

# カリフォルニア大学サンディエゴ校 滞在記

大阪大学コミュニケーションデザイン・センター/  
大学院基礎工学研究科

伊藤 京子

# 自己紹介

- 所属
  - 大阪大学
    - コミュニケーションデザイン・センター
    - 基礎工学研究科
- 研究内容
  - コミュニケーション支援システムの開発
    - 科学技術コミュニケーション
    - 医療コミュニケーション
  - 省エネ行動支援インタフェースの開発

昨年度 サンディエゴに滞在して  
きました

# 発表の概要

- 滞在地の概要
- 11ヶ月を振り返って
- 研究紹介
  - 合成顔表情の実験
  - エネルギー・環境問題への意識調査

# 滞在

- 期間 : 2011年4月～2012年3月
- 場所 : アメリカ合衆国カリフォルニア州  
サンディエゴ
- 大学 : カリフォルニア大学サンディエゴ校  
– Department of Computer Science and Engineering

# サンディエゴ

- 位置 : カリフォルニア州・西海岸の南端の街
- 人口 : 122万人 全米7番目
- 気候 : 温暖
- 特徴 :
  - ハイテクの街 Qualcomm・バイオ・製薬・医療機器
  - 人種が多彩

# カリフォルニア大学サンディエゴ校 (UCSD)

- カリフォルニア大学(10校)のうちの1つ
- 1960年創立
- 6つのカレッジ
- スタッフ : 1076
- 学生数 : 学部 23663 大学院 5513
- キャンパス : 8 664 320 m<sup>2</sup>
- (参考)大阪大学
  - 1931年創立
  - スタッフ:3108
  - 学生数:学部 15541 大学院 4789
  - キャンパス:1 588 635 m<sup>2</sup>



# 11ヶ月を振り返って：言葉

- 苦労しました
- Tutor
  - 大学幹旋
  - 自分で見つけた
- 娘の言葉
- Noはいわない？
- ネイティブと話すことは難しい
- 非ネイティブと話すことは楽しい



# 11ヶ月を振り返って：生活

- 食生活・車の利用・アパート
- ITの普及
  - Kindle, iPad, Smartphone
  - レストランのHP
- 大学内で・・・
  - 教授の出身国は様々
  - 人種が異なる人達はあまりまじわっていない？
    - けれど「いつ帰るの？」とは聞かれない？
  - 学生の服装が地味

# 11ヶ月を振り返って: 煎茶

- お茶会をしました

# 11ヶ月を振り返って：研究関連

- 日本とは・・・
  - 日本とのSkypeミーティング
  - 2名の学生さん渡米
- UCSDでは・・・
  - 最初のミーティング
  - 読むのが早い・時間が大事
  - ラボ間の交流
  - 授業
  - 博士課程(5年一貫)
  - 公開Job Talk

# 研究紹介

1. 合成顔表情の実験
2. エネルギー・環境問題への意識調査

# 合成顔表情の実験

# 先行研究～患者-医師間のコミュニケーション支援～

## ■ 患者の表情の利用

合成顔表情技術を用い  
顔写真から任意の表情を  
つくり出すことが可能

表情作成インタフェース

医師による有用性評価

「患者にとって表情が十分選択でき、簡便に操作できる点が良い」

# 開発したシステムの特徴

## 自身の顔写真から生成される合成顔表情を介して表現する

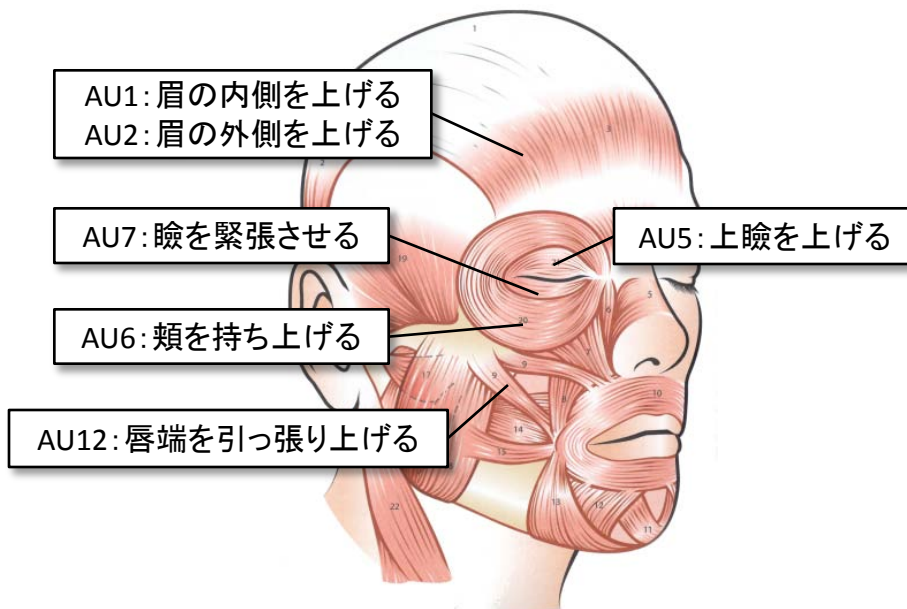
- 合成顔表情
  - 物理的制約を解放
  - 定量化が可能
- 自身の顔写真
  - 注意を向ける点が表現に影響

# 合成顔表情(1/2)

## ■生成の概念

FACS(顔面表情記号化システム)\*

顔面筋肉の知見を基に44種類の動作単位Action Unit(AU)を用いて表情を記述する手法



喜び(Ekmanの定義<sup>9)</sup>)



AU6  
(頬を持ち上げる)

+

AU12  
(唇端を引っ張り上げる)

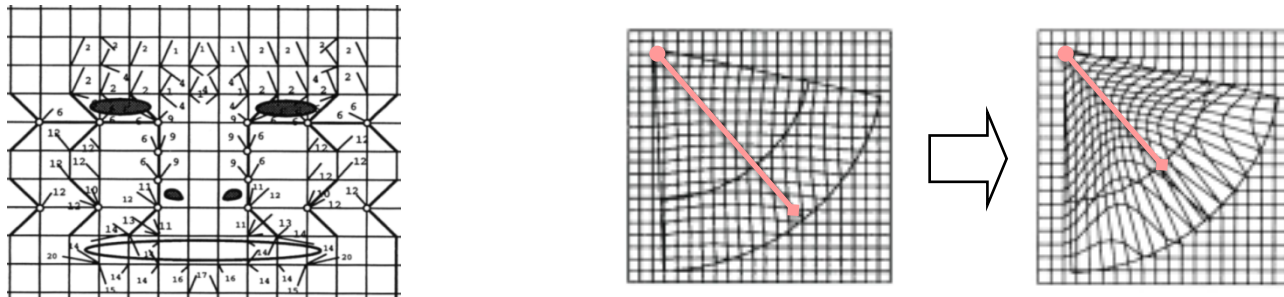


# 合成顔表情 (2/2)

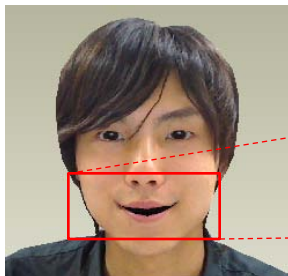
## ■ コンピュータグラフィクスでの実装

### 筋肉モデル法\*

表情筋の収縮率をシミュレーションし顔表面の変形を算出することで表情変化を合成する手法



$AU_i$ に関連した表情筋の収縮率(強度):  $k_i$



$(k_1, k_2, \dots, k_N) = (0.3, 0.0, \dots, 0.5)$

AU12: 唇端を引っ張り上げる



0.0

0.5  
 $k_{12}$

1.0

\* K. Waters: "A Muscle Model for Animation Three-Dimensional Facial Expression.", SIGGRAPH '87, Vol. 21, No. 4, pp.17-21, 1987.

# 表情作成インタフェース：手順

## 1. 基本設定

## 2. 詳細設定

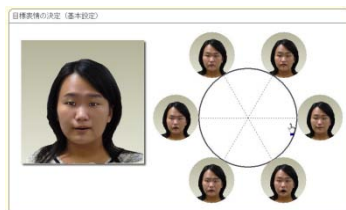
円状のマップから1点をおおまかに選択

部位(眉, 目, 頬, 口, 顎)を選択しAUの強度をスライダーで調節

- 主にマウスを利用して操作
- 利用するAU: 25種類(眉:3, 目:5, 頬:2, 口:10, 顎:5)

# 操作履歴

$t$  : 各設定での経過時間



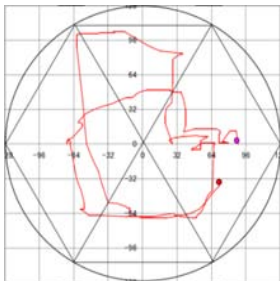
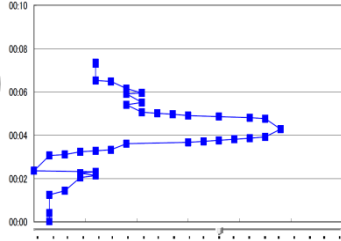
過程①

結果②



過程③

結果④

	基本設定 (basic)	詳細設定 (detailed)	全体
過程	<p>① 座標時系列  <math display="block">\mathbf{z}_t = (x_t, y_t)</math> <math display="block">= (r_t, \theta_t)</math>                     時間  <math>T_b</math> </p>	<p>③ 各AU強度の値時系列  <math display="block">\mathbf{k}_t = (k_{1t}, k_{2t}, \dots, k_{25t})</math>                     時間  <math>T_d</math> </p>	<p>時間  <math>T</math>  <math>T_b + T_d</math></p>
結果	<p>② 選択点の座標  <math>\mathbf{z}_{T_b}</math></p>	<p>④ 作成表情の各AU強度の値  <math>\mathbf{k}_{T_d}</math></p>	

# Interface for Creating Facial Expressions

# Experimental Design

## ■ Participants

- A monocultural society : Japan
  - Japanese college students (“Japanese students”)
- A multicultural society : The United States
  - College students living in the U.S. (“American students”)

## ■ Method

We heuristically analyze the facial expressions created by participants without limiting conditions

# Method (1/2)

## ■ Experimental flow

(1) Answer questions about themselves (5 min)

Age, sex and \*the country where they've lived the longest etc.

(2) Learn how to use the interface and practice it (5 min)

✘ Use the experimenter's face picture (Experimenter)

(3) Create the desired facial expressions starting from their own face pictures using the interface (No time limit)

(4) Answer questionnaires (5 min)

e.g., Select words (e.g., joy, sadness) for emotion describing the facial expression (Multiple answers possible)

\* Only for American students

# Method (2/2)

## ■ Method of analysis

- The words describing the facial expressions:
  - Clarify what kind of facial expressions they tend to create
- The AU intensities of the facial expressions:
  - Analyze the characteristics  
(the intensity and the SD of each AU)

In order to establish basic knowledge,

we focus on Ekman's facial expressions of the 6 basic emotions

(joy, wonder, sadness, dislike, anger and fear)

# Results (1/3)

## ■ Participants

- 30 Japanese students  
19 males and 11 females, Average age: 22.4 years  
In Osaka University
- 29 American students  
15 males and 14 females, Average age: 23.8 years  
In University of California, San Diego

## ■ Data for analysis

- 30 Japanese students
- 19 American students \*

\* Those who have lived in America longer than any other country



# Results (2/3)

■ Facial expressions created by the participants

The  
Japanese

The  
American

# Results (1/3)

## ■ Facial expressions created by the participants

### Adjective Words for Emotion

Positive (10)	joy	pleasure	happiness	love	satisfaction
	warmness	longing	respect	tenderness	curiosity
Neutral (7)	doubt	pride	patience	vacant	pity
	shame	wonder			
Negative (18)	ennui	jealously	repentance	intolerance	unpleasantness
	hesitation	anxiety	sadness	loneliness	painfulness
	dislike	disappointment	hate	humiliation	indecent
	anger	contempt	fear		

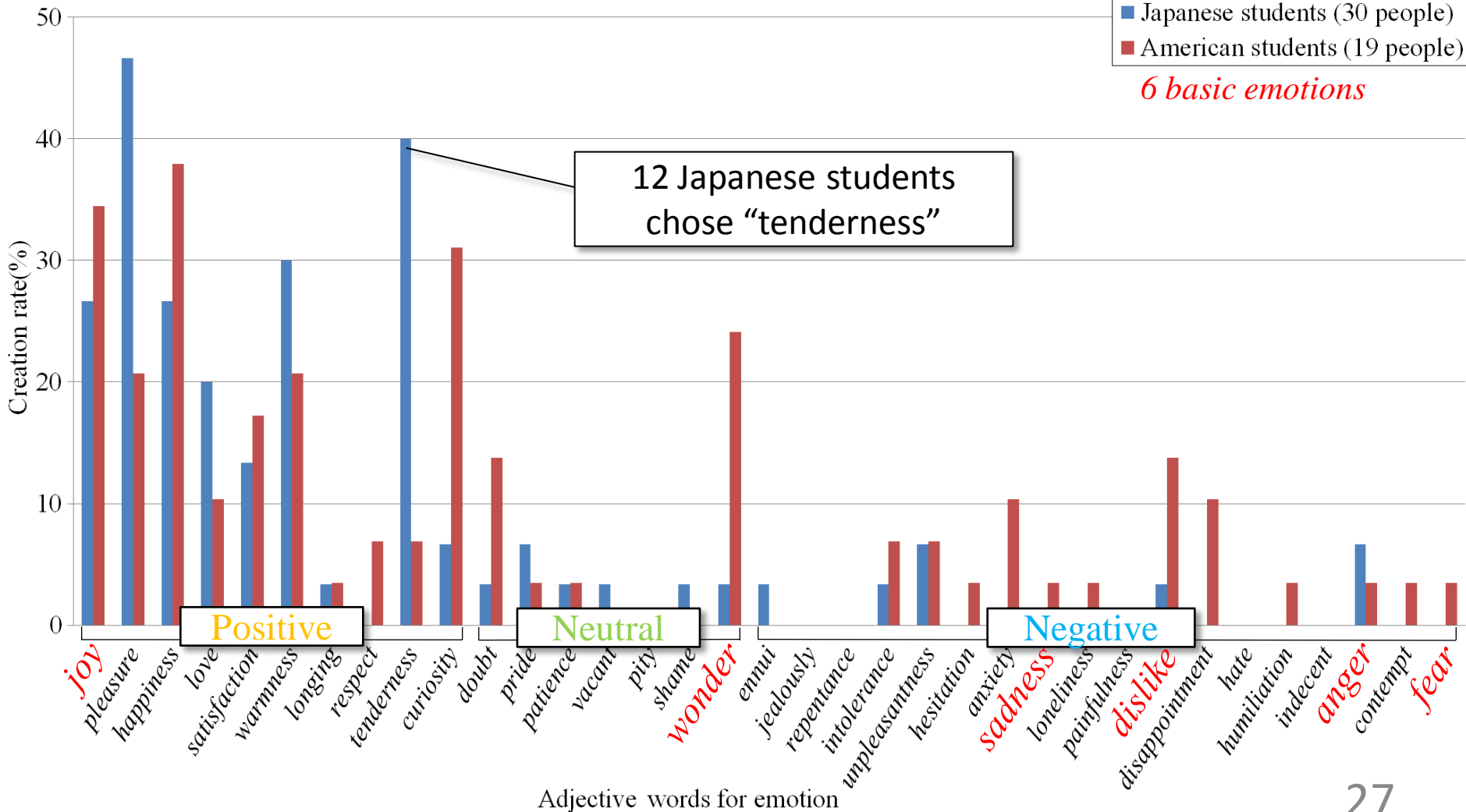
*6 basic emotions*

# Results (2/3)

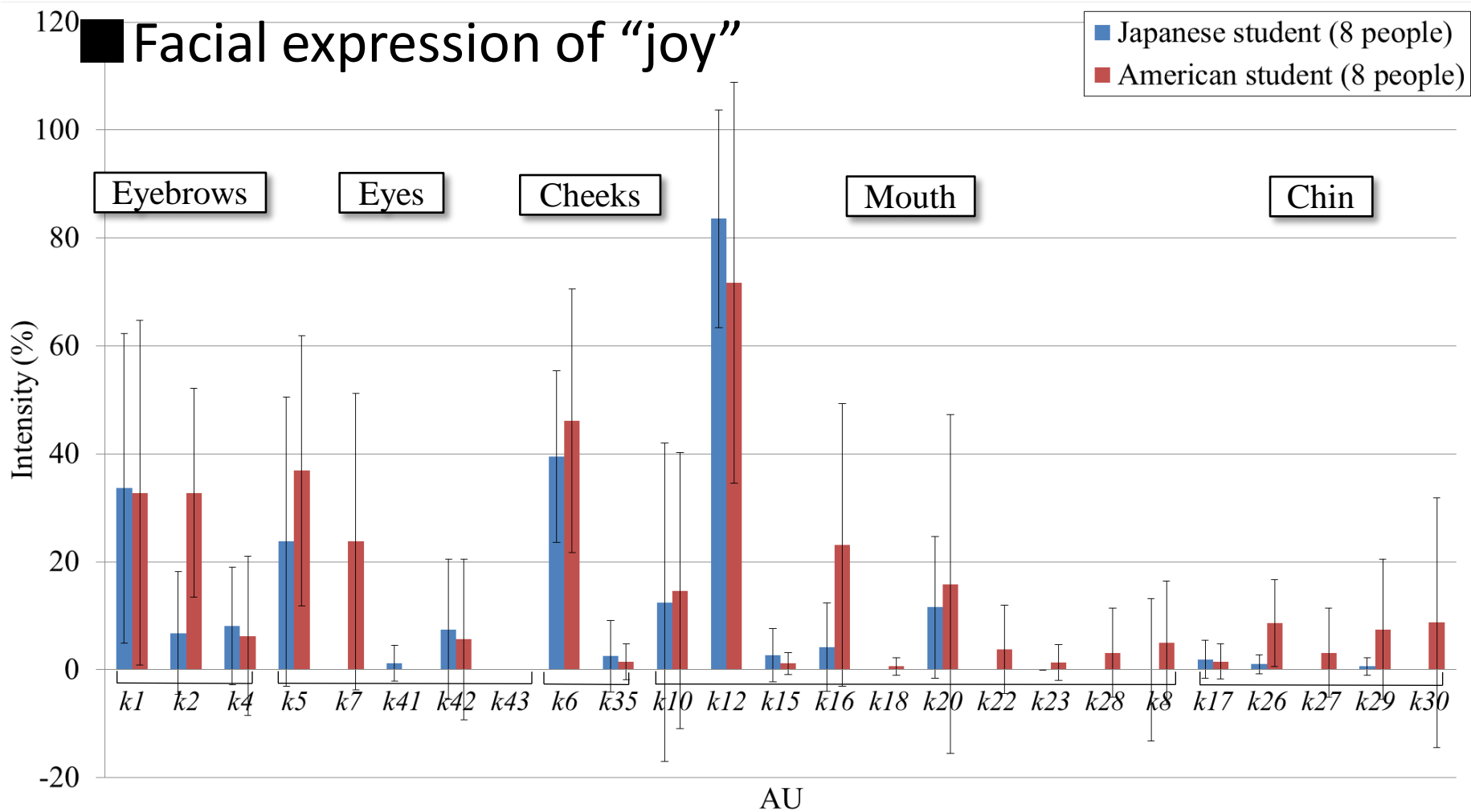
■ Facial expressions created by the participants

■ Japanese students (30 people)  
■ American students (19 people)

*6 basic emotions*



# Results (3/3)



# Discussions (1/2)

## ■ Facial expressions created by the participants

- Positive facial expressions created by many participants
- Fewer negative facial expressions created by Japanese

➤ Similar to the display rule Ekman showed:


Japanese make less negative facial expressions than American in social situations

Japanese students

American students

# Discussions (2/2)

## ■ Facial expression of “joy”

- Most AU intensities of the American:  
Stronger than those of the Japanese
  - The SD of most of the AU intensities of American:  
Larger than that of the Japanese  
(18 AUs in 25)
- 

### Facial expressions:

- **Not clearly and exactly** expressed in monoculture
- **Clearly and exactly** expressed in multicultural

# Future Investigations

## ■ Experiment instructions

Ask the participants to

- Create neutral or negative facial expressions

➤ Decoding Rules <sup>6)</sup>

Negative facial expressions are more important than positive ones

- Create a certain facial expression, in a certain context  
(e.g., “Please show you are “angry” face to a child”)

## ■ Experiment Settings

Conduct experiments on people in other countries.

6) H. A. Elfenbein, and N. A. Ambady, “Cultural similarity’s consequences: A distance perspective on cross-cultural differences in emotion recognition,” *Journal of Cross-Cultural Psychology*, Vol.34, pp.92-110, 2003.

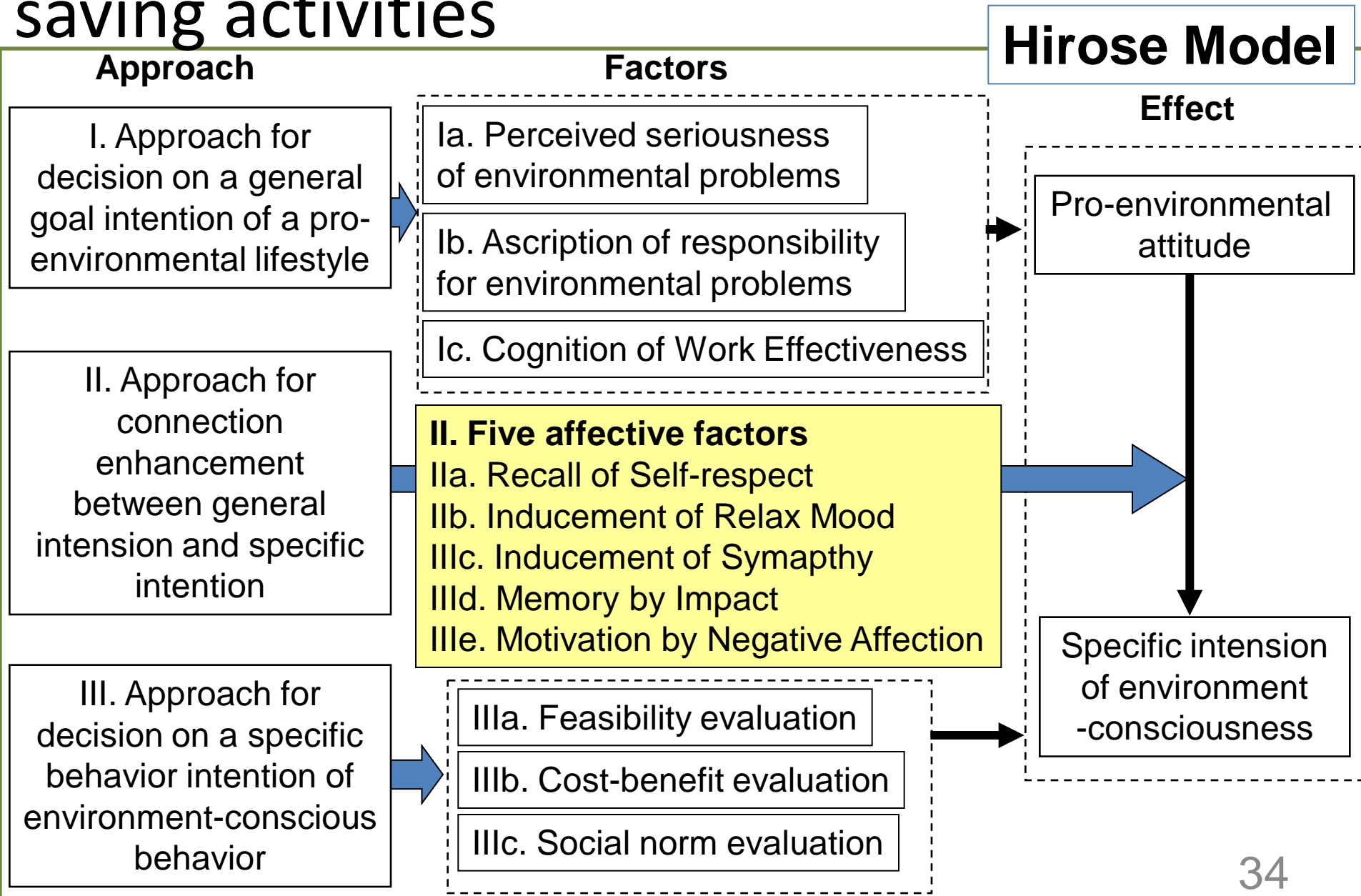
# エネルギー・環境問題への意識調査 ～省エネ行動支援インタフェース開発に向けて



# 先行研究

- 省エネ行動支援アフェクティブインタフェース

# Proposal of a model for supporting energy-saving activities



# Related studies

- Eco-feedback visualization Studies
  - The effect of information on residential demand for electricity (Matsukawa, 2004)
  - Power cord (Gustafsson, et al., 2005)
  - Ubigreen (Froehlich, et al., 2009)
- Applied psychological model
  - Attitude model
    - Assumes that “pro-environmental behavior will be automatically followed from favorable attitudes towards the environment”

# Preliminary study

- Conducted online survey
- Purpose
  - To consider how people think about electric consumption and environment
- Method
  - On line survey
  - 153 participants (Oct to Dec, 2011)( almost all American, live near here)
- Results
  - The participants answer that they are “environmentally friendly” and turn off the lights very often and turn off computers often
  - They answer that they turn off switches more often at home than in public space
  - About the degree they want to know information, the results are more positively correlated between three information; the carbon dioxide emission, the electricity bill, and the waste on electricity consumption in public space than at home

# Purpose

- To design an interface for eco-feedback in buildings
  - How do people think about electric consumption and environment?
  - What information do people want to get about electric consumption?
  - How should we present the information to people in buildings?
  - Could I design human to human interaction for eco-feedback in buildings?

# Procedure

- Pre-interview
  - To make the questionnaire items in Survey 1
- Online Survey
  - Based on the results of pre-interviews, I had prepared a survey with 61 questions.

# Results: pre-interview before survey

- Participants

- 8 persons (3 male, 5 female; 3 Japanese, USA, China, Bangladesh, Iraq, Ireland), 20-30 min per person

- About energy saving activities in each country, comparison between the country and the US, environmentally friendly, comparison between their house and building

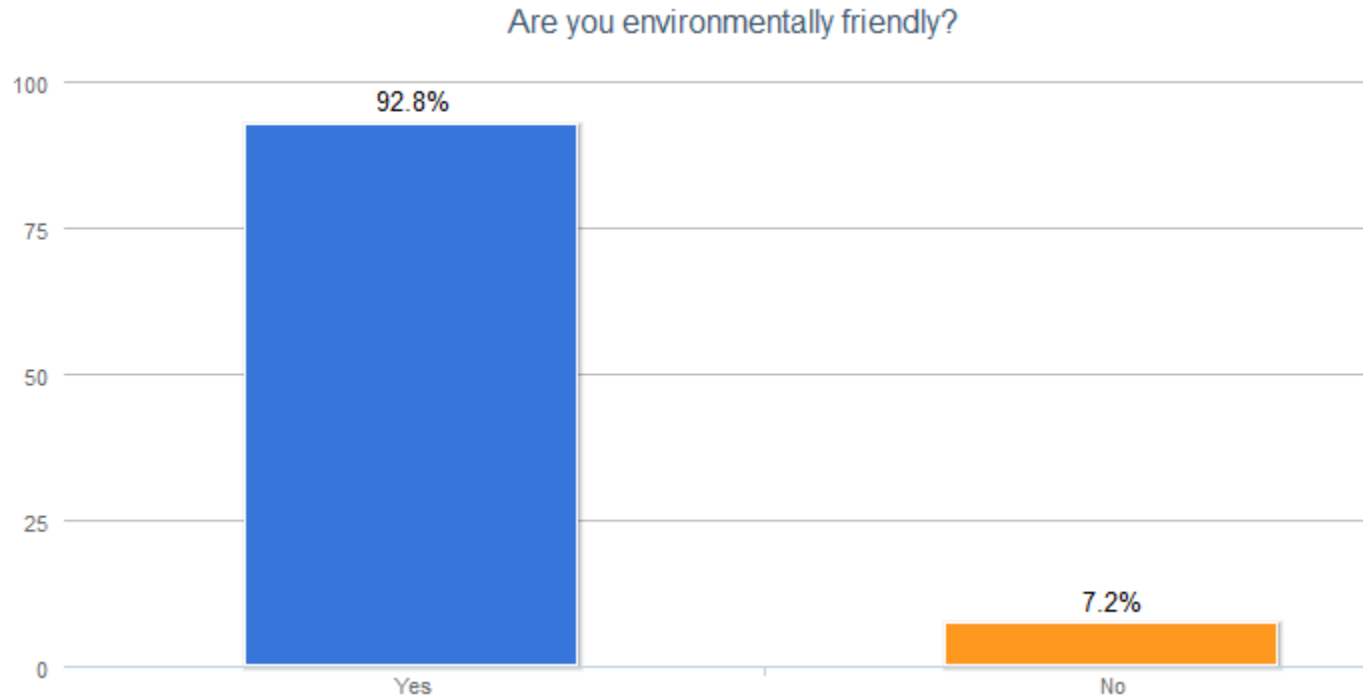
- It turned out that the energy consumption and people's consciousness about it depend on the situation, economic, energy resources in the country

# Results: Online

- Questions (61 items)
  - Demographics, degree of environmentally friendly, degree of turning off switches, new habit, education about it, estimated price, preferred information, values, other people, and so on
- Participants (153 persons)

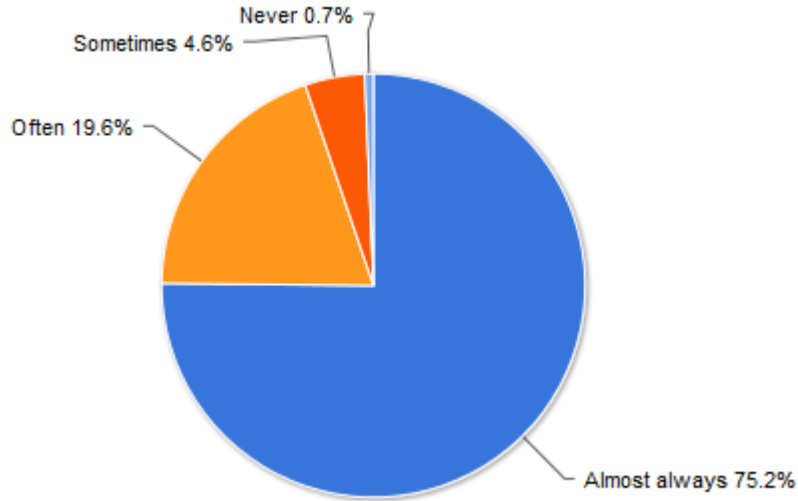


# Q: Are you environmentally friendly?

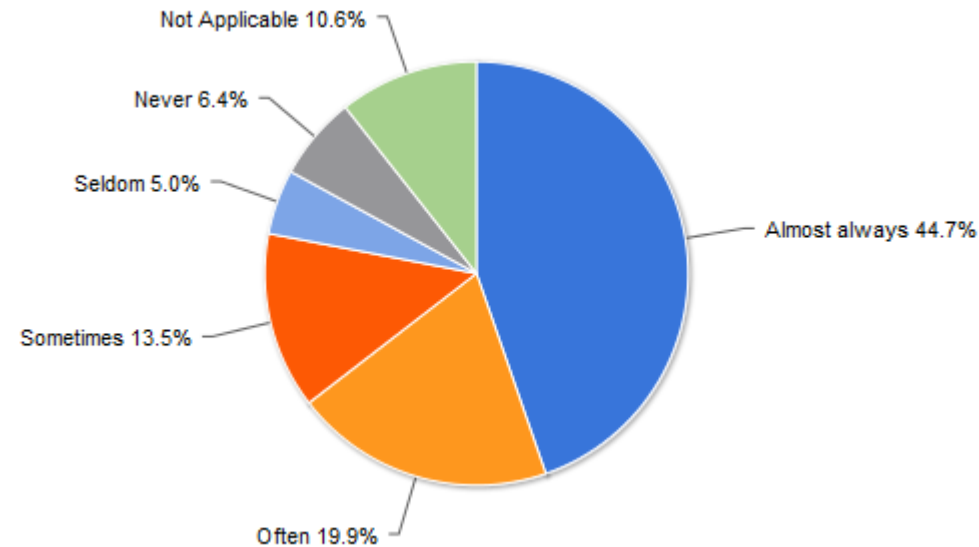


# Q: I turn off the lights when it is not being used

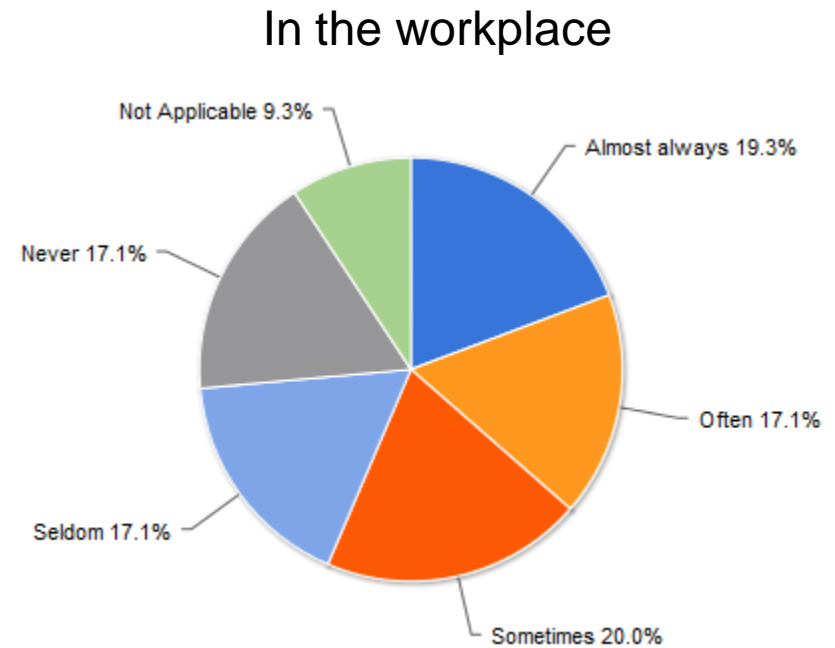
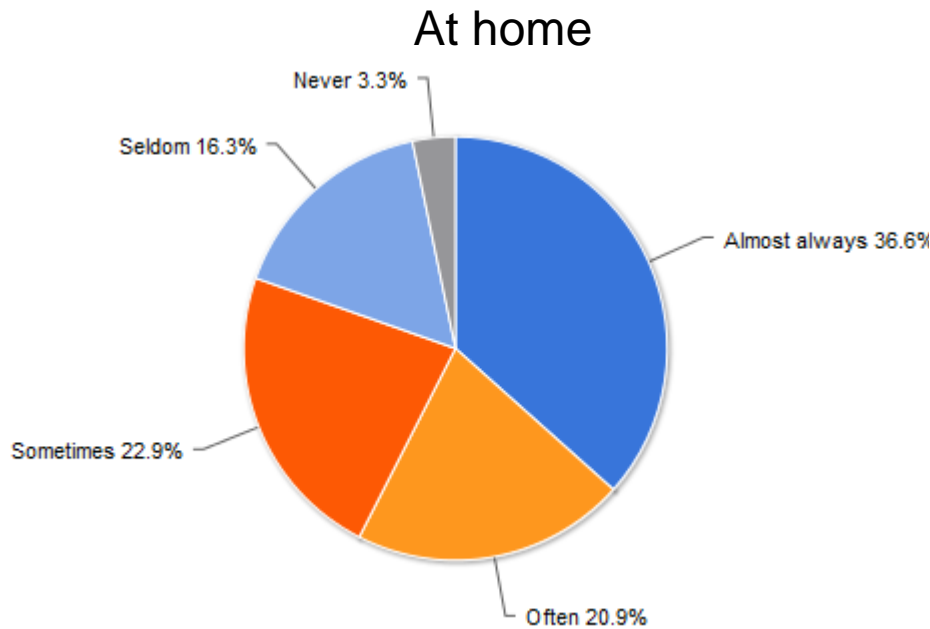
At home



In the workplace



# Q: I turn off computers when it is not being used



# Results (1/3)

1. Are almost all high educated (#4)
2. Are 40 years old (avg) (#3), and have lived in the US for 32 years (avg) (#13)
3. Answer that they are “environmentally friendly” (#16, 39, 40)
4. Answer that they turn off the lights very often (#19), turn off computers often (?) (#21) [Turn off]
5. Answer that some of them have started new habit to help conserve the environment recently (#22). The habit includes recycling, less driving, buying low energy devices, and so on. (#23) [New habit]
6. Answer that the estimated bill is \$58 (avg) (#25) and the estimated payment per 1 kWh is \$16 (avg) (#27) [Bill]

# Results (2/3)

7. Answer that their parents have told them to turn off the lights (#31) and some of them got any education on environment at school (#32) [Education]
8. Answer that they want to know “waste of electric consumption” (#35) more than bill (#34) and CO2 emissions (#33) [Information]
9. Answer that environmentally friendly is the most important among the three (environmentally friendly, economic efficiency and cutting waste) (#43) (as of each elements, the rate of “strongly agree” is cutting down waste > environmentally friendly > economic efficiency) (#40-42) [Values]
10. As of automation, some participants agree (67%) and some disagree (10%) (#44) [Automation]

# Results (3/3)

11. Answer that they turn off switches more often at home (#19-21) than in public space (#53-55) [Comparison, Turn off]
12. Answer that they want to know these information on their house (#33-35) more than on their public space (#50-52) [Comparison, Information]
13. Answer that they want to know the activities helpful for energy saving at home more than in public space (#36, 58) [Comparison, Helpful activities]
14. For them, closer or familiar the people are to them, higher the degree of environmentally friendly is (#29, 37, 38, 57) [Other people]
15. Answer that they have opportunities to talk about someone on energy saving sometime (#56) [Other people]

# Future Plan

## Event (state element)

### Air conditioner

- Outdoor Temperature
- Room Temperature
- Door Open/Close
- Room Population
- Weather

### Light

- Outdoor Brightness
- Room Brightness
- Window Shade Open/Close
- Human Position (distance from window)

### Computer

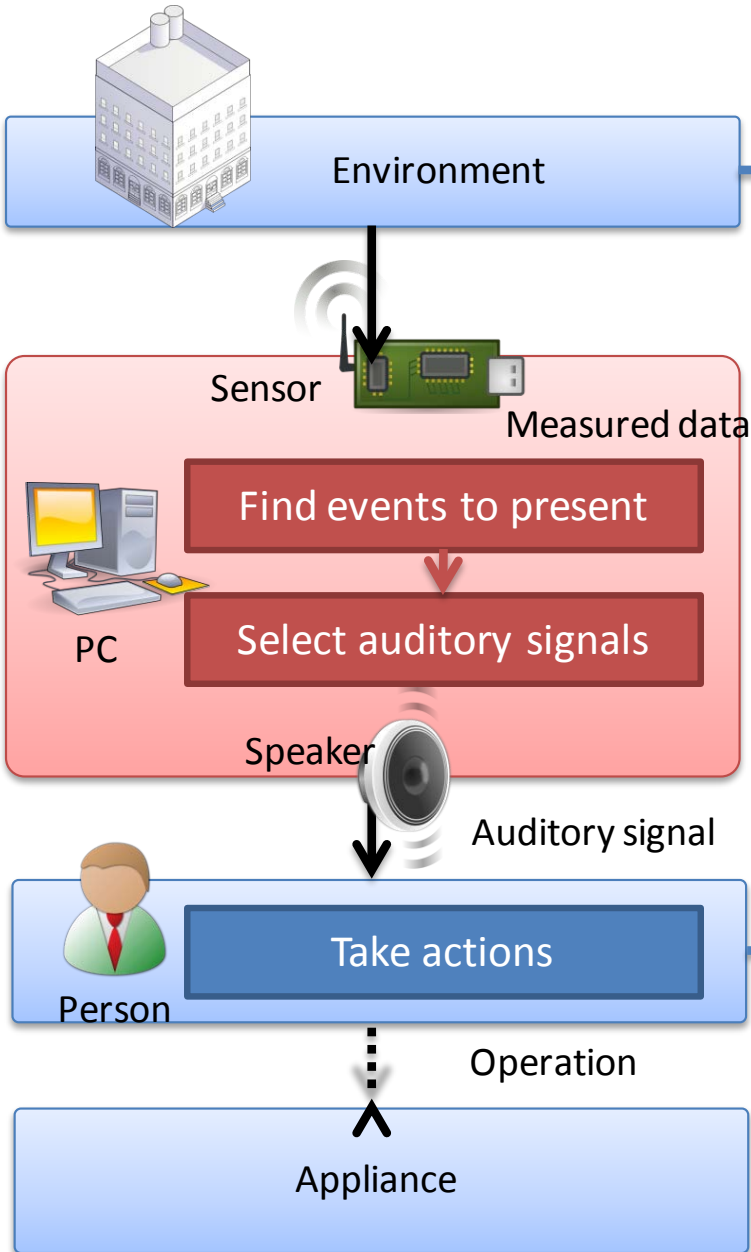
- Computer On/Off
- Room Population
- Total Power Consumption

## Action (expected)

- Set present temperature low
- Turn air conditioners off

- Turn lights off

- Shutdown computers
- Turn monitors off



# おわりに

- Fallen Star by Do Ho Suh