

New Information Technologies in the Home: A Study of Uses, Impacts, and Design Strategies



Project NOAH

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Near Information Technologies in the Home: A Study Use, Impacts, and Design Strategies

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The purpose of this study is to develop conceptual schemes for the design of the technological environment in the home as well as relevant living spaces in the home. The study brings a multi-disciplinary approach to an emerging area of research that has much significance to the conceptualization of the home in the information age.

Background

Recent advances in communication and information technologies have begun to impact our work and home lives. It is well documented that the emergence of the personal computer in the 1980s and the Internet in the 1990s has radically altered people's work environments. Recent survey data reveal similar trends in the domestic sector. (See the special issue of the journal, *Communications of the ACM* focused on "Internet @ Home" (ACM 1996) and Venkatesh 1996; Venkatesh & Vitalari 1992). The news media has frequent articles on how new technologies are changing the patterns of home life, especially in terms of family communication, work at home, entertainment, on-line banking/shopping, to name a few.

What is not clear is the exact nature of the impact of these information technologies on social life at home, and their possible implications for the design of the technologies for the home and the design of the home itself based on the changing social and technological environment. What is required is a systematic research in this emerging area.

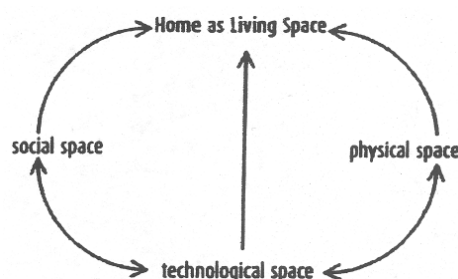
Our study examines the design aspects of new technologies as well as the design of home environments in which the technologies are to be used.

Theoretical Framework

For our purposes, we conceptualize the household in terms of "Home as Living Space" consisting of three

related constructs, (a) social space, (b) technological space and (c) physical space (see Figure 1).

Figure 1 Home As Living Space



Social space may be identified in terms of the household social structure (e.g. parents, children), the household activities performed by household members, the time allocation for such activities, and the social dynamics which occur between and among family members while performing the activities. Household activities are varied and include cooking/ meal preparation, home management, family recreation and entertainment, family communication within the household and with the community outside the home, family shopping, home management and other everyday-life activities.

Physical space refers to the interior spatial organization of the home which includes all of these are some of these: Dining area, formal living room, den or family room, bed room(s), study room(s), work space, and adjacent areas to the home that are alongside or outside the physical structure such as patio, garden, balcony.

Technological space refers to the configuration of technologies in the home, starting from kitchen appliances to the TV to the telephone, the computer, and a variety of other domestic technologies. Tech-

nological space also includes the specific uses of these technologies for performing household activities as identified within the social space.

The structure of the three spaces identified above vary according to the demographics of the family, their cultural or sub-cultural backgrounds, life style factors, and household preferences. However, broadly speaking, it is safe to say that the living space of the family can be described in terms of the three constructs, the social space, the physical space, and the technological space.

In this study we focus on the intersection of the three spaces, especially within the context of new information technologies. Derivatively, we try to operationalize the spatial schemes in terms of their implications for the design of the technological and physical spaces. We operationalize them in terms four components: 1) household use of information technologies-current and anticipated uses-and their impacts on home life (social and technological spaces); 2) design of new technologies for the home emerging from an understanding of the household use of technologies (technological space); 3) use of timespace considerations in the design of the technological environment in the home (social and technological spaces); and 4) design of the livable spaces within the home based on our understanding of other components (social and physical spaces). The novelty of our approach is highlighted in the following discussion.

The three spaces, identified above-social, technological, and physical-are closely linked by the very nature of household dynamics and activities. The question we wish to address is how to use these spatial schemes for design considerations. The customary approaches to home design take into consideration the social space and the physical space. The technological space has not been considered as important or as material as the other two for designing the home. Similarly, in designing technological products for the home, even less consideration is given to the physical space. Our study examines these spaces simultaneously in a holistic fashion.

Although our conceptual discussion incorporates all domestic technologies (i.e. technological space broadly defined), our specific interest is in the in-

formation and communication technologies. The discourse relating to these new technologies must be examined in terms of two temporal realities: the existing or current reality, and the futuristic vision attributed to these technologies. We believe the character of these technologies will change in some fundamental ways as new technologies are developed. For example, with few exceptions, currently, few domestic technologies are discrete and not linked. That is, typically, the stove is not connected to the telephone and so on. In addition, the domestic technologies are designed as uni-purpose in functionality and well defined (i.e. there are no ambiguities as to their purpose; e.g. a toaster toasts and a refrigerator keeps food items cool or frozen).

However, scenarios and prototypes are being developed where domestic technologies can "talk" to each other and to technological systems outside the home. In addition, the technologies can be preprogrammed, hence the label, smart appliances. We also foresee the emergence of smart homes where the entire home is computerized and automated. All these developments point to immense technological possibilities that have barely begun to surface. The question we ask is what goes into the design of these new technologies. What considerations enter into the design of the technologies? Similarly, how is the home itself going to be designed to accommodate these new technological possibilities? Given that families inhabit homes and they live within the context of social space, how should we take into account the social spatial considerations in designing both the technologies as well as the interiors of homes within which these technologies are embedded? All these rhetorical questions need to be rephrased as researchable questions and investigated very systematically.

Based on the general four-part theoretical model above of the implications of new information technologies in the home, we can devise a more detailed "process" model which captures some of the facets of the relationship between information technology and its use in the home.

Research Model

We begin by proposing a detailed "process" model (Figure 2) which captures some of the facets of the relationship between information technology and its use in the home. In this model we indicate that the

introduction of the computers and new information technologies in the home (Fig-2 1-4) can theoretically have several impacts, (Fig 2, 5a, 5b, 5c, & 5d).

First (5a), *computers and related information technologies affect homes*. The insertion of this technology in a space may change the characteristics of that space. They come with a particular design and certain physical characteristics, and demand certain locations (close to walls with electric outlets). As Venkatesh and Vitalari (1992) have shown, in the early years, computers were used primarily for work in the home, and were located in a space designated as "study." This is still the case.

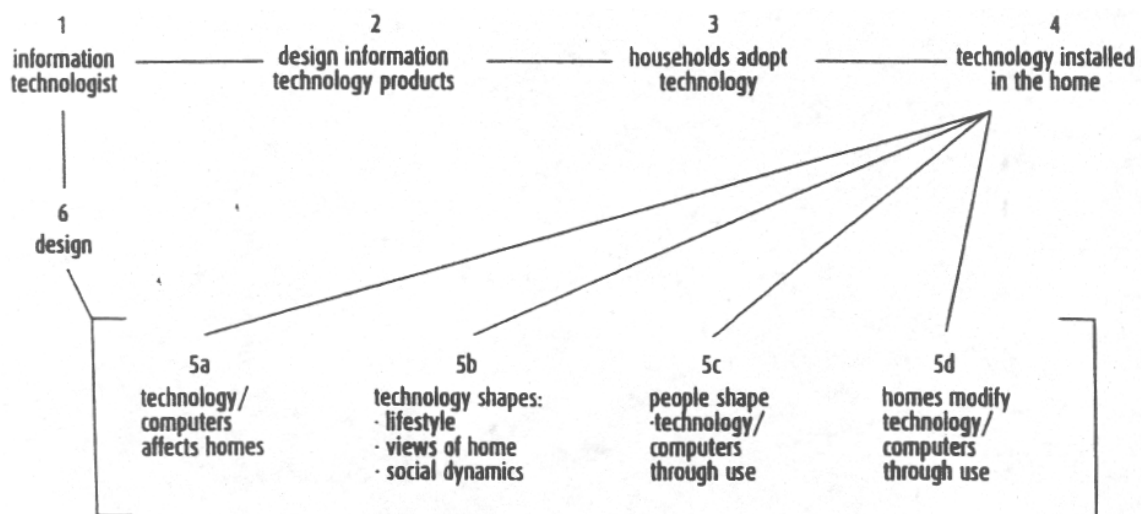
They affect space-time in the home and the home may have to be designed to accommodate this technology. The home may need to be wired and outfitted to take advantage of this technology, much like the office has been. It is useful to think of design for "ubiquitous computing" (Streitz et al 1998).

The design of living spaces in homes needs reconsideration. Additional space is required to place the computer, the VDT, printer, speakers, paper, printouts, and other auxiliaries. Support services, such as telephone connections, dedicated phone lines, electrical outlets, are also needed. If several people share the computer, access has to be provided. Although there are several writings about design of homes

(Rasmussen 1966; Darby 1963; F Friedman 1989; Von Meiss 1990), they have not addressed considerations of computers and need very well. Environmental programmers have attempted to include people's needs into the design process through the use of social science procedures (Sanoff 1977; White 1972; Duerk 1993; Mazumdar 1992). But here too, explicit attention to the computer in the home is lacking. This research could make significant contribution to Environmental programming for new information technologies in homes.

Information technology and computers affect people in the home (5b). Their presence may affect lifestyle as many tasks that were performed in particular ways may change. People may work at different times, spend more time at home, change the time they spend in transit, and may affect when and how people conduct other activities. The computer may be given a certain "position" and even special treatment. Treatment of others (including pets) in the house may change, thus affecting household and perhaps even external, social relations. Power relations in the home may change in subtle ways. Those more proficient in the use of the computer or simply faster in typing may gain privilege. Some may therefore be enabled and empowered though others may feel disabled and loss of power. Information gained through the computer may also change power relations involved with knowledge.

Figure 2 A Process Model of Technology in the Home



People may modify the computer and the technology (5c). Households may not change the computer, may change it only superficially, such as its appearance, or may modify it in more major ways, such as through the addition or removal of parts, applications, hardware, software programs, and other objects that may make it quite different from the original. How people modify the technology, and to what degree, will give us some clues about how the computer is viewed and what it means to the household.

Homes may modify computers (5d). Though it is the people who will actually do the modification, it may be initiated by the design of the home. For example, the computer or parts of it may be displayed prominently, or hidden away in unobtrusive locations. These may require the design of the computer as a physical unit to be modified. Pursuing this area of inquiry will teach us about how the computer is used and how it may be designed differently the next time.

The feedback to the producers of technology occurs through the arrow connecting the impacts and Figure 2, 6. This suggests that the process of technology production and consumption is an ongoing process and needs continuous monitoring.

Research Questions

This research project is aimed at testing these models through answering the questions motivated by, and based on, our analysis of the issues discussed above. The primary research questions are:

1. How do families view and use computers and new information technologies? Who uses them and for what purpose? How much time is spent in using the technologies?
2. What is the technological space that defines the use of the new technologies? That is, what is the configuration of new technologies, and how are they situated in the physical and social space of the household? How are these spaces defined?

We are particularly interested in the following secondary questions.

3. How does the technology affect the home?

4. How does the technology affect/modify domestic life?
5. Few do: how do people utilize the technology?
6. How is the technology modified for acceptance in the home?

Tertiary questions we wish to pursue are:

7. What aspirations do the household members have for the computer? What difficulties do the households face with the computer? What are the primary blocks the household faces in the use of the computer?
8. Based on current uses and practices in the home and the social structural issues, what schemes can we propose for the design of new technologies in the home? Similarly, what schemes can we propose for the design of interior spaces? For example, if people are doing job-related work at home, how does the workspace get organized? Similarly, if technologies can talk to each other, how do we conceive of livable spaces that incorporate these technological possibilities?
9. What social and cultural factors must be taken into account in designing the schemes for new technologies and interior spaces? What models of cultural adaptation would be appropriate in making the technologies accessible and desirable?

Methodology

In order to answer these questions and test these models it will be necessary to conduct a multi-disciplinary effort including social and cultural analysis, design, and marketing. We are now conducting an exploratory naturalistic field research project drawing on anthropological and sociological ethnography and participant-observation. The exploratory includes an ethnographic study of about 70 households in the Orange County and greater Los Angeles area.

The research data collection protocol consists of the following: The standard qualitative research data collection techniques of observation, participant observation, in-depth, intensive, long interviews, as well as photographic documentation, archival research, and collection of information on the design and physical environment of the home. The interviews are unstructured to enable us to be open to the numerous possibilities that will emerge in the

field. The interviews are open-ended so that subjects can describe what is important to them. Questions are based on an emergent research technique, dependent on answers to previous questions and on previous interviews. The early six to eight interviews will enable us to refine the questions and revise the protocol so that the instrument is more sensitive. The households are selected using a snowball sampling technique. Households are contacted prior to the study via telephone and recruited on the basis of their computer and other media ownership.

Data will include field notes based on observation, taped interviews, videotapes, still pictures, and a short questionnaire.

Data will be transcribed into a textual format and will be analyzed both manually and using sophisticated computer software for textual data (e.g. NUDIST).

References

Danby, Miles (1963) *Grammar of Architectural Design*, Oxford, UK: Oxford University Press.

Dholakia, RR.; Mundorf, N.; & Dholakia, N. (eds) *Information technology in the home: Demand side perspectives*. Mahwah, NJ: Erlbaum.

Friedman, Jonathan B. (1989) *Creation in Space*, Dubuque, IA, Kendall/Hunt.

Duerk, Donna P (1993): *Architectural programming: information management for design*. New York, N.Y.: Van Nostrand Reinhold.

Mazumdar, Sanjay (1992) "How Programming Can Become Counterproductive: An Analysis of Approaches to Programming," *Journal of Environmental Psychology*, Jan:12(1):65-91.
Rasmussen, Steen Eiler (1966) *Experiencing Architecture*. Cambridge, MA: MIT Press.

Sanoff, Henry (1977) *Methods of Architectural Programming*. Stroudsburg, PA: Dowden Hutchinson & Ross.

Streitz, Norbert A.; Geissler, J.; & Holmer, T. (1998) "Roomware for cooperative buildings: Integrated design of architectural spaces and information spaces", in Streitz, Norbert A.; Konomi, S. & Burkhardt, H.-J (eds.) *Cooperative Buildings: Integrating information, Organization, and Architecture*. Berlin, Germany: Springer-Verlag.

Venkatesh, Alladi & Vitalari, Nicholas P (1992) "Emerging distributed work arrangement: An investigation of com-

puter-based supplemental work at home." *Management Science*, 38(12)(Dec) 1687-1796.

Venkatesh, Alladi (1996) "Computers and other interactive technologies for the home." *Communications of the ACM*, 39(12., Dec): 47-54.

Von Meiss, Pierre (1990) *Elements of Architecture* New York, NY: Van Nostrand Reinhold.

White, Edward T. (1972) *Introduction to Architectural Programming*. Tucson, AZ: Architectural Media.

Winters, Nathan B. (1986) *Architecture is Elementary: Visual Thinking Through Architectural Concepts*. Salt Lake City UT: Gibbs Smith.

