Technology in the Home: Are You Ready for E-living?

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Agenda

- Human Factors Approach

- What is e-living?

- Applying the human factors approach to e-living

- Considerations/challenges/opportunities

- Going forward

What is human factors engineering?

- Multidisciplinary approach to multi-faceted problems
  - Ergonomics
  - Occupational & Environment Safety and Health
  - Sociotechnical Work Systems

- Micro-level to Macro-level exploration

- Effective design is the goal
  - Design the problem out if possible

- Interactions are critical

Balance Theory of Job Design

- Elements *interact* to determine the way in which work is done and the effectiveness of the work in achieving individual and organizational needs and goals.   Smith and Carayon, 1989

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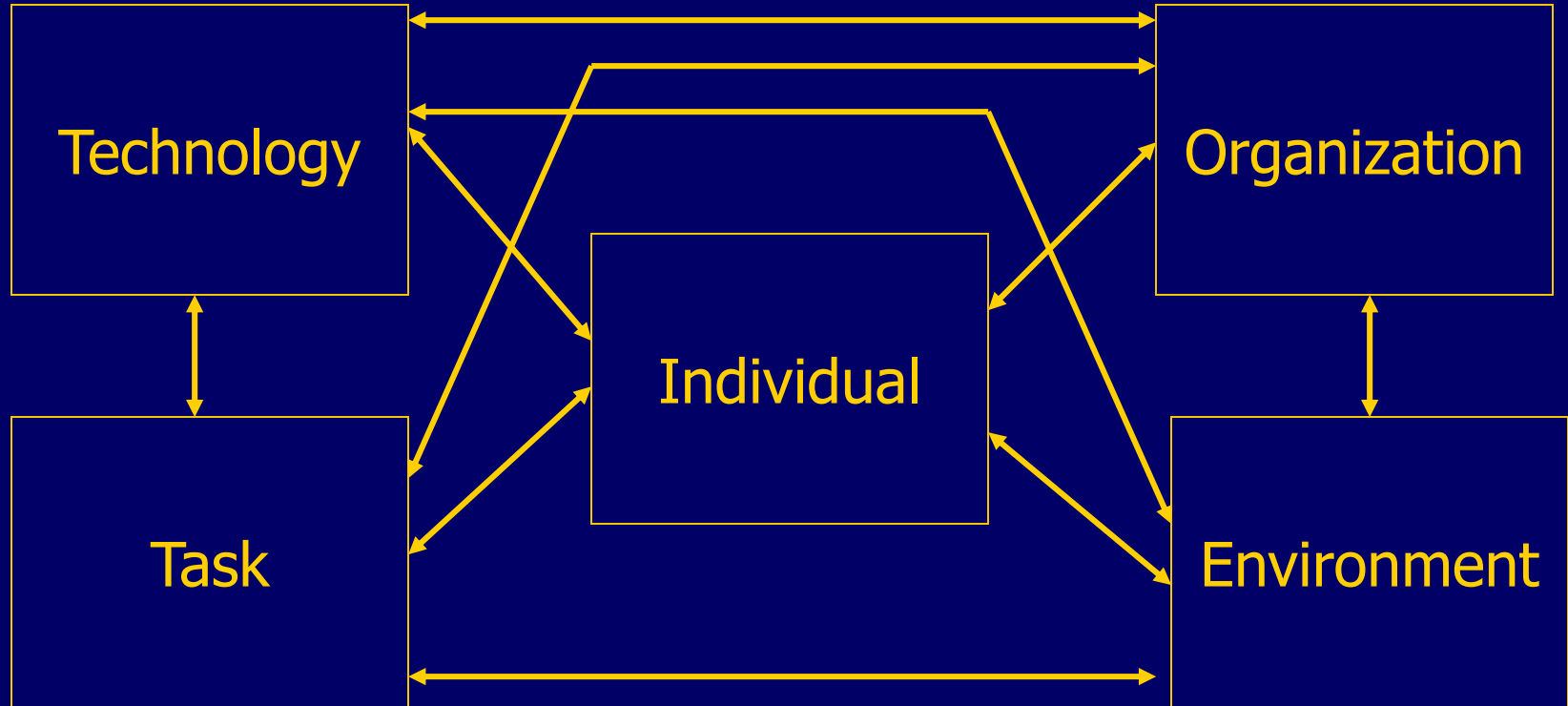
E-living

- The ability for individuals to communicate or transact information throughout the home environment
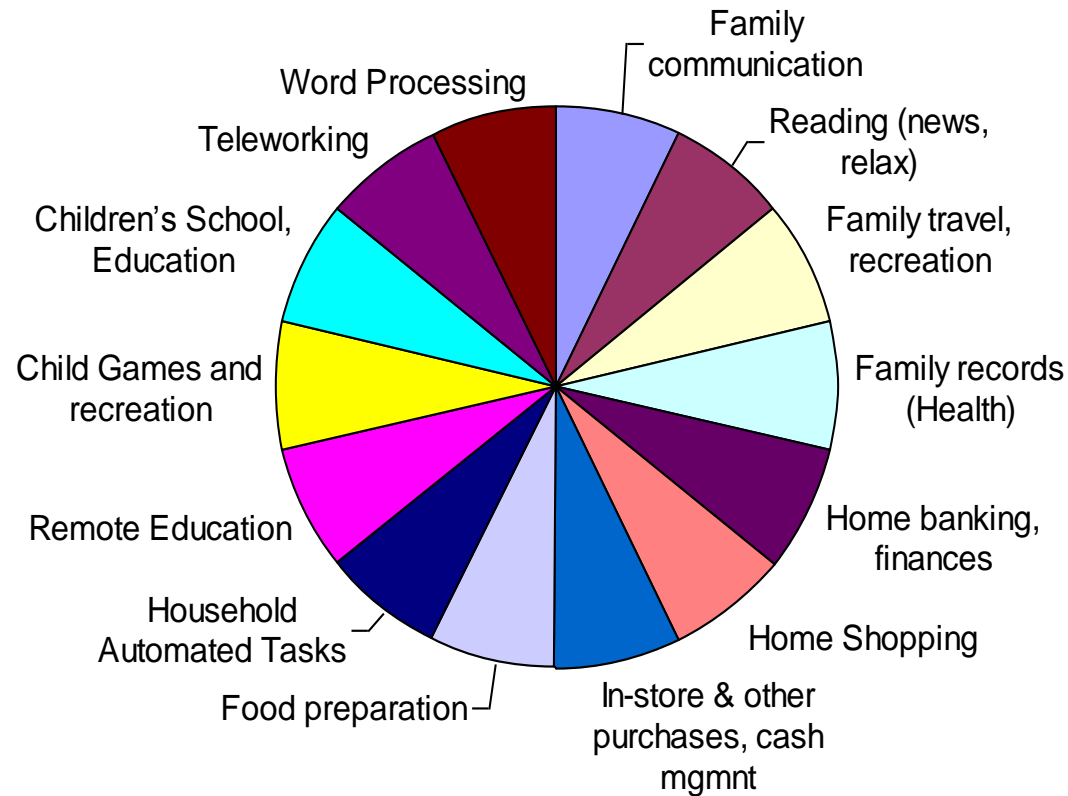

- *In the home of the future, electronics will be seamlessly integrated into your home with built-in flat-screen monitors, wireless connections and voice or gesture recognition, so that you will hardly notice its presence. In fact, the home of the future will actually look more like the home of the past — when TVs, DVD-players, speakers, computers, remote controls and wires didn't clutter your livingroom!*
Phillips Home Lab

E-living: Smart Homes

- Music everywhere
- Internet access throughout the home
- A fridge that you can remotely interface with to find out if there is any fresh milk left
- Walk up to your front door and it will grant you access
- Create "your environment" when you walk into the room
- A toilette that monitors your health with every flush
- Hub for security/monitoring
- Appliances that take care of themselves
- Run your washing machine or your dishwasher when energy prices are lower
- Clothing that monitors your heart rate and mood and that can tell you how it should be washed

Consider the home as a work system

Pie chart segments (clockwise from top):
- Family communication
- Reading (news, relax)
- Family travel, recreation
- Family records (Health)
- Home banking, finances
- Home Shopping
- In-store & other purchases, cash mgmnt
- Food preparation
- Household Automated Tasks
- Remote Education
- Child Games and recreation
- Children's School, Education
- Teleworking
- Word Processing

- **From Project NOAH (Alladi Venkatesh)**

Household-Technology Interactions

FIGURE 2

A Representation of the Internal Structure of the Household-Technology Interaction

	A.2 Sub-Environments**					
	Food Management	Household Maintenance Finance	Leisure/ Recreation Entertain- ment	Social/Family Communication	Work/Emp- loyment	Family/Develop- ment/Well- being
A.1 Family Members (As Adopters & users of technology)"	Primarily (parents)	Primarily adults	Whole Family	Whole Family	Primarily adults	Children and adults
A.3 Household Activities Targeted for Technology Use**	Meal Preparation & Consumption Washing Dishes etc., Grocery Shopping	Family Shopping Cleaning Tax Pre- paration Family Budget	Watching TV Holiday Travel Movies Games	Telephone Conversations Family Communication Holiday Reunion Correspondence	Job-related Activites Telecom- muting	Children's Education Adult Education Family Fitness Dieting Holiday Gathering
B.1 Configuration of Household Technologies #	Kitchen Appliances Automobile ATM Machine Computer Home-shopping (On-Line)	Washer, Dryer Automobile ATM Machine Computer On-line Home-banking	TV, VCR, Stereo Automobile Computer Multi-media On-Line Services	Telephone Answering Machine Fax Computer/email Internet On-Line Services	Telephone Answering Machine Fax Automobile Computer Internet	Typewriter VCR Telephone Computer Internet

** **Elements of Social Space**

\# **Elements of Technological Space**

Technological Evolution in the Home

Towards more dependency on technology →

Simple	Electrification	Automation	Intelligence	Artificial Intelligence	Human Intelligence
Early Home	World of Energy	World of Simple Programmable Machines	World of Smart Machines	World of Thinking Machines	World of Life
-Walls -Lights	-Appliances	-Telephone -Television -Radio -Security system -Flush toilets -Sensors	-Smart appliances -Computers -Fax -Cellular phones -PCS	-Biotech biometrics -Robotics -Neural Networks	-Clones -Living Homes

Smart Appliances as part of the Networked Home
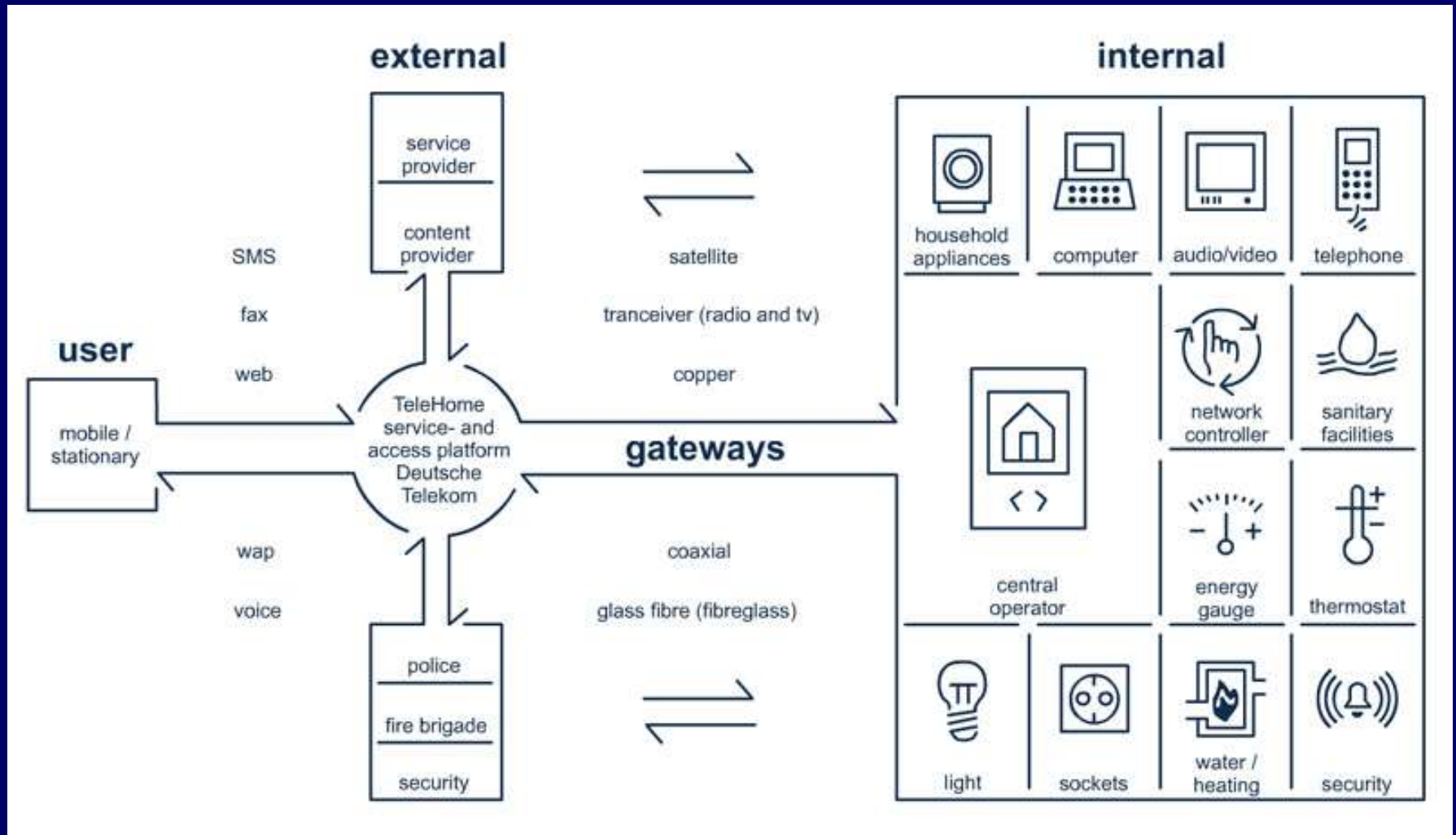
Living Space Model
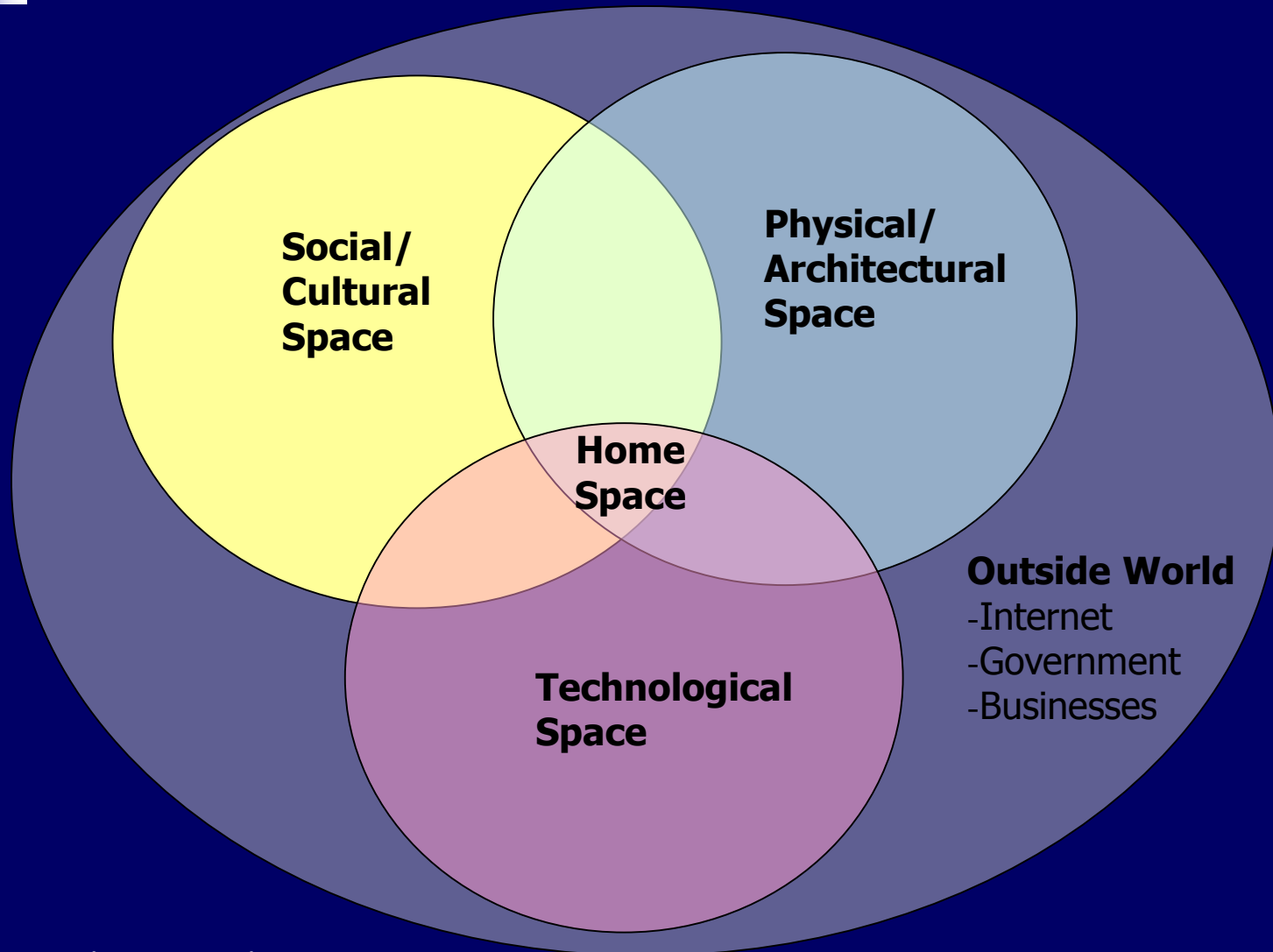
Applying human factors to e-living

- Do the features and interfaces of the technology fit with what we are trying to accomplish in our daily lives at home (and beyond)?

- Ergonomic considerations

- Work system considerations

Ergonomics / Interface

- Concept PC:
  Foot rest converts to PC screen and keyboard

- Screen fridge:
  Watch TV
  Look up recipes
  Plan Meals
  Leave messages

http://www.electrolux.com/screenfridge/

Work System:
Let's consider the 'smart' fridge

LG's Internet Refrigerator http://www.lg.ca

What are we supposed to do with our smart fridge?

- Feature list of smart fridges
    - Internal Communication (built in video for messages)
    - External Communication (internet connection, email)
    - Food management/track food supplies
    - News/TV, radio, music
    - Surf the web
    - home security
    - Digital cook book – custom tailoring to ingredients on hand
    - Remote access
    - Home management (digital calendar)

- Recall the balance theory work system
    - Is the technology compatible with the activities we are trying to do in our daily home lives?
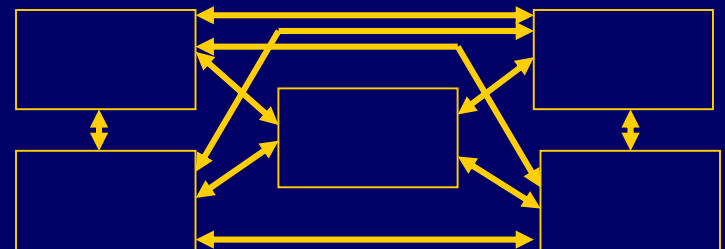
Applying human factors to e-living

- Do we have TVs in our kitchens?

- What are we usually doing if we are watching a TV in the kitchen?
  - Sitting? Standing? Looking at our fridge?

- Where are we usually when we plan our meals?
  - In the kitchen? Sitting? Standing?

- How do we input?
  - Touch screen keyboard. If want to add a non-digital recipe?

- How do we output?
  - Keep looking at the screen? Want a copy of the schedule?

- Can record a message – how do we ensure it is read?

- What if something isn't put back into the fridge?

Applying human factors to e-living

- Room for improvement

- Interactions of how activities are actually performed do not appear to reflected in the technology interfaces

- Research needed!

Some considerations….

- Privacy
- New home development (e.g. building codes)
- Technology standards
- Costs may create a further digital divide
- Old homes versus new homes
- Moving to another home
- Increased technology dependency
- Ergonomics

Policy → Privacy

- Fair information practices
  - Government and businesses will be in a position to collect vast amounts of "private" data
  - What should 'they' be allowed to collect?
  - How should 'they' be allowed to use it?

- Energy consumption
  - Can track which appliances are being used when.
  - New pricing models?
  - New Services?

- Health information
  - We know what you have been eating….
  - Your scale, clothes, and toilette are telling us things….

Policy → Quality and Standards

- Home security/management systems
  - Reliability
  - Contingency
  - Software quality
  - Hardware quality
  - Training

- Standards
  - Appliances
  - Networks
  - Buildings
  - Furniture
  - All have to work together!

Interconnectivity

- Connected Home Appliances-Object Modeling (ANSI/AHAM CHA-1-2003)

  The purpose of the standard is to promote new appliance services and features enabled through networking by describing generic appliance models, objects, and high-level messages. The models define standardized elements of appliances that are accessible and controllable remotely by users, service providers, and other devices, independent of the underlying network. The standard is written for appliances that contain a communications interface module linked to a home network system.

Current Contributors

- MIT – Media Lab, Artificial Intelligence Lab
- UC Irvine – Living Space Model
- Inhaus Project, Germany
- Various Industries (e.g. Appliance Manufacturers, Energy Sector)
- Technology Developers (e.g. Nortel, Microsoft)

- Challenge is to bring many domains together
  - Industrial design
  - Architecture
  - Technology
  - Business
  - Government

Business Drivers

- From the Association of Home Appliance Manufactures:

Appliance Technology Roadmap

DOE is particularly interested in the area of more intelligent or "smart" appliances that have the potential to enhance comfort and convenience, while also addressing energy management. It is anticipated that many home appliances will be connected to a communication system that will allow for many new features and opportunities.

Emerging business opportunities

- New roles:
    - Home programmer
    - Trainer for you in your home
    - "move" specialist

- Design
    - The home
    - The furniture
    - Other appliances

- Insurance options/alternatives

- New information
    - Energy management
    - Consumption patterns

Suggestions

- Focus not on a particular appliance, but on the system
- View the home as a collection of interface points
  - We will want to do many different home activities at each of those points
  - Some overlap of what we do at the different points, but also some unique activities
  - Look beyond 'an individual' as the user
- Be considerate of ergonomics, quality, and reliability
- Given due attention not only to the hardware and the software, but also the *information and its use.*
- Look beyond the concept of the computer and keyboard
  - Voice, touch, biometrics

Looking beyond individual as user

FIGURE 9
Parent-Child Tandem User Interface

- Family members working together
- Seating
- Screens
- Input devices

Going forward…

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  - Look beyond 'an individual' as the user
- Be considerate of ergonomics, quality, and reliability
- Given due attention not only to the hardware and the software, but also the *information and its use.*
- Look beyond the concept of the room, the computer and the keyboard
  - Voice, touch, biometrics, ubiquitous or pervasive computing

Thank you!