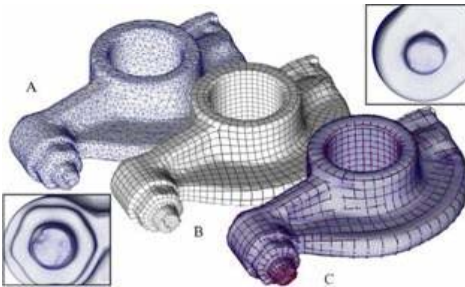


University of
British Columbia


Computer Graphics: Modeling

CPCS 524

<http://www.cs.ubc.ca/~sheffa/dgp>



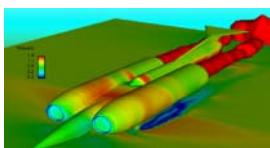
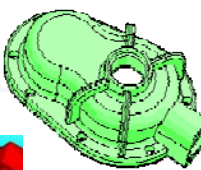


1




Geometry Processing

- Shape is a basic property of most objects
- Geometry processing: computerized modeling & manipulation of 3D geometry



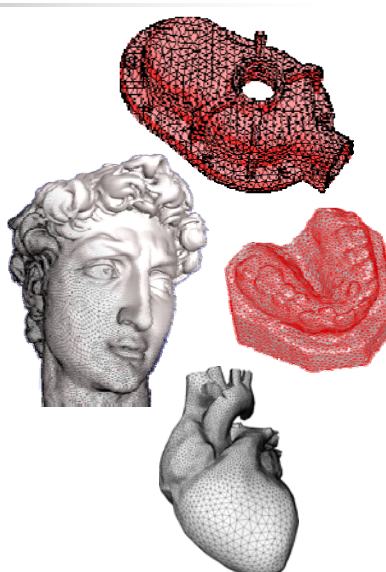
2



University of
British Columbia

Geometry Processing: Meshes

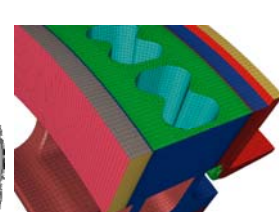

- Focus on discrete (polygonal mesh) models
 - Typically triangular
- Why discrete?
 - Simplicity – ease of description & transfer
 - Base data for rendering software/hardware
 - Input to most simulation/analysis tools
 - Output of most acquisition tools (CT, MRI, laser, etc..)



University of British Columbia

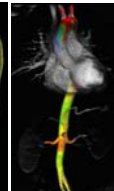
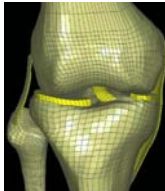
3

Applications

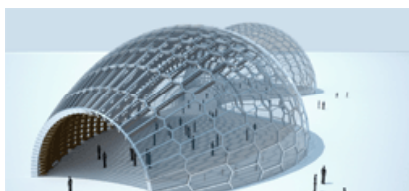


Games/Movies

Engineering




Medicine/Biology



Architecture


University of British Columbia

4




Tools?

- Use techniques from both Math & CS
 - Differential geometry
 - Computational geometry
 - Graph theory
 - ...
- ...Combined with a lot of intuition...
- Work on real data = Write a lot of code 😊




University of
British Columbia

5




University of
British Columbia




Administratia

6




Course Info

- Alla Sheffer
Office: ICICS/CS x651
e-mail: sheffa@cs.ubc.ca
Office hours: Wed 2-3
- Web page: www.cs.ubc.ca/~sheffa/dgp
 - Includes lecture slides
 - www.cs.ubc.ca/~sheffa/dgp/announcements.html
 - Info on all changes & news
 - Please check OFTEN




University of
British Columbia

7




Grading

- 40% - Assignments
 - Use existing mesh data-structure/GUI
 - TBD (soon)
 - 10% - Assignment 1: Mesh Processing "Hello World"
 - Goal: Learn basic mesh data-structure/programming environment
 - Out: **soon**
 - 17% - Assignment 2: Mesh Simplification
 - 18% - Assignment 3: Mesh Deformation




University of
British Columbia

8




Grading

- 20% - Paper presentation
 - Possible sources: proc. of SIGGRAPH, Symposium on Geometry Processing (SGP), Eurographics, Shape Modelling (SMI)
 - Presentation requires: ppt slides + one page summary submitted a week ahead.
- 10% - Class participation
 - **Weekly summaries**
 - Sumarize material List issues, questons, etc...
 - Peer feedback for presentations
 - Reading presented papers (before presentation)




University of
British Columbia

9




Grading

- 25% - Final project
 - Two options
 - Pre-defined
 - Description on the web end of February
 - Likely topic: Reconstruction
 - Free-form
 - e.g. based on paper you or someone else presented
 - Includes proposal, report & presentation
 - Done in pairs




University of
British Columbia

10





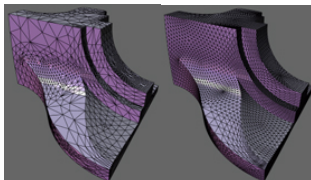
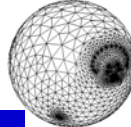

Course Topics

11

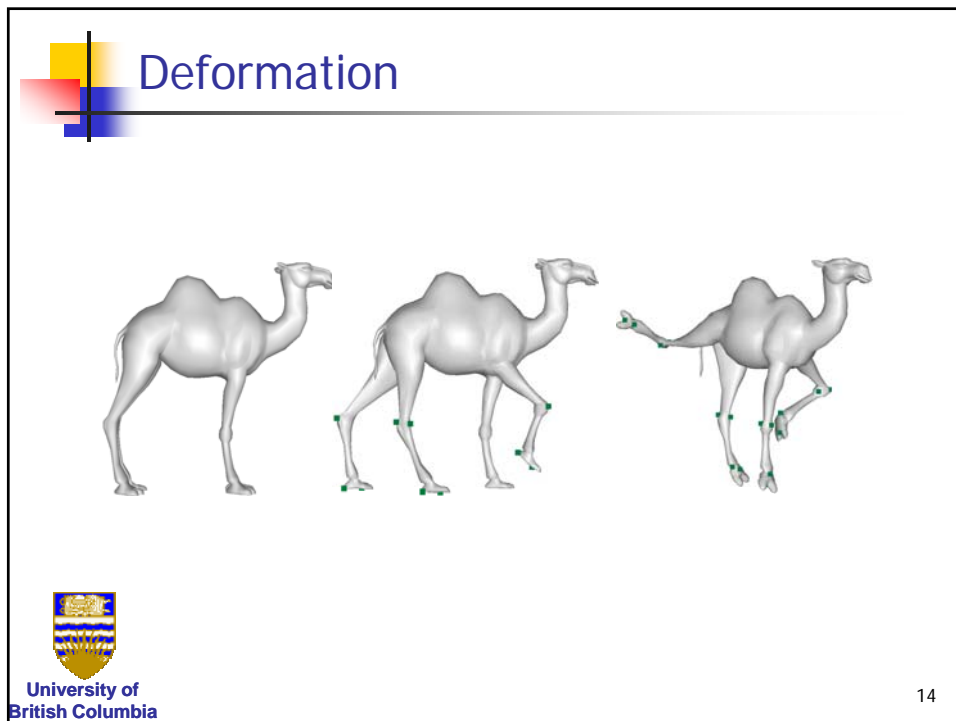
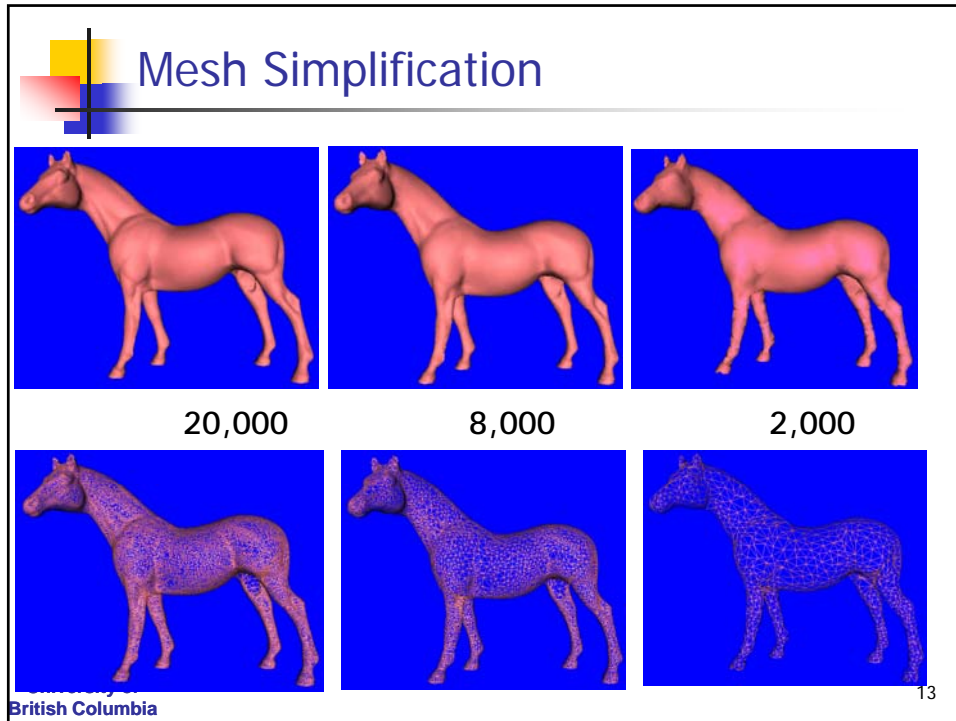


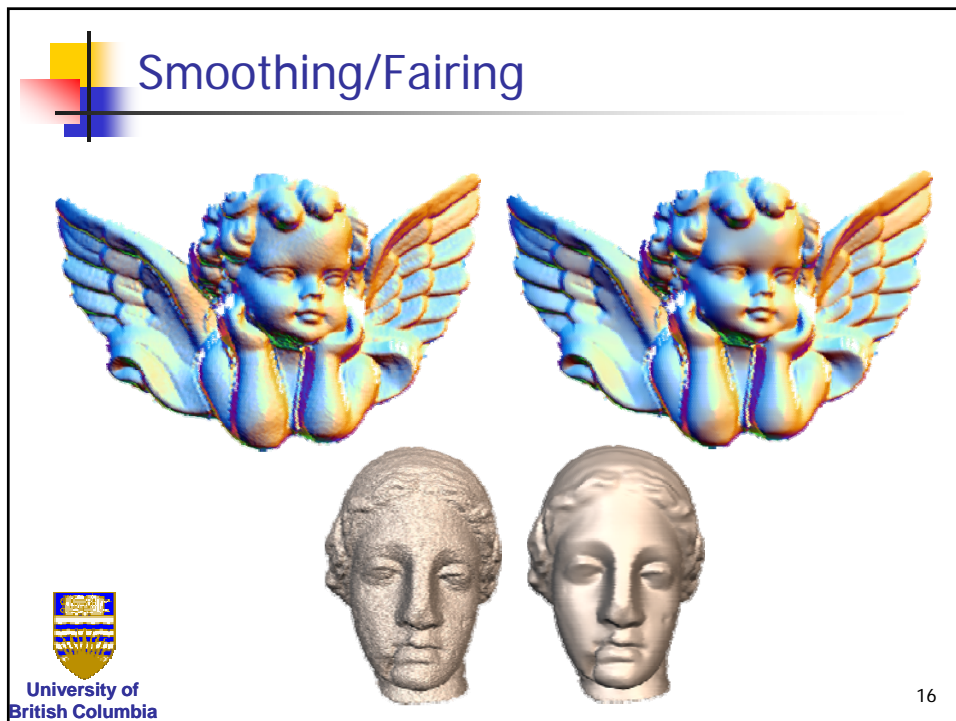
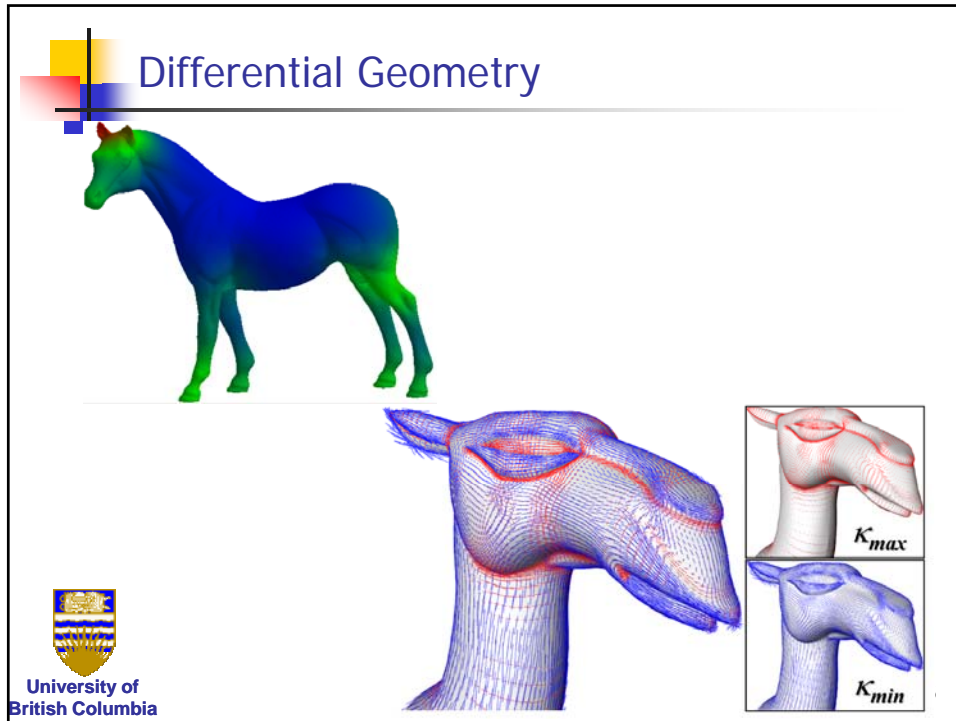
Syllabus (provisional)

1. Intro to meshes – terminology, topology, etc..	7. Parameterization & its applications
2. Simplification	8. Meshing & Remeshing
3. Deformation/Editing	9. Reconstruction
4. Differential geometry for meshes	10. Modeling
5. Smoothing/Fairing	11. Analysis
	12. Subdivision

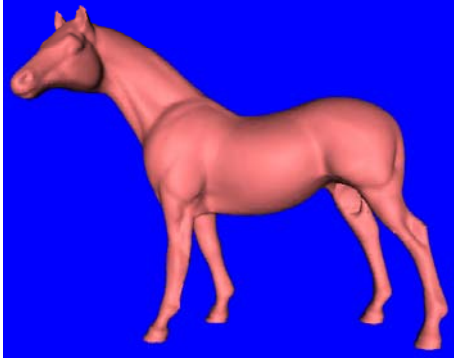


12






Mesh Compression




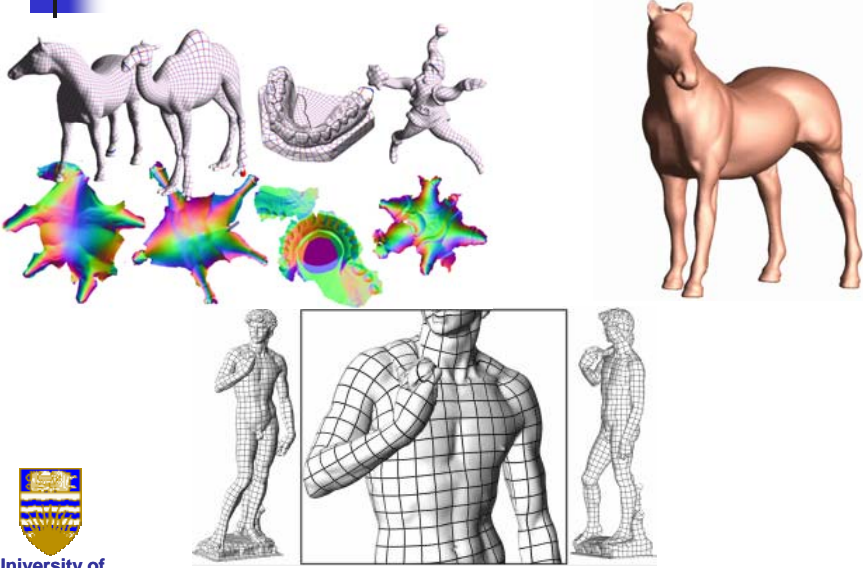
VRML = 200K, zipped VRML = 70K, compressed = 15K



University of British Columbia

17

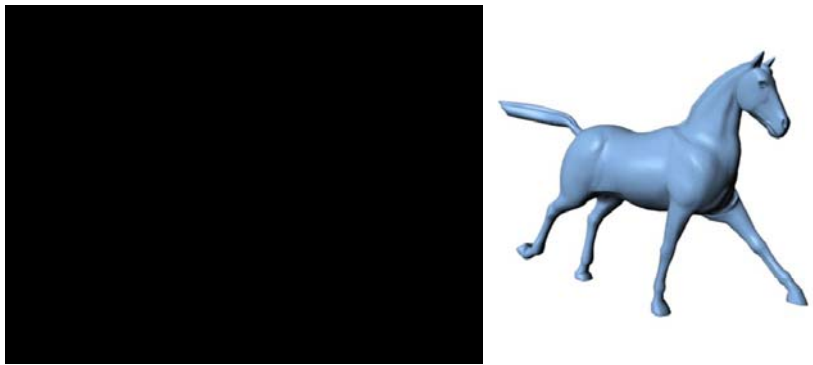
Parameterization




University of British Columbia

18

Morphing/Properties Transfer



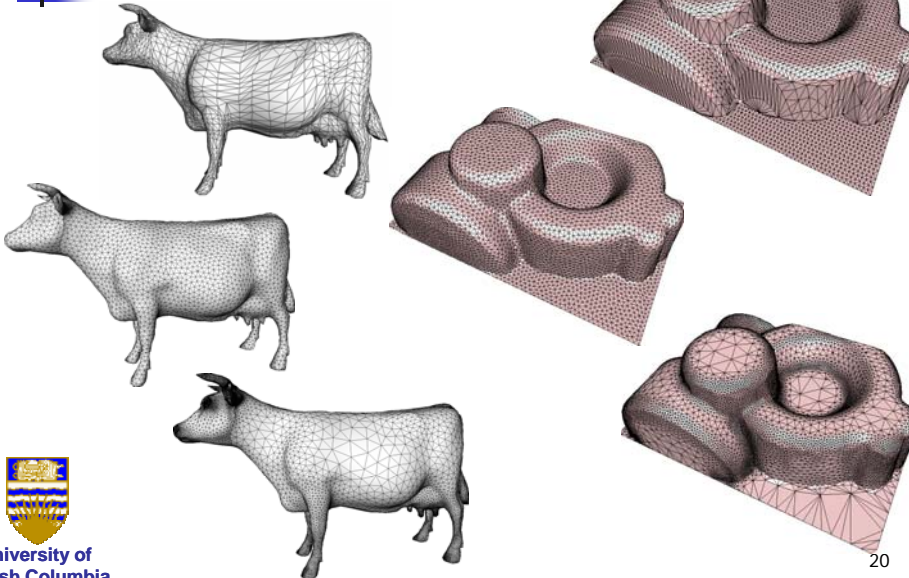
The slide features a title 'Morphing/Properties Transfer' with a decorative graphic of overlapping colored squares (yellow, red, blue) to its left. Below the title, there is a large black square on the left and a 3D rendered horse model on the right, illustrating the concept of transferring properties from one shape to another.




University of British Columbia

19

Remeshing





The slide features a title 'Remeshing' with a decorative graphic of overlapping colored squares (yellow, red, blue) to its left. Below the title, there are three wireframe cow models on the left and three corresponding remeshed cow models on the right, demonstrating how the mesh density of a 3D object can be adjusted.




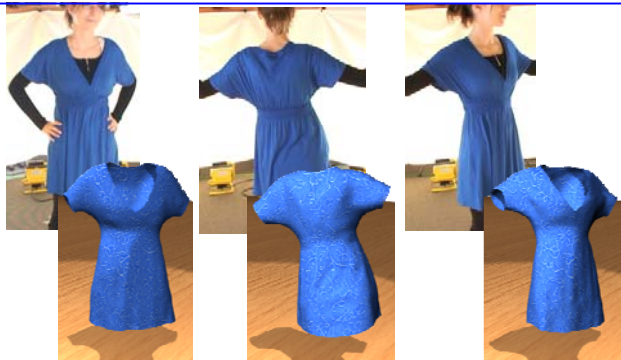
University of British Columbia


20

Reconstruction

	
Female	
Platform:	WB4
Scanhead:	WB4
Number of Polygons:	243,442
Scan Time:	16 Seconds
Number of Scans:	1







University of British Columbia


21

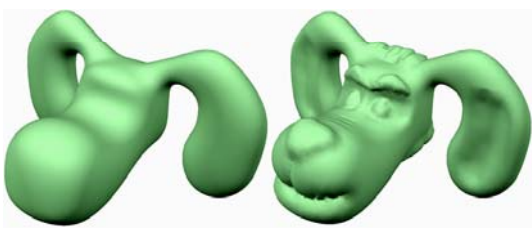
Modeling




(a) (b) (c) (d)










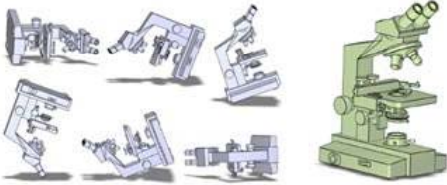
University of British Columbia

22

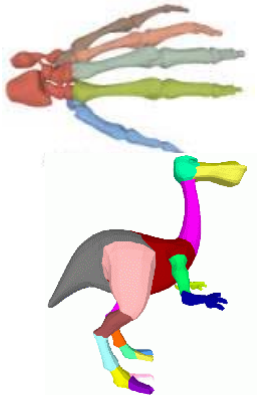
Analysis




Matching



Orientation/View Selection




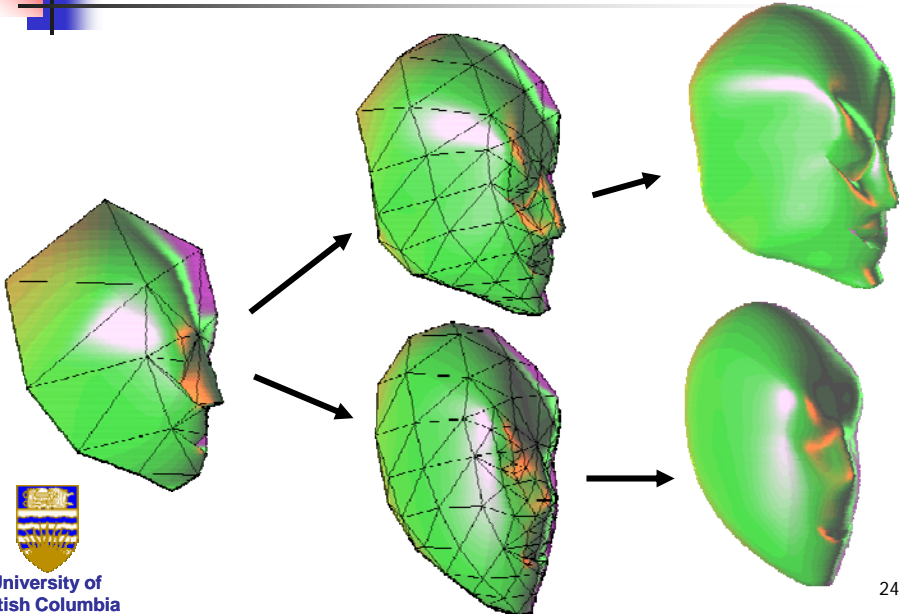
Segmentation



University of British Columbia

23

Subdivision



University of British Columbia

24



As-rigid-as possible frogs

- Source material:
 - <http://www-ui.is.s.u-tokyo.ac.jp/~takeo/research/rigid/index.html>
 - <http://igl.ethz.ch/projects/ARAP/>



University of
British Columbia

25