DEVOXX™ 4KIDS

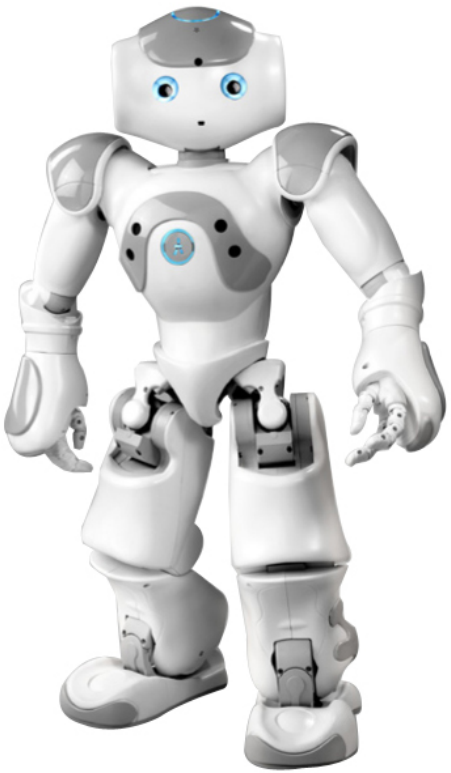
NAO

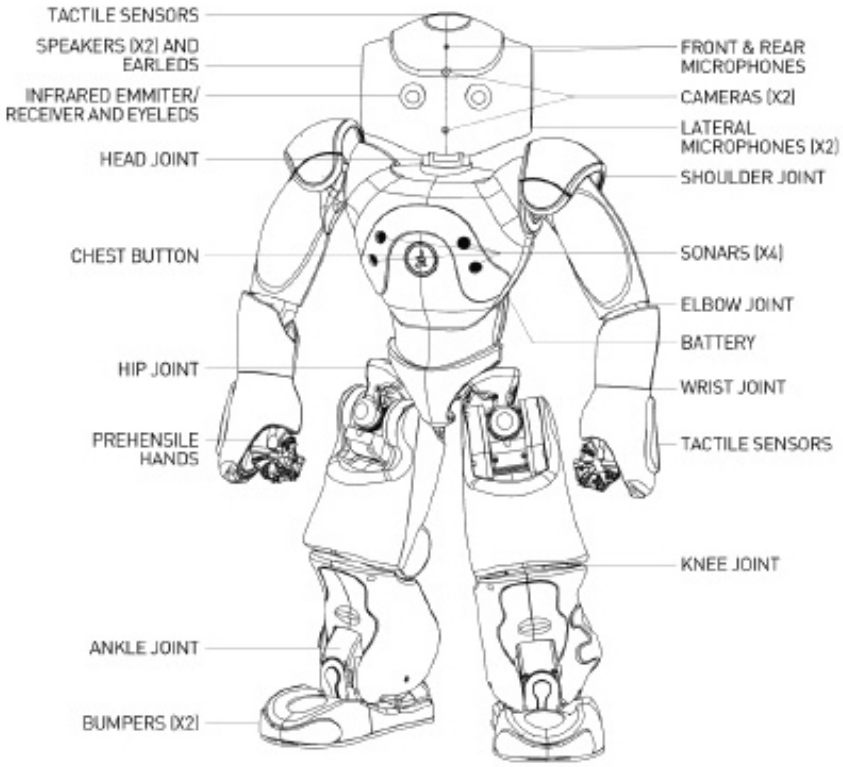
Programming a humanoid robot

www.devoxx4kids.org

Introducing NAO

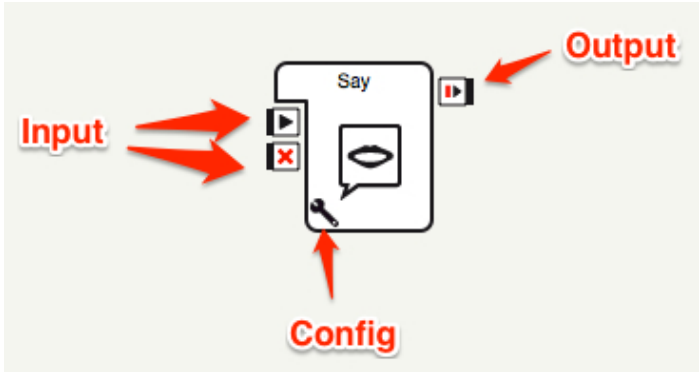
- But I'll let him introduce himself!





Choregraphe Software

- NAO Visual Programming
  - Allows users of NAO to create and edit simple movements and interactive behaviors.
- Demonstration



NAO's Mission

1. Make NAO walk towards you and stop in front of you.
2. NAO asks you to give him the ball and asks you where to put the ball.
3. NAO looks around and finds the place you identified.

4. NAO goes there, and places the ball down.

Preparation

- Start Choregraphe
- Create a new project
- Load the Library: Devoxx4Kids.cbl
- Place and configure boxes
  - Set Speech Language
  - Set Reco. Lang.
  - Tactile Head

- Connect the boxes to the starting point.

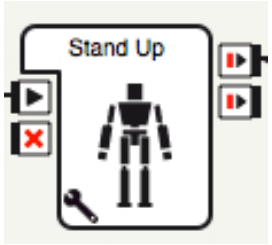
Exercise 1

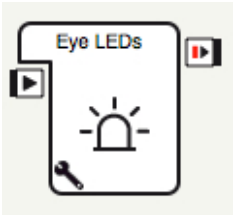
- Make NAO walk towards you
  - Infrared Sensor (Eyes)
  - Sonar
  - Eye Color

1. Create a new box in the root plane
   1. Change the Name: Walk to Person
   2. Change the Image: move.png
   3. Type: Flow Diagram

Exercise 1 (continued)

2. In the new box Walk to Person
   1. Make NAO stand (Stand Up)
   2. Walk Tracker
      1. Green eyes when NAO finds you (Eye Leds)
      2. Red eyes when he doesn't find you (Eye Leds)
   3. Use NAO's sonar
      1. Detect an obstacle (you)
      2. Stop the Walk Tracker





3. Link the sensor on NAO's head to the new box

Exercise 2

- Ask the ball
  - Raise right arm and open the hand
  - Make NAO speak
  - Make him understand what you say
    - NAO ask a question with 2 possible answers
  - Lower the arm and close the hand

Exercise 2 (continued)

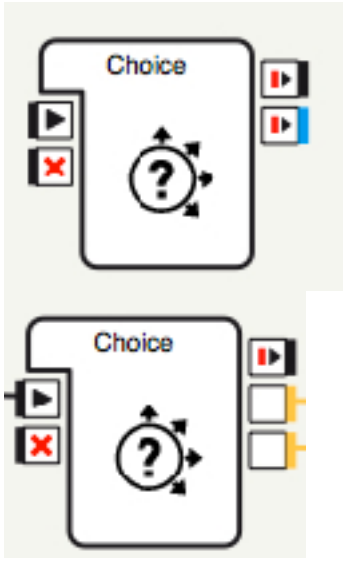
1. Create a new box in this plane
   1. Change its name (up to you to choose)
   2. Type: Flow Diagram
2. Add 2 outputs
   1. Double-click on the new box
   2. Click on the  (top right)
   3. Name for output 1 : Chair
   4. Name for output 2: Box

Exercise 2 (continued)

3. Change the color of the eyes
4. Raise NAO's right hand (librairy)
   1. Box : Raise Right Hand
5. Make NAO speak with the Say box
   1. NAO must ask for the ball

Exercise 2 (continued)

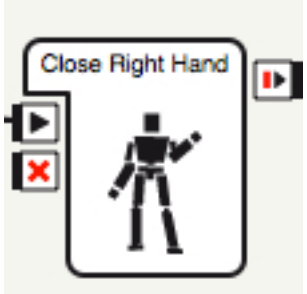
6. NAO asks where he should place the ball
   1. Create a nex box
      - Type : Flow Diagram
   2. Add a Choice box
      - Edit the output of the box
        - Rename the output answer into answer1
          - » Type : Number : 1
          - » Naturel : Punctual
        - Add a second output : answer2
          - » Type : Number : 1
          - » Naturel : Punctual



      - Double-click on the box to enter the question and the answers
   3. Make NAO repeat the answer you gave him

Exercise 2 (continued)

7. NAO lower his arm and close his hand
   - Go back to root plane.
   - Add a Close Right Hand box
     - Link both outputs to the box



Exercise 3

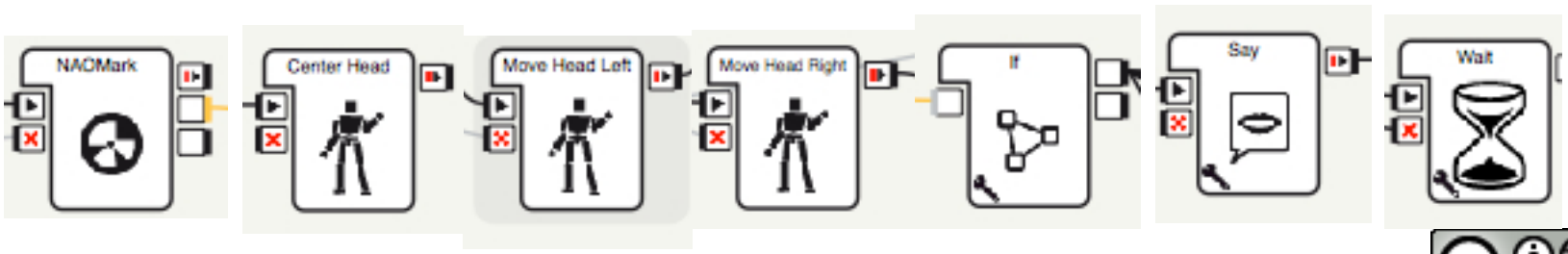
- NAO looks for the right place where to drop the ball
  - Turns his head
  - Looks for the right NAOMARK
  - Says he found the right place
  - Says he hasn't find the right place

Exercise 3 (continued)

1. Create a new box in the main place
   1. Change name : Research
   2. Type: Flow Diagram
2. Add 1 output
   1. Double-click on the new box
   2. Click the  (top right corner)
   3. Name for the output : Found

Exercise 3 (continued)

3. In the new box, add:
    1. A NAOMark box
    2. A Center Head box
    3. A Move Head Left box
    4. A Move Head Right box
    5. An IF box
    6. Two Say boxes
    7. Three Wait boxes (Change timeout to 4,000000)



Exercise 3 (continued)

4. Connect the starting input of Research box to:
   1. Center Head
   2. NAOMark
   3. A wait box
5. Make NAO's head turn from left (Move Head Left) to right (Move Head Right)
6. Connect the NAOMark to the IF box
   1. Configure the IF box :
      1. Condition Operator : =
      2. Value to compare : 68

Exercise 3 (continued)

7. Conect the output output_then of the IF box to the Input :
    1. onStop  of boxes Wait, Move Head Left, Move Head Right
    2. onStart  of a Say box
        1. Use Say box to say that NAO has found a box to drop the ball
        2. Don't forget to make NAO say he hasn't find any box where to drop the ball. It's up to you to find out how to do!
8. Then get back to main plane and do the same thing for the chair (copy/paste + modifications).

Exercise 4

- NAO goes to the required place to drop the ball
  - Walk to the box or the chair (NAOMARK)
  - Sfoot sensorsenseurs des pieds to avoid collision with box or chair
  - Drop the ball

Exercise 4 (continued)

1. Create a new box in root plane:
   1. Edit name: Walk to NAOMark
   2. Type: Flow Diagram

Exercise 4 (continued)

2. In the new box, add:
   1. A Mark Walk Tracker box
   2. A NAO facing Mark box
   3. A Bumpers box
   4. A Move To box
   5. A Say box
   6. 2 Wait boxes (Change timeout to 0,500000)
   7. 2 Eye LEDs boxes
   8. A Drop Ball Move Back and Sit box

Exercise 4 (continued)

3. Connect the starting point of Walk to NAOMark box to the input of NAO facing Mark
4. Connect the output of NAO facing Mark àto the input onStart of:
    1. Bumpers :
        1. NAO must walk 2 steps backward
        2. Stop all other boxes
        3. NAO must say he found the place « Im in! »
    2. Mark Walk Tracker
        1. Eyes turn to blue if NAOMark is no longer detected
            1. Output: onLost connected to Input onStop
            2. NAO take a step
            3. NAO must say he has arrived « Im in »
        2. Green eyes if NAOMark is detected

Exercise 4 (continued)

5. In the root plane, add the Drop Ball Move Back and Sit box and connect it to the Walk to NAOMark box