UNIVERSITY of OTAGO
Te Whare Wānanga o Otāgo
NEW ZEALAND
SAPERE AUDE

Multi-modal exploration of rugged digital terrain on mobile devices

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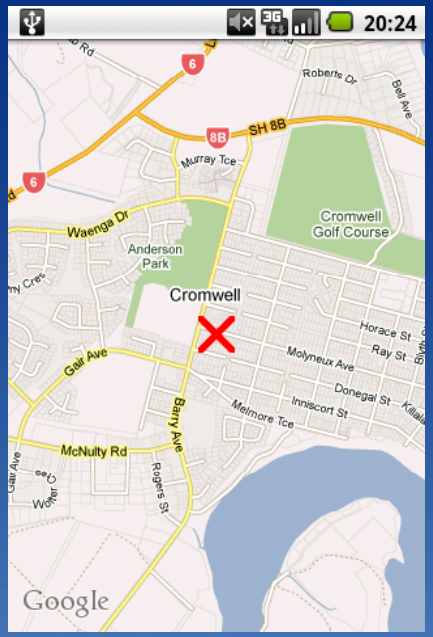
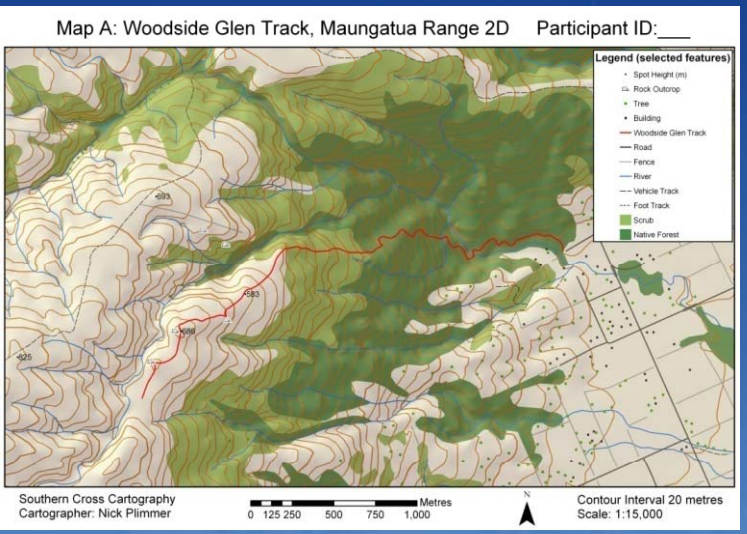
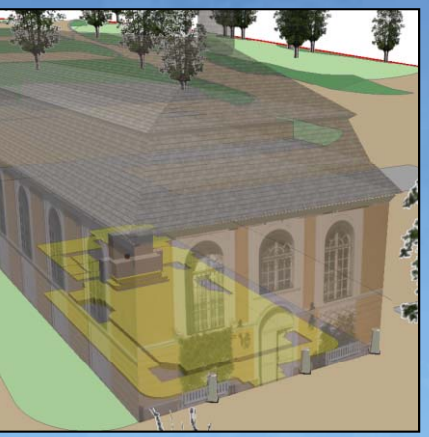
Overview

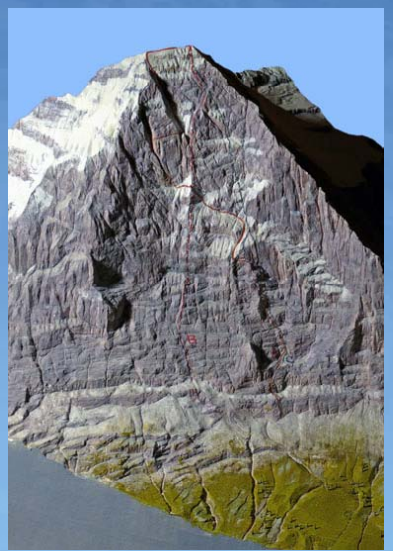
- Mobile devices are becoming dominant in digital map display (tablets too)
  - Challenges of small map display, storage / processing limitations
  - Dominance of Google Maps / Earth

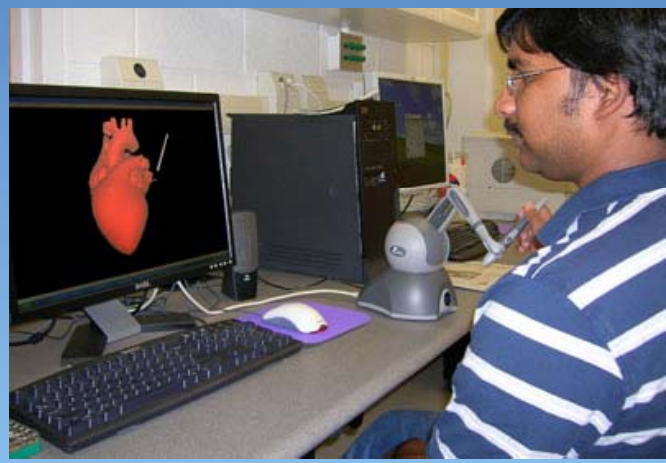


What about terrain?



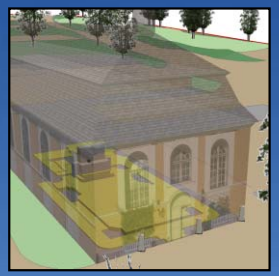




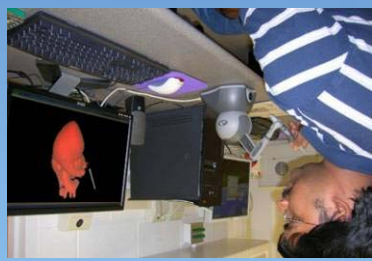


What do they not communicate?

- The look of a surface?

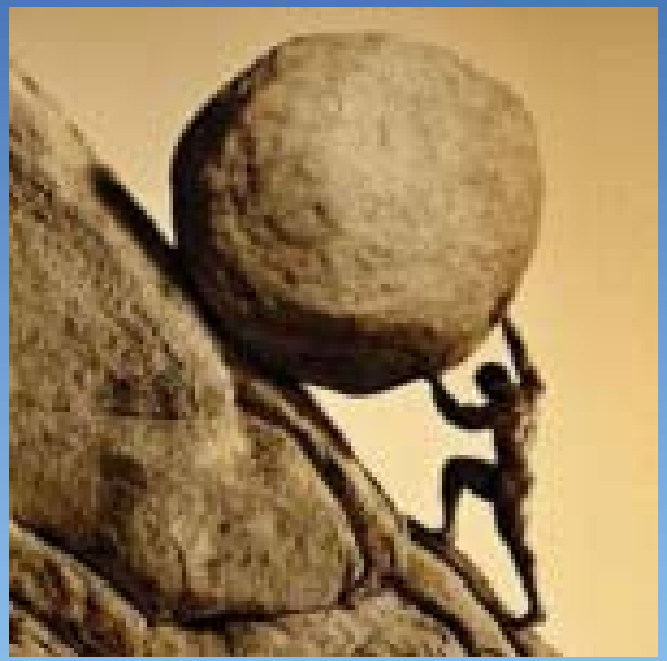


- The *feel* of a surface?



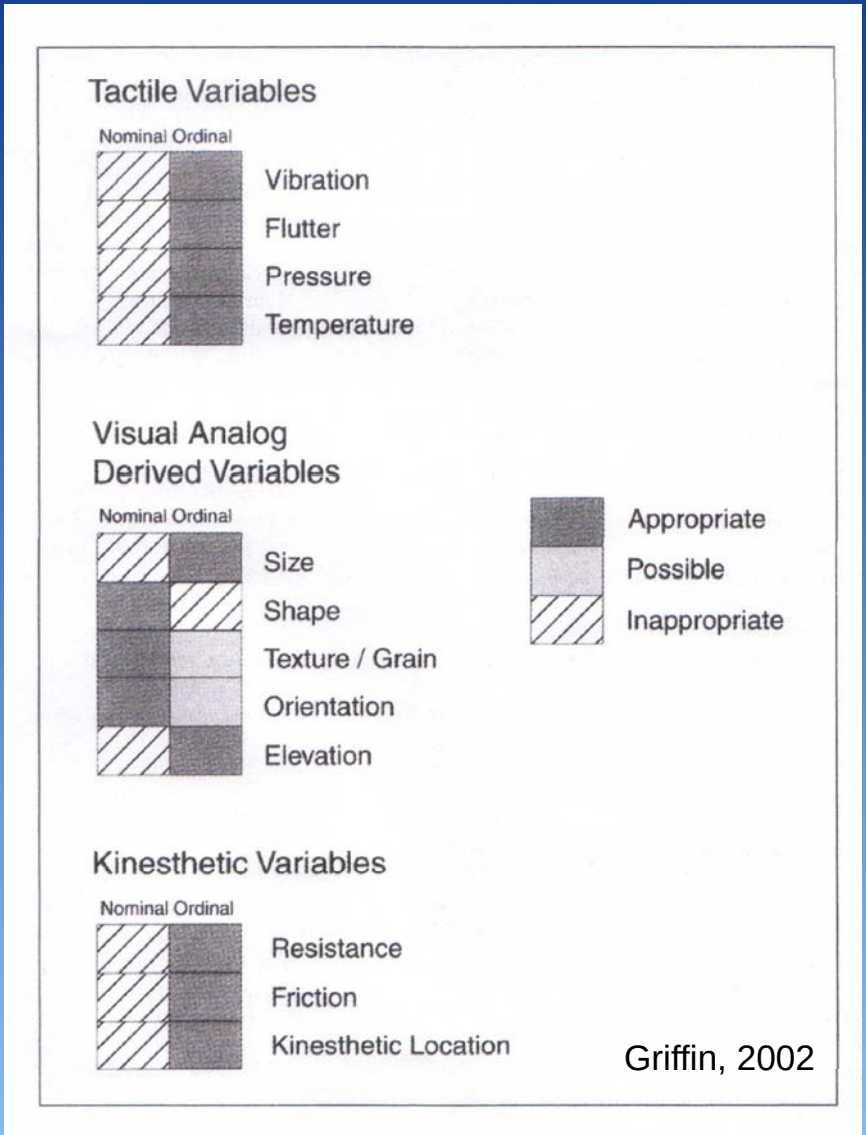
- Really?

Rolling ball examples



What about balls?

- Actively engaged with the data
- "Energy" spent to roll the ball
  - Gravity, momentum, force
- Sense of presence
  - A spherical avatar
- Haptic (and sound) feedback



Minimal Requirements

Graphics

- OpenGL ES 2.0 (graphics language)

  provides direct access to vertex and fragment shaders

Sensors

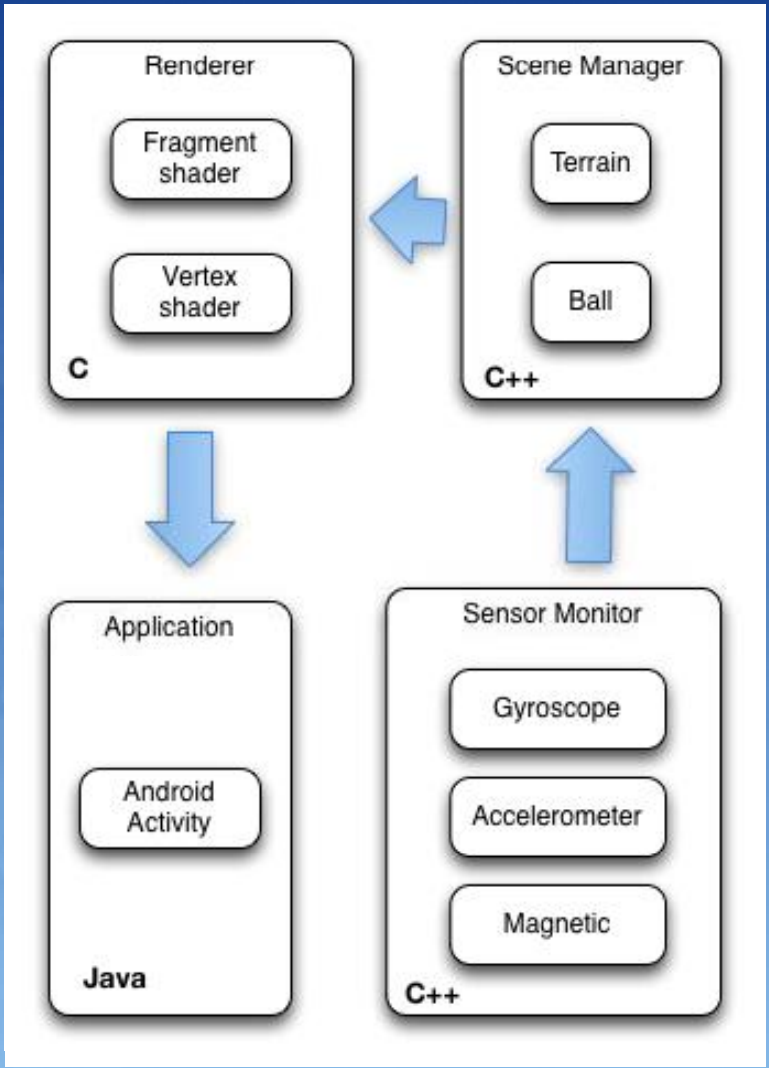
- Accelerometer / Gyroscope
- Magnetic sensor

  supported on modern Android/iOS smartphone & tablets

Development environment: software and hardware

- Android HTC Desire (2.3.7)
- Galaxy Nexus (4.1.1)
- Eclipse
- Android SDK and NDK
- GitHub version control
  (public version coming soon)

Architecture Diagram

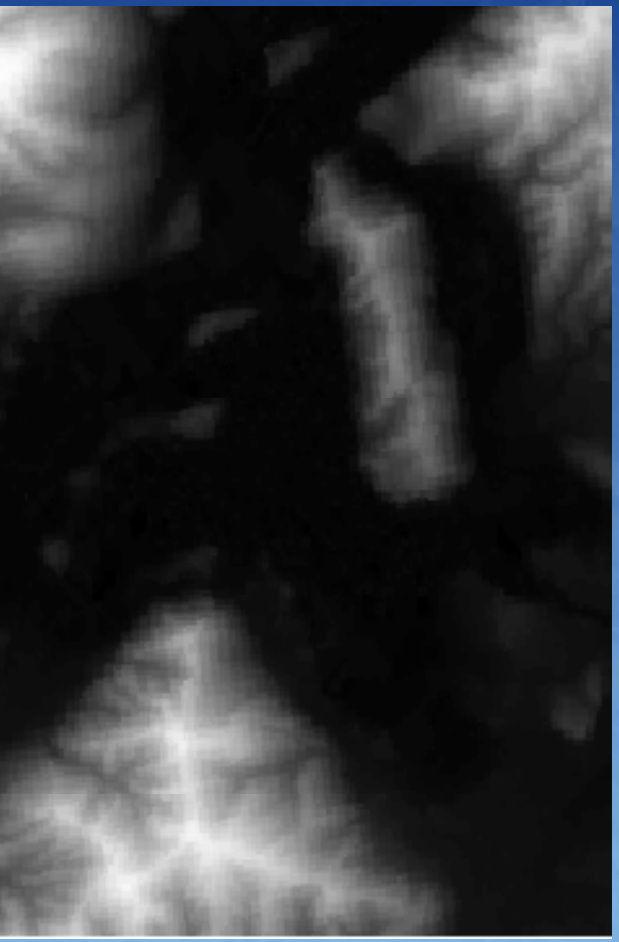
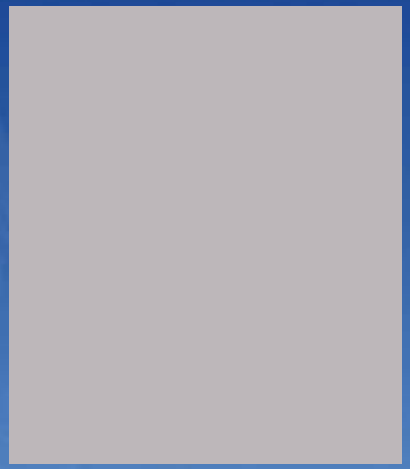


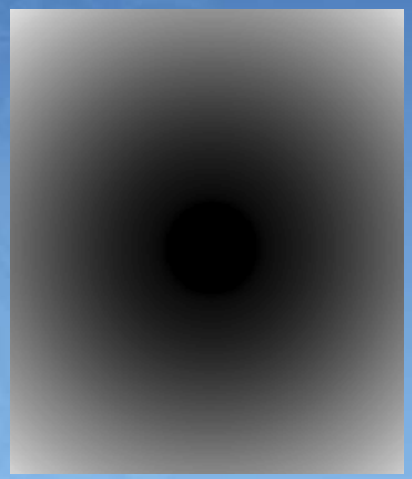
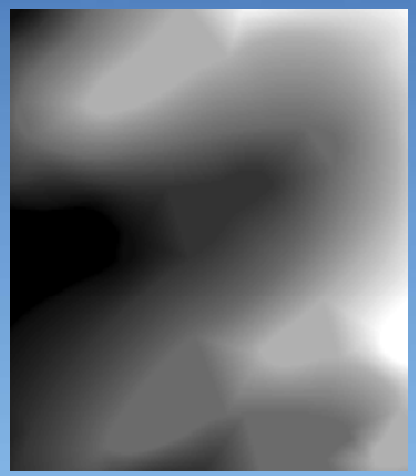
What goes on behind the scene

- **Sensors** feed data to the scene manager (C++)
- **Scene Manager**
  - prepares the scene objects
  - sets data for renderer in OpenGL rendering engine
- **Renderer** (mixed C and C++ code and Graphical Library Shader Language, GLSL)
  - Dynamically binds vertex and fragment shaders
  - renders the scene with a given perspective and lighting arrangements
- **Processors** internally perform
  - matrix manipulation, matrix algebra and geometry manipulation to create the scene out of triangles.
  - Lighting setup is already provided.
- **Application** is managed from Java through Android Activity, which sets the initial graphical context
- Textures and additional effects currently under development.

Screen shots

Data

Summary

- Richness of elevation not communicated?
- TerrainBall is tilting / twisting the terrain (the device) to roll the ball
- Haptic feedback to add to the visual
- Future testing on usability
- Where would you use this?
- Learning of terrain data – retention enhanced? (outdoor types, kids)
- Adding game like elements?