PCOs for a Lego Mindstorms Simulator

From time to time, @TheTestLab includes a Mindstorms Robot. We don't tell people exactly what it does, but it has wheels, a sensor pointing downwards, and a bunch of buttons.

I have built a robot simulator, to match some of the robot's behaviour.

In the TestLab at STAREast 2013, the RST trio* explored the simulator to build three individual Product Coverage Outlines.

They took about 30 minutes, worked together in public, and used their own machines and tools. Here are the unrevised PCOs they developed.

* RST teachers
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Simulator by:
James Lyndsay | @workroomprds | workroom-productions.com

Ask me for a copy of the simulator

Developed for use in NDS/Cisco workshops May 2013.
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TestLab: Mindstorms Robot Simulator for STAREast 2013
Press the orange button to start the robot
Click on the board to change colour
You can drag the robot when it's moving.
The square thing simulates the lego robot, and the round one was used in Paul Holland's session W2.

Lego Mindstorms Robot Simulator PCO

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TODO:
- test for state-based effects which may further inform the PCO
- go through the HTSM for potential new perspective
- compare this PCO with others, including Michael and Paul
- look at this on different platforms
- play with actual robot

Instructions

Board
- squares (25)
  - color
- actions
  - place robots
    - while robots are moving
  - configure board
    - configure squares

square robot
- dragging
- movement
  - state
    - moving
    - not moving
  - unit of movement
  - window of detection
- shape
- arrows
  - right
  - left
- color detector
  - what is the exact field of the the detector???
  - what about other colors??? What is the color tolerance???
  - can detect other robots???
- location
- orientation (360)
- rules
  - white = Don't Move
  - red = detector left one unit, orientation left 90 degrees
  - black = detector forward one unit, orientation left ninety degrees
  - blue = detector forward one unit, orientation left ninety degrees [same as black???]
  - green = detector right one unit, orientation 90 degrees right
  - yellow = forward one unit, orientation unchanged
  - grey = no movement
- color word display

context menu (inert???)

circle robot
- dragging
- movement
  - moving
  - not moving
- shape
- arrows
  - right
  - left
- color detector
- location
- orientation (360)
- rules
  - white = stop

states
- startup
- during animation
- post-animation
- overlapping robots

stuff (not part of PCO)
- refresh page
- no stop button???
- could I have more than one robot in the sim???

MindStorms Robot Sim

Platform

Browsers
- Chrome
- Firefox
- Internet Explorer — 🚩 ??? Appears not to start at all under I.E.

Flash Player
- On Chrome, version 11.4.402.278

Operations

Structure
- Web page source
- Flash source

Time

Function
- Clicking on square changes colour
- Robot (automatic): read reticle
- Robot (clicking) — Clicking on arrows rotates the robots 10 degrees clockwise or counterclockwise.
- Robot (dragging)
- Mousing — Changes icon to dragging hand when in the field and not on an object

Data

Problems

Risks

Bugs
- Apparent help icon doesn't provide much in the way of help.

Issues
- Don't have an external description of the product so far.
- ??? Appears to be running under Flash 11.7.700.179 on Chrome. Other versions?
- Under Firefox, a message appears on startup saying that the plugin is vulnerable and should be upgraded.
- ??? Click and drag isn't terribly responsive. Sometimes on dragging the square robot (so far) gets stuck.
- Clicking on the square robot causes the word "WHITE" to appear beneath, even when the robot is sitting on a non-white square.
- ??? Square robot appears to read undocumented "grey" when you place the reticle over bits of the round robot.
- Square robot reads all bits of the round robot as "grey" (including the orange button) except for the white square on it.

Subtopic

Test ideas
- Break down the underlying product with a Flash decompiler?
- Make sure that each robot reads each colour
- Based on memory, some colours cause different behaviour when AFTER other colours. Watch for sequences of squares.
- Also watch for different behaviours based on initial orientation.
- Compare behaviours of different robots

Interfaces

UI

Product

Text

Square thing
- Appears to be a simulation of one robot
- There circle at the top seems to be a kind of reticle

Arrows — Appear to be

Circular thing
- Appears to be a simulation of a different robot
- ??? Inconsistent with the first robot, no reticle

(Initially red) grid

Squares

####### Colours
- Red — Squarey: Move forward one square; rotate left
- Green — Squarey: Move forward one square; rotate right
- Yellow — Squarey: Move forward one square; stop
- White — Squarey: Stop
- Black — Squarey: Move forward one square, rotate left
- Blue — Squarey: Move forward one square, rotate left — ??? Why is this the same as black? I am suspicious.
- Grey (from other robot; see issues)

Robot appears to change behaviour based on colour under the reticle.

5 x 5

Spool logo
- ??? Mouseover displays Workroom Productions name
- Click and hold brings up general greetings — ??? Having to hold makes information hard to mark/transfer

Question mark (help?)
- ??? Mouseover changes to a different question mark.
- Clicking dims rest of UI, brings out

Clicking and dragging

Flash

Right-click
- Zoom in
- Zoom out
- Show all
- Quality
- Print
- Settings
- Global settings
- About Adobe Flash Player (versions)

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Product Coverage Outline for circular Lego Mindstorms Simulator

Problems
- After viewing the text from question mark, there is a flashing cursor on the bottom of screen

Issues
- When I click the question mark the text does not stay visible long enough to read. I must click and hold - not obvious
- Copyright date is 2012 in Workroom Productions information
- Displayed text is not always visible - does not change as background changes
- At one particular zoom level you can see white lines but not at other zoom levels

Time
- When exactly does it detect the color?
- Does sequence of colors matter?

Operation
- Orange button does not move robot if over white at start
- Robot stops when white is sensed
- Red - robot rotates CW then moves "forward" - toward arrows
- Green - robot rotates CW then moves "backward" - away from arrows
- Yellow - robot rotates 180 degrees then moves "forward" - toward arrows
- White - stops robot
- Black - robot rotates CCW then moves "forward" - toward arrows
- Blue - robot rotates CCW then moves "backward" - away from arrows

Platform
- different browsers
- Different OS
- PCs

Structure
- Not applicable

Function
- How does robot react to each color?
- Click and drag the robot

Data

Interface
- Boxes
  - Red
  - Green
  - Yellow
  - White
  - Blue
  } Available colors
  - 5x5 grid
- Question mark - Displays some text while clicked
- Workroom productions logo - Displays text when pressed
- Circular Robot
  - Arrows - appear to rotate robot
  - Orange start button
  - Sensor window - shows underlying color
  - Click and drag to relocate
    - Can move robot while it is active
  - Displays color in text when color is "sensed"