

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

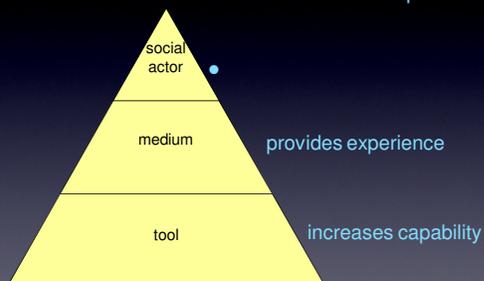


Computer as change agent

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



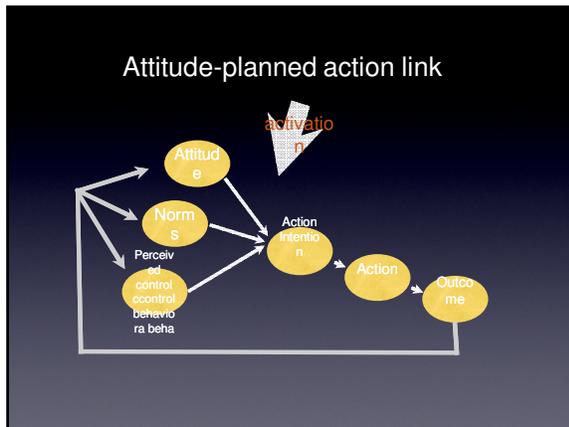
The functional triad (Fogg, 2003)



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.

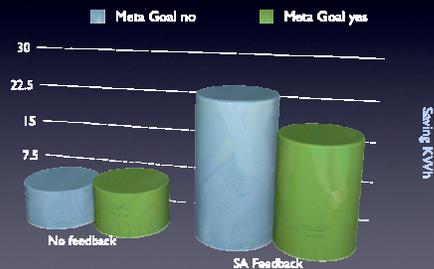
- **Goals or standards are organized hierarchically.**
- **Attention is limited and therefore only goal-feedback gaps that receive attention actively participate in behavior regulation.**
- Feedback interventions can change the locus of attention and therefore affect behavior.



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



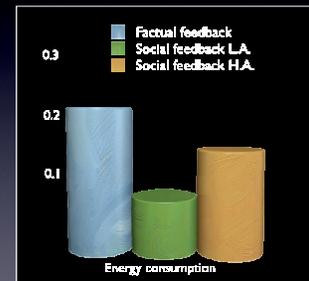
Method

- 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

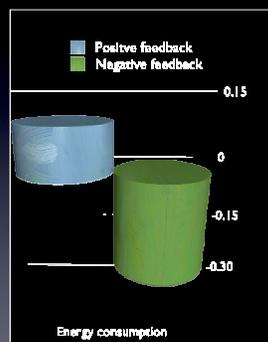
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Energy Consumption with social feedback with high or low agency vs factual feedback



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

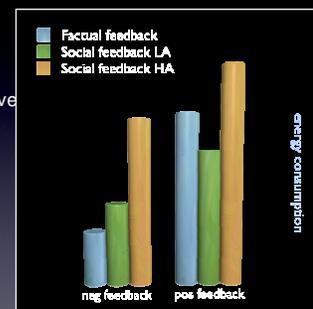
Positive vs negative feedback



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

Negative vs positive feedback

Negative feedback less consumption than positive feedback

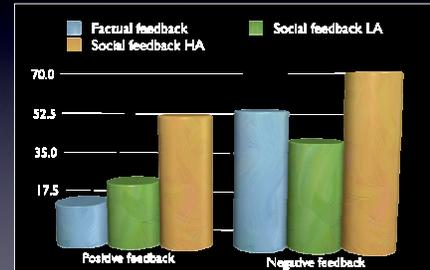


Feedback modes: speech dominates facial expressions and lights



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.

Study 3

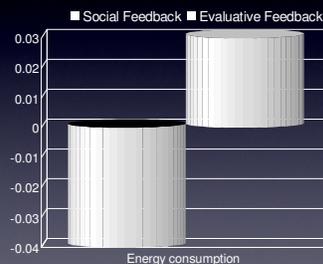
- Separate positive and negative feedback
- Distinguish factual, evaluative and social feedback features
- hypothesis: evaluative feedback stronger behavioral disposition than factual feedback
- evaluative feedback refers to factual standard
- social feedback refers to social standard

Social feedback 

Evaluative feedback 

Results

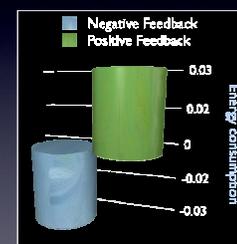
- Social feedback saves more than evaluative feedback



$F(1, 976) = 19.79$; $p < .0001$

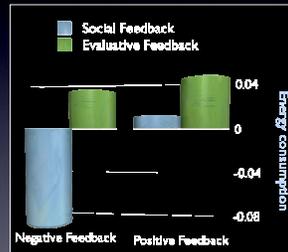
Effect of feedback valence

- 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



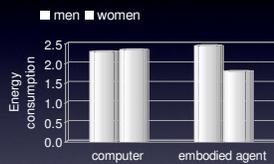
| FEEDBACK EXAMPLES | Factual feedback | Evaluative feedback |
|-------------------|---|--|
| Embodied agent | "level 3" "level 6"  | "pretty good" "very bad"   |
| Computer | "level 3" "level 6" | "pretty good" "very bad" |

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: $F(1,67,073) = 5.991, p < .05$

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:

- iCat 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 post-hoc 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

- 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.