DARWIN-OP DRIVES

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Outline

- Conception
  - Why have a humanoid drive?
- Simulation
  - Interface challenges
  - Algorithm prototyping
- Realization
  - The Robot and the Roomba

Concept

- Humans have developed countless tools to extend our capabilities. With the ability to use these same tools, humanoids can become our most versatile invention yet.

Autonomous vehicles

- Why do *we* drive?
  - Go further, faster
  - Traverse the roughest terrains
  - Carry more stuff
- Why Autonomy?
  - Safety
    - Eliminate *human* error
  - Convenience
    - Drop-off, pick-up, chauffeur
  - Optimization
    - Traffic, time, gas

Current Efforts

- DARPA Grand / Urban Challenge
- Google's driverless car, etc.
  - One car outfitted with many sensors
  - Tested and tuned
  - Car type chosen for specific application

Why have a humanoid drive?

- Adaptability
  - **Form -** our world was built for us
    - Able to use our tools in our environment
  - **Multi-use** - drive to a destination and perform a task
  - **Learning** - adapt to different cars
  - **Hardware** - changes to vehicle not necessary

Our Solution...

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DARwIn-OP Humanoid Application Challenge ICRA 2012

Brittany Killen, Sun Chunyang,
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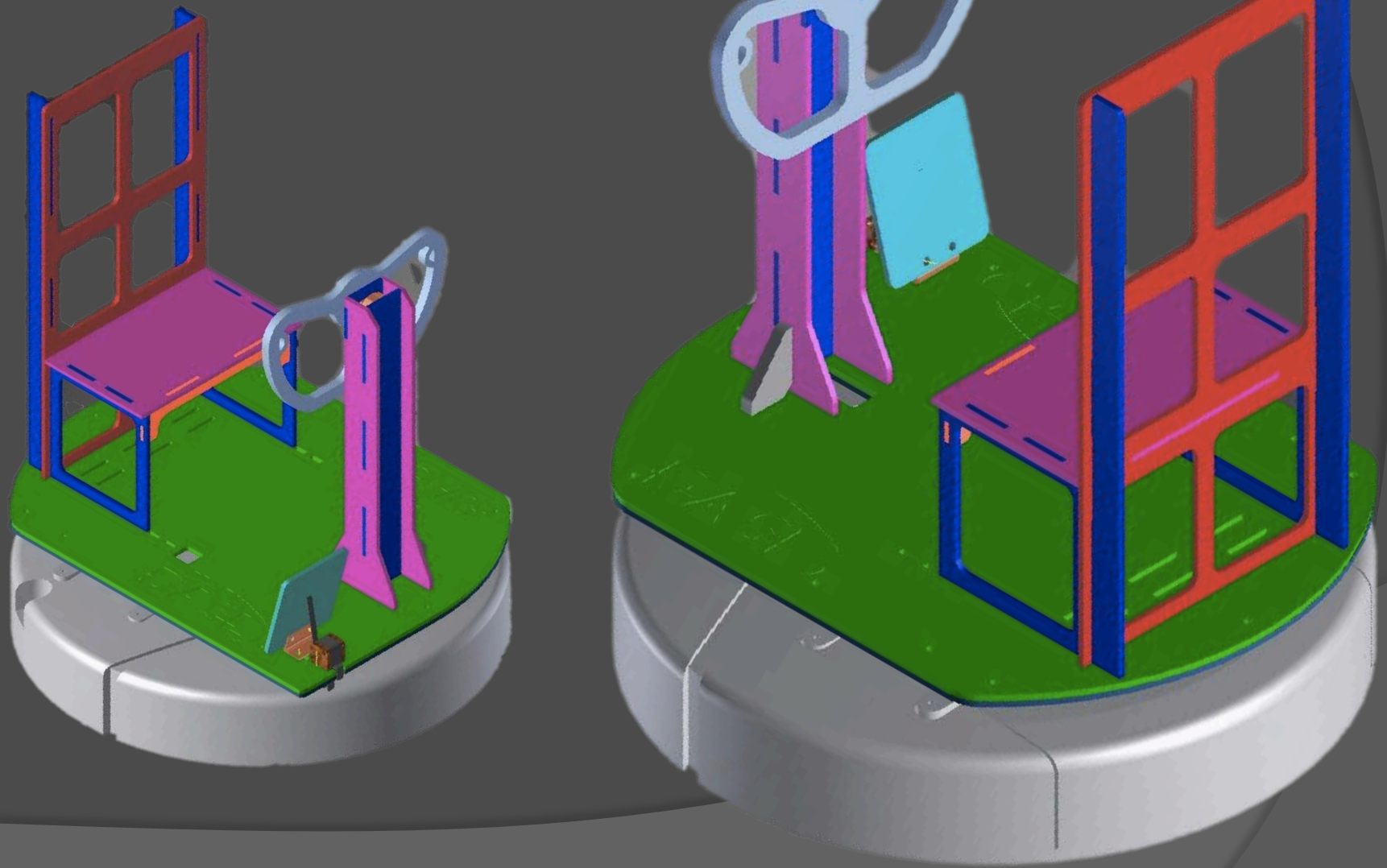
Drexel Autonomous Systems Lab

The real thing…

- DARwIn-OP remains unmodified
  - Vision Processing
  - Steering controller outputs arm movement
  - Foot puts the pedal to the metal

- iRobot Create (vehicle)
  - Differential Drive with Atmel
    - Digital I/O
    - A/D
  - Laser-cut acrylic steering wheel, seat & pedal
  - Potentiometer controls angular velocity
  - Gas pedal controls forward velocity (1/0)

The real thing...

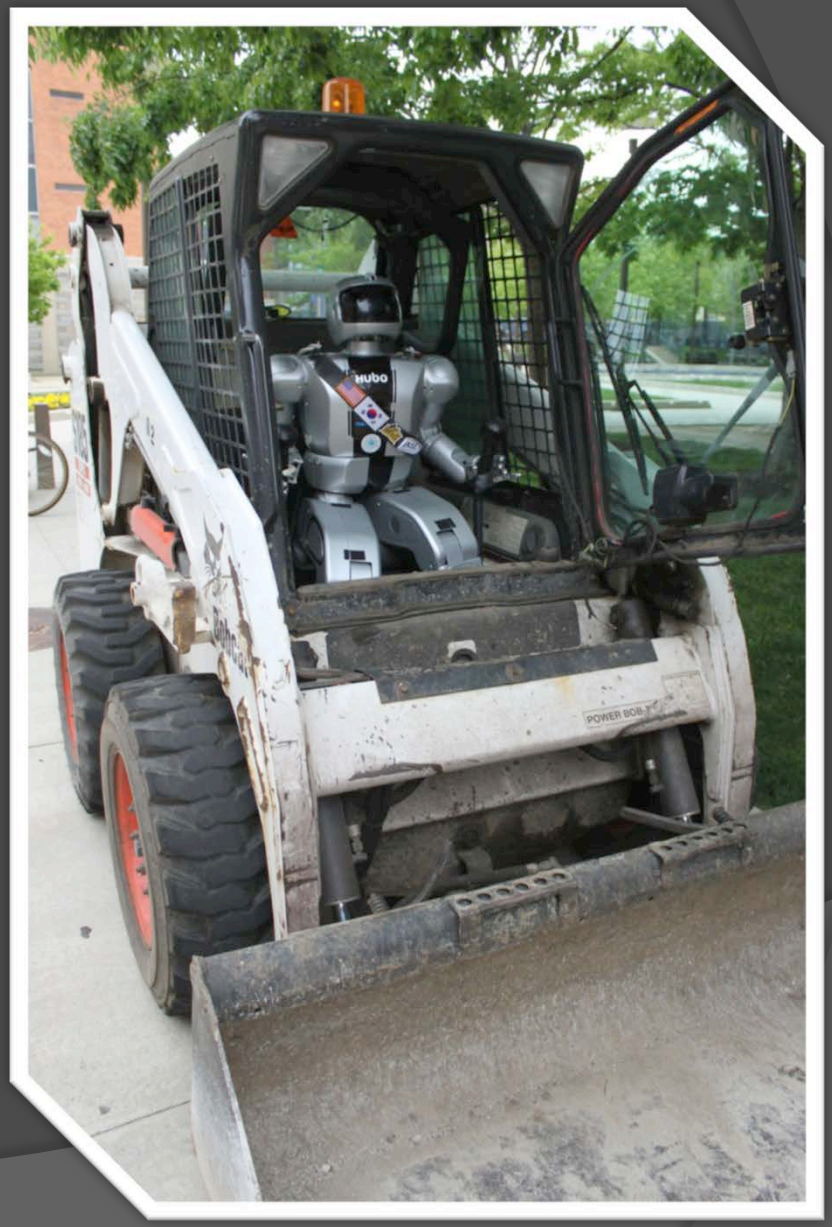


The real thing…

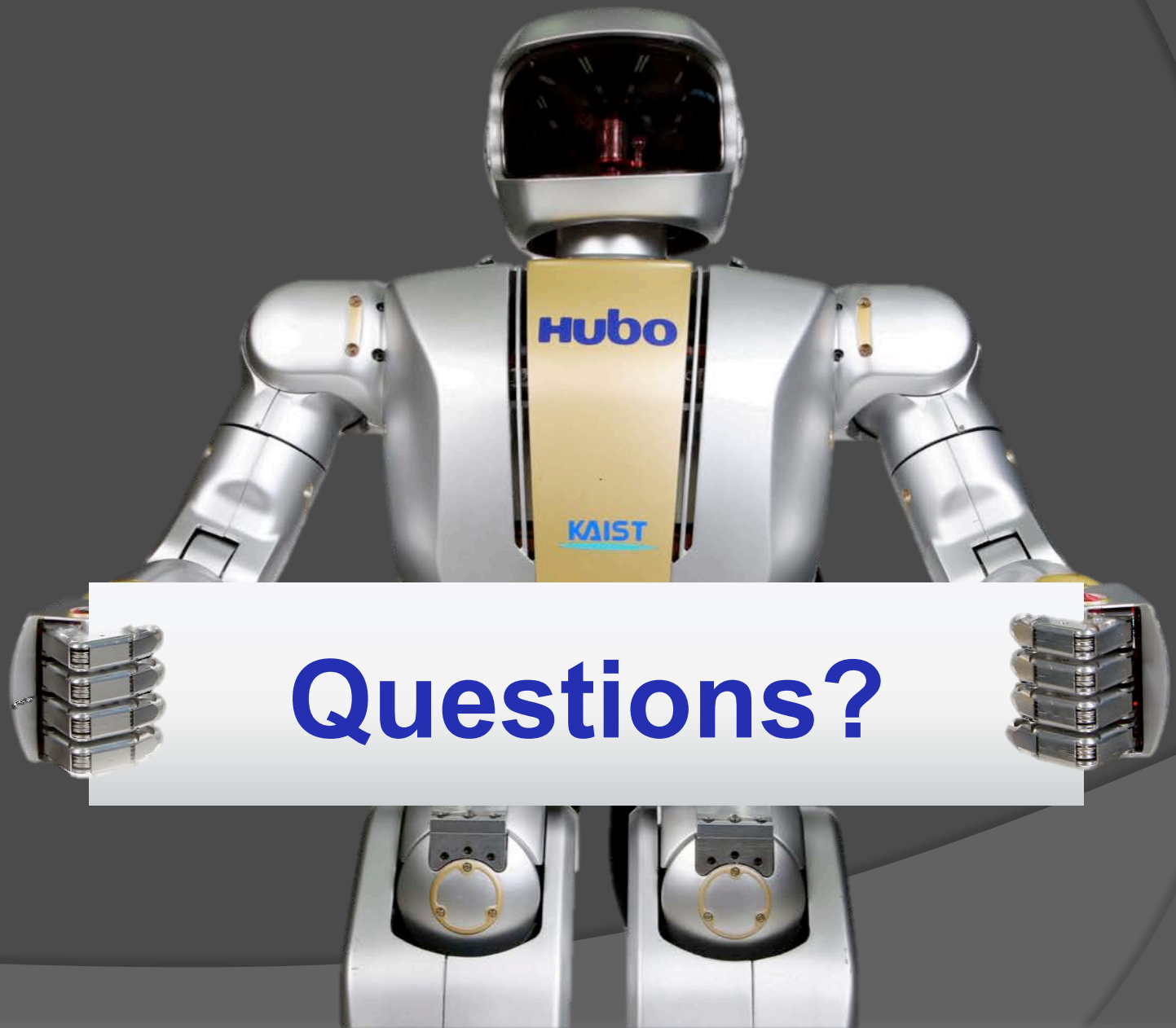
- DARwIn's Arms
  - IK for movement in the steering plane
  - PD control
  - Elastic constraint to steering wheel
- DARwIn's Eyes
  - Road and Blob following
  - Image processing
    - HSV segmentation
    - Erode and dilate
    - Image projection

What's next?

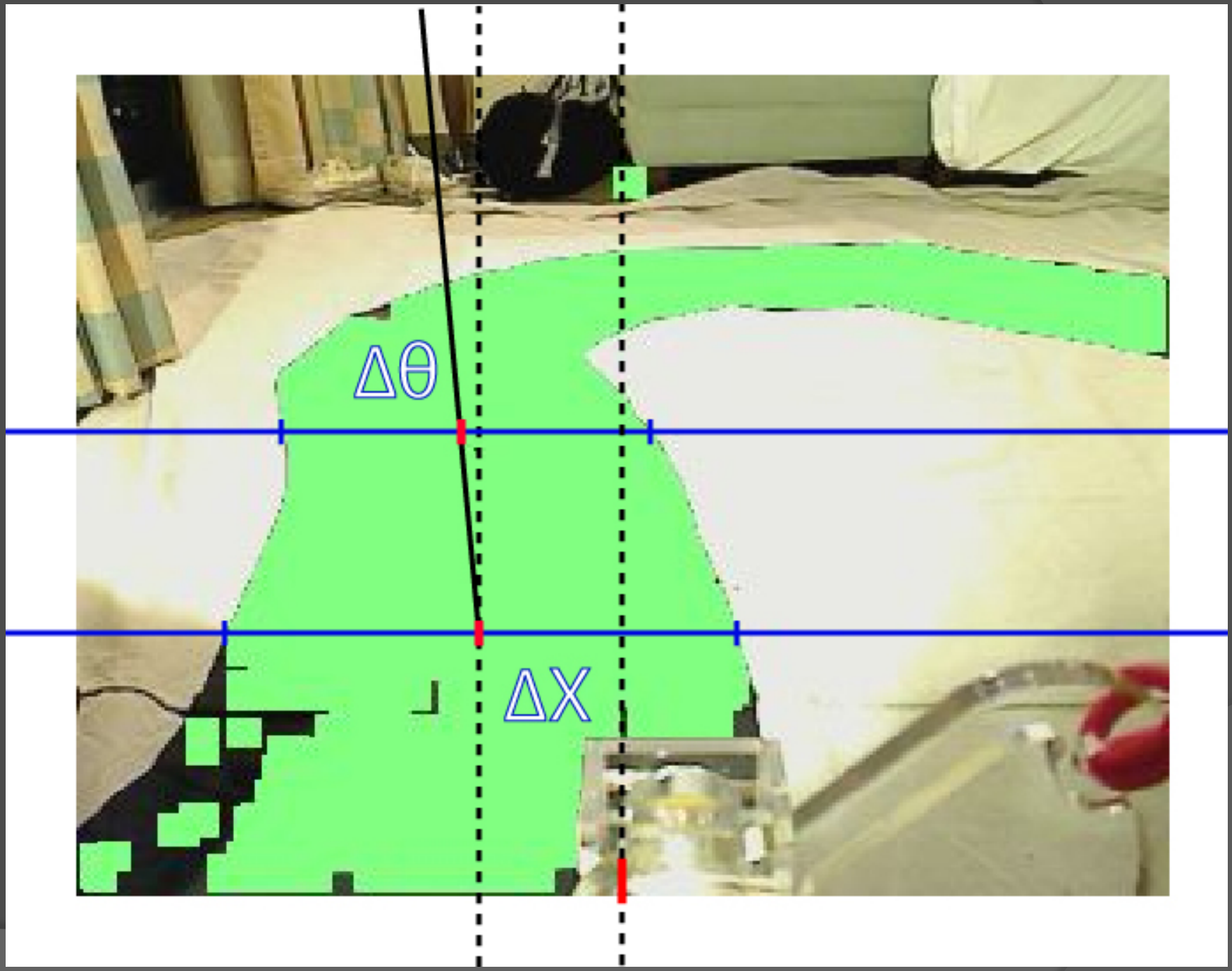
- DARPA Research Challenge
- Sensory Augmentation (e.g. Blind)



Thanks!



Questions?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Inspiration