Standardization in RoboCup@Home

IROS WS: Towards Standardized Experiments in HRI

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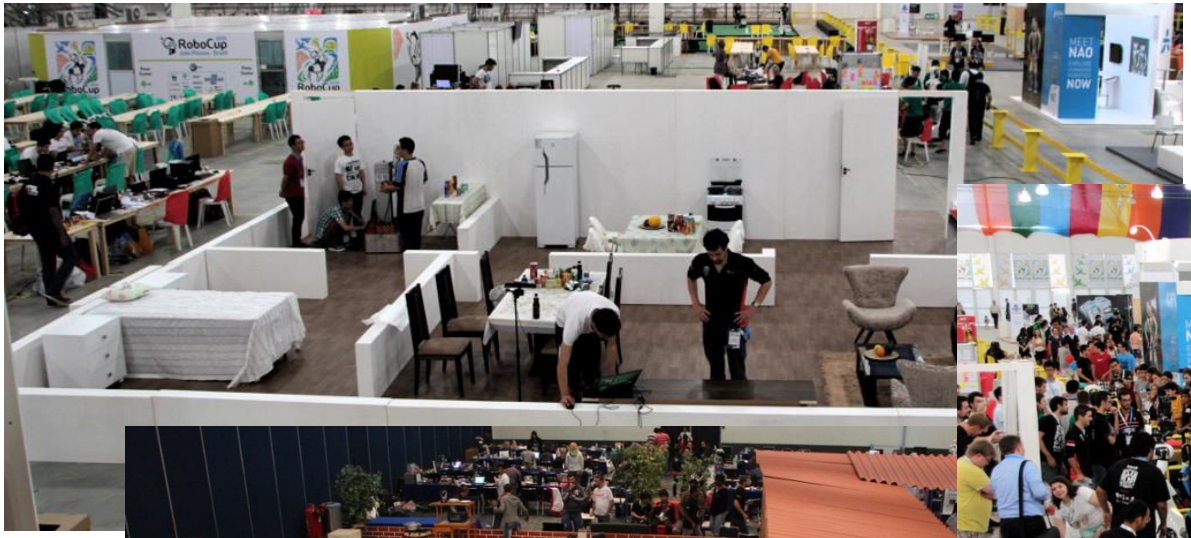
What is RoboCup@Home?

- Evaluating integrated AI+Robotics systems
  - Realistic/real environments, human-robot interaction
- Public event for promoting AI/Robotics research



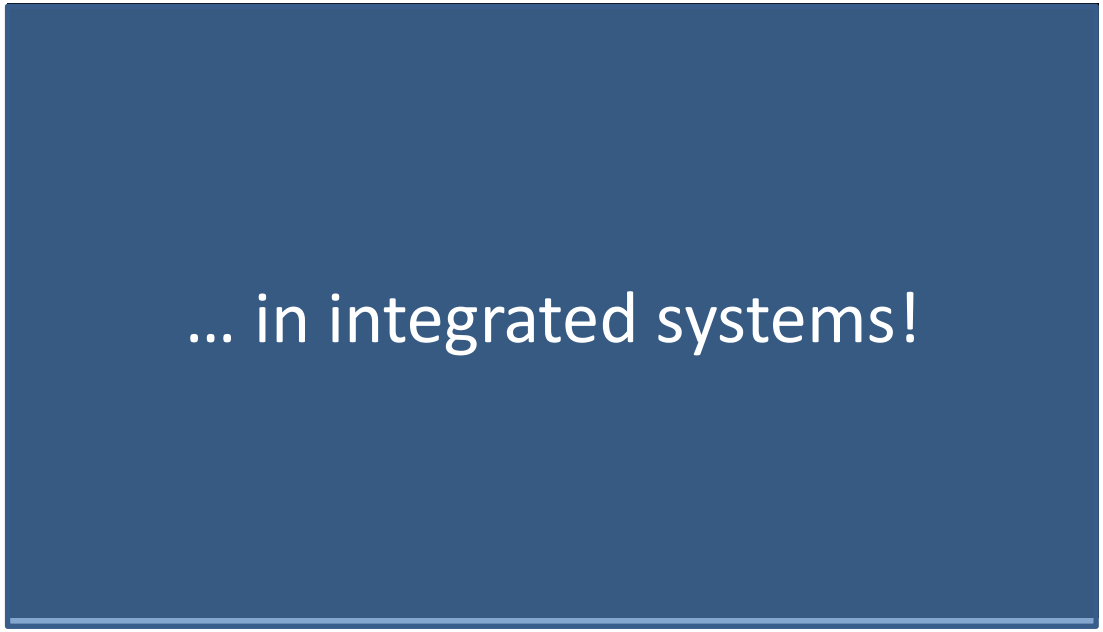
Joao Pessoa, Bazil, 2014

Mexico City, Mexico, 2012

What is tested in RoboCup@Home?

Skills/capabilities needed in RoboCup@Home

- Navigation
- Mapping
- Person recognition
- Person tracking
- Object recognition
- Object manipulation
- Speech recognition
- Gesture recognition
- Cognition (planning, dialogue, monitoring)



Video by ToBI (Bielefeld U, Germany) and NimbRo (U of Bonn, Germany)

RoboCup@Home: Tests defined by TC

5.4. Person recognition test

An Operator is introduced to the robot, which needs to learn what the Operator looks like. Once the robot has gathered enough information about the Operator, the Operator mixes within a crowd and the robot needs to find the Operator. Once the robot has found its Operator, it must explain how it must state information about the Operator, such as mood and gender.

5.4.1. Goal

The robot has to identify the Operator within a crowd and state information about the Operator and the crowd.

5.4.2. Focus

This test focuses on people detection and recognition; as well as pose recognition and human-robot interaction with unknown people.

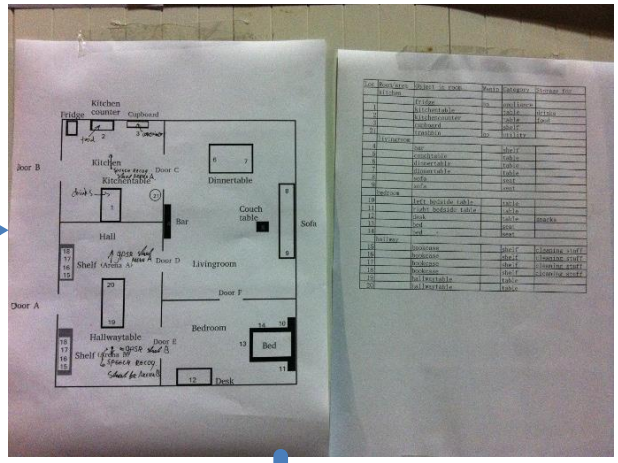
5.4.3. Setup

1. **Operator:** A "professional" operator is selected by the TC to test the robot. This person may a different be drafted from the crowd in each run.
2. **Other people** There are no restrictions on other people walking by or standing around throughout the complete task.

5.4.4. Task

This test may also be held outside the arena This is in order to have the possibility to run multiple robots in parallel and reduce the total time needed to test all robots.

1. **Start:** The robot starts at a designated starting position, and waits for the "professional" operator. When the referees start the time, the team is not allowed to instruct the operator.
2. **Memorizing the operator:** The robot has to memorize the operator. During this phase, the robot may instruct the operator to follow a certain setup procedure. **Learning operator name:** Optionally, the robot may ask the operator for his/her name and make the interaction after finding the operator again more natural.
3. **Wait for Start Command:** Once the robot states it has finished memorizing the operator, it must wait for a Start Command via ASR (or using the Continue rule if need be; Section Section 3) while the operator walks around the robot and moves behind it to blend in with the crowd. This test is not concerned with audio and voice recognition. Therefore, the start command may also be given by a single key press.
4. **Find the crowd:** After the time elapses, the robot must turn about 180°, approach to the crowd and start looking for the operator.
   - **Crowd size:** The crowd may contain between 5 and 10 people, standing or sitting or lying within an area of 5 meters (diameter).
   - **Crowd position:** The crowd will be located behind the robot at a distance between 2 and 3 meters apart.



RoboCup@Home: Test defined by TC

Cocktail Party

Follow me

Emergency situation

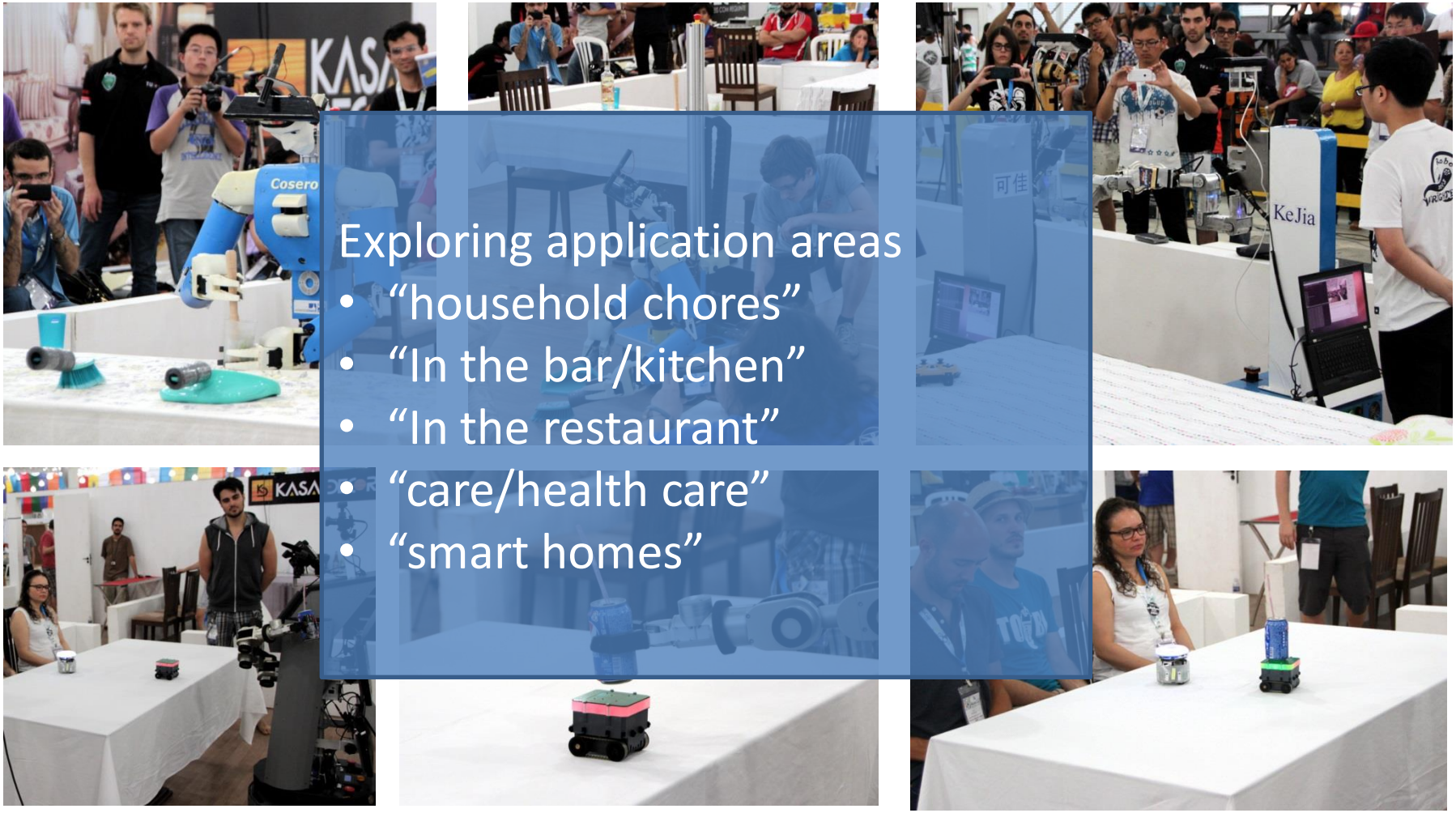
Basic Functionality

Follow me

Restaurant

RoboCup@Home: Open Demonstrations

- Open Challenge / Demo Challenge / Finals



Exploring application areas
- “household chores”
- “In the bar/kitchen”
- “In the restaurant”
- “care/health care”
- “smart homes”

Robot skills introduced by teams

ToBI team (Bielefeld University, Germany)

- opening doors
- “functional” navigation
- semantic 3D mapping
- tool use
- bimanual manipulation
- sound separation
- etc.

TU/e team (TU Eindhoven, The Netherlands)

NimbRo team (University of Bonn, Germany)

Standardization in RoboCup@Home

General rules:

- Safety first: emergeny stop button, etc.
- Arena (Walls, doors, floor, appearance, furniture, etc.)
- Changes to arena (major changes, minor changes)
- Objects (known, alike, container, special, unkown)
- Robots (max. size & weight): No standard platform!
- Gestures, start signals, operators, restarts, etc.

Scoring system:

- Evaluates task completion
- Scores are defined for each step in a task
- Fixed time limit and maximum score for each test.
- Open demonstrations have a subjective evaluation (Jury).

RoboCup@Home as a benchmark for AI/Robotics

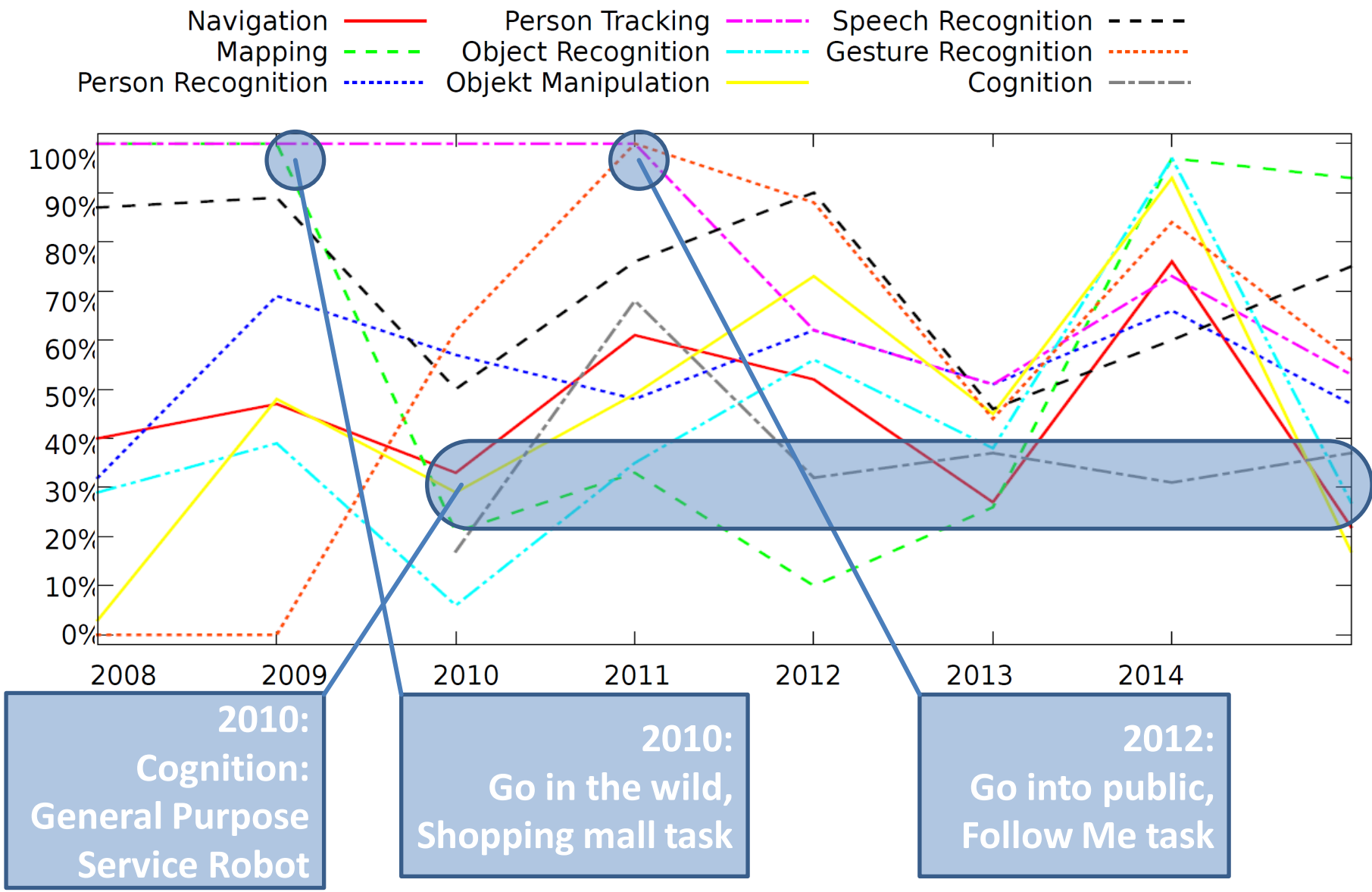
	Navigation	Mapping	Person Recogn.	Person Tracking	Object Recogn.	Object Manipul.	Speech/ Gesture Recogn.	Cognition
Follow Me	49 %		6 %	39 %			6 %	
Clean Up								
Who's who								
Emergency Situation								
General Purpose Service Robot								
Restaurant								
Open Challenge								
Demo Challenge								
Final								

Defined by the Technical Committee

Defined by the teams

- Task *T1* consists of a sequence of subtasks *S11 … S1n*
- The Score of *T1* is the sum of the sub-scores of *S11 … S1n*
- Define probability that capability *C* is the reason for failure in subtask *Sij*
- A capability score of 100% means that all subtasks where capability *C* is relevant are successfully solved.

How to measure the progress in RoboCup@Home?



Long term goals in RoboCup@Home

- **Prospects 2016 and beyond**
  1. Naïve users
     - Understanding intentions
     - Multi-modal dialogue
     - Reasoning about own capabilities
  2. No Setup! Just go *out of the box*
     - Semantic mapping
     - Categorization
  3. Long-term operation (30min and more)
     - Reasoning about own state

Conclusion

RoboCup@Home:

- is an **on-site competition** (non-standard platform, non-standard environment, standardized tasks)
- includes **non-standardized elements** (arena decorations, real shops or restaurants, audience, etc.)
- provides a **testbed and benchmark** for a large variety of skills (see rulebooks 2009-2015 at www.robocupathome.org)
- is testing capabilities on a **system-level** (capturing dependencies between skills/capabilities)
- explores **application areas** (household, care, restaurant, smart-homes, etc.)

- **is open to your contributions!**

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Eindhoven, The Netherlands, 2013

Thank you for your attention!