Real Robots Don’t Drive Straight

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PEDAGOGICAL GOALS OF USING ROBOTS

- fun & engagement
- learning engineering
- learning AI

let's look at parallel challenges for engineering and AI educators

FEEDBACK: THE CENTRAL ENGINEERING CONCEPT

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don't forget autonomic processes, like maintaining body temperature, etc…

FEEDBACK IS INVISIBLE

We literally are not aware that we are doing it

Except when we are learning something new (or when perception breaks down)

- steering a bicycle
- swimming in a lane

STUDENTS DON'T BELIEVE IN FEEDBACK

- "omnicient robot fallacy"
- imperative programming
- "drunkard's walk" is an outlandish idea
- "why doesn't it drive straight?!"

IS A ROBOT A MACHINE OR A CREATURE?

it depends on how we frame the task…

CASE-WESTERN EGG HUNT CONTEST

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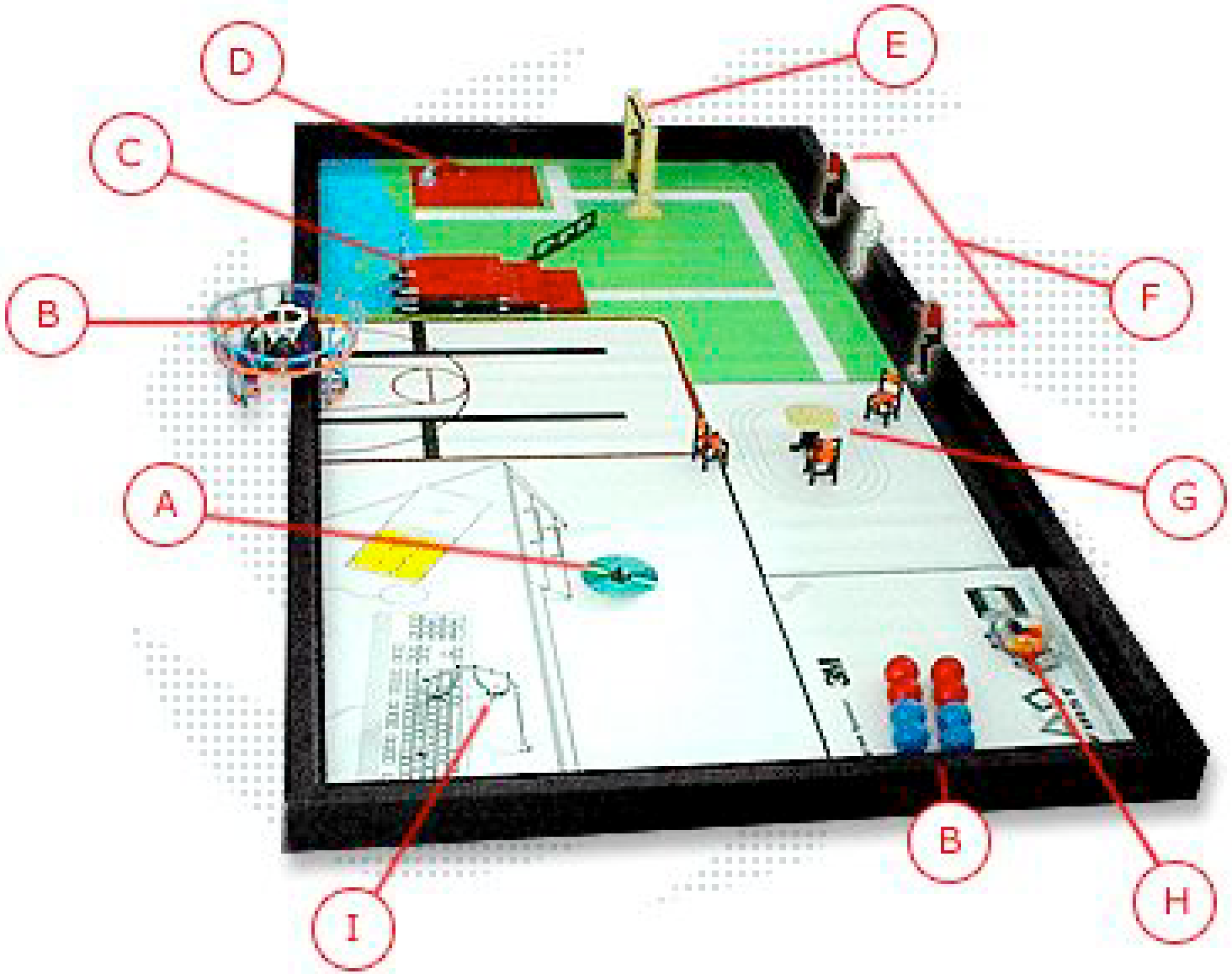
FIRST LEGO LEAGUE 2004 CONTEST



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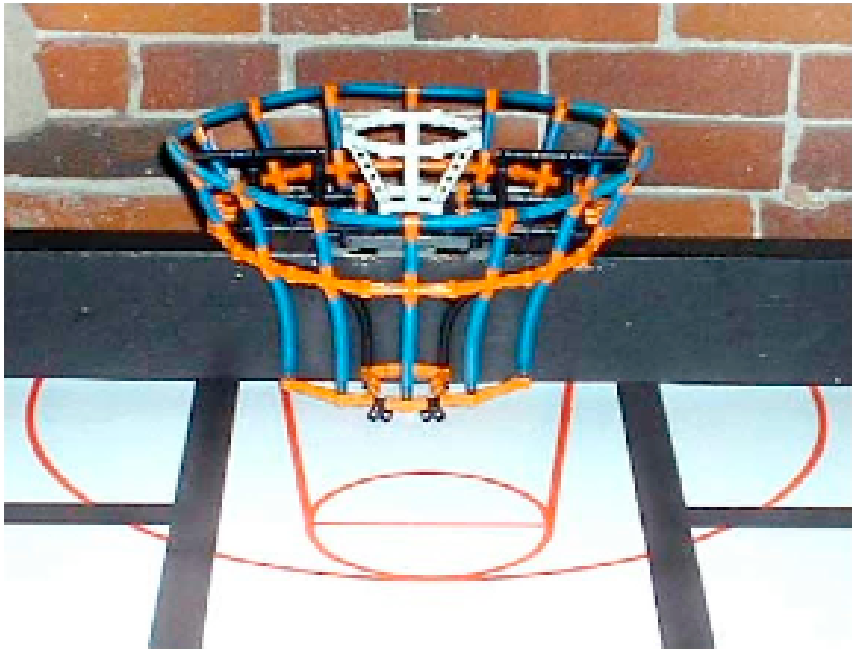
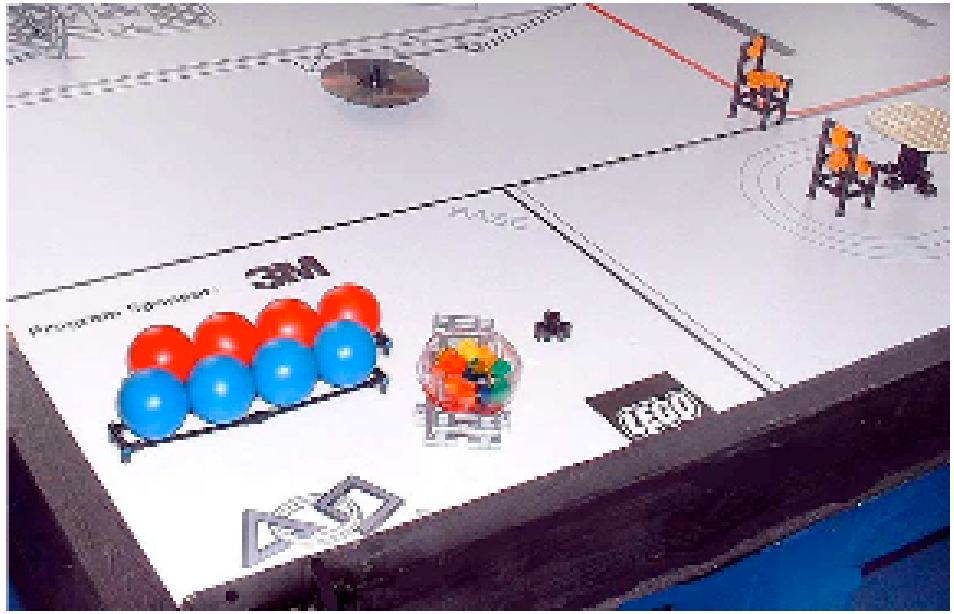
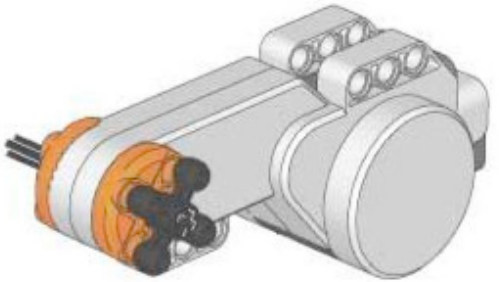
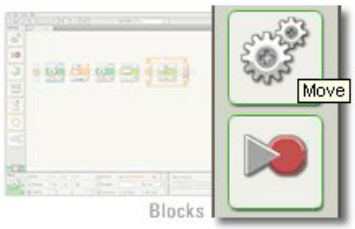




THE SOLUTION: MAKE DRIVING STRAIGHT A PRIMITIVE!

- add quad encdr to motor
- default motion cmd is in revolutions, not time
- can key together left & right motors





CURE WORSE THAN DISEASE

- much evidence that middle-schoolers understand conditionals and feedback when given good materials
- community learns over time
- these are kids' first intro to robotics

MOVING ON TO AI

- AI educators want to teach AI
- students have too much fun building
- students spend too much time debugging HW
- but…

AI & CLASSROOM ROBOTS: NOT SO MUCH?

- classical, knowledge-based AI assumes a perfectly represented world (e.g. search, expert systems, planning, game-playing)
- forcing it on sloppy classroom 'bots makes the AI look bad
- students might have fun & learn the AI, but do they believe in it?

NEWER AI ON ROBOTS: YES

- Greenwald and Artz's neural and Bayesian networks to process IR reflectance sensors (and extract signal from lots of noise)
- Thrun's probabilistic robotics
- and of course, Brooks' original provocation of reactive robots

REAL ROBOTS DON'T DRIVE STRAIGHT

- things that look straight aren't
- feedback is a powerful idea
- kids are smart -- let's not hold back the good stuff
- be creative to find AI that works well on sloppy systems