

Football Robotics

Challenges and Opportunities

Skip Horvath

Robotic Football Concept

- Begin Modestly
 - ND only
 - Attempt intramural robotic football competition
 - Establish competition parameters
- Present to New Dean
- Gauge Student and Faculty Interest

IDENTIFYING NEEDS

- Identify Faculty Sponsor
- Gauge Student Interest
- Have Something to Present to New Dean of Engineering by January 2008
- Provide for Non-Engineering *Human* Interest

3

ACADEMICS

1. Offer Robotic Football Option in Senior Capstone Design Courses
 - Build in opportunity for cooperative ME-EE work
2. Explore Use of First-year Course to Identify Interested Students
 - Potential to participate in first intercollegiate effort before graduation

4

TECHNOLOGY READY NOW

- Hardware
 - Robo-One (fighting robots)
 - Plen (bipedal, skating & dancing robot)
 - iRobot Create Challenge
 - Lego Mindstorm (robotic kits)
- Software—Microsoft Initiative
- Robotic Competitions Causing Rapid Innovation
 - X Prize
 - DARPA Grand Challenge (NC State in finals)

5



NC State Robotic (Driverless) Car in Finals

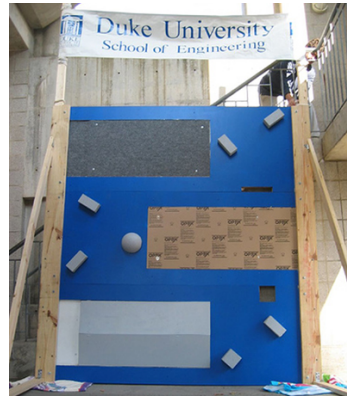
6



Robo Cup Soccer



RoboCross Baseball-Hitter



Duke Robo-Climb

7

ISSUES NEEDING EARLY RESOLUTION

- A. Humanoid v. Functional
- B. Human Controllers v. Artificial Intelligence
- C. Mimic Football Rules or Evolve Football Rules

8

HUMANOID v. FUNCTIONAL

- Humanoid
 - Various Models Perform Complex Activities
 - Kabuki Dancing (synchronized)
 - Acrobatics
 - **But** Requires Considerable Energy Just for Bipedal Balance; Must Self-Right
 - Relatively Expensive
- Functional
 - Low Center of Gravity Ensures Stability
 - **But** Must Establish Human Connection
 - Relatively Inexpensive

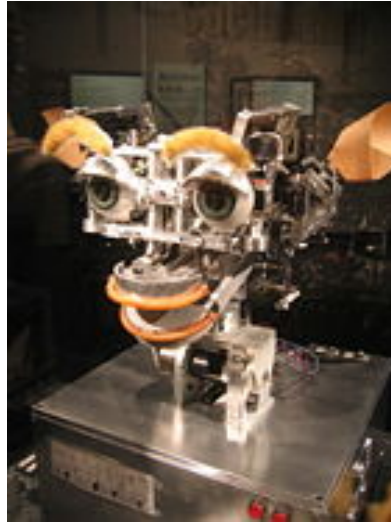


9

HUMAN v. ARTIFICIAL INTELLIGENCE

- Remote-Controlled Players
 - Reduces Software Development Needs
 - Human Interest Focused on Controllers or Robots
- Autonomous Players
 - Requires Sophisticated Software & Sensors, Whether Instructions Self-Contained or Broadcast
 - Robots Themselves Must Generate Human Interest

10



Kismet

11

MIMIC v. EVOLVE RULES

- **Mimic—Try to Duplicate Game of Football As Fast As Possible**
 - Start with Modern Football Rules
 - Simplify only when necessary
 - Inject passing, field goals, etc. as technology permits
- **Evolve—Begin with Football circa 1869**
 - Team with Ball Must Run to End Zone
 - Allow Game to Evolve as Innovators Dictate in Competition

12

WHO DECIDES?

- Hold Series of Meetings over Next Two Years
 - ND Faculty sponsor(s) and undergrads/grads tackle issues
 - Trial exhibition game to occur when ready
- At End of Two-Year Period, Challenge Another School to Contest
 - Rules (race and blocking?)
 - # Units/team
 - Length of game time
 - Size, surface of field