

Perception of Mooney Faces: Extreme Generalization through Inverse Rendering?

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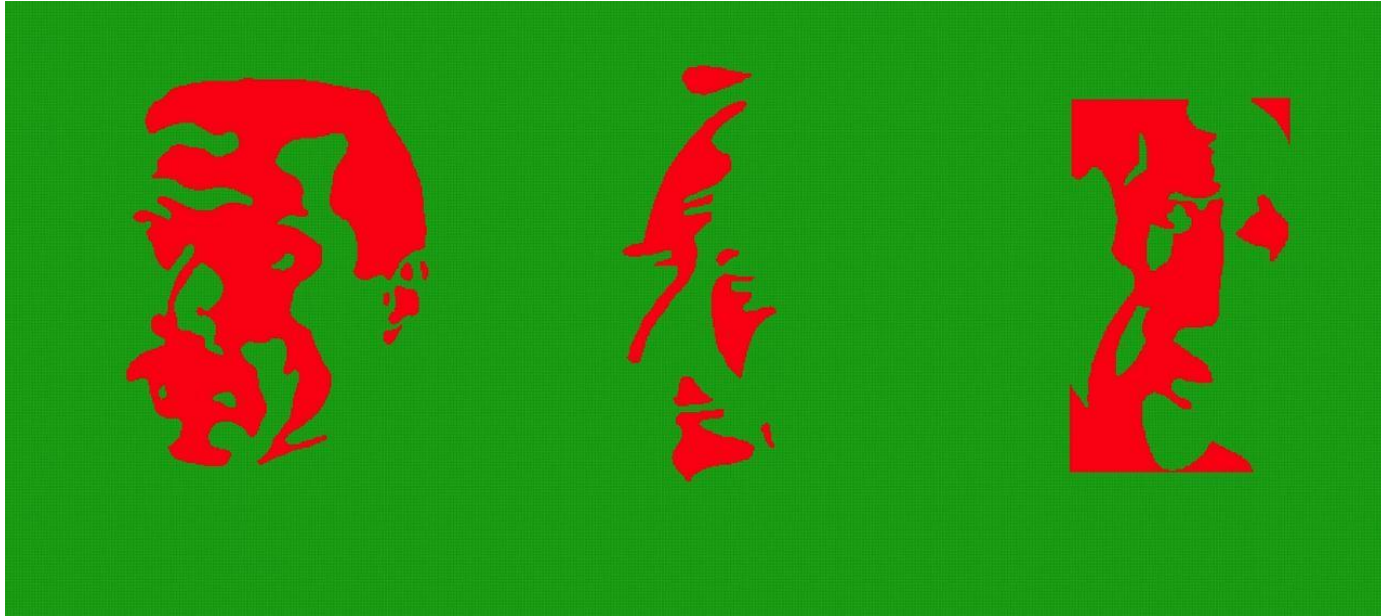


Motivation to study Mooney Images



3D data: Zuffi, Kanazawa, Jacobs, & Black, 2017, BFM: Gerig et al., 2018 and MPI FAUS: Bogo, Romero, Loper, & Black, 2014

Mooney Images: Contrast Inversion



<https://cavlab.net/Demos/Shadows/>

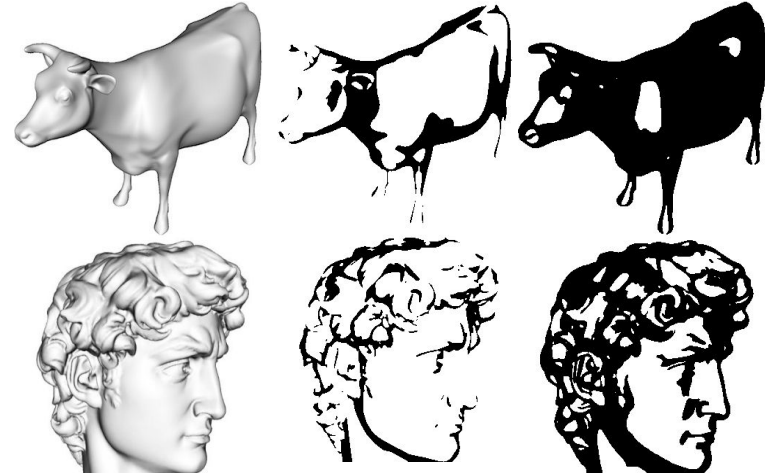
Mooney Images and Line Drawings



RGB
face

Charcoal
drawing

Mooney
face



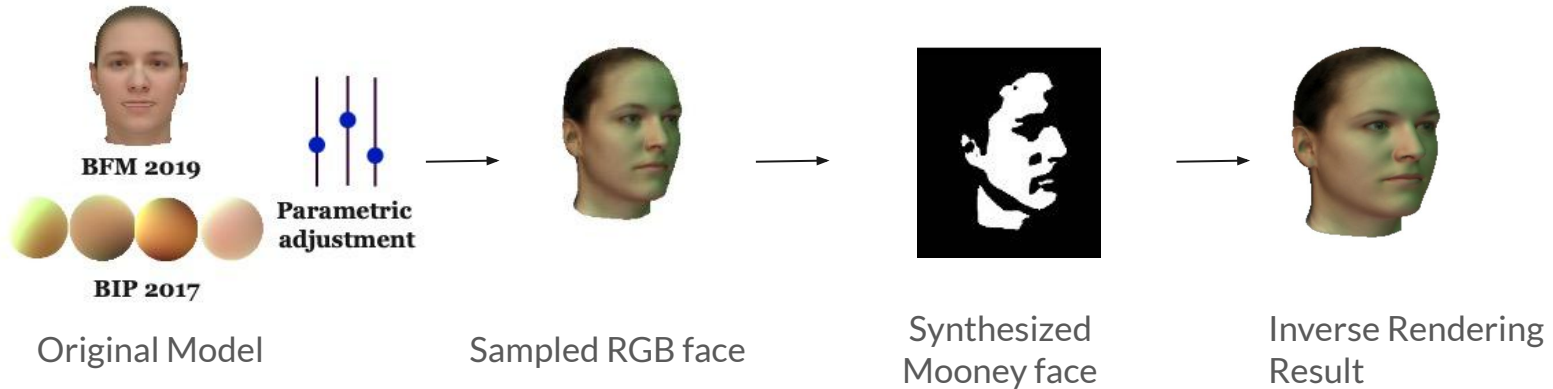
Object
under
lighting

Contours

Thickening
of contours

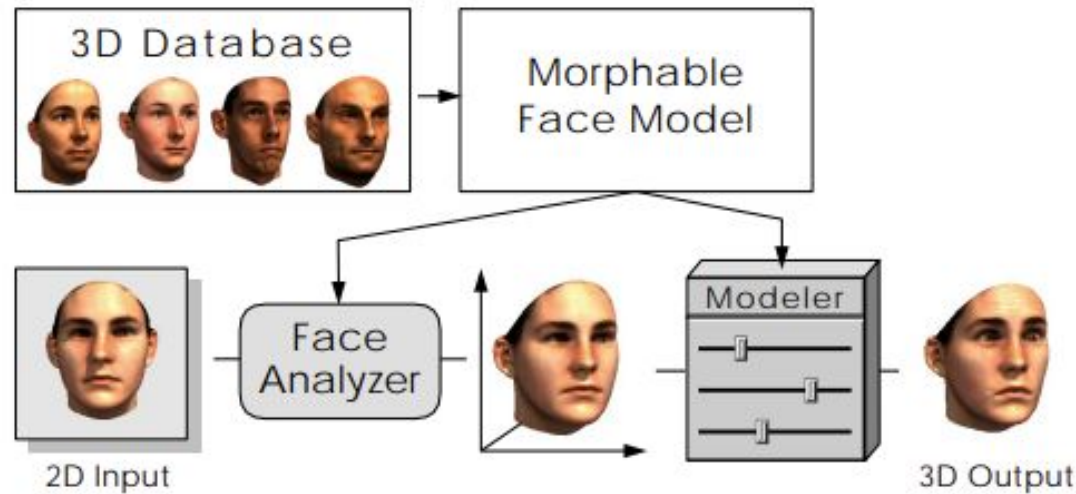
Cow and Face data: Hertzmann 2020

Pipeline



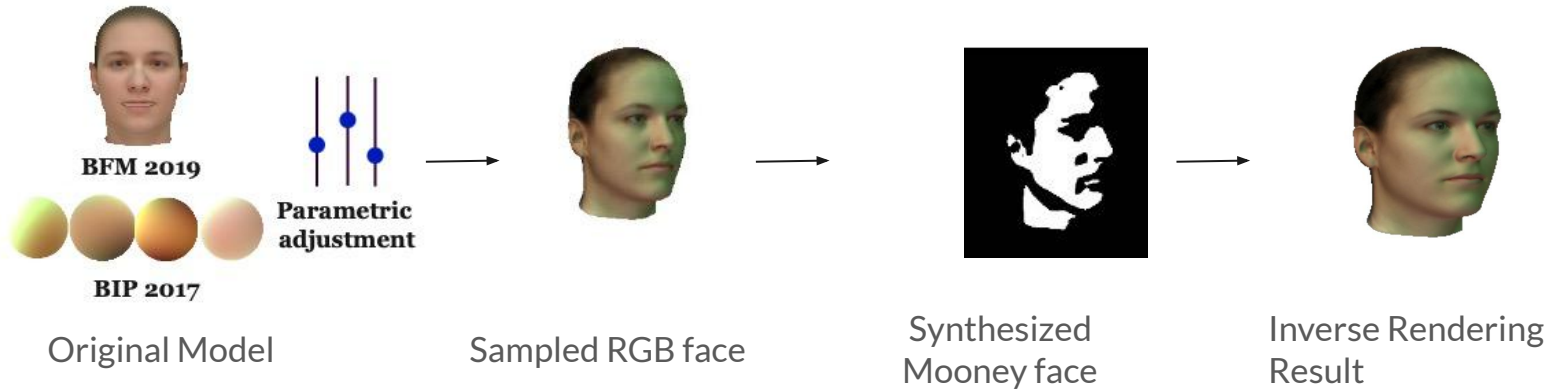
BFM - Basel Face Model: Gerig *et al.* 2018; BIP- Basel Illumination Prior: Egger, Schönborn, Schneider, A. *et al.*

Pipeline: Sampling a new face



Blanz and Vetter 199

Pipeline



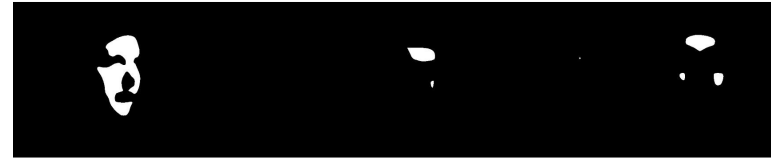
BFM - Basel Face Model: Gerig *et al.* 2018; BIP- Basel Illumination Prior: Egger, Schönborn, Schneider, A. *et al.*

The need for a new way to generate Mooney faces

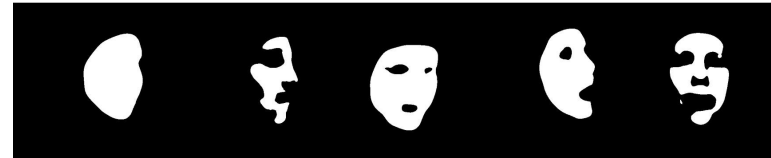
Blur



Threshold



$t=0.70$

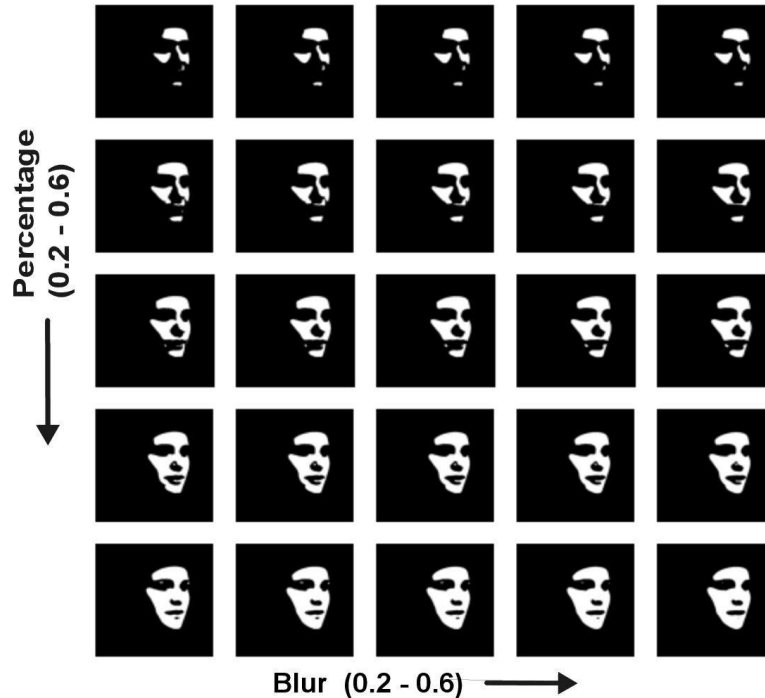


$t=0.43$



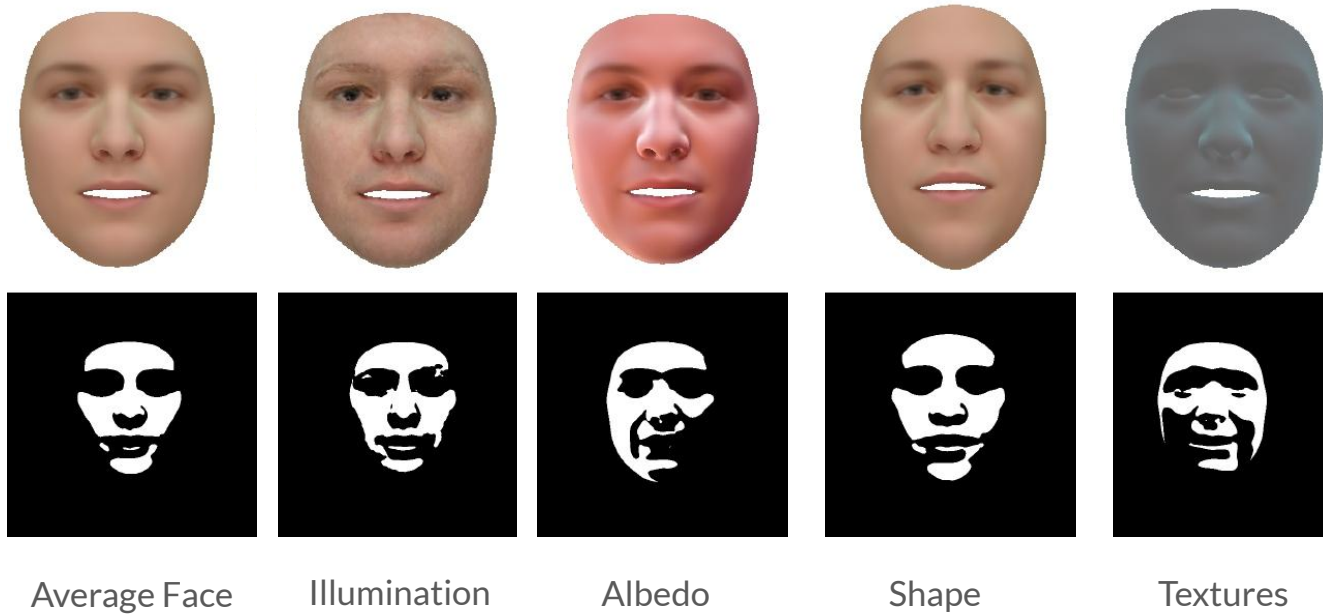
$c=0.42$

A new way of generating Mooney faces



$c = N_B^t / N_W^t$
 N_B^t - no. of black pixels at threshold t
 N_W^t - no. of white pixels at threshold t

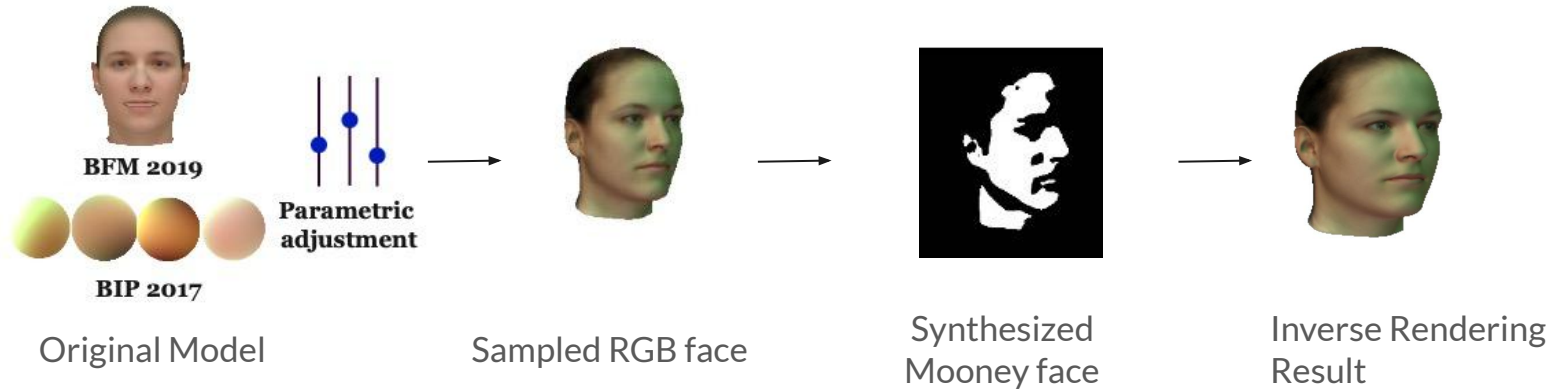
Factors affecting Mooney formation



Mooneys in Motion

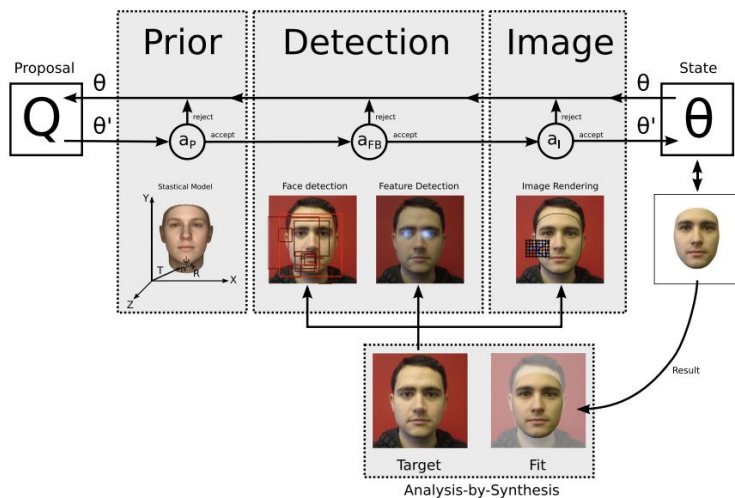


Pipeline



BFM - Basel Face Model: Gerig *et al.* 2018; BIP- Basel Illumination Prior: Egger, Schönborn, Schneider, A. *et al.*

Pipeline: Inverse Rendering, Analysis by Synthesis?



Target



Illumination Only

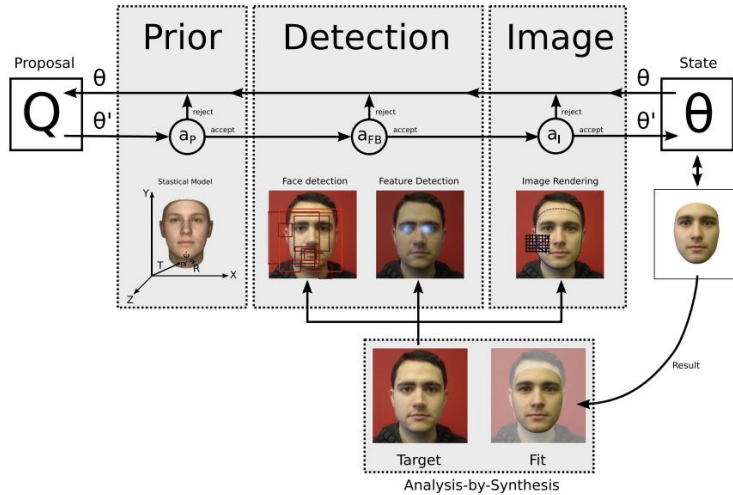


Transform Layer



Gerig., Morel-Forster, Blumer., Egger., Luthi., Schönborn., & Vetter 2018

Pipeline: Inverse Rendering, Analysis by Synthesis?



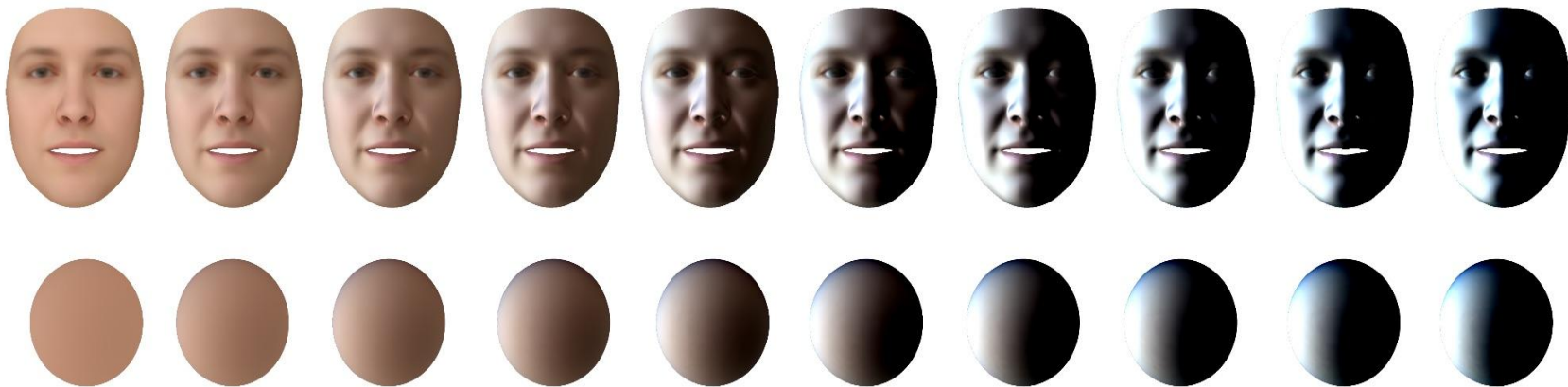
Target



Illumination Only

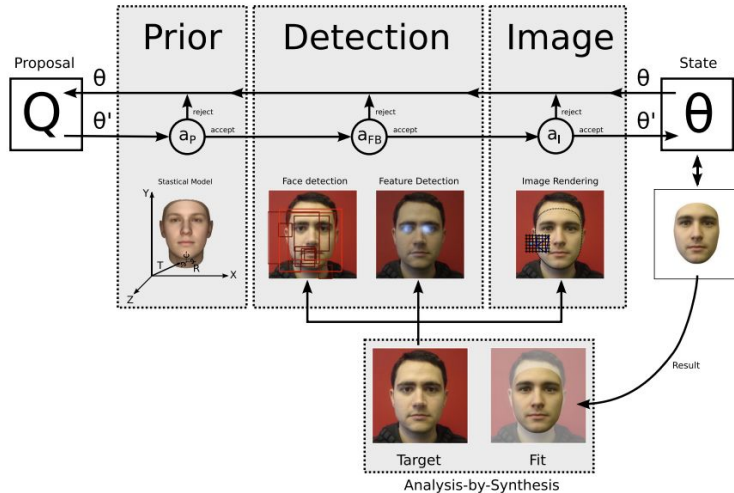
Gerig., Morel-Forster, Blumer., Egger., Luthi., Schönborn., & Vetter 2018

Interpretation via extreme illumination



Gerig., Morel-Forster, Blumer., Egger., Luthi., Schönborn., & Vetter 2018

Pipeline: Inverse Rendering, Analysis by Synthesis?



Transform Layer

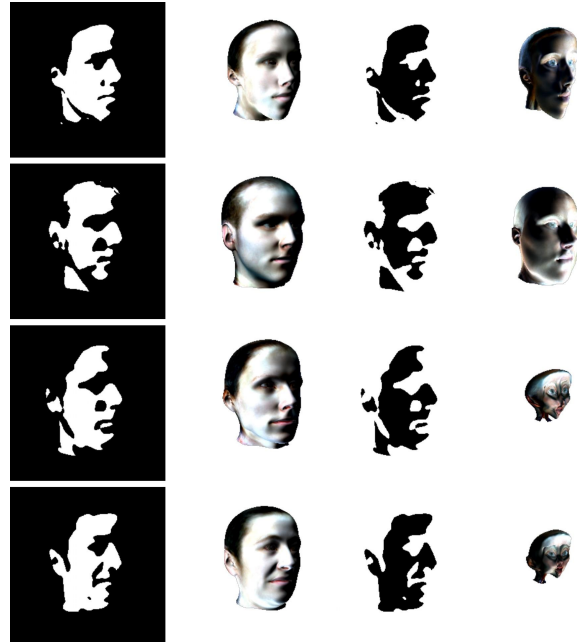
Additional layer during MCMC sampling, pixel wise log-likelihood

Gerig., Morel-Forster, Blumer., Egger., Luthi., Schönborn., & Vetter 2018

Analysis By Synthesis



Contrast inversion? How does it affect perception?



Reconstruction is ill-posed



original



reconstructions



Conclusion



- Mooney faces help to understand human perception
- They can be interpreted easily via extreme illumination
- Our contributions
 - We developed a new way to generate mooney faces
 - We demonstrate our hypothesis by showing that Mooney faces can be approximately explained with an inverse graphics model when we allow for strong illumination extrapolation



Thank You