

# Iterative Design of a System for Programming **Socially Interactive Service Robots**

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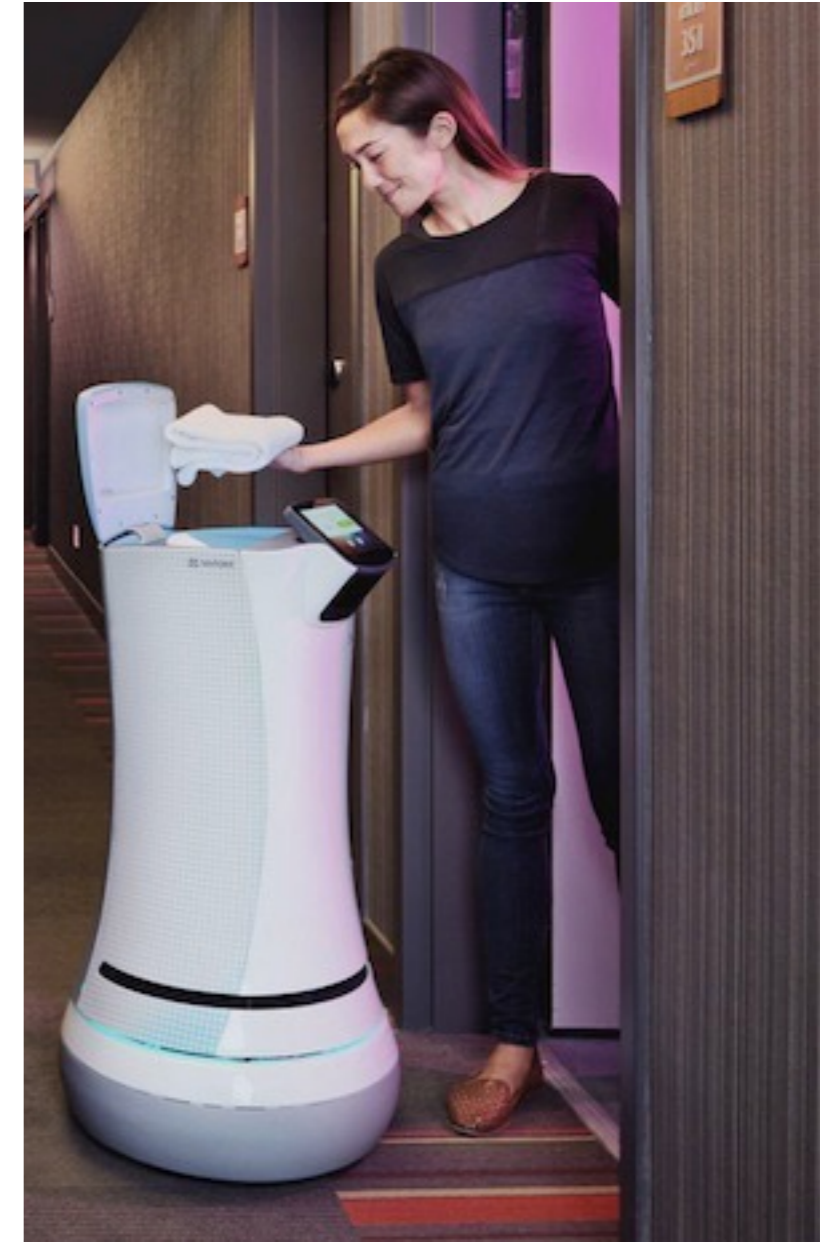




Aethon TUG



Vecna QC Bot



Savioke Relay



savioka relay

Residence  
Inn  
Marriott

WALLY  
THE BUTLER  
at your service

Residence  
Inn  
Marriott

# Research Question

*How can we design a programming system for service robots to support socially interactive behaviors?*



# Approach

1. Formative Study
2. *iCustomPrograms*
3. Field Study 1
4. Enhancements
5. Field Study 2

# Formative Study

# Procedure

- Analyzed “wish-list” data
- 5 Savioke customers (4 hotels, 1 airport)
- Most (4/5) used Relay for at least 2 months

# Use Cases

- People Delight
- Service Recovery
- Mobile Kiosk
- Demo



*iCustomPrograms*

# *CustomPrograms*

- *iCustomPrograms* extends *CustomPrograms* (Huang et al. HRI 2016) with emphasis on *interactive* behaviors.
- *CustomPrograms* is composed of
  1. Primitives: e.g. nav, user interaction, bin, ...
  2. Blocky: visual programming interface

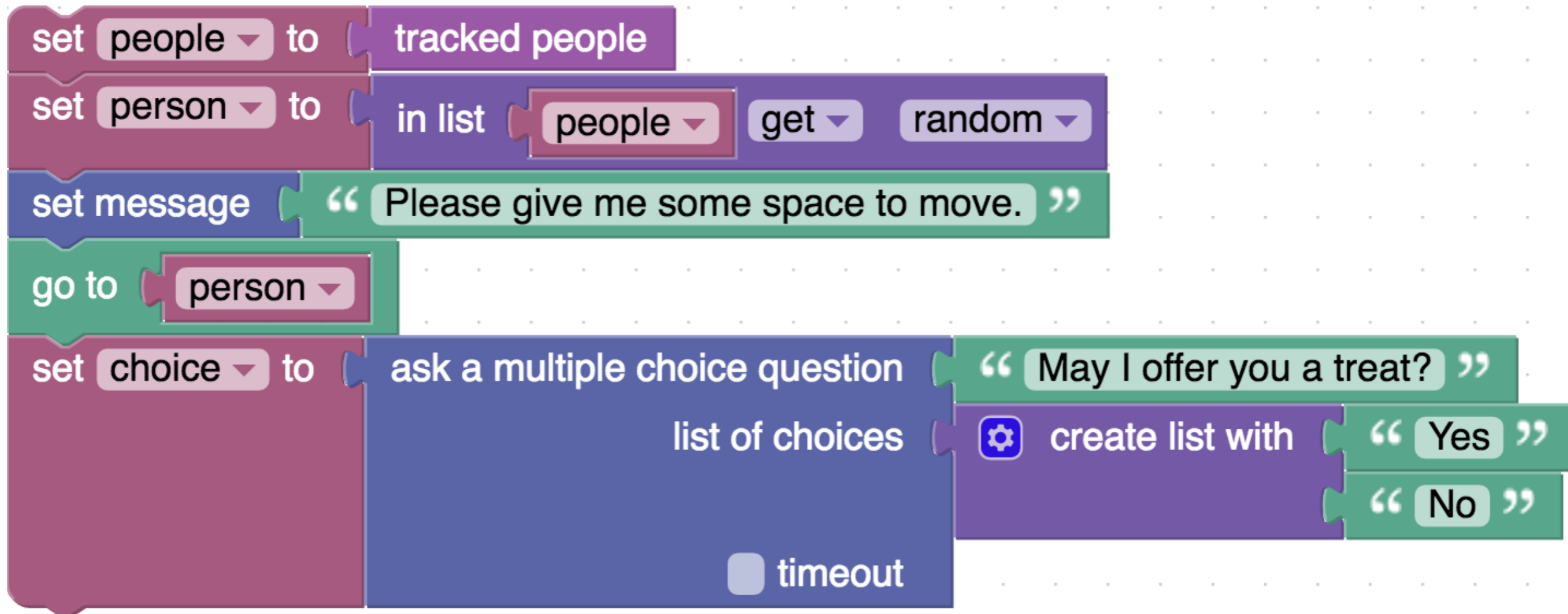
# Approaching People

name

returns

findPeople()

List



```
set people to tracked people
set person to in list people get random
set message to "Please give me some space to move."
go to person
set choice to ask a multiple choice question "May I offer you a treat?"
list of choices create list with "Yes" "No"
timeout
```

The image shows a sequence of Scratch code blocks for a script. The blocks are: 1. A purple 'set' block: 'set people to tracked people'. 2. A purple 'set' block: 'set person to in list people get random'. 3. A green 'set message' block: 'set message to "Please give me some space to move."'. 4. A green 'go to' block: 'go to person'. 5. A blue 'ask a multiple choice question' block: 'set choice to ask a multiple choice question "May I offer you a treat?"'. 6. A purple 'create list with' block: 'list of choices create list with "Yes" "No"'. 7. A blue 'timeout' block: 'timeout'.

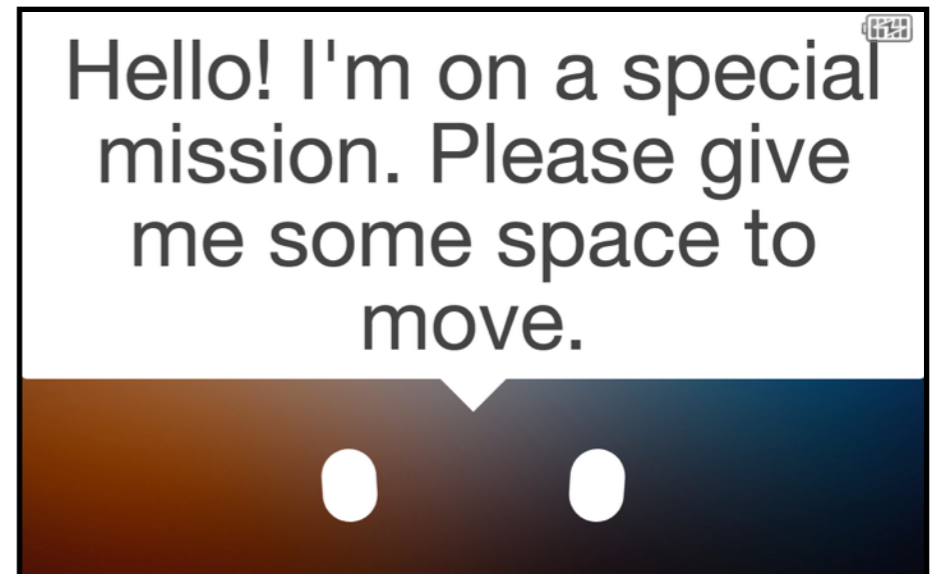
# Field Study 1

# Study at Airport

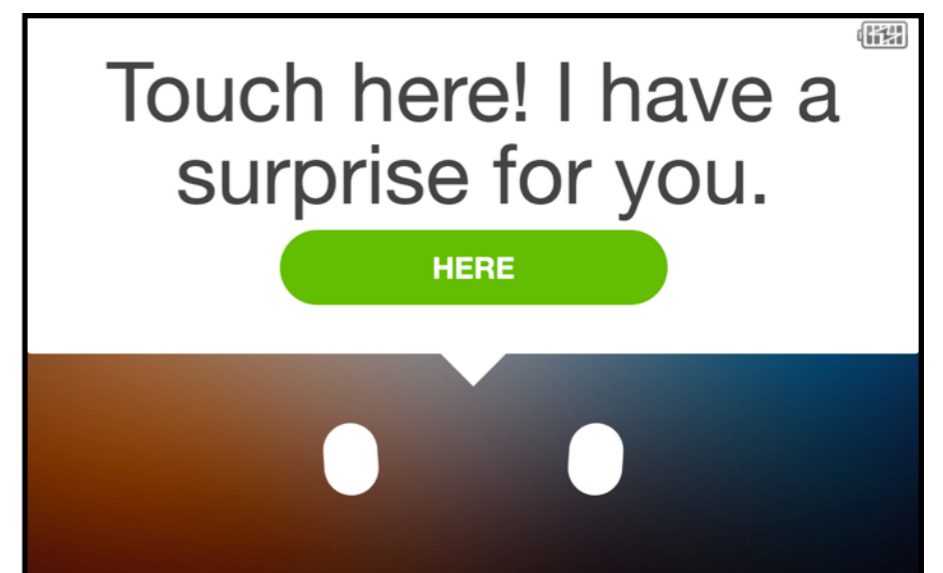
- Held in the property of the airport customer (A5)
- Design and implemented two interactive applications with the airport staff using *iCustomPrograms*
- Deployed 4 times (3-4hrs each) over 2 weeks
  - monitored by the staff and Savioke employees

# People Delight

1. Go to a pre-defined location
2. Wait for a person to interact
3. Approach a (found) person and wait for them to interact
4. Repeat



Screen while moving



Screen while waiting

# Findings

- Problems with approaching people
- Initiating interactions via moments and sounds
- Desire for richer control over interactive primitives



# Enhancements



# Touch-to-Start

**name**

**Returns**

goToUntil(string location)

bool

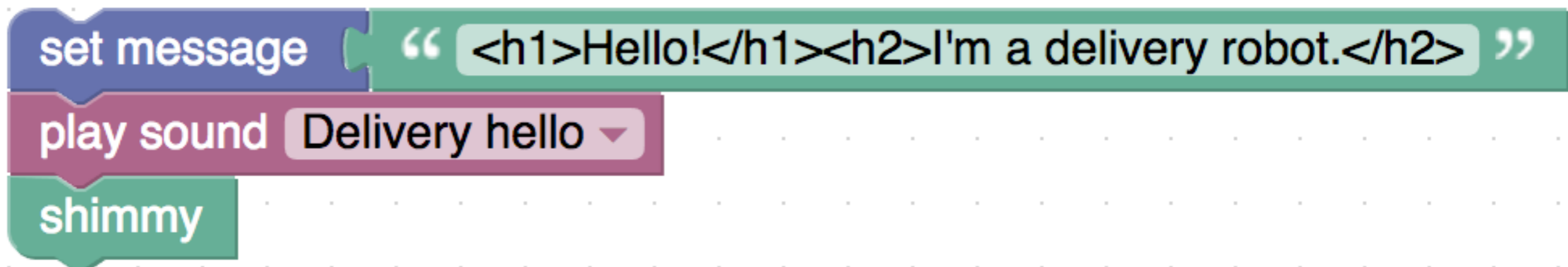
```
set message to "Touch screen to start"
set arrived to go to until touched "Lobby 1"
repeat while not arrived
do
  show message for 5 seconds "Hello there!"
  set message to "Touch screen to start"
  set arrived to go to until touched "Lobby 1"
```

The image shows a Scratch script with the following blocks:

- set message** to "Touch screen to start"
- set arrived** to go to until touched "Lobby 1"
- repeat while** not arrived
  - do**
    - show message for 5 seconds** "Hello there!"
    - set message** to "Touch screen to start"
    - set arrived** to go to until touched "Lobby 1"

# Richer Control over Interactive Primitives

<b>name</b>	<b>Returns</b>
displayMessage(string htmlText)	void
askMultipleChoices(string htmlText, string[] choices)	string
...	
playSound(string sound)	void



# Field Study 2

# Usage in Airport

- 9am-5pm over Easter and local holiday weekends
- ~500 passengers interacted over each weekends
- Most popular among children (7 or up), group travelers, and young adults

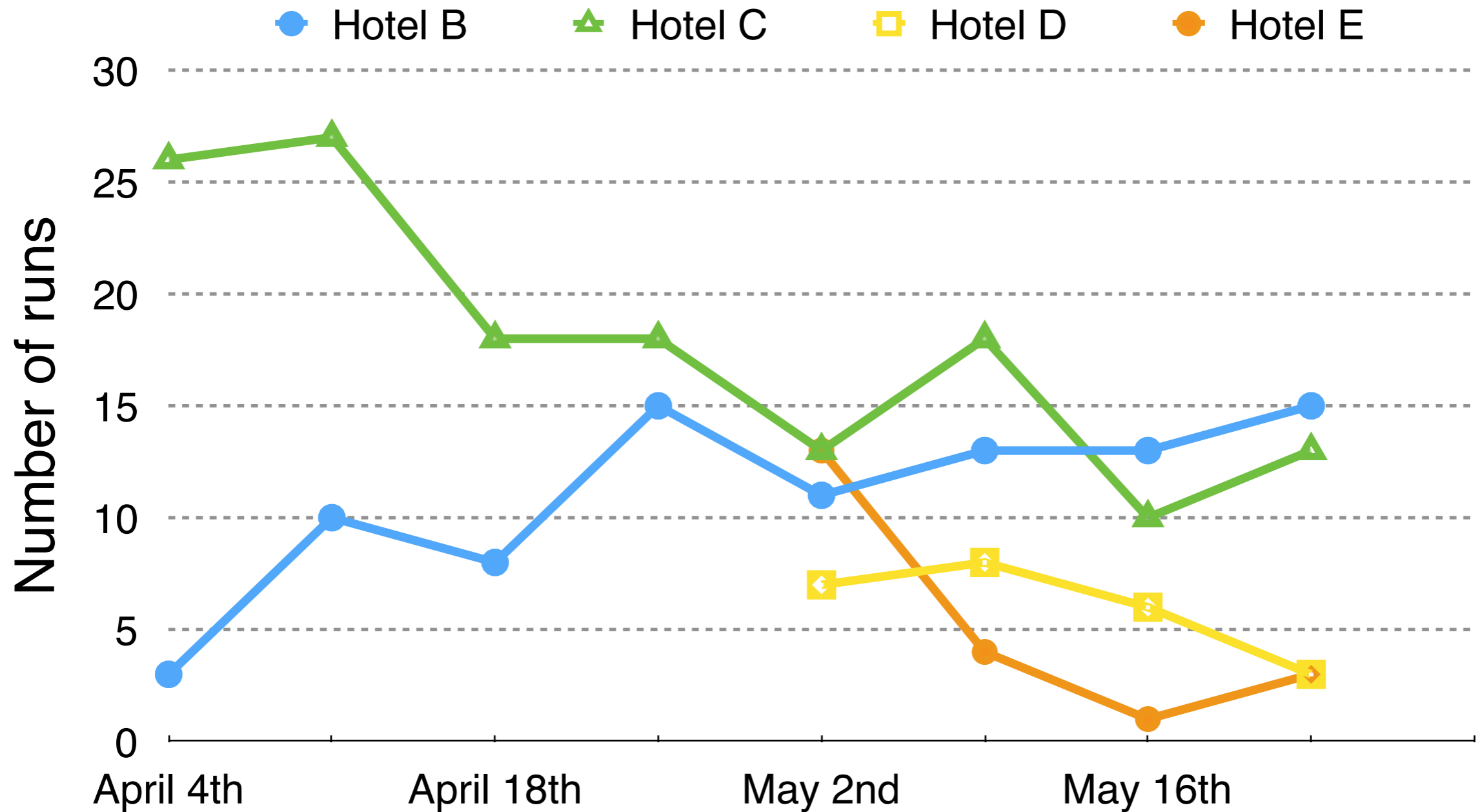


Pictures from the Easter weekend



Pictures from the local holiday weekend

# Usage in Hotels



# Summary

- To support interactive behaviors, the system must support
  - people aware behaviors (proactive & passive)
  - rich control over user interaction components
- We demonstrated the interactivity of *iCustomPrograms* applications in the field.