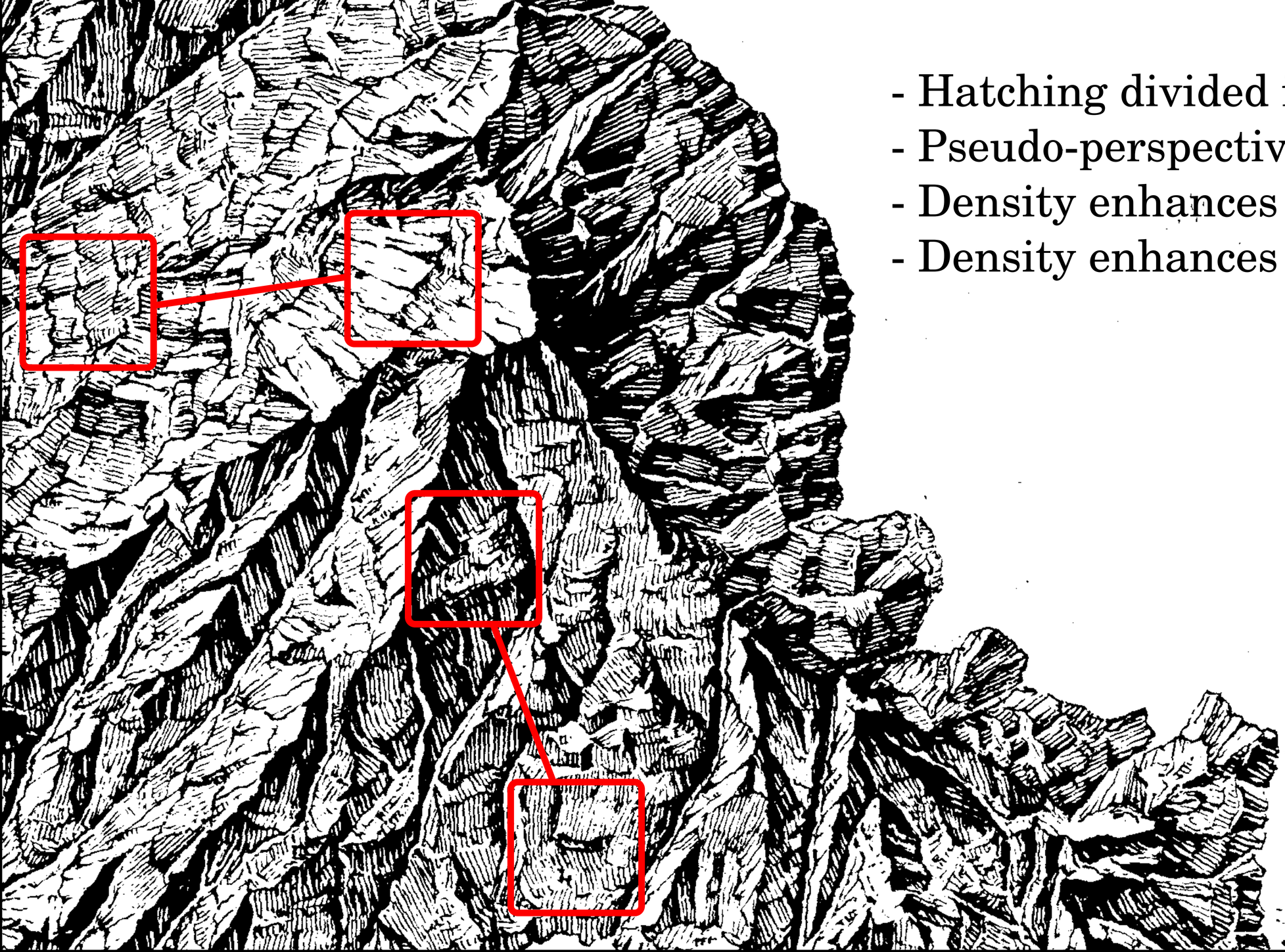
- Hatching divided into mountain faces



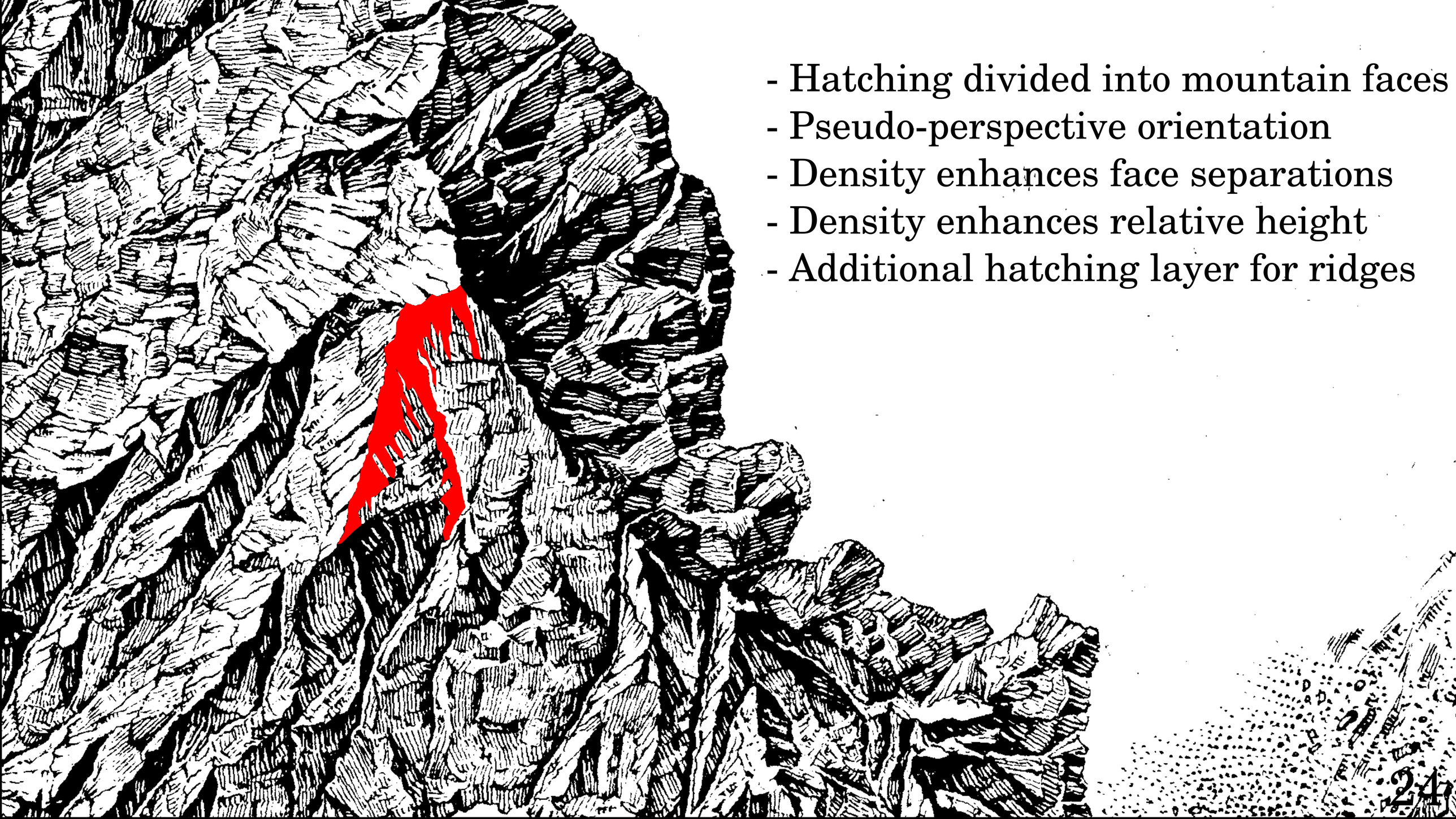
- Hatching divided into mountain faces
- Pseudo-perspective orientation



- Hatching divided into mountain faces
- Pseudo-perspective orientation
- Density enhances face separations



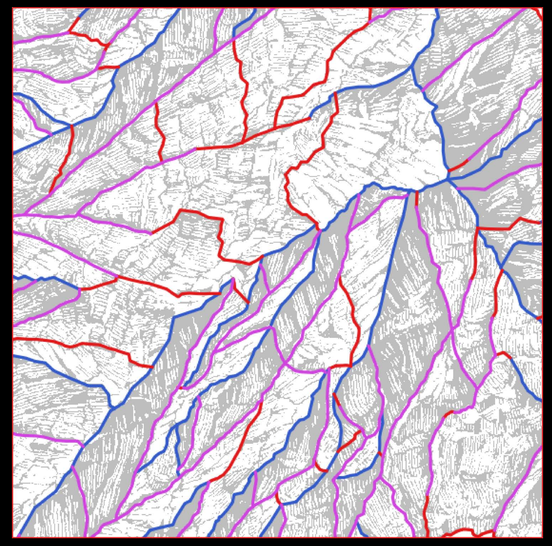
- Hatching divided into mountain faces
- Pseudo-perspective orientation
- Density enhances face separations
- Density enhances relative height



- Hatching divided into mountain faces
- Pseudo-perspective orientation
- Density enhances face separations
- Density enhances relative height
- Additional hatching layer for ridges

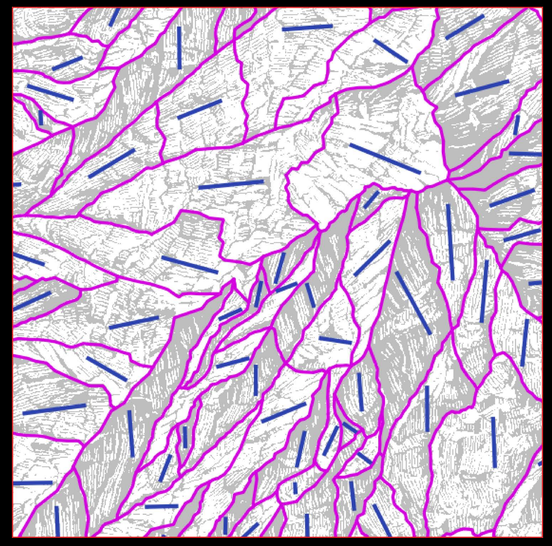
Input Data

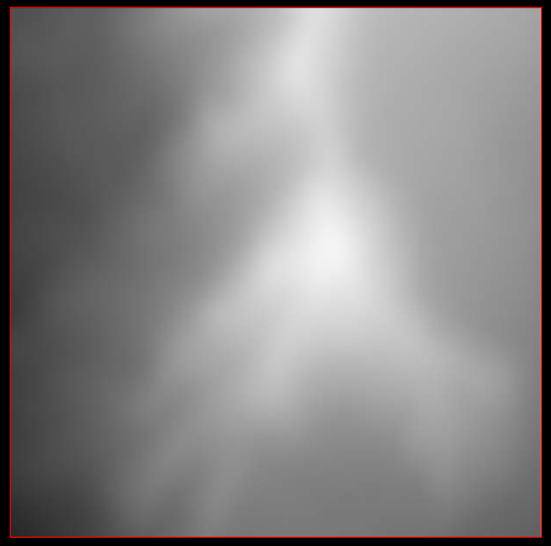
Partition



Density

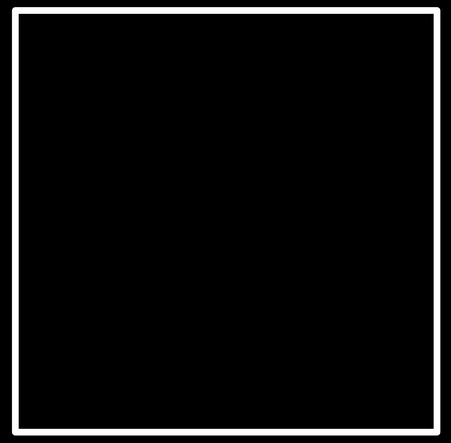
Orientation



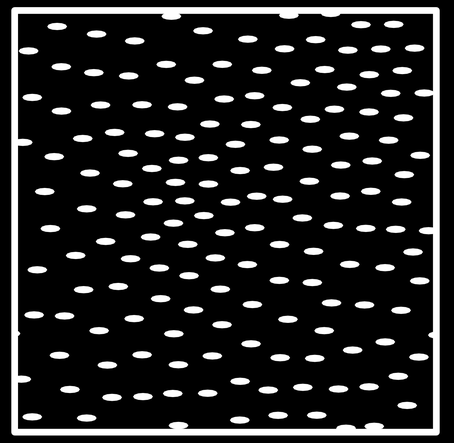


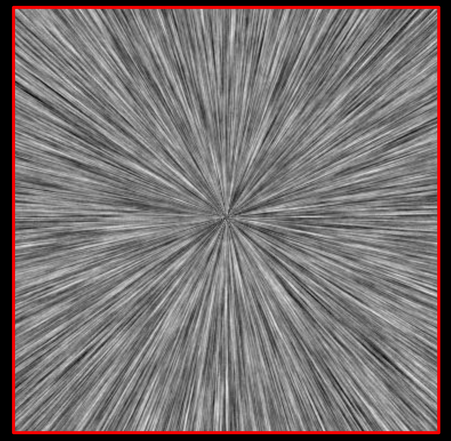
Height


Stationary arrangement

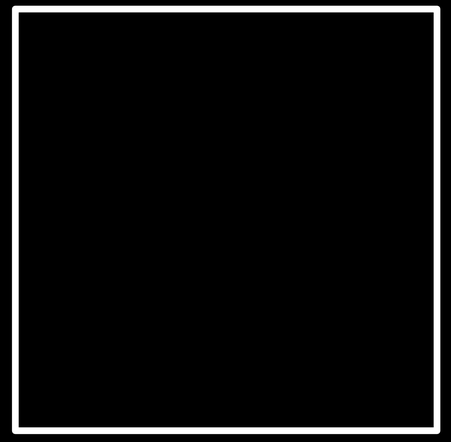


Stationary arrangement

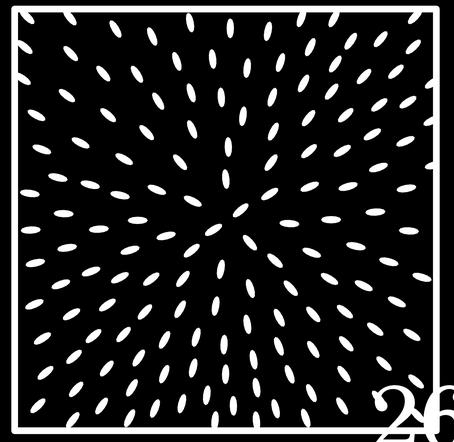




Controlled arrangement



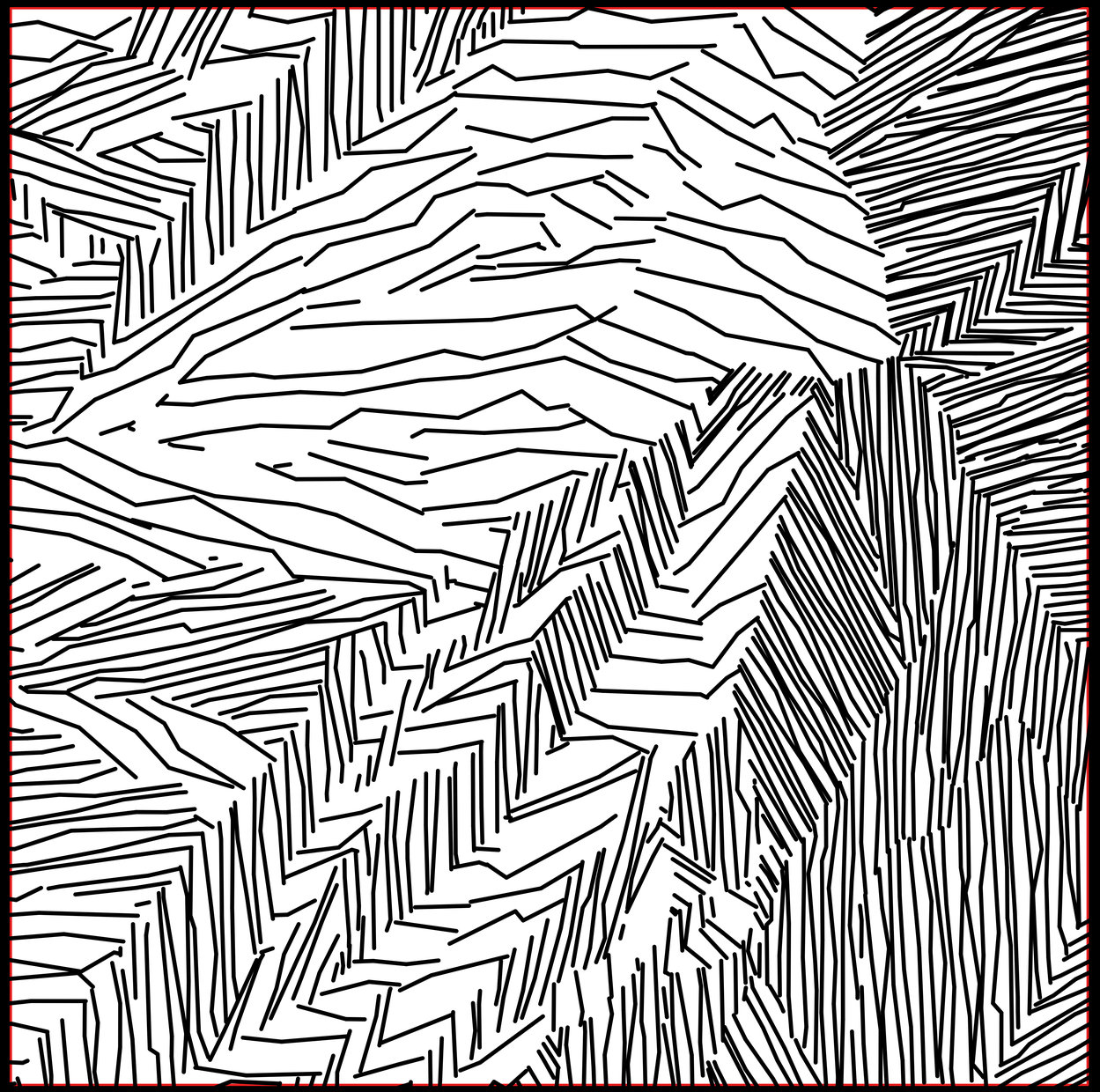
Spat-varying arrangement



Design Iterations

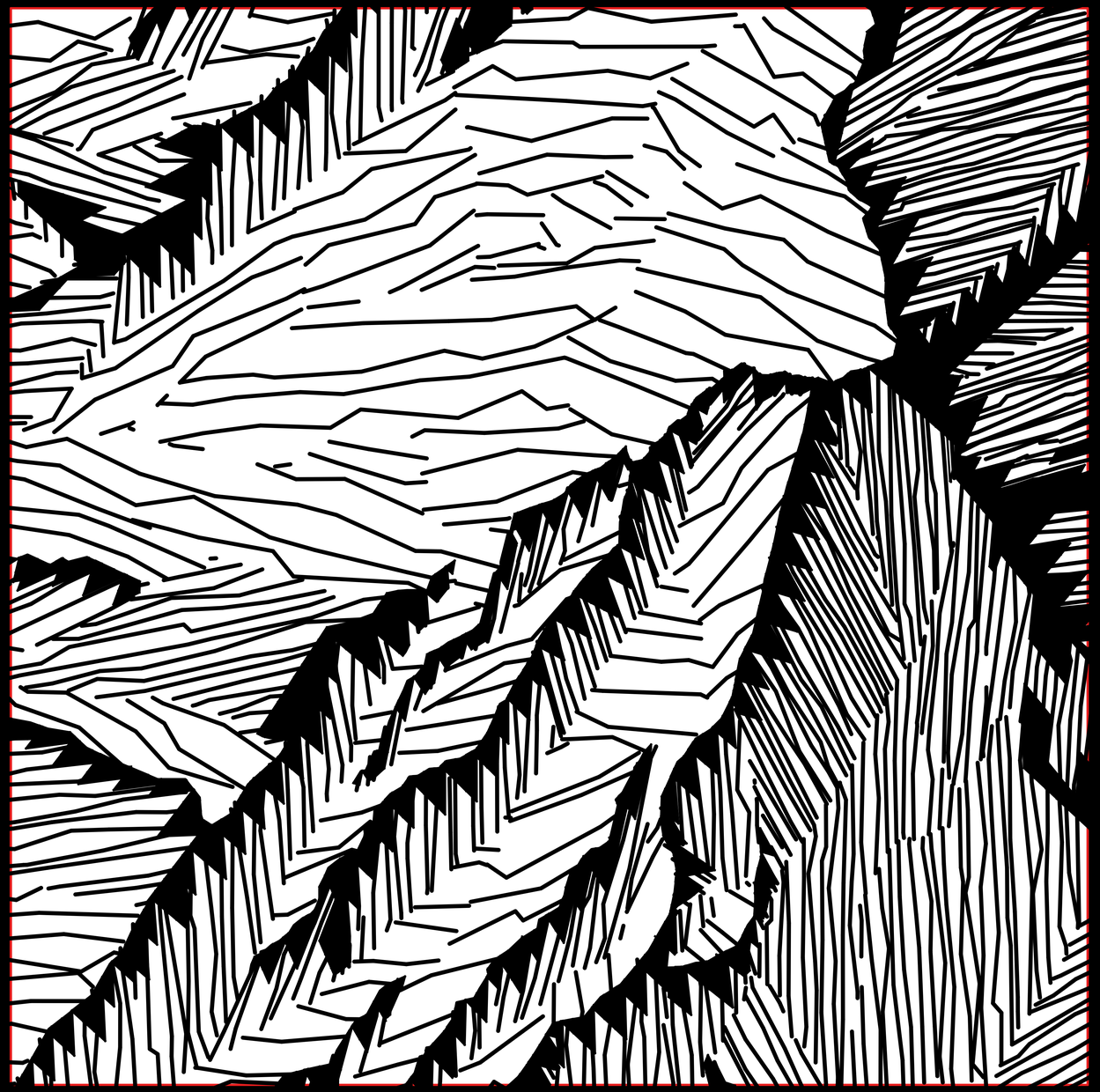
Design Iterations

- Hatching divided into mountain faces
- Pseudo-perspective orientation
- Density enhances face separations



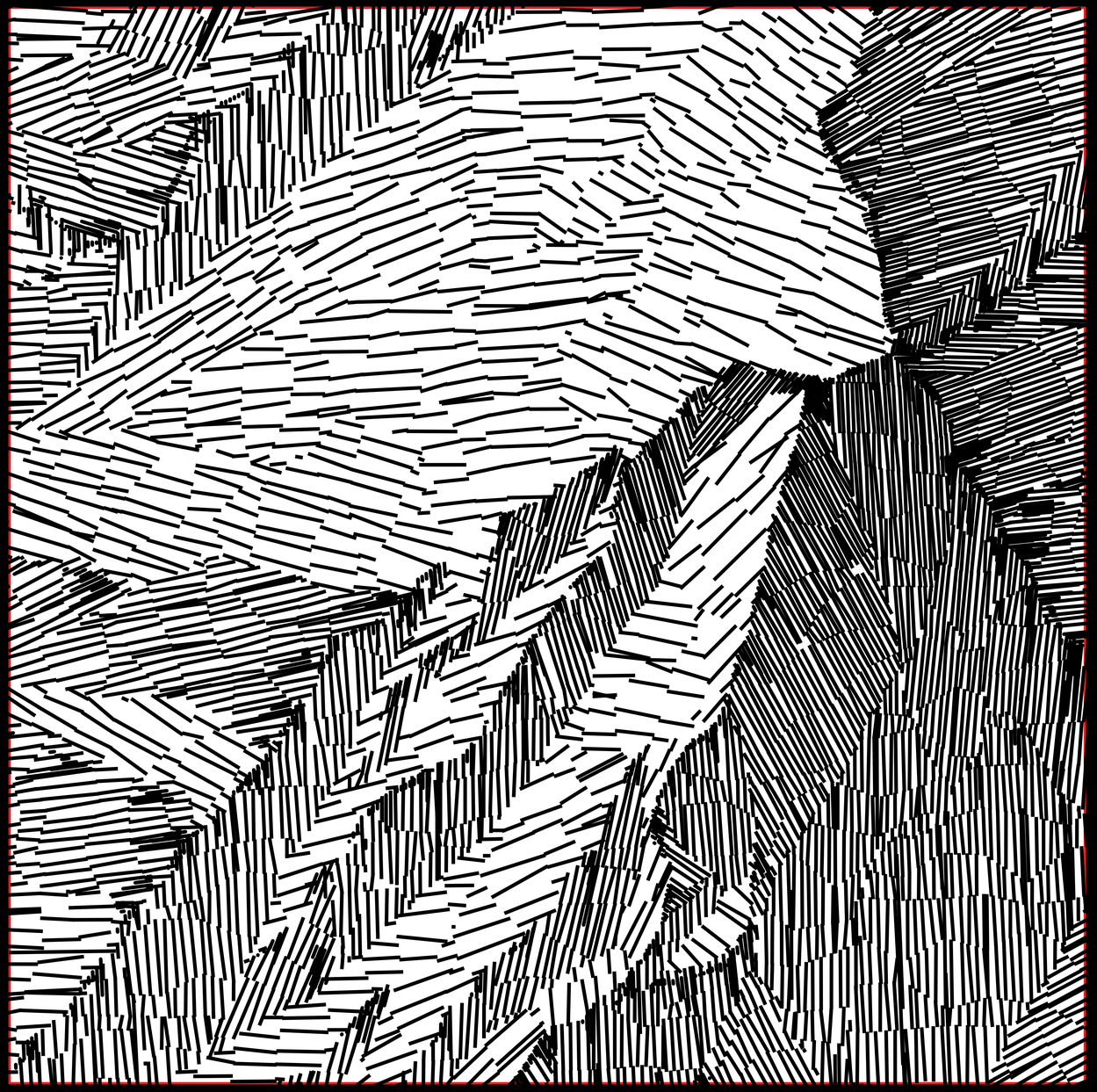
Design Iterations

- Hatching divided into mountain faces
- Pseudo-perspective orientation
- Density enhances face separations
- Additional hatching layer for ridges



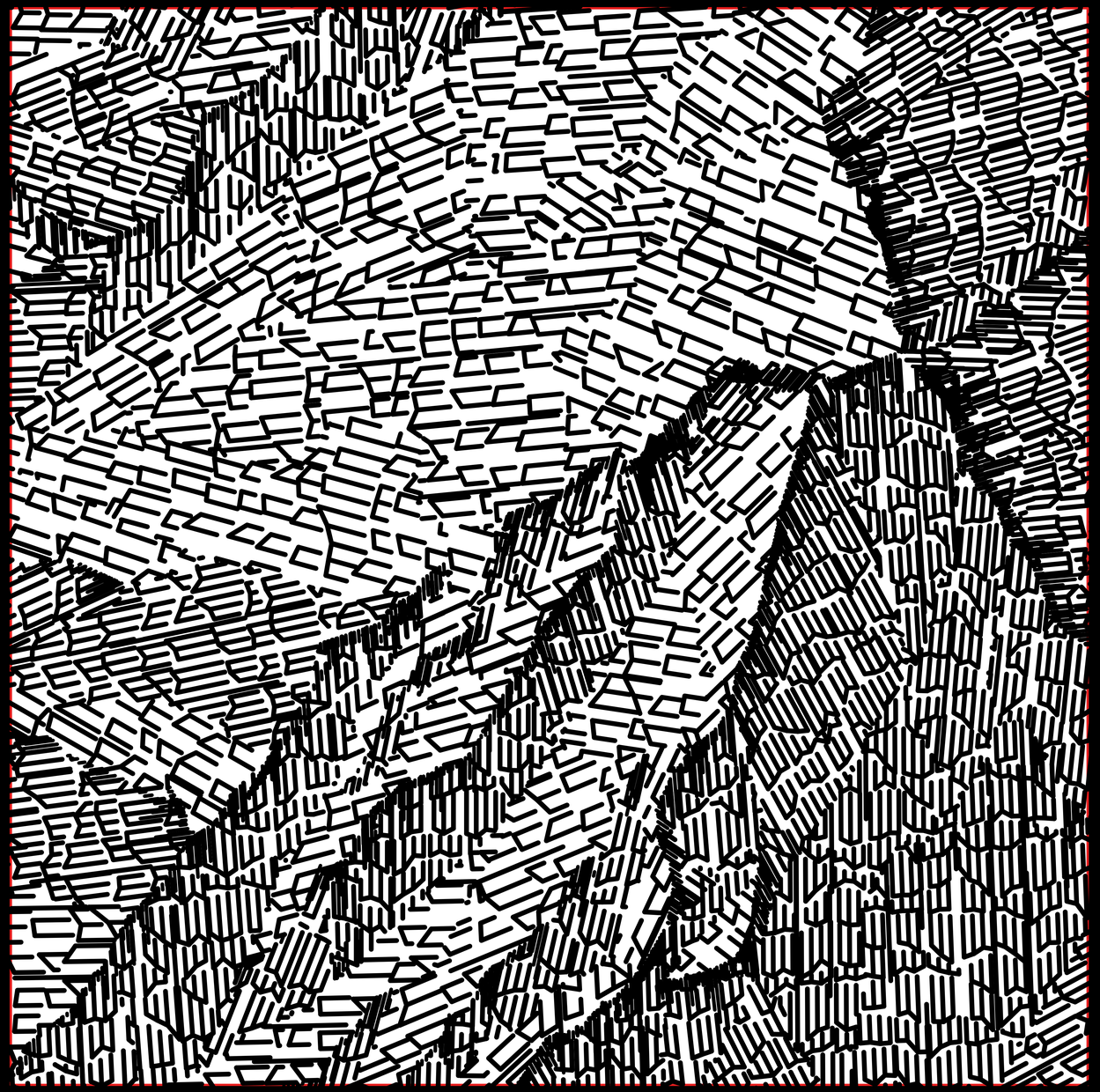
Design Iterations

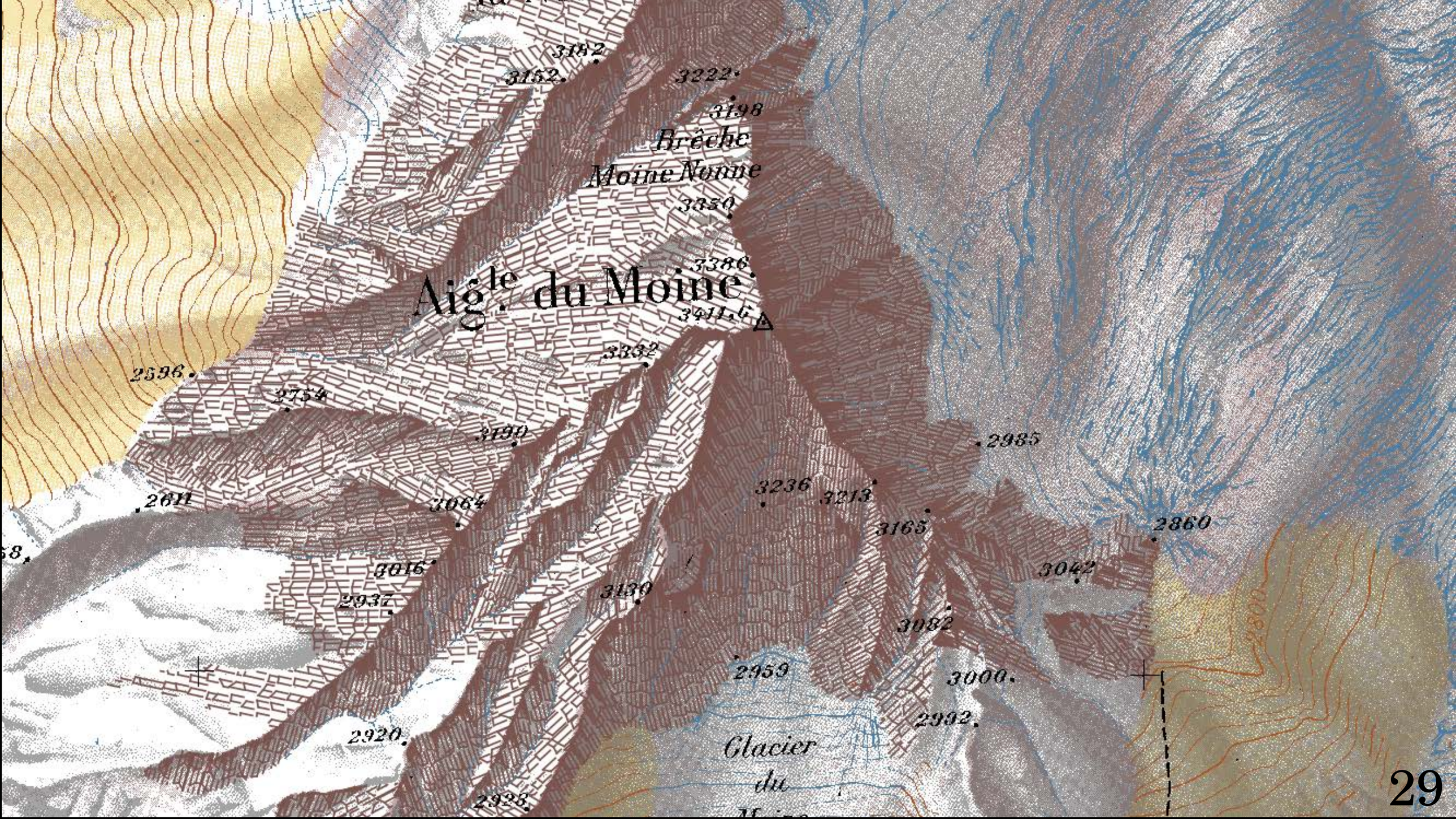
- Hatching divided into mountain faces
- Pseudo-perspective orientation
- Density enhances face separations
- Additional hatching layer for ridges
- Density enhances relative height



Design Iterations

- Hatching divided into mountain faces
- Pseudo-perspective orientation
- Density enhances face separations
- Additional hatching layer for ridges
- Density enhances relative height
- More complex arangement

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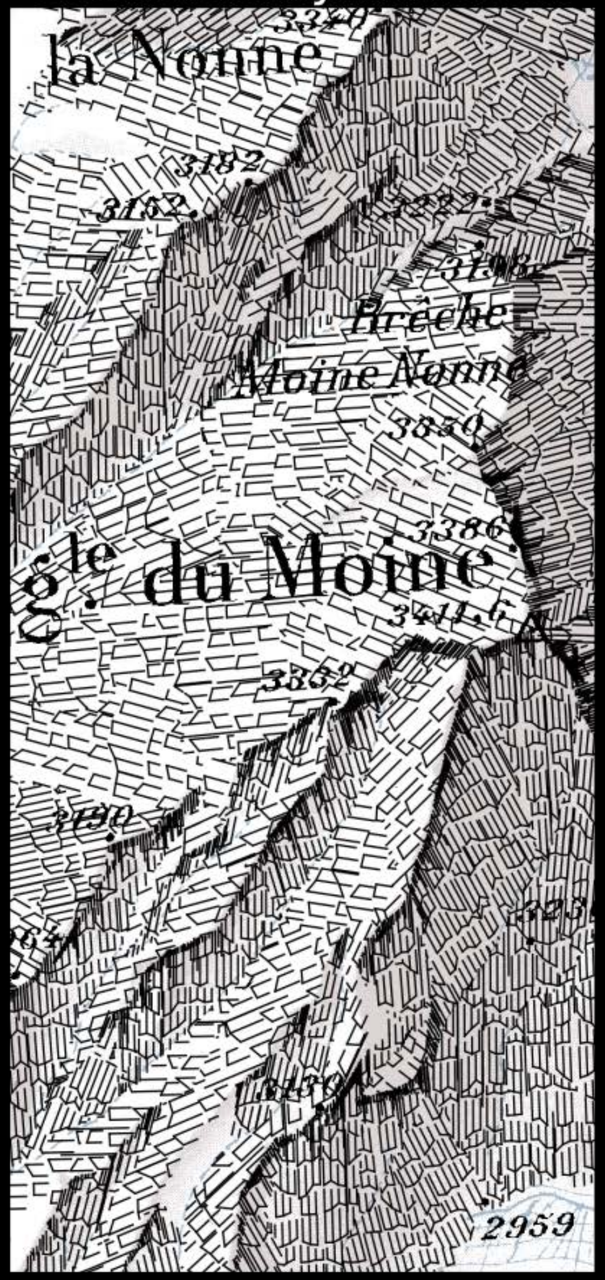
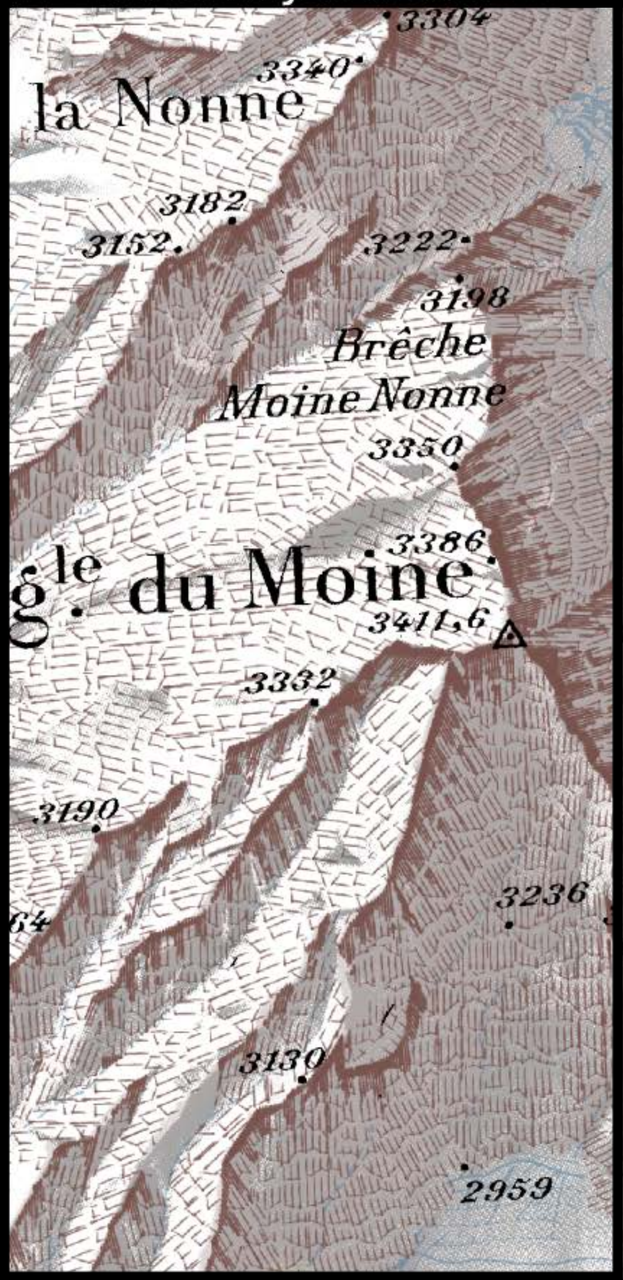
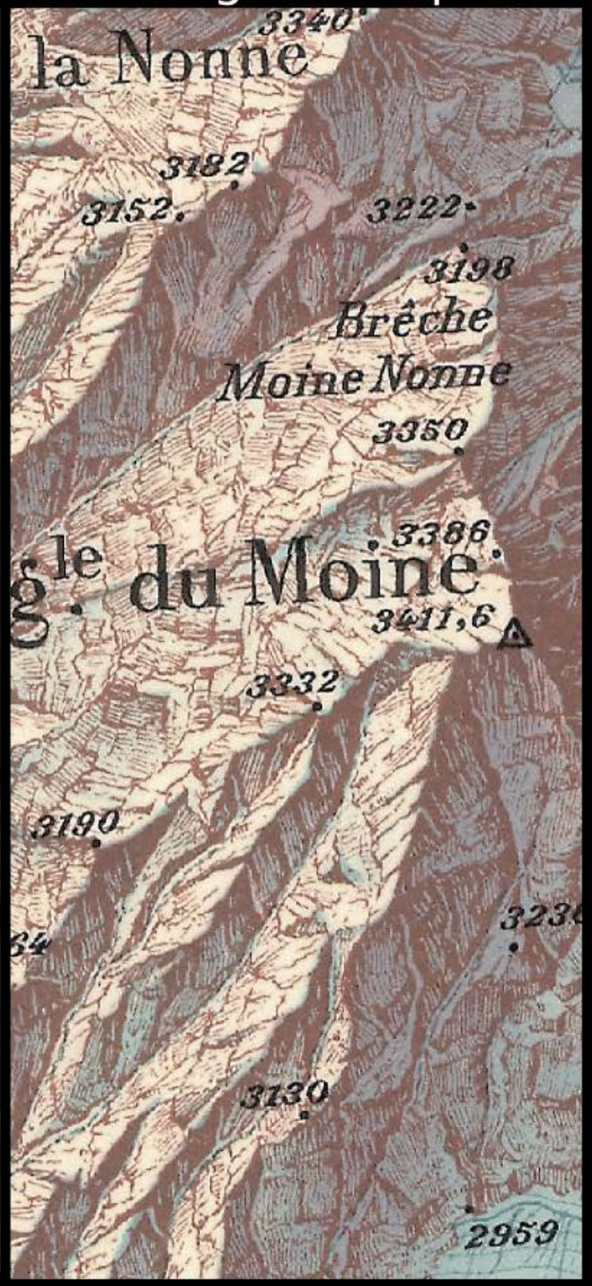
before stylisation



after stylisation



original map



Application to Cartography - Conclusion

- Good design flexibility

- Potential applications for other map themes

- Opportunity for user-tuned maps