RESIDENTIAL RESOURCE USE FEEDBACK TECHNOLOGY
A FRAMEWORK FOR DESIGN

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THINKING OF THE WORLD

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DESIGNING RESOURCE USE FEEDBACK TECHNOLOGY

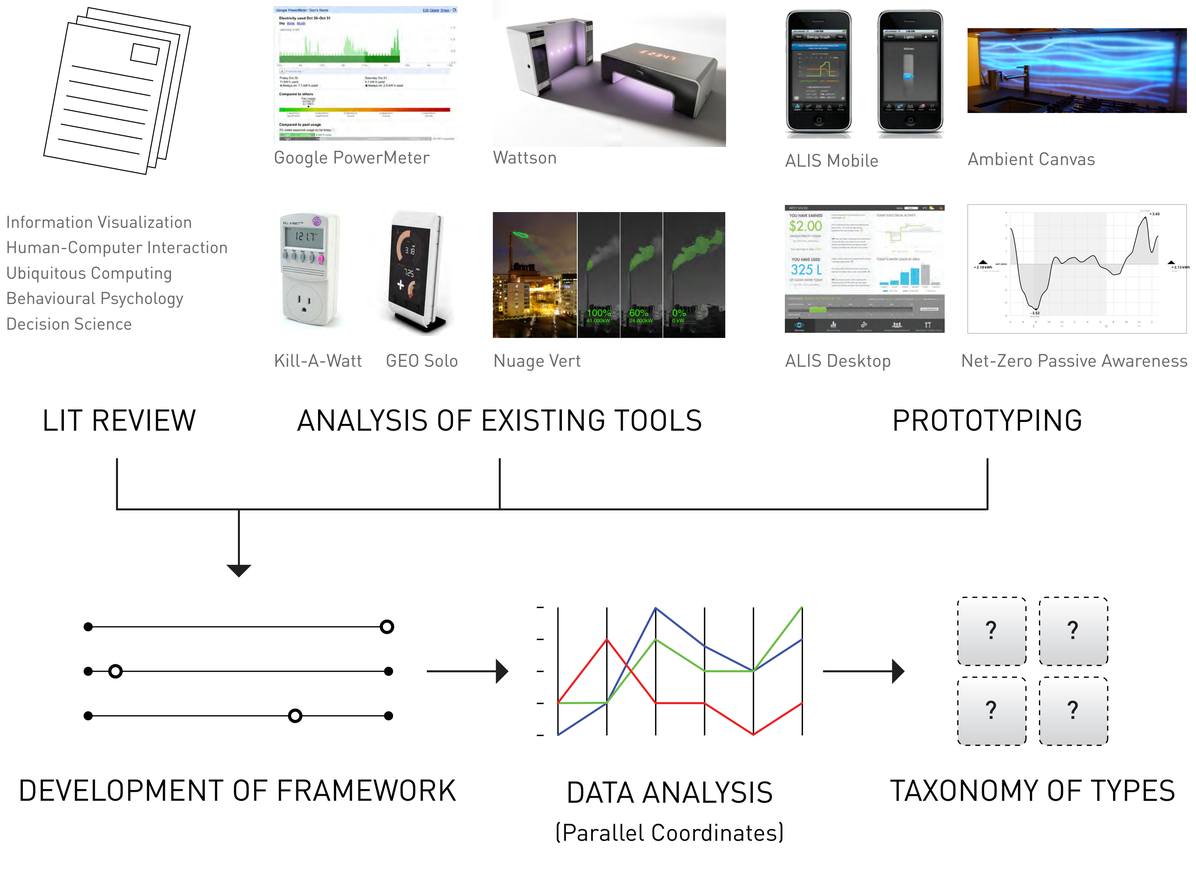
Providing effective feedback on resource consumption in the home is a key challenge of environmental conservation efforts. However, existing approaches have relied on a variety of assumptions about effective techniques without a unifying theoretical foundation, or a means of reliably comparing the strengths and weaknesses of different approaches. This is a design space in need of some structure. We present a comprehensive framework for the analysis and design of tools that provide feedback on residential resource use. We base this framework on our research experience in three contexts: 1) the design and implementation of energy management systems in two high-profile sustainable homes, North House and West House, 2) a review of the relevant literature, and 3) an analysis of existing products and tools in the marketplace and research community. We propose five sets of dimensions upon which these tools may be mapped: **Context**, **Behaviour**, **Human Factors**, **Aesthetics**, and **Data**. The framework serves both the investigation of existing instances and the design of future systems.

EXAMPLE: THE POWER-AWARE CORD

A. Gustafsson, M. Gyllenswärd, "The Power-Aware Cord: Energy Awareness through Ambient Information Display," Proc. ACM CHI Extended Abstracts, pp. 1423-1426, 2005.

The Power-Aware Cord is an ambient display intended to promote energy awareness. When active, the cord displays light either at a static intensity or as pulsating or flowing patterns, with intensity and frequency mapped to the current electrical draw of the attached devices. The parameters of the Power-Aware Cord have been mapped onto the dimensions of the framework below.

THEORY DEVELOPMENT



CONTEXT

SPATIAL — Local — Remote
Where is the resource consumed, in relation to where the feedback is provided?

TEMPORAL — Past — Present — Future
When is the resource consumed, in relation to when the feedback is provided?

BINDING — Tight — Loose
How tightly bound is the representation of the feedback to the context in which it is delivered?

BEHAVIOUR

COMMUNICATIVE INTENT — Informative — Advisory — Motivational — Notification
What is the communicative intent of the feedback?

BEHAVIOURAL MODEL — Rational Choice — Norm Activation
What psychological model of behaviour change does the feedback address?
J. Froehlich, L. Findlater, J. Landay, "The Design of Eco-Feedback Technology," Proc. CHI, pp. 1999-2008, 2010.

MOTIVATIONAL STRATEGY — Antecedents — Consequences — Social Influences
What motivational strategy does the feedback utilize?
R.D. Katzev and T.R. Johnson, Promoting energy conservation: An analysis of behavioural research, Boulder, CO: Westview Press, 1987.

DECISION SUPPORT — Tactical — Strategic
What mode of decision-making does the feedback support?

AESTHETICS

AESTHETIC CLASSIFICATION — Artistic — Pragmatic
What are the aesthetic criteria of the visualization?
R. Kosara, "Visualization Criticism—The Missing Link Between Information Visualization and Art," Proc. InfoVis, pp. 631–636, 2007.

HUMAN FACTORS

ATTENTIONAL DEMAND — Perceptible — Legible — Attentive — Alerts
What level of attention does the feedback require?

DEGREE OF INTERACTIVITY — Passive — Moderate — High
What degree of interactivity does the interface afford?

DATA

MENTAL MODEL — Financial — Scientific — Environmental — Equivalents
What mental model does the data address?
G. Wood, M. Newborough, "Energy-use information transfer for intelligent homes: Enabling energy conservation with central and local displays," Energy and Buildings, 39, pp. 495-503, 2007.

VALUE TYPE — Relative — Absolute
Are the data presented in absolute or relative terms?

SCALE — Small — Large
How large is the data set (number of discrete data points available for simultaneous display)?

SAMPLING RATE — Interval — Continuous
What is the sampling rate of the data?

REPORTING RATE — On Demand — Interval — Continuous
What is the reporting rate of the data?

PHYSICAL SCOPE — Appliance or Outlet — Room — Home — Neighbourhood — Larger than Neighbourhood
What physical scope is encompassed by the data?

SOCIAL SCOPE — Individual — Household — Community
What social scope is encompassed by the data?