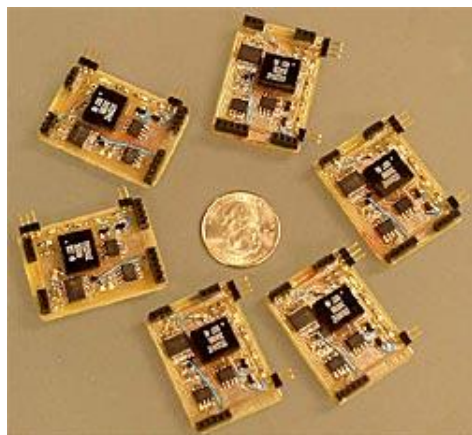


Cracking the Black Box

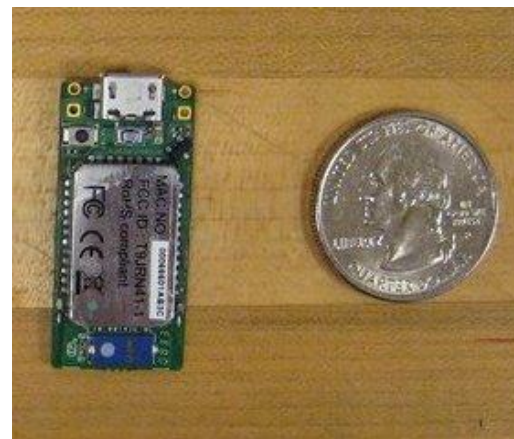
Ned Burns and Stephen Intille

MIT House_n

(Thanks to Intel and the NSF for funding House_n home sensor work)



MITes



Wockets



PlaceLab



BoxLab





7/27/2009





7/27/2009



Activity recognition
Context recognition
Context awareness

Barriers

- Diverse home environments
- Heterogeneous sensors/technology
- Missing sensors
- Unique human behavior

Barriers

- Diverse home environments
- Heterogeneous sensors/technology
- Missing sensors
- Unique human behavior

PlaceLab data

Taking out the garbage

Rank	Object
1	Window blinds
2	Recycling bin
3	Computer keyboard
4	Cabinet
5	Closet

Getting ready to sleep

Rank	Object
1	Pillow
2	Cabinet
3	Faucet
4	Eyeglasses
5	Towel holder

Eating a meal

Rank	Object
1	Remote control
2	Cabinet
3	Television
4	Window blinds
5	Closet

In order to modify the system, the user has to provide it with some kind of **information**.

Information

- Perceived
- Acted
- Annotated

Information

- Perceived
 - What the user *thinks* they do and interact with when they perform a specific task.
 - Surveys, games, common-sense reasoning
- Acted
- Annotated

Information

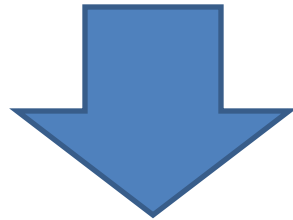
- Perceived
- Acted
 - The user demos or performs a particular task
 - Conceptually attractive, easy for users to understand
 - Possible confounding factors: observer effect, ignores multitasking, interleaving
- Annotated

Information

- Perceived
- Acted
- Annotated
 - Hand-annotation of naturalistic activities (past or present), including start/stop times
 - Most time consuming, requires some kind of exterior motivation (game, etc.)

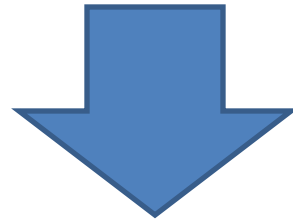
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In order to provide the right **kind** of information, the user needs to understand **what's going wrong** and **how to fix it**.

In order to modify the system, the user has to provide it with some kind of **information**.



In order to provide the right **kind** of information, the user needs to understand **what's going wrong** and **how to fix it**.

Mental model

Plan

Pilot study¹

- Audible reminder system
- Assumption that system was “context sensitive”
 - Annoyed by “absurd” behavior
 - Expected context to include time of day, location, activity currently taking place
- Cheat sheet
 - “Lights & (turning down) shades”
 - “Take J’s call”
- Modified behavior
- Wanted ability to link reminders to specific activations/activities

Example

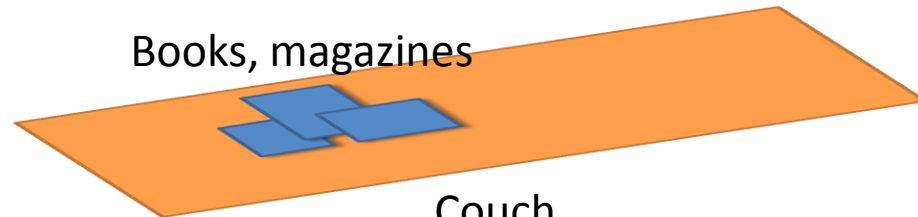


User

Example



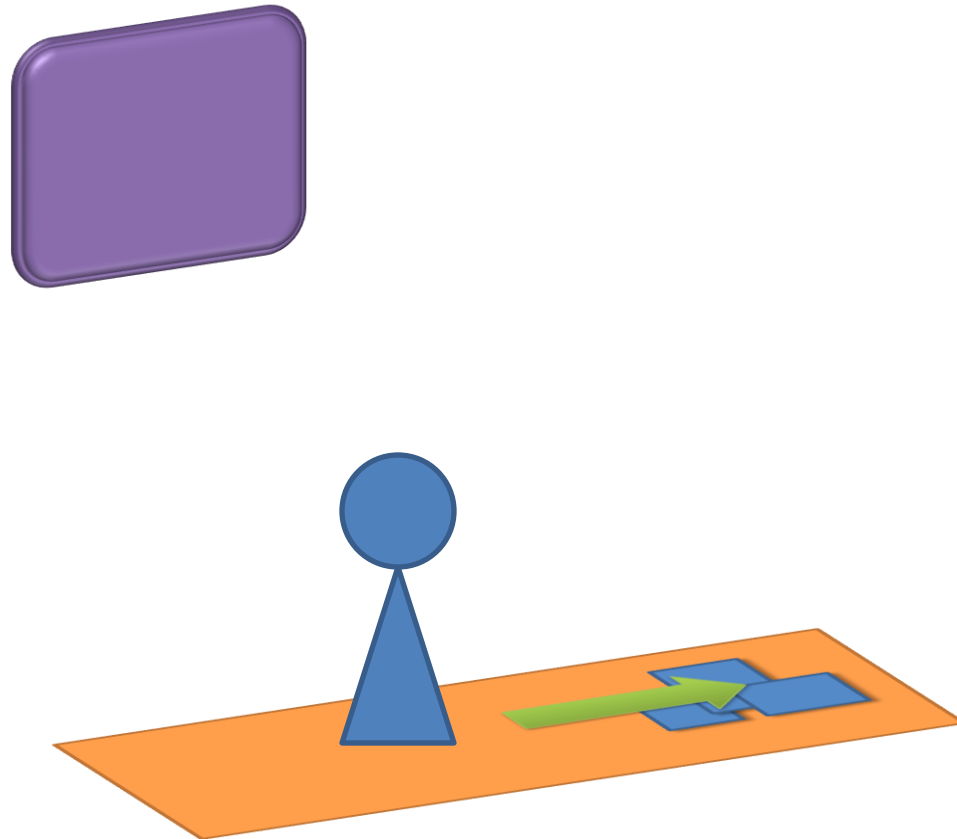
TV



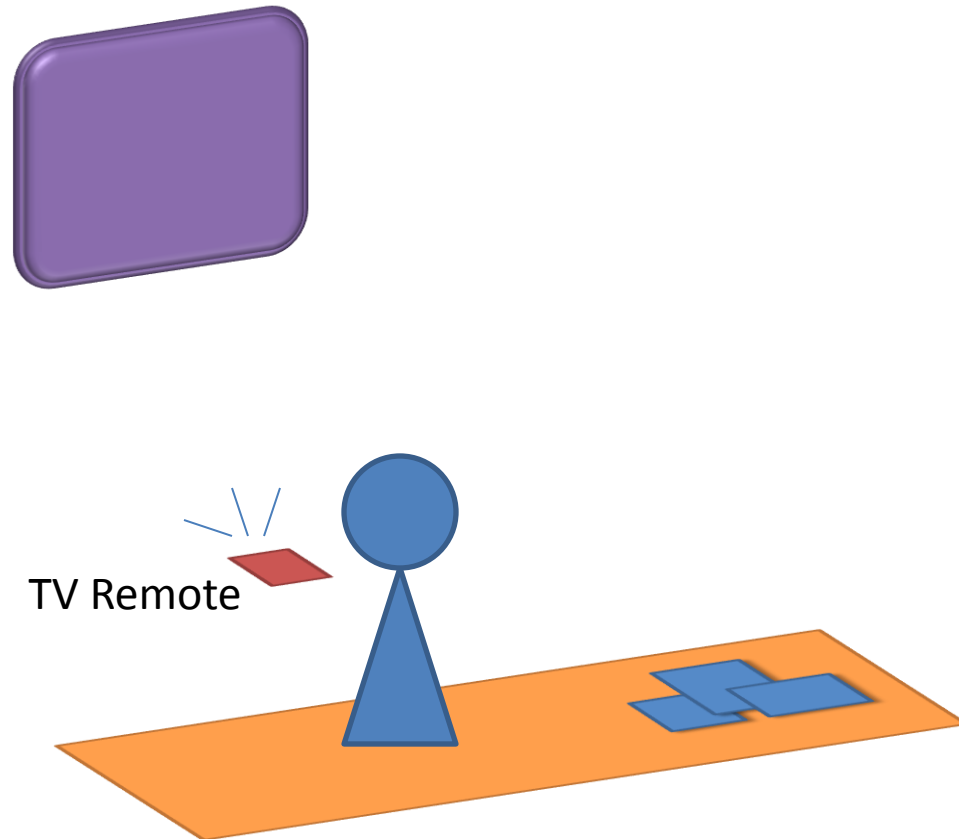
Books, magazines

Couch

Example

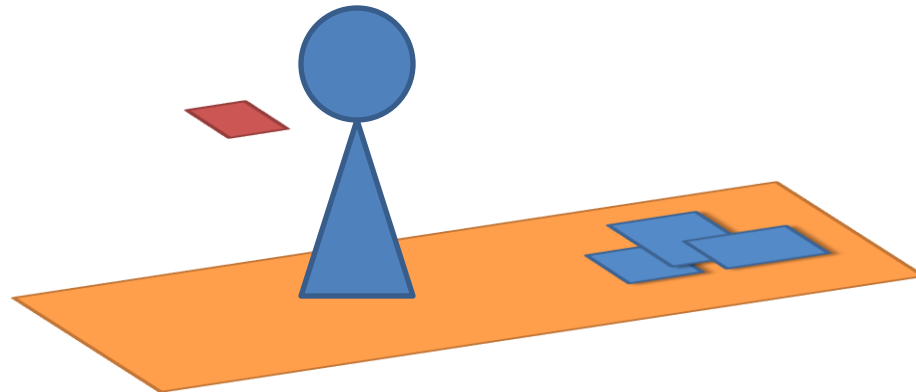


Example



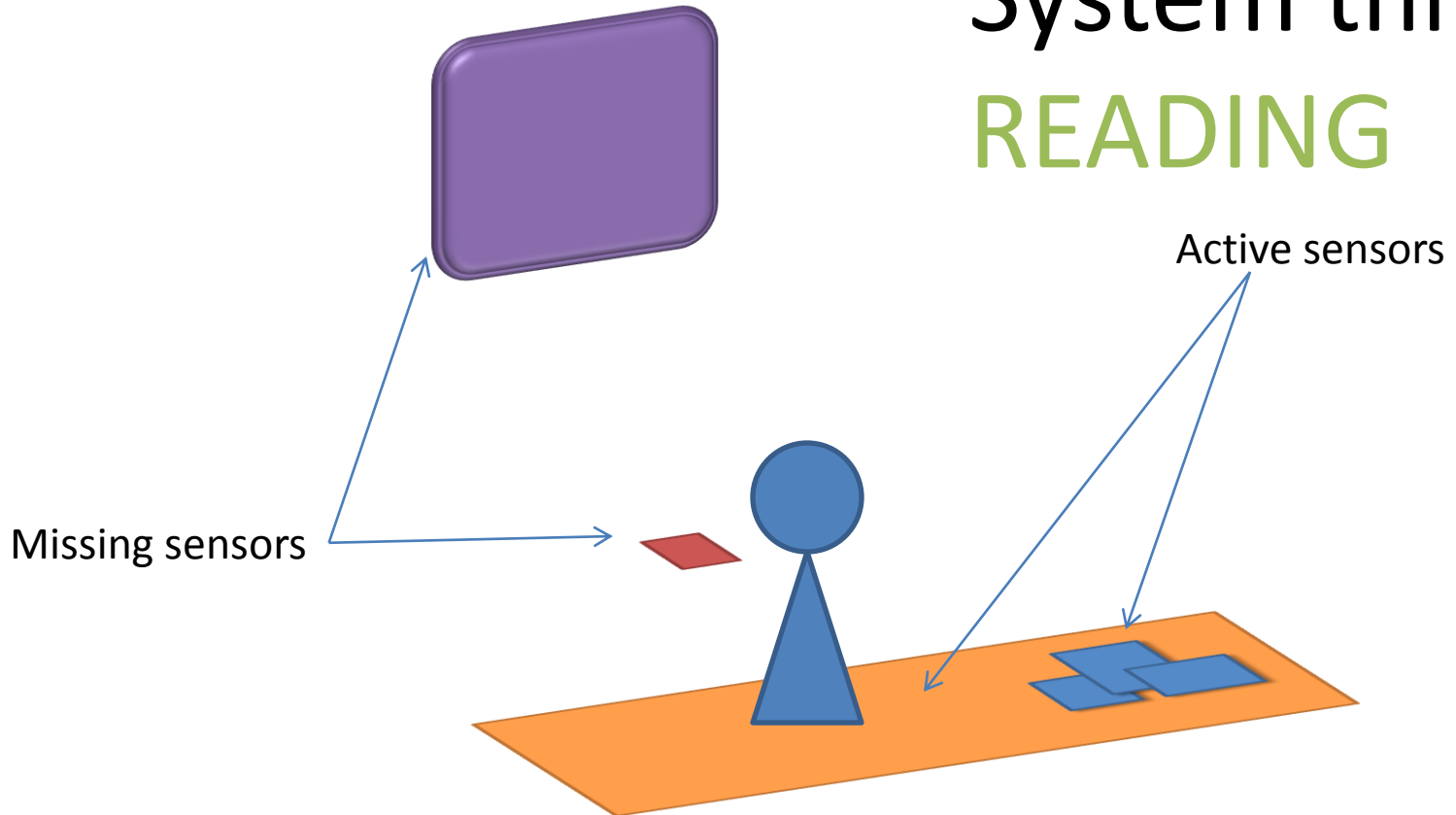
Example

System thinks:
READING



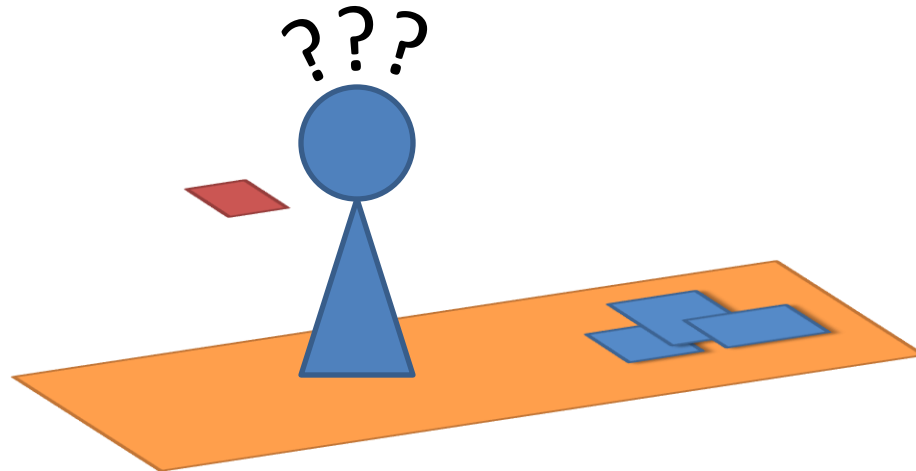
Example

System thinks:
READING



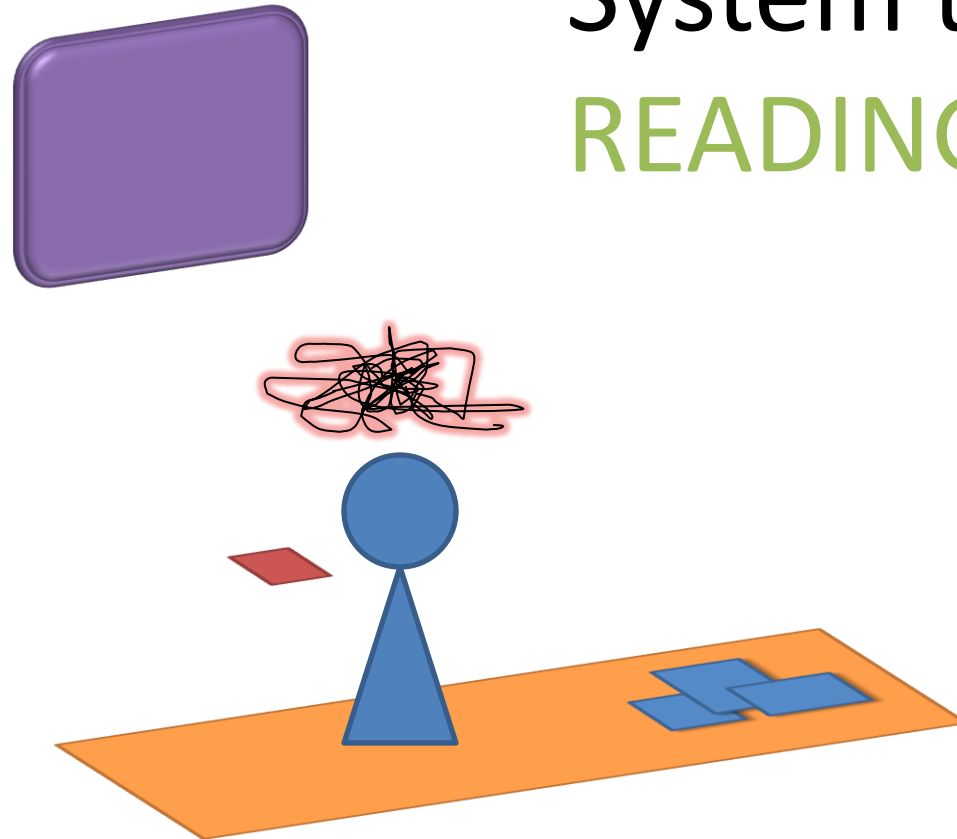
Example

System thinks:
READING



Example

System thinks:
READING



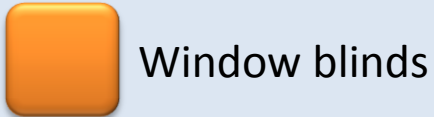
See also:

C. Beckmann, S. Consolvo, & A. LaMarca, "Some Assembly Required: Supporting End-User Sensor Installation in Domestic Ubiquitous Computing Environments," *Proceedings of the 6th International Conference on Ubiquitous Computing: UbiComp '04*, Nottingham, England, (Sep 2004), pp.107-24.

What we saw



Dishwasher



Window blinds



Trash can



Loud



Kitchen

Doing the dishes



Sink



Dishwasher



Drying rack



Trash can



Loud



Kitchen

Taking out the t



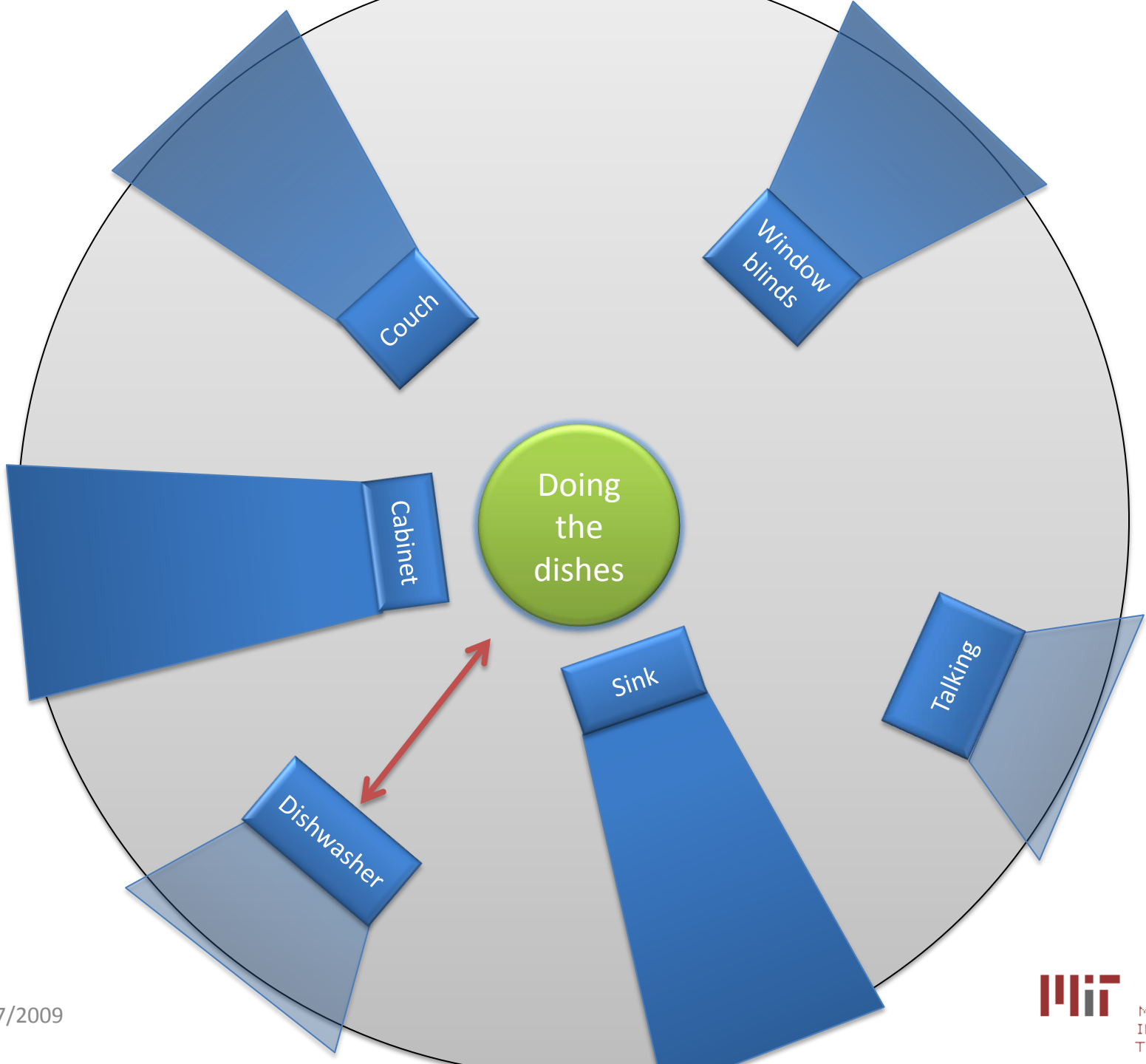
Window blinds

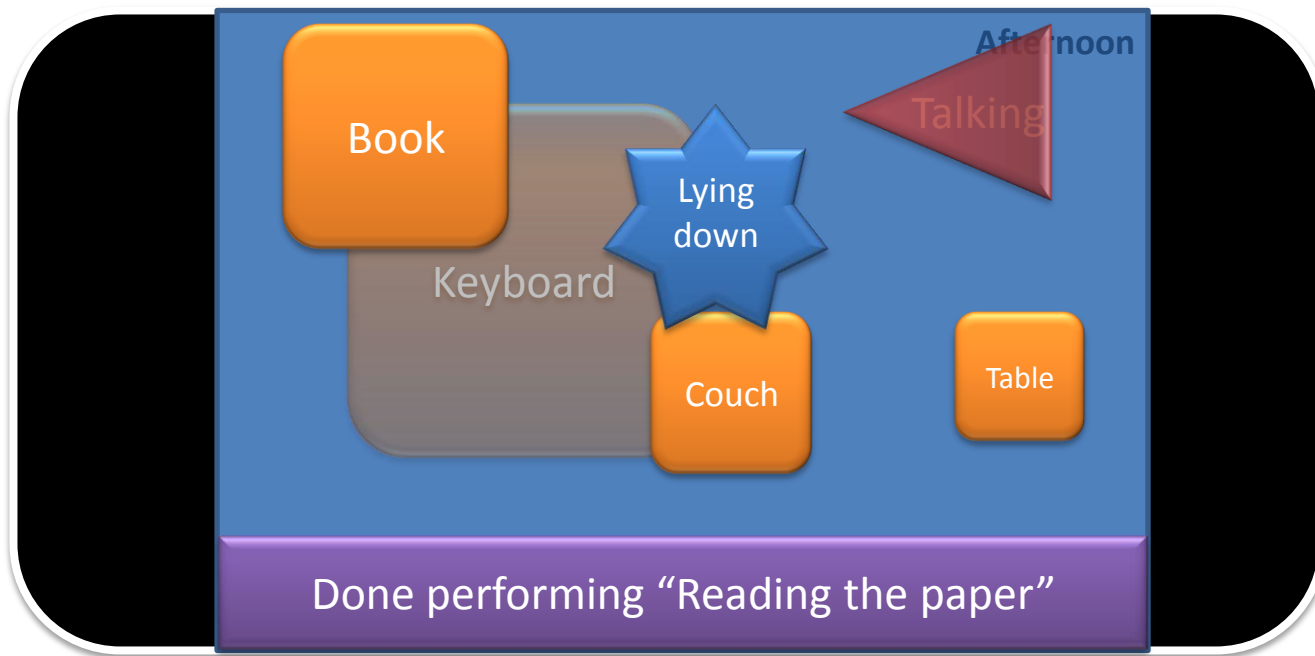


Trash can



Door





Questions?