CS3451, Graphics

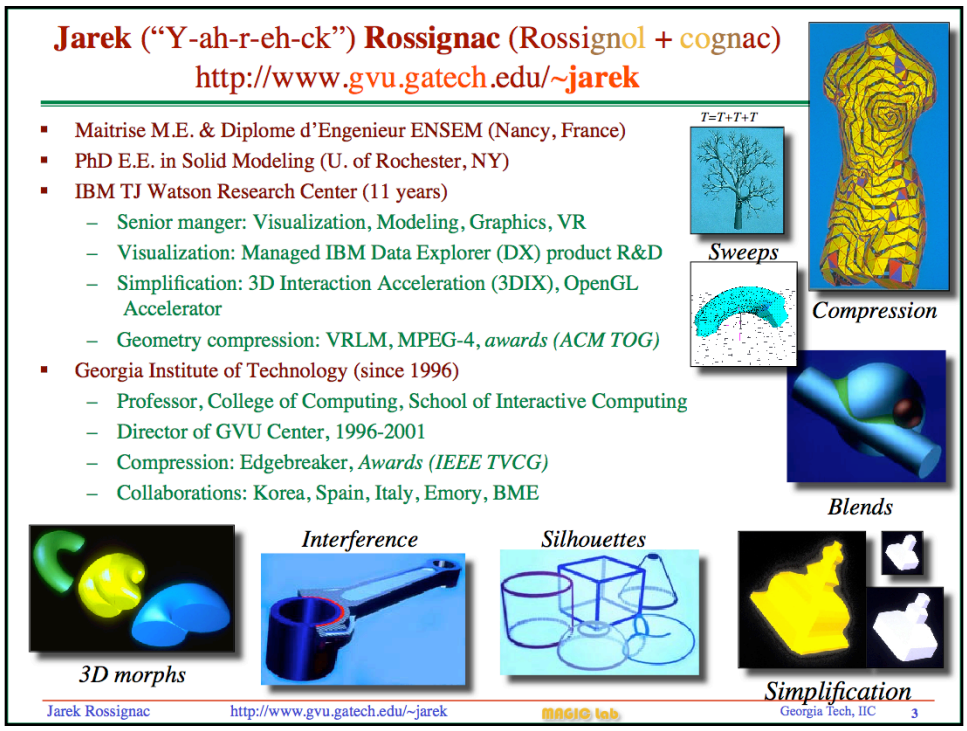
Georgia Tech College of Computing
Interactive & Intelligent Computing

- Course objectives
- Instructor
- Rules & expectations
- Resources
- Processing
- Projects

Course objectives and philosophy

- The course is **NOT** teaching
  - The skill or processes of artistic content creation
  - The use of commercial CAD or animation packages
- It teaches the **mathematical** and **algorithmic** foundations of
  - Geometric modeling in 2D and in 3D, Graphics, and Animation

  so that you can invent, design, implement, and test new techniques that help artists, players, engineers, scientists.
- Side benefits
  - Practice your **math** and **programming skills**
  - Understand **why** things are done this way
  - Learn **critical** thinking and mathematical **rigor**
  - Develop **intuition** and algorithmic **problem solving** abilities
  - Practice **communication** and **teamwork** skills


Jarek ("Y-ah-r-eh-ck") Rossignac (Rossignol + cognac)
http://www.gvu.gatech.edu/~jarek
Maitrise M.E. & Diplome d'Engenieur ENSEM (Nancy, France)
PhD E.E. in Solid Modeling (U. of Rochester, NY)
IBM TJ Watson Research Center (11 years)
Senior manger: Visualization, Modeling, Graphics, VR
Visualization: Managed IBM Data Explorer (DX) product R&D
Simplification: 3D Interaction Acceleration (3DIX), OpenGL Accelerator
Geometry compression: VRLM, MPEG-4, awards (ACM TOG)
Georgia Institute of Technology (since 1996)
Professor, College of Computing, School of Interactive Computing
Director of GVU Center, 1996-2001
Compression: Edgebreaker, Awards (IEEE TVCG)
Collaborations: Korea, Spain, Italy, Emory, BME
T=T+T+T
Sweeps
Compression
Blends
3D morphs
Interference
Silhouettes
Simplification
Jarek Rossignac
http://www.gvu.gatech.edu/~jarek
MAGIC lab
Georgia Tech, IIC
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Expectations

- Prerequisites
  - Solid **math** skills in linear algebra and calculus
  - Comfortable **programming** expertise (Processing, Java…)
- Expectations -- Students should
  - Attend every class
  - Active participation: exercises, answers, teamwork
  - Take lots of notes: Board, discussions…
  - Study a lot for before and after lecture: slides, your notes, readings
  - Implement projects early and alocate time for the write-up
  - Plan to spend 12 hrs / week on this class

Test 01

On separate sheet write the following (8 mns):

- "CS3451 Fall 2011 Test 01"
- First and LAST name
- Program (CS, CM…):
- Year (3rd, 4th…):
- Your favorite programming **language** (Java, Processing…):
- Most complex **pgm** that you have written by yourself:
  # loc, what it did
- Dot product (1,2)•(5,3) =
- Write (in seudo-code) a simple program to do the following:

```
Array int[] A = {32, 4, 6…};  // Input: contains n integers.
int S;                        // Output: the sum of the largest two.
```

Grading Policy

- 40% : 4 Individual Projects (programming and write up)
- 20% : 1 team project
- 40% : 3 Midterms (10/10/20) (closed books, cheat-sheet)
- bonus : Pop Quizzes (on past, current, and next class)
- No Final

Syllabus (may evolve)

Lecture	Content	Project	Date	Textbook se
1.	Course outline, Processing, Neville, Project 1A	P1	Aug 23, Tu	
2.	Curves, animation, surfaces: parabola, Bezier, b-spline.	P1	Aug 25, Th	2.5, 15
3.	Polyline sampling smoothing, subdivision. Project 1B	P1	Aug 30, Tu	
4.	Points, vectors, frame changes, motions, matrices	P1	Sep 01, Th	2.4,2.7,5,6,17
5.	Primitives (edge, triangle, circle), represent, intersect. Project 2	P2	Sep 06, Tu	
6.	Polygon: definition, inclusion, intersection, area, moment	P2	Sep 08, Th	
7.	Curvature and Minkowski morphs	P2	Sep 13, Tu	
8.	Physics, free fall, collision detection, elastic shock	P2	Sep 15, Th	
9.	*Review*		Sep 20, Tu	
10.	MIDTERM 1 (10)	P3	Sep 22, Th	
11.	3D geometry: cross, mixed, frames, matrices, motions	P3	Sep 27, Tu	
12.	3D graphics in Processing: shapes, camera, lighting, transforms	P3	Sep 29, Th	
13.	Pipeline: perspective, rasterization, z-buffer, textures	P3	Oct 03, Tu	3,7,8,11
14.	GPU: architecture, shaders, capabilities and applications	P4	Oct 06, Th	18
15.	Triangle meshes, Corner Table, topology, Euler equation	P4	Oct 11, Tu	12
16.	Normals, components, holes, silhouettes	P4	Oct 13, Th	
17.	Smoothing, subdivision, geodesic walk, isolation, skeletons	P4	Oct 18, Tu	
18.	*Review*		Oct 20, Th	
19.	MIDTERM 2 (10)	P5	Oct 25, Tu	
20.	Guest lecture	P5	Oct 27, Th	
21.	Arrangements, Delaunay, Voronoi	P5	Nov 01, Tu	
22.	BSP, CSG	P5	Nov 03, Th	12.4
23.	Morphology, distances, MAT, rounding	P5	Nov 08, Tu	
24.	Motion, warping, bending, skinning, IO	P5	Nov 10, Th	16
25.	Light, reflection, ray tracing, photorealism	P5	Nov 15, Tu	4,10,13,20,24
26.	Shadows, Visibility	P5	Nov 17, Th	
27.	Perception, color, optical illusions		Nov 22, Tu	21,22
28.	*Review*		Nov 29, Tu	
29.	MIDTERM 3 (20)		Dec 01, Th	
30.	*Project presentations*		Dec 06, Tu	
31.	*Project presentations*		Dec 08, Th	

Reference books

- Fundamentals of Computer Graphics. **Shirley (required)**
  - Great (detailed) introduction to geometry and rendering
- Processing: A Programming Handbook for Visual Designers and Artists, **Reas**, **Fry**
  - Detailed overview of programming and graphics in Processing
- Computational Geometry: Algorithms and Applications. **de Berg, van Kerveld, Overmars, Schwartzkopf**.
  - Efficient algorithms for convex hulls, Delaunay, Booleans, medial axis…
- Processing for Visual Artists: How to Create Expressive Images and Interactive Art. **Glassner**.
  - Project-based intro to programming in Processing (more for artist)

Projects guidelines and deliverables

- Ethics
  - **Not** OK to copy code or answers from other students or teams
  - It is OK to look at material posted, published, or provided for class
    - **Cite** clearly all sources of inspiration for your code and your write-up
    - Strive to improve them: produce an original, compact and elegant solution
  - Demonstrate ability to finish a small project
    - No extension, no excuse (start early and plan for possible problems)
- Deliverable **code**
  - Working sketch (submit through T-square)
    - Short and simple source code (points for elegance and conciseness)
    - Comments where needed (brief, clear, useful)
- Deliverable **report**
  - Header: CS3451 Fall 2011 Project X, First Last name, your picture
  - Typed write-up (11 pts font): Short, concise, formal
  - State assignment and your answers
    - Demonstrate in-depth understanding of a topic
    - Explain what you have implemented, how, and why
    - Explain what does not work and why (suggest possible fixes)
    - Reference sources
  - **BRING PRINTED COPY TO CLASS ON DUE DATE**

Web site for the course

Most material will be distributed through T-square:
https://t-square.gatech.edu/portal

Additional material is available at:
http://www.gvu.gatech.edu/~jarek/graphics
- Slides, Reading, Links, Code examples, Resources

TAs

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- Hernan Liatis (hliatis3@mail.gatech.edu)
- Jacob Pike (jpike3@gatech.edu)