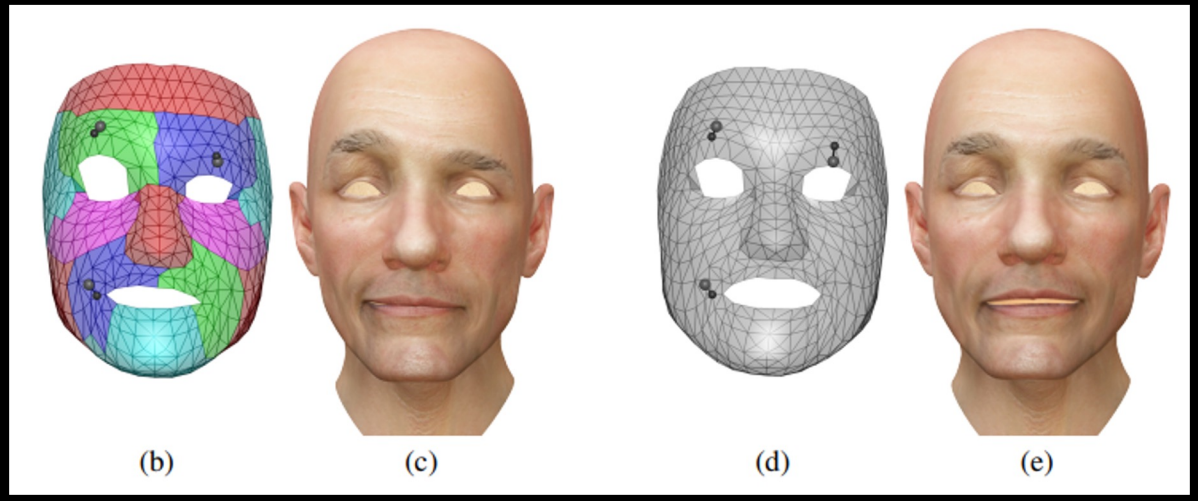
Region Decomposition of Face Expressions

Dataset:

- 1000 Registered face scans of the same person performing different expressions with vertex correspondence, used for PCA decomposition
- Test on unseen expression by projecting test face on principal components

Method:

- Reconstruction = Template face + expression bases * expression principal values
  - Global expression bases: decompose whole face
  - Local expression bases (w/o smoothing): divide regions on face and decompose individually



E.g., Local Bases (with smoothing)
test-time refinement of principal values:
reconstruction error + smoothing constraint

$$E(\boldsymbol{\zeta}) = \sum_{i=1}^{M} \|\mathbf{v}^i - \mathbf{B}^i\mathbf{c}^i\|_2^2 + \beta \sum_{i=1}^{M}\sum_{j=i}^{M} \|\mathbf{B}_j^i\mathbf{c}^i - \mathbf{B}_i^j\mathbf{c}^j\|_2^2,$$

Reference: https://flame.is.tue.mpg.de/index.html, http://www.iainm.com/publications/Tena2011-Interactive/paper.pdf

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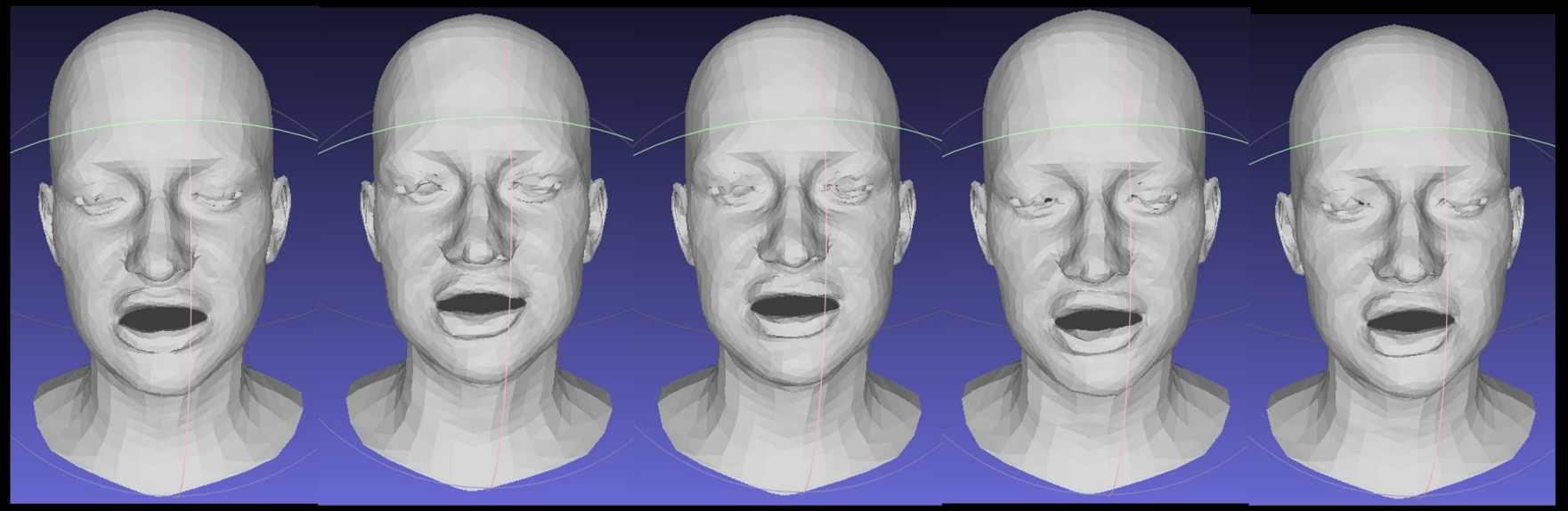
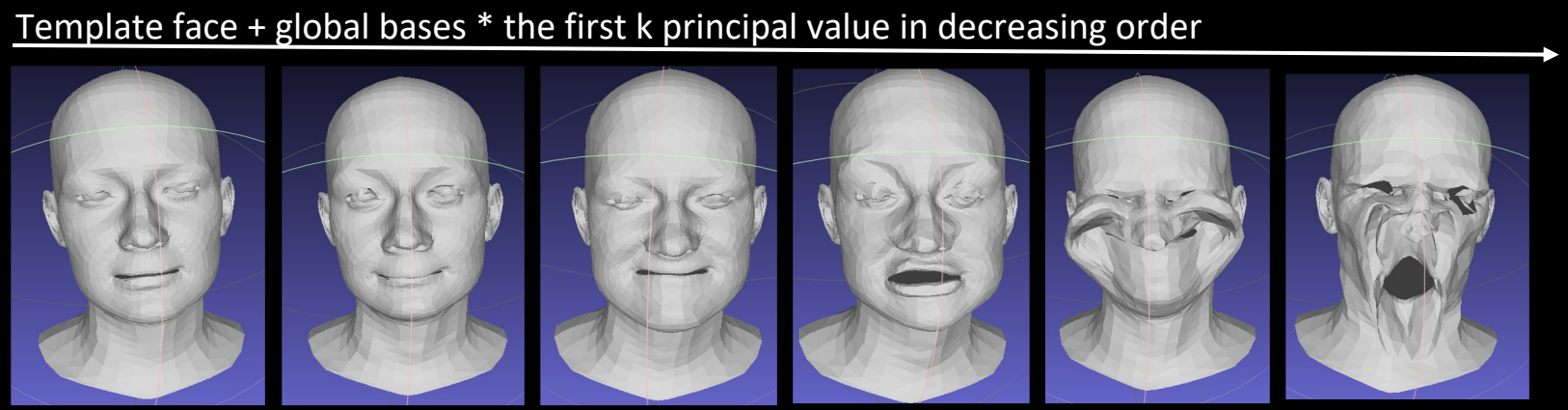
Test reconstruction results using PCA bases





Results:

- Global based method failed to learn the local details, and difficult to perform local manipulation
- Local bases method provided better representation power
- Local bases method with smoothing helps smoothly connect the reconstruction from individual bases