

Social Influence through Persuasive Agents

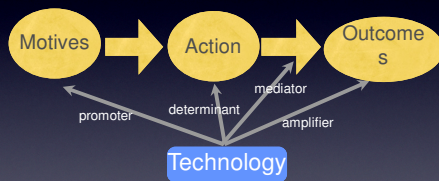


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What is Persuasive Technology?

- Any interactive intelligent system designed to change people's attitudes and/or behaviors.
- intentional
- non-coercive
- non-deceptive

Four roles of technology in conservation behavior

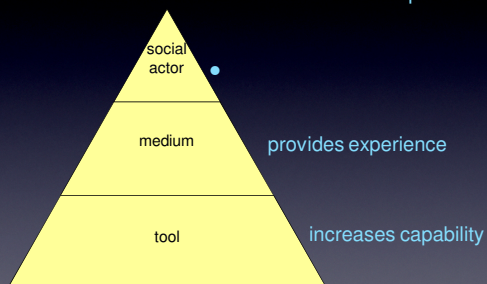


Computer as change agent

- persistent
- anonymous
- manages huge volumes of data
- many channels and modalities (e.g. games)
- scale easily
- go where humans cannot go



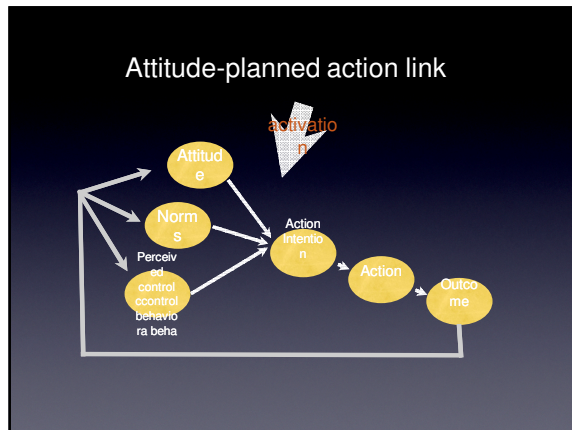
The functional triad (Fogg, 2003)



Persuasive Technology: Tool Functions

- making tasks easier:
 - offering skills, abilities, knowledge
 - (e.g. wizard, decision aid, captive tunneling devices)
- performing calculations that motivate:
 - (eg exercise feedback)

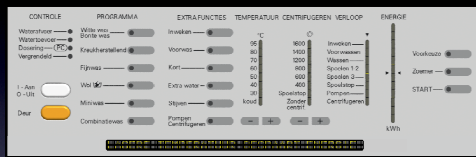




Early work on feedback (1975-1990)

- reaction to 'consciousness' approach:
- emergence of a behavioristic approach: learning theory
- Feedback
- Incentives
- Modelling
- Prompting

Interactive feedback



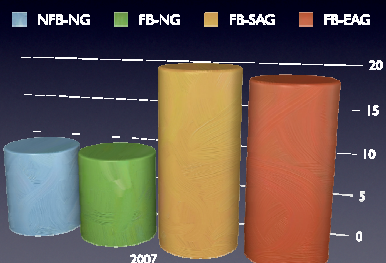
- Using user interface of systems
- User and action specific
- Immediate and interactive

Feedback Intervention Theory

Behavior is regulated by comparisons of feedback to goals or standards.

- **Goals or standards are organized hierarchically.**
- **Attention is limited and therefore only goal-feedback gaps that receive attention actively participate in behavior regulation.**
- Feedback interventions can change the locus of attention and therefore affect behavior.

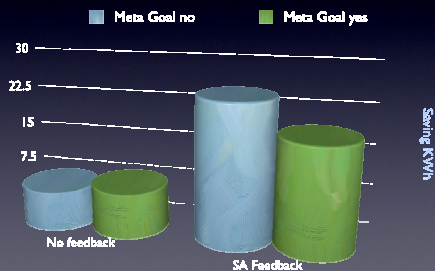
Self-set vs. Experimenter-set Goal vs No-goal



Task Performance Hierarchy Example: Washing clothes

- Meta-task processes: "I'm a clean person."
- Task-motivation processes: "I must do the laundry today."
- Task-learning processes: "What's the best temperature for washing a wool sweater?"

Distracting from task by activating a meta goal (MG)



Some preliminary conclusions

- Interactive Energy Feedback can improve energy efficiency and consumption levels.
- In particular true if:
 - there is a matching goal-feedback connection
 - goals are task-specific without meta-goal interference
 - feedback is without delay and connected to action
 - behavioral change is under control

Hypothesis: Social feedback from artificial persuasive agent promotes behavioral change?

- social praise and compliments from humans work as positive incentives (Bandura & McDonald, 1963)
- less attention for negative incentives
- agency

Social incentives

Can a system be social and what makes it social?

- social presence evokes social behavior
- praise enhances liking
- in/outgroup member
- experience gratitude
- use of similarity cues
- trust makes a difference



Negative information

- Learning theory underrates negative feedback
- Negativity bias
- Self-regulation
- Critical attitude, less automatic responses

Hypothesis 3: Perceived agency of source enhances social feedback

- Intentionality
- Essence
- Autonomy



Method

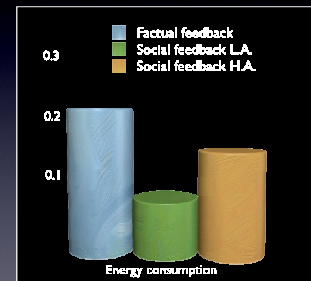
- factual vs low agency vs high agency
- N= 23; 10 trials
- iCat Victor: moving lips, eyes, eye-lashes, and eye-brows, head
- simulated washing machine panel
- Factual feedback condition: energy meter (6 levels)

Social feedback from Victor

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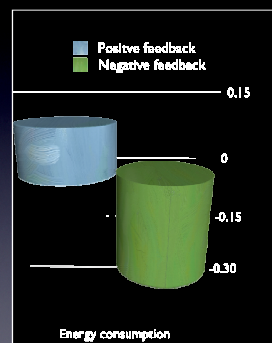
Energy Consumption with social feedback with high or low agency vs factual feedback

- MANOVA:
F(2,30)=3.42, $p < .05$;
F(1,30)=6.64, $p < .05$.



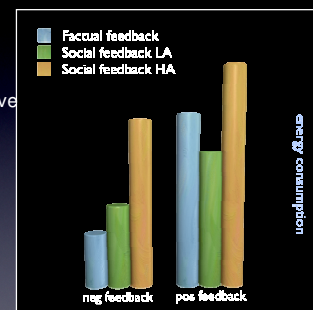
Positive vs negative feedback

MANOVA F (1, 786)=164.51,
 $p < 0.001$



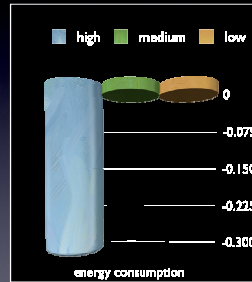
Negative vs positive feedback

Negative feedback less consumption than positive feedback



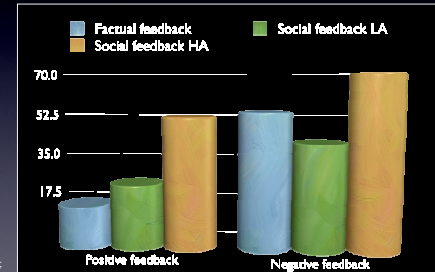
Feedback modes: speech dominates facial expressions and lights

MANOVA: $F(2, 786)=10.13$;
 $p<0.001$



Effect of social feedback and feedback valence

MANOVA: $F(2, 786)=4.60$;
 $p=0.01$



Preliminary conclusions study 2

Social feedback stronger behavior change than factual feedback. Including negative feedback enhances behavioral change. Supports notion of self-regulation. No observable effect of perceived agency; improve on verbal operationalisation and explicit measurement. Verbal expressions seem essential for effect of social feedback. Social cues need further exploration.

- Separate positive and negative feedback
- Distinguish factual, evaluative and social feedback features
- hypothesis: evaluative feedback stronger behavioral disposition than factual feedback
- evaluative feedback refers to factual standard
- social feedback refers to social standard

Social feedback



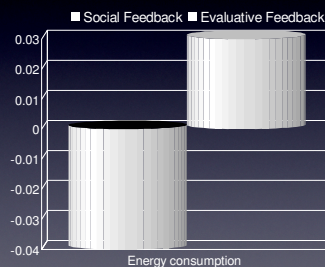
Evaluative feedback



Results

- Social feedback saves more than evaluative feedback

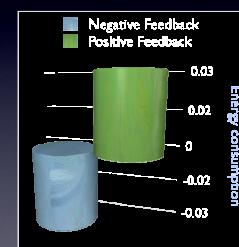
$F(1, 976) = 19.76$; $p < .0001$



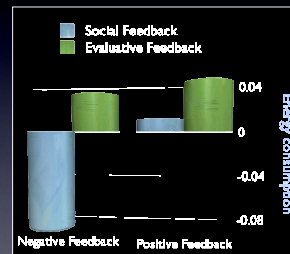
Effect of feedback valence

- Negative feedback saves more energy than positive feedback

$F(1, 976) = 12.12$; $p < .01$



Feedback Valence x Social/Evaluative



Preliminary conclusions 3

- Single negative fb stronger than single positive fb
- Social fb stronger than factual-evaluative fb

Study 4: Vossen, Midden & Ham, 2009

- Distinguish source embodiment and speech
- Replicate Feedback types: factual-evaluative vs social
- Replicate Positive vs negative feedback

hypothesis 1: Social feedback more effective if source appearances emits social cues

However.

* Mixed results: Verbal feedback from a virtual agent not always more effective than verbal feedback from a computer. Sampling effects?

* Gender effects

- females seem more attentive to nonverbal social cues than men
- females seem better at decoding social cues, especially facial ones

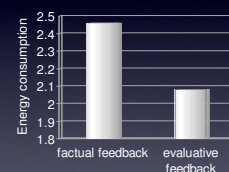
hypothesis 2: females may be easier persuaded than males by a socially embodied agent

Design: 2 (fb source: embodied agent vs. computer) by 2 (feedback type: evaluative feedback vs. factual feedback) by 2 (gender: male vs. female); Participants: 25 women, 51 men



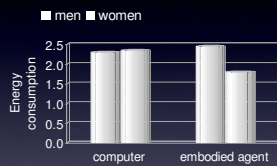
FEEDBACK EXAMPLES	Factual feedback	Evaluative feedback
Embodied agent	"level 3" "level 6"	"pretty good" "very bad"
Computer	"level 3" "level 6"	"pretty good" "very bad"

Evaluative Feedback saves more than factual feedback



Factual Feedback vs evaluative feedback: $(F(1, 66.888) = 6.115, p < .05)$

Effect of embodiment on consumption behavior moderated by gender



Embodiment x Gender: $F(1,67.079) = 5.691$, $p < .05$

Conclusions study 4

- 1) Evaluative feedback saves more than factual feedback
- 2) Women seem more sensitive to embodiment than men
- 3) Negative feedback saves more than positive feedback

Limitations:

- i Cat rather feminine
- both the iCat and the computer used voice, which is a strong social cue.

Reactance to persuasive agent

- Interactive factual feedback more effective than positive feedback
- Task oriented goal setting enhances effects of feedback
- Social feedback more effective than factual feedback
- Various social agent cues seem to play a role: speech, evaluation, embodiment
- Negative feedback more effective than positive feedback (in well-structured, high control context); ethical issues; reactance issues
- More work needed to model role of social

Wrapping up

- Rapid diffusion of persuasive technology
- Need for understanding mechanisms and effectiveness of persuasive agents.
- Great potential for serving human wellbeing, e.g. health, sustainability, social responsibility, empowerment.
- Need for ethics and regulation, e.g. in commercial and ideological domains.