NATIONAL COLLEGE OF ART & DESIGN
DEPARTMENT OF INDUSTRIAL DESIGN

integrated design

GLOBAL COMMUNICATION

The impact of technology on Design and Society approaching the Third Millennium

BY

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Integrated
design

COMMUNICA

Technology

is a system or body of knowledge...

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Table of Contents:

List of Tables

List of Illustrations:

List of Abbreviations

A/V	Audio/Video
CD	Compact Disc
CD-I	Compact Disc-Interactive
CD-R	Compact Disc – Recordable
CD-ROM	Compact Disc – Read Only Memory
CD-RW	Compact Disc – Rewritable
CRT	Cathode-ray tube
DAC	Digital to Analog Converter
DBS	Direct Broadcast Satellite
DD	Dolby Digital
DSS	Digital Satellite System
DTS	Digital Theater System
DTV	Digital Television
DVD	Digital Versatile Disc
DVD-RAM	Digital Versatile Disc – Random Access Memory
DVD-ROM	Digital Versatile Disc – Read Only Memory
EIBA	European Installation Bus Association
GB	Giga-Byte
HES	Home Electronic System
JPEG	Joint Picture Experts Group
LCD	Liquid Crystal Display
LD	Laser Disc
LED	Light Emitting Diode
MB	Mega Byte
MD	MiniDisc
MHz	Mega Hertz
MPEG	Motion Picture Experts Group
NT	Network
NUI	National University of Ireland
PC	Personal Computer
RAM	Random Access Memory
ROM	Read Only Memory
SBP	The Sunday Business Post
TV	Television
UCI	Universal Control Interface
USB	Universal Serial Bus
V	Volts
VCR	Video Cassette Recorder
VHS	Visual Home Entertainment System

Introduction

Recent years have seen the rapid development of new technologies, which provide us with new methods of communication both at a local level and in a global context. These new methods of communication not only allow us to converse with other people but with our everyday domestic products. Along side the development of these technologies have been the increase in integrated products. Designers have been able to combine or integrate numerous products using these technologies.

With the Millennium only around the corner, it is important at this time to explore these technologies, to look at their present status and to understand their potential. The following dissertation will examine how these technologies will affect product design, and where do the limitations lye. This study will provide insights into designers' perspectives on technologies and integrated design.

The following dissertation will address such issues as why we have integrated products and systems, what products have been integrated and how are they have been integrated? We will look at the advantages and disadvantages of integrated products and along side this who uses them. Domestic products and appliances at the heart of our everyday lives have been integrated as part of a household system. Communication can occur between one appliance and another when part of a home integrated system and the user can communicate with the appliances by way of a universal interface. Communication is a very important factor in the development of integrated products and their successful use in our present societies and the future potential of these products. An examination of

communication methods will be forthcoming. The World Wide Web and its affect on domestic lifestyles, along with appliance communication within the home and in a global setting, will be discussed. What is the range of external communication will a user have with these integrated appliances and how will we communicate with them?

Exploring new technologies and design concepts that will utilise these technologies will be an important part of this thesis. Such as integration of all kitchen appliances, heating systems, lighting systems and all multimedia devices, all of which could be controlled from anywhere in the house by using a Universal Control Interface (UCI). Internet connections to our domestic appliances could allow us to download recipes and automatically preset your cooker/microwave to exact cooking times and heat. Future downloads of information and upgrade of appliances though The World Wide Web and/or electrical wiring could means maintenance of these products is instantaneous and carefree.

Aim and Scope of the Study

The aims and scope of the thesis are:

1. To explore the literature on global communication and integrated design in order to establish an overview of existing products and how they are used in society.
2. To conduct a focused review and appraisal of existing integrated design, in particular that of the Siemens Home electronic System.
3. To investigate designers' perspectives on integrated products and determine how their views are expressed in practice.

4. To provide insight into the social impact of the development of the technologies which allow designers to create integrated products.

Structure of the Thesis

Chapter One of this dissertation reviews the relevant research literature in relation to global communication and integrated design. The review shall provide an insight into the influences that have lead the author to an interest in this subject matter. This first section will also briefly identify the concept, and reality, of communication through integrated products, and shall include a description of the various forms of design integration and numerous methods of communication.

Chapter Two deals with integrated multimedia products. This chapter briefly reviews and attempts to define the term 'multimedia' and how it should be understand in relation to integrated products and its implications for global communication. A analysis of the Sony S-Link System and the Philips DVX-8000 home entertainment system is undertaken as examples of current and brand new multimedia products and systems. Global markets and cultural influences will be reviewed as part of the criticism of these products.

Chapter Three focuses on an appraisal of the Siemens Home Electronic System (HES). The review of the HES is conducted in the form of a case study in order to identify the current status of integrated systems in relation to design and society. The appraisal shall try to evaluate whether this kind of system will become part of our everyday lives. If this system succeeds, why will it, where many other products and systems have failed before?

Chapter Four is concerned with an evaluation of the social impact of the technologies and the change brought about by their use. This chapter will briefly

outline how integrated design has impacted on peoples lives in the past, how we are affected presently and will speculate on future impact of integrated design an related technologies. The change in society and change in social interaction as a result of technological developments will also be dealt with.

Chapter Five describes the future of integrated design and communication, referring to technologies and social aspects closer to home as well as on a global level. A review of research and development currently being carried out by a group of Electronic Engineers at NUI College in Galway that deals with technologies, which assist in the creation of the 'Smart Home', will transpire. Philips Electronics 'Vision of the Future' project shall also be examined and will give some insight into perceptions of future design and society. Finally, the concluding remarks summarises the main material discussed in the study and some suggestions for further research are proffered.

Chapter 1 Global Communication and Integrated Products

Introduction

Much of the material that has been researched while compiling information for this thesis is technology based. Some of the technologies are in use at present, others are being developed and a number of them are at this time are conceptual but in the near future may be feasible. While the author has a large knowledge of the capabilities of many of these technologies, the reader may challenge the authors understanding of any of the technologies discussed.

In order to compile information relevant to this study, it was important to research a wide range of topics. Understanding people's perceptions of integrated products and the value these products have in their everyday lives was a very important part of this research. These topics were identified as:

1. Design and product integration,
2. Global markets and global positioning,
3. Communications,
4. New technologies,
5. Multimedia and virtual reality,
6. Social change and cultural influences,
7. And vision / perceptions of the future.

To cover these subjects comprehensively it was necessary to further break down this subject matter into four main headings – Design, Communication, Technologies and Socio-cultural. Each heading then encompasses some of the remaining themes. For example, the socio-cultural heading would include social change, cultural influences, global markets and global positioning.

1.1 Design

The act of Design, defined by Webster's Dictionary, is to draw or sketch an outline of ~ and/or to plan or scheme. It can also be look upon as an arrangement, lay out or proposal. To integrate is to make entire or to give a sum or total to a number of elements. Furthermore, integration is the act of making a whole out of parts. Thus we can conclude that design integration or integrated design is an outline, plan or scheme through which a number of components are made whole and multifunctional. The integration of these components may enable the end product to perform a task, which is common to the functions of each part and in addition to perform a multitude of others tasks, where each one may be performed by an individual component. A second approach to integrated design is to see "man, his tools, environment, and ways of thinking and planning, as a nonlinear, simultaneous, integrated, comprehensive whole."(Papanek, 1985, p. 293) Integration by design should cater for all of our human needs and functions through products with which we can interact and are almost a part of ourselves - not just part or our environment.

> **If we wish to relate the human environment to the psychophysical wholeness of the human being, our goal will be to replan and redesign both function and structure of man into an integrated living environment, an environment capable of growth, change mutation, adoption, regeneration, in response to man's needs.**
>
> (Papanek, 1985, p. 294)

Papanek's book *Design for a real world* (1985) has provided an essential insight into issues which address the importance of integrated design. Human factors are among these issues that are addressed. He believes that there is a need for a revision in the manner in which designers are educated. To create 'unity' or

integrated design, the human being 'needs designers to be able to deal with the design process comprehensively'. To provide such an education the designer must be thought a broader set of disciplines and reduce specialisation in particular areas of design or the design process. This approach would generate a comprehensive overview of the many issues related to the design process.

During the research of this subject the author felt it appropriate to revise some previously read books, including Penny Sparkes' *An Introduction to Design & Culture in the Twentieth Century* (1994) and *Objects of Desire* (1986) By Adrian Forty. The former deals with the early twentieth century period of crucial growth for design, the modern design period and form 1950s onwards where society and culture are interlinked in design theory and process. These board issues are explored in the first chapter of each section, and the author then concentrates on thematic issues such as the professionalism of the designer, state support of design, design and the mass environment, and the impact of the mass manufacturing companies and the new technology on design. Forty's *Objects of Desire* provides a comprehensive insight into the last two hundred years of design history. He examines specific products through each period of design while addressing fundamental design issues. The aesthetic of products and their functions are investigated, questioning design and consumer influences, market changes and marketing campaigns. "Do we decide on purely aesthetic grounds, or because our choice has been influenced by a successful marketing campaign?" (Forty, 1986, p. 13)

Specific products, which will be used as case studies as part of this thesis, have been explored in much depth through current literature in the form of company brochures, advertisement campaigns, articles and web sites. A great

deal of the information gathered from these web sites on the *Siemens Home Electronic System* and the *Sony S-link system,* provided descriptions and specifications of the products and systems. General information on the thinking behind these products was found in articles that were indirectly related to this particular subject mater. Research of the *Philips DVX-8000 Home Entertainment System* was assisted greatly by the product web site. Not only was a description and specification of the product given but also some insight into the concepts and visions which have drive the creation of the system. Furthermore, research was enormously benefited by the Philips Electronic *Visions of the Future* web site. This site reports on the progress of Philips *Vision of the Future* Project which is investigating societies needs and perceptions for the future.

1.2 Communication

> **Communication: the act of making known; intercourse by speech, correspondence, messages; information; means of passing from one place to another; a connecting passage.**
>
> (Webster Dictionary, 1991)

To achieve successful integrated design the designer must uphold good communication levels with the consumer. The designer must be able to communicate with his client to identify particular needs and problems. A solution or perhaps a number of solutions can only be formulated with a constant communication flow between the designer and client or user group. When the product has been produced the consumer must be able to communicate with the product itself. In other words, the design of the product should allow the user to operate it with ease. The user must be able to understand the controls and/or symbols indicating the controls. "An object becomes a symbol when it acquires

through convention and use a meaning that enables it to stand for something else."(Fiske, 1988, p. 95) Therefore the designer should used symbol which are known by the user group. Although this does not mean that the designer should not introduce new symbols to that user group, but must provide an explanation as to the meaning of the symbol. Fiske discusses the various elements with which we communicate in his book *Introduction to Communication Studies* (1988). This book outlines the basic concept of many of these communication elements such as symbolisation. These elements cover visual, written and oral communication. Fiske also describes the implications that each form of communication can have. Further study of communication methods and their implications was afforded by James Watson's text *Media Communication* (1998). This text does not relate directly to the subject of integrated design, although it is necessary to review its material in order to put mass media in context. The role, practice and influence of mass media in contemporary society are introduced and an emphasis on the social, cultural, political and economic contexts in which the media operates is yielded. Watson provides a distinct conceptual setting for understanding the process of communication. He describes and explains each of the media type in some detail enhancing our perception of these media. Similarly, Tony Feldman gives an insight into past, present and future media. *An Introduction to Digital Media* aims to convey an understanding of Digital Media in particular. This text addresses fundamental questions about digital media and its potential use in our everyday lives. Feldman looks at digital media under two headings that of the packaged offline media and the transmitted interactive online services. A perspective on 'multimedia' is also present in this book – chapter two will deal with this theme. *The Electronic Age* (1993) by Eamonn Hall reviews the Irish telecommunication

industry over the past thirty years. The book gives an account of the industries current capability and future potential. Hall provides a perspective on the status of our home industry in relative to the global industry. "Electronic communication extends man's senses virtually to the ends of the universe." (Hall, 1993, p. ix) Many insights into the available communication resources are contributed. We are also afforded with explanations of the theories and technologies at the origin of these communication modes.

1.3 Technologies

Technology can be defined as a body or system of knowledge, and can also be said to be a science of mechanical and industrial arts, as contrasted with fine arts. Research of this theme was quite interest, although at times, some of the terminology was a bit baffling. Much of the literature read was in the form of technical journals and computer/media periodicals. The scope of the study of this subject matter was to investigate and understand current technologies and how they can impact on designers' creativity. Turkles' *Life on the Screen* presents a number of perceptions of technology and deals with the concept and reality of the Internet and cyberspace. Hall describes cyberspace as:

> **A place without physical walls or indeed physical dimension where the telephone conversations occur, where electronic signals are routed, stored and transferred both in real-time and delayed.**
>
> (Hall, 1993, p. 128)

The impact of technologies on business and society is reported and assessed in Martin's *Cybercorp the New Business Revolution.* He also discusses the change which will occur with the introduction of these technologies in the large business corporations.

1.4 Socio-cultural

"The trouble with our times," wrote the French poet Paul Valéry, "is that the future is not what it used to be." Once we seemed to be evolving gently towards the future. Now the pace of change is accelerating exponentially and the future seems to be racing towards us. Time itself is becoming compressed, and not only time, communications networks are squeezing distances and bringing us closer together – space, too, seems to be contracting. The integrated circuit is largely responsible for these dramatic changes in our experience of these two primary dimensions. Many homes now contain more computing power than was available in the whole world fifty years ago. In minutes, we can gather information from almost anywhere in the world that armies of clerks once needed months to find. Each year, real-time video telephony and electronic mail are becoming more widespread.

> **One psychological result is that we no longer see ourselves as static in relation to time and space: we feel time is accelerating and we must keep up with events occurring in the world around us. Another is that as we become more mobile physically, and more connected 'virtually', space too seems to enlarge, making us 'virtual nomads' with few fixed points of reference.**
>
> (Visions of the future, www.design-philips.com/vof)

Many of our most recent social trends are emerging from this development. It is this cultural change which is was important to identify during research. The *Visions of the Future* project lends a vast insight into both current and future socio-cultural trends. The project takes research results on cultural change which has occurred, and then uses that information to create 'an abstract model' using time and space as their basic parameters and applied it to everyday situation to

determine potential trends in society. Additional views on these situations were taken from a panel of experts around the world. Convergence with the work of futurologists such as Toffler, Naisbitt, Gaudin, Popcorn and others was also sought during the project research. The results of the project paint a concise picture of socio-cultural attitudes and preoccupations by the year 2005.

Nobuoki Ohtani's book *Japanese design and Development* analyses Japanese design and manufacture in relation to social change in Japan and on the global markets. Description and explanation of global markets and social perceptions are provided and examined in this text. Ohtani explores Japanese management culture and its effect on product development, and concludes that Western companies still have much to gain from adopting certain traditional Japanese techniques.

Culture may be considered as "the unwritten, feeling part of an organisation" (Daft 1995, p. 333). It reflects "the way people within the organisation are treated...act and interact and strongly influence the way things get done". (Armstrong, 1996, p. 361) A more comprehensive psychologist's definition:

> **Organisational culture is the pattern of basic assumptions that a given group has invented, discovered or developed in learning to cope with its problems of external adaptation and internal integration, and that have worked well enough to be considered valid, and therefore, to be taught to new members as the correct way to perceive, think and feel in relation to those problems.**
>
> (Management Review, 1984)

Technology can give us another set of clues as to the type and nature of the culture in certain organisations. An design culture is quite different from an electronics culture, for example, and both are dramatically different from a

consumer culture." In cultural terms this is an interesting observation as in the intervening period the explosion in electronics with the advent of the personal computer has made electronics synonymous with consumerism. Therefore, it is important for the designer to explorer these issues.

Conclusion

Much of the information gathered during research has both educated the influenced the author on the subject of integrated design and the topics mentioned before. This knowledge will be used as a basis from which to draw during the composition of this thesis. The four headings described and reviewed above will be intertwined, and their influenced on integrated design and society will be unveiled in the following chapters.

Chapter 2 Integrated Electronic Multimedia Systems

Introduction

The following chapter will examine integrated multimedia products which currently occupy our global markets. This chapter briefly reviews and defines the term 'multimedia'. How multimedia should be understood in relation to integrated products and its implications for global communication. An analysis of the Sony S-Link System and the Philips DVX-8000 home entertainment system is undertaken as examples of current and brand new multimedia products and systems. Global markets and cultural influences in the design of these systems will be reviewed as part of their criticism.

2.1 Multimedia – defined and related

Before any multimedia system are discussed it is important to understand what is meant by 'multimedia'. Multimedia is all things to all people. The name can convey a highly specific or less than nothing, depending on your audience. In fact, multimedia is a singular mix of disparate technologies with overlapping applications in pursuit of a market and an identity.

Feldman in attempting to understand and define 'multimedia' briefly retraces the development and use of this word. He describes a kit used by teachers in the classroom during the 1970s. The kit was termed as a 'Multimedia Kit', which contained various individually packaged media such as "pupils' booklets, teachers' guides, film strips, audio tapes and photographic slides". There was a great difficult for teachers to combine or integrate these various media.

Simultaneous projection of the photographic images and playing of the audio tapes while trying to follow their handbooks proved very difficult.

The solution lay in the use of computers, but such as an application was unthinkable at the time. Computer technology was only being developed in the mid-1970s. Computers were mainly used to storage and access text information and for processing large amounts of this information. They filled large rooms that had to be air-conditioned to prevent the system from overheating. There was anything form a half hour to three hours to boot time before the computer was ready for use and only then could be use for six to seven hours.

By the mid-1990s it was quite possible to produce comprehensive multimedia applications with much ease by way of computer. An environment can be created that will support many different forms of media in which they are merged to a point where they function as one or as multimedia. An appropriate definition of what is considered as multimedia in society today is as follows:

> **'Multimedia' is the seamless integration of data, text, sound and images of all kinds within a single, digital information environment. (Feldman, 1997, p.24)**

It can be deduced from this definition that in its very essence multimedia (or a multimedia application) is the 'seamless' integration of a set of closely-knit contrasted forms of individual media that are immersed in the whole multimedia experience.

The integration of these multiple media can only take place in a common environment. The most appropriate environment in which to integrate 'data, text, sound and images' is a digital environment. Non-digital media must digitised in order to be manipulated and integrated.

> **Hybrid systems using part-analogue and part-digital information will not survive in the long term. Pure analogue systems – such as traditional video discs, for example – are a technological dead end...Quite simply, multimedia, lying at the heart of electronic media development, can have no serious future unless it is also digital. (Feldman, 1997, p.25)**

The foreseeable future holds many new developments in terms of technology and its application, much of which will stem directly from digital systems. However, digital technology and the diverse range of products that accompany it can only fully, and truly, support integrated media through complete integration of these products.

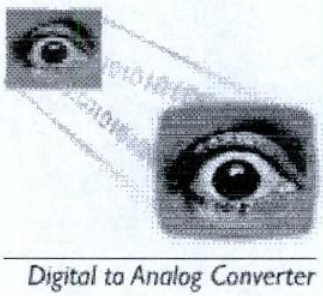

Figure 2.1 **Image conversion quality example**
Image from DVX 8000 web site

2.2 Multimedia Products

This next section will evaluate two multimedia systems the first of which is the produced by Sony, the 'S-Link system', and the second the 'DXV-8000' assembly by Philips. The approach to integration and the different methods used to achieve integration will be identified and examined in both cases. We will also consider the cultural approach and influences, which lead the designers to achieve a level of integration. The question of how markets may have some persuasion on design will be looked at briefly. This shall include a look at local markets and global markets.

2.2.1 Sony S-Link System

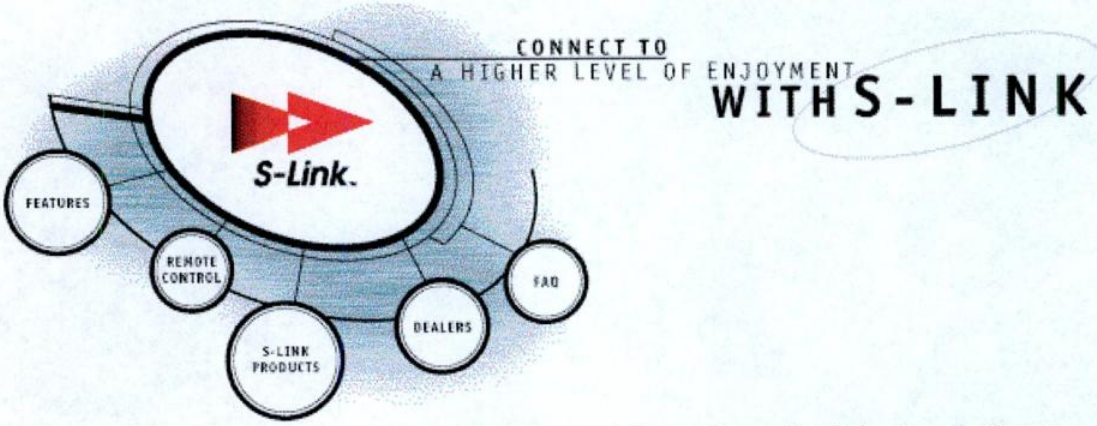

Figure 2.2 **Sony S-Link System Logo**
Courtesy of the Sony Corporation at www.sel.sony.com

The Sony S-Link system is based on an approach to product integration and communication. The Japanese designers have undertaken the task of designing a method of integrating, (or maybe just connecting), any of their existing multimedia products and future products that may arise from innovation or simply redesign. This approach is typically Japanese and quite different to that of the Europeans or Americans. The 'ever-changing' markets in Japan are lead by and led technological innovation.

> **...the Japanese love gadgetry, the dominance of highly skilled and well-educated engineers in decision-making, the fostering and evaluation of technological research according to market potential, and having the vision to introduce new features and technological improvements to the market while Western competitors are still nervously pondering whether 'the market is ready for it'. (Ohtani, 1997, p. 40-41)**

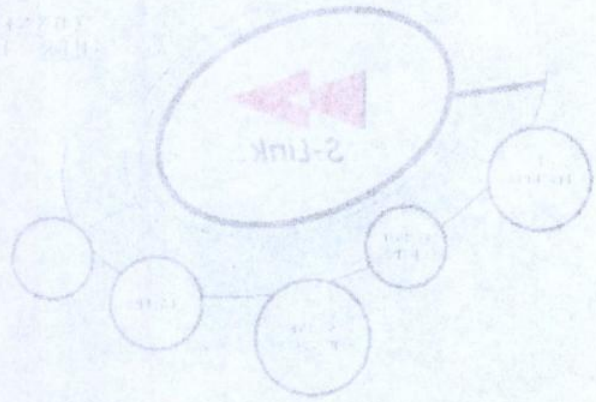

Figure 2.3 **Sony S-Link System Universal Remote**
Image from www.sel.sony.com

Sony has always been regarded as one of the leading innovators in new technologies. Their products share a common connection of quality and often reliability. "And now, they share another bond that makes viewing and listening experience even more pleasurable: S-Link connection". S-Link connection is an exclusive feature built into many Sony components which allows them to 'communicate' with each other.

> **When you 'make the connection' to this smart system, your products will perform together at a new level of sophistication never before realized. The S-Link system will change the way you see and hear forever. It gives you the ease and flexibility you need to fully tap into the potential of your Sony system. (www.sony.com)**

The majority of existing Sony electronic products can be upgraded and used as part of the S-Link system by a simple plug-in connection. Each unit is connected in turn through this plug-in by the S-Link cable to create an integrated Audio/Visual system. The cable allows the components to communicate with each other. The electronic units that are normally handle separately, when connected to each other by the S-Link cable, operate as one singular system. Playing a video becomes as simple as placing the cassette into the VCR. S-Link connection will automatically turn on the television set, VCR and receiver, adjust the settings to the proper inputs and begin to play.

S-Link connection is not only easy to use, but completely flexible. You can build a complete system all at once, or start out simply with just a TV and VCR. Sony offers a wide range of audio and video products with the S-Link feature that integrate into your system seamlessly. "There's no complicated setup procedure or programming involved, just the same simple plug-in connection". Many other advanced features are available using the S-Link connection as the brain of the system, such as a 'CD Mega Control' and 'CD Syncro Recording'.

The CD Mega Control allows the consumer full control over a library of compact discs through any one of Sony's CD changers. The current products on the market have capacities ranging from 5 to 50 CDs right up to 200 discs. Further to this, the CD Syncro Recorder control allows automatic setup of disc data for recording onto MiniDisc (MD) or Cassette tape. A CD player with peak search will scan the disc and use the data to set the tape deck or MD to the optimal recording level. Then it will cue up the tape and automatically begin recording.

The S-Link feature provides everything the consumer wants from their system available with a convenient touch of a button. S-Link system can be control with any of the Sony remotes and directly from Sony products that feature it. For simplicity and further integration Sony developed S-Link Remote Commander. This remote control is an optional part of the system, but ultimately it eliminates the need for multiple remotes.

Sony have stated that the "S-Link connection will continue to be an important feature in future products, such as DVD. So...you can be confident in knowing that...new components will fit in seamlessly with...current ones to further expand the boundaries of entertainment".

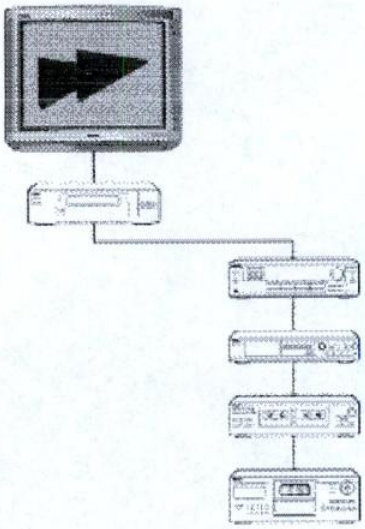

Figure 2.4 **System Link**
Image from www.sel.sony.com

2.2.2 Philips DXV-8000

Figure 2.5
Philips DVX8000 Home Entertainment System
Courtesy of Philips Electronics at www.mmhometheatre.com

The DVX-8000 is a multimedia home entertainment system which combines many of Philips' electronic products to form an interactive audio and visual system. Unlike the Sony S-link this system relies on the combination of simultaneously developed technologies such as wide-screen TV, DVD players and touch screen remote controls. The S-Link is based on the concept on connectivity via a universal cable, where as the DVX 8000 is a complete system with all products design specifically to work side-by-side. Although similar to the S-Link the DVX 800 can be assembled in many combinations and the consumer does not have to purchase all the products at once.

In the age of Digital Convergence, traditional forms of entertainment are evolving into completely new experiences for the audience. As different media intersect and expand, viewers are encountering more intelligent programming - interactive entertainment that listens and responds to input. Television, movies, computers, gaming, and audio systems are being designed to work together in ways that unfold each technology's possibilities. T his new era of hybridization is opening doors for people of all ages who want to go beyond the passive reception that has characterized our relationship to media and entertainment in the past. Now, you can actually take an active role in your favorite TV show, music CD, or videogame, simply by taking advantage of your own creativity and the amazing technology at your fingertips.

Traditionally, people have had to travel outside of the home for entertainment and community. Trips to the stadium, the café, the movie theater, the market, and the mall all provided individuals with new, mind-expanding stimuli and a connection to others. Home was a place where people could get away from the world of work and friends, and experience solitude or family life. But the boundaries between public and private life are blurring as new technology enables us to be apart and a part, simultaneously. From our homes we can have real-time "conversations" with people all over the globe via the Net, do our shopping online, listen to our favorite band live in Dolby Digital, and watch the latest movies on large screens with booming surround sound in our living rooms. As high-end technology trickles down into everyday life and the appliances we use in our homes become more and more state-of-the-art, the emphasis moves away from technology and toward our ability to create an immersive, digitally mediated environment.

To do this, we must re-imagine the architecture of home entertainment. Instead of thinking in terms of separate components - such as stereo system, computer, television, or VCR - it's more productive to view each appliance as one part of a larger, interrelated system. As soon as various components are understood, designed, and used in relationship to each other, their potential and power multiplies. For example, your cutting-edge stereo system may blow you away when you're listening to your favorite CDs, but hook it up to your wide-screen television and suddenly Sunday football takes on a whole new tone and tenor. Add a DVD (explained later) connection, and you'll soon be watching a crystal-clear movie with earth-shattering sound. But let's not stop there - if your PC is wired to run on the same 'screen' (or monitor) as your television, you'll be able to surf the tube and the Net at the same time.

What's the difference between a fusion of entertainment appliances and having, say, a calculator on your watch? Well, this convergence of media systems is an essential step in creating immersive environments that will inspire you, the audience, to interact with your entertainment. Which is a big leap from the passively recepted media systems of the past. So often, our relationship to machines and technology has been one of intimidation and misunderstanding. But a new generation of multimedia technology has been conceived to perform in a language that is more accessible and attractive to users. Instead of having to decipher the language and gestures of machines, people are finding that machines have been built to communicate in a way that's familiar to them. And communication is the paramount foundation for collaboration and creativity. Now, you can stop shouting out the answers to Jeopardy from your living room, use your Internet connection to visit the Jeopardy web site, and you'll find yourself

playing the daily double in a live game. New game shows like You Don't Know Jack boast a mix of pop culture and twisted trivia - you can play the computer or play your friends. And soon, you'll be able to play game shows on TV against other people on the Internet. Connecting with other people - with other members of the audience and cast - is one of the most startling advances in convergent home entertainment. Instead of just thinking about the questions you'd like your favorite celebrities to answer, ask them on online talk shows, such as the TV Food Network, NBC, Microsoft Network and many others.

The Internet is not all about graphics and information - the Web is swiftly becoming audiophiles' premier source for the latest in new music. You can sample new tunes in Dolby Digital on the Net, then download them and burn your own CD. We can also listen in on live concerts on new Net channels such as JamTV. Now, when you can't make it to your favorite band's show, you can still get down to their real-time riffs at home. The Internet's potential as being an abundant - and reliable - source of fun and learning for kids is finally a reality. When you access the Net via your TV, you'll be amazed at all the resources available for kids. They can play along with the Tiny Toons, Sesame Street, and Carmen Sandiego. Or, you can sit them down in front of the TV to get help with their homework. Children can also make their own music by drawing with Maxis SimTunes. With access to sites like these, TV's not just a brain drain for children anymore. Advancements in convergent media mean that viewers are given multiple choices for how they want to experience information, entertainment, and communications. There are countless opportunities available for you to interact with your home entertainment system and take a more active and aesthetic role in

the media you experience. But this is only the very beginning of a wave of possibilities in integrated technology.

Audio technology

The advancements in digital audio technologies have been one of the most exciting developments in home entertainment, and for good reason. Quite simply, the new Dolby Digital and DTS surround sound technologies give you an auditory experience unlike any you have heard before. Each provides outstanding 3D surround sound. When integrated with a high quality video source like DVD movies, these audio technologies help create an atmosphere of realism previously found only in a state-of-the-art theater. So, how do you get them? Presently we have two great digital audio alternatives, Dolby Digital and Digital Theater System. Both are outstanding, and both use compression to fit more audio information into a given digital data space and both provide six discrete channels in an arrangement called 5.1. Discrete 5.1 means there are six audio channels: five main channels - center, left, right, surround left (back speaker), and surround right (back speaker); plus a sixth subwoofer (bass) channel. This setup allows our ears to process sound track audio as we would process sound naturally. As sound moves from one spatial area to another, the sound source moves through the three dimensional space (from speaker to speaker) and our ears hear the sound coming from different points in the three dimensional space. This means when we view a jet roaring over our heads, with 5.1 Dolby Digital or DTS audio, we'll have a very realistic experience of the plane moving from front to back or vice versa. So this is great, but why have two types of 5.1 digital sound?

As with most entertainment products, the reasons are technical and historical. Suffice it to say that Dolby, the company that brought Dolby noise reduction to audio and advanced Dolby Digital Theater to cinemas, was eager to bring its technology to the consumer. In 1995, Dolby first started making its consumer version of its theater system available as a technology called AC-3. This stands for Audio Codec-3. This is too technical for a consumer product name. So, presto, the name is changed to Dolby Digital. Now that's a consumer friendly name. But, what does it mean? Basically, Dolby Digital gives you 5 separate channels of sound plus the subwoofer channel in a very small (digitally speaking) space. Remember, since we are dealing with digital audio, all of the analog sound we hear coming out of the speakers is first delivered to us as digital data. It turns out that high quality digital audio data takes up lots of space. In other words to store a high quality sound digitally requires a large amount of data storage space. To pack more audio information (all those extra channels, for example) into the available space, Dolby Digital compresses the digital audio information first and then passes that compressed version around before finally decompressing it and playing it through your speakers. Still with me? Digital audio compression in Dolby Digital uses a lossy compression algorithm. This means that when the data is compressed, some information is lost. The idea is that when the data is expanded, the missing information will not be missed by the human ear. In fact, many people cannot hear the difference. But some claim that they can. For them the DTS audio system was created.

Created by a group of Hollywood movie makers led by Steven Speilberg, Digital Theater System is exactly like Dolby Digital, except that it uses a different compression scheme. While Dolby Digital uses a high compression ratio to

squeeze high quality audio into a 384 kbps data stream similar to that of an audio CD, DTS uses a much lower compression ration. What this means is that DTS loses less of the audio information when it is expanded but at a price of higher data storage requirements. Some audiophiles claim that DTS sounds even better than Dolby Digital, but many consumers cannot detect any difference. At present, Dolby Digital has a larger presence in the market with many more titles available in this format. But, DTS is gaining ground and it is anticipated that in the future, both standards will co-exist.

Of course, to get the best from DD, DTS or any other audio format we will need optimized speaker and a physical space to play them. If we are lucky enough to have a well-designed acoustic area for your home theater equipment we are set. This gear helps us compensate for less than perfect audio environments. While equalizers are not the ultimate solution to poor room acoustics, they can be of great help in some situation. While care should be taken to place speakers properly within your listening space, sometimes your room will not support the flat audio response desired. Equalizers or EQs give us finer grain control overboosting or damping certain frequencies. With simple bass and treble controls, your adjustments are coarse and may miss your goal. With 5, 6, 11, or more band equalizers, we have the ability to adjust just those frequencies that are being absorbed by your living room curtains for example, or by your over-stuff couch. Again, while they are not total solutions, EQs can help overcome minor acoustic problems. There are also new auditory digital technologies that work with Dolby Digital and DTS systems that provide even more expressive sound tracks specifically aimed at recreating the theater experience for movies. 'Cinema RE-EQ' is an advanced sound processing technology from Lucasfilm, Ltd.

derived from its highly successful THX Theater Technologies. THX, available in only a few high-end cinemas, provides a highly defined standard of precise audio processing geared for the acoustics of large theaters. It permits crisp dialog no matter how loud the surrounding sounds, and for stunning special effects, with equal responsiveness throughout the auditorium. It is acclaimed for its expressiveness and its ability to place sounds with pinpoint accuracy. Home THX Controllers decode the digital 5.1 channels and applies unique enhancements before these decoded signals are reproduced.

'Re-equalization,' or as it is known commercially, Cinema RE-EQ compensates for the effect of reproducing sounds in a smaller room that have been originally processed for a large movie theater with high-frequency equalization. Without this process, the sound levels would be skewed toward the higher frequencies, making the sound seem overly 'hissy' or brilliant. In large auditoriums, these high frequencies are damped down while in a small home viewing room, these sounds are unnaturally loud. Home THX Re-equalization restores the original flat-response characteristics before the signals are amplified and used to drive loudspeakers resulting in a warmer, more natural sound.

USB is a new serial bus standard that was created with the PC in mind. It was designed to allow all sorts of external peripheral devices to communicate in a 'plug-and-play' fashion with the personal computer. Established by PC and telecom firms this standard is being adopted by consumer electronics companies to create external digital video and audio products, including speakers. USB boasts a fast 12-megabit/sec data rate that allows digital audio information to be delivered to external speakers.

DVD Systems

Digital Versatile Disc technology (sometimes known as Digital Video Disc) has arrived and is rapidly replacing Compact Disc and Laserdisc systems. This new technology has a greater capacity than the majority of digital and analog formats. As a comparison, the DVD format holds 17 gigabytes of data (that's 17 billion 8-bit bytes!) per disc as compared to a mere 650 megabytes (650 million 8-bit bytes) for an audio CD or a computer CD-ROM. This extra space is obtained using newer digital laser technologies and tighter layouts and smaller manufacturing tolerances. The system will read virtually all digital formats and outputs high quality digital images along side superb quality audio. Table 2.1 shows a comparison of DVD format to that of other main stream analog and digital formats both. This technology was introduced in America during the early months of 1998 and to Europe some seven months later. From the outset the DVD has caught the attention of the consumer and the entertainment industry.

Many may not understand the technology, but it is the stunning quality of the video and audio output. The realism, the clarity of the picture, the true, rich colors and the greatly improved immunity to analog noise and artifacts. One of the reasons for the visual advantage of DVD is that it offers improved video resolution over other consumer video formats. It delivers approximately 500 horizontal lines, as opposed to the 430 lines delivered by laserdisc, the 400 by S-VHS tape, and the 240 lines by standard VHS tape. As part of the commitment to providing higher quality video output, DVD players now provide a new, higher quality component video output. Component video will provide increased resolution in the color portion of the video signal and will greatly reduce noise when used with TVs, or line doublers with component video inputs.

Another advantage of the extra space available to the DVD format is its ability to support multiple screen aspect ratios. The standard 4 x 3 aspect ratio of the traditional TV forces moviemakers into unwanted compromises when providing consumer versions of theater films. Either you get the pan-and-scan version where the camera points at the most interesting item on screen (and eliminates the rest of the picture) or you get letterbox versions that waste large portions of the screen with black bands at the top and the bottom of the picture. With DVD, you can specify your desired screen aspect ratio. If you have a large screen display, you can use all of it by choosing the 16:9 aspect ratio (the wide-screen versions see figure 3.5) and letting the DVD automatically display the movie as it was intended to look. As stunning as the video improvements in DVD are, the audio improvements match them. DVD can support multiple audio systems. In the U.S. (and North and South America, and ASIA) where the NTSC video standard is used, the DVD standard calls for a minimum of stereo audio and/or Dolby Digital for multi-channel audio. In Europe and other countries where PAL or SECAM video is the standard, the DVD spec calls for the use of stereo audio and/or MPEG-2 audio. Since the DVD can support any digital standard, multiple audio formats (including those yet to be developed) can be implemented on DVD discs. This means that standard stereo audio and superior Dolby Digital and/or Digital Theater System audio formats can and most probably will be included on the same disc.

Table 2.1 DVD Comparison Chart

	DVD	*LD*	*VCR*	*CD*	*CD-ROM*
Capacity	17 Gb	2 hour movie	2-6 hours	650 Mb/ 74 min	650 Mb
Reproduction capability	DVD, DVD-ROM, DD, DTS, Video, Audio, LC, CD, CD-ROM	LD	Analog tape Video, Audio	Audio	Data, Video, Audio
Format	All digital formats	Laserdisc	Tape	Audio	Compact disc

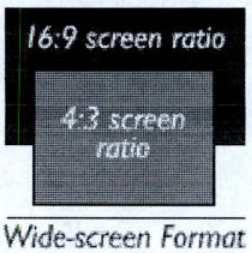

Figure 2.6 **Screen viewable area formats**
Image DVX 8000 web site

Remote control

Pronto Intelligent Remote Control is a universal learning remote control that combines elegance, flexibility and ease of use. It features both a large touchscreen display with an intuitive user interface and direct-access buttons to conveniently provide home entertainment control. Remote controls are typically limited to a certain number of components and/or functions - not this one. Pronto's unparalleled design combines the benefits of a dynamic, digital user interface with direct access buttons. It is easy to add, delete and label new buttons or menus. This allows maximum customization according to individual needs and tastes. A special feature prevents tampering with stored commands. It is also

easy to personalize the Pronto remote - set up and change the user interface with any number of components. This remote control replaces all other product remotes.

Tactile feedback buttons provide direct access to channels and volume, and the display and buttons are backlit for use in the dark. Pronto can learn to operate any device that receives infrared signals. Its learning capability, limitless configuration options and unique interface make Pronto the intelligent remote control.

Figure 2.6 **DVX 8000**
Pronto Intelligent Remote
Image from DXV 8000 web site

Conclusion

It is quite possible that the Sony system, in the short term, will be the most successful means of integrated design allowing the user to upgrade their current system and to expand with more equipment to achieve a fully integrated system. But the Philips DVX 8000 system and the thinking behind its' development may be a more appropriate form of multimedia design integration for the future. This system can be though of as an extension of our human body allowing us to experience audio and visual events as well as communicating through the system with others.

Chapter 3 Electronic systems household product integration

Introduction

The following chapter is devoted to systems that allow full integration of all electronic appliances and systems in the home. An important element of such a system is its communication abilities and the capacity with which the user can communicate with and through this system. Advantages and disadvantages will be outlined, along with the social impact this system and its technology may have. This chapter focuses on an appraisal of the Siemens Home Electronic System (HES). The HES is one of Europe's first systems which endeavors to fully integrate all house electronics. The appraisal shall try to evaluate whether this kind of system will become part of our everyday lives.

3.1 Siemens Home Electronic System [HES]

Figure 3.1 Siemens HES logo
www.hausgeraet.de/english/hes-online

Siemens developed the Home Electronic System as a management system for the private household. Their Web site advertises the HES by saying, "it provides simple reliable monitoring and control of all electrical systems and appliance functions within the home". Although the system can be run with many different brands of products Siemens advice and promote their own household products. Much of these products have no additional features but can be connected to the HES. Having said that, Siemens have redesigned some of their

standard kitchen appliances to increase compatibility with the HES and further expand the products' range of functions. Such products include a fully automatic washing machine, a built-in cooker, a Fresh Food Center and also a dishwasher; some of which will be describe later.

A number of concepts were planned to be realised during the development of the Home Electronic System. The first and most important objective was to develop a universal interface that would allow the homeowner to access, communicate and control any of or all the electronic systems and appliances in the household. This interface would best be achieved through the use of PC or Mac systems, which are already a part of many homes. This objective could not be accomplished without a form of communication that would be used between the interface and the appliances. Initial ideas used existing technologies such as phone and/or fiber-optic connections. Siemens HES communication methods will be discussed later.

It was essential that Siemens had good reasons to undertake the development of the HES project. Research was carried out in order to determine and then to evaluate these reasons. These motivations included economical effects and convenience, both of which are used by Siemens to promote their system. The approach taken to provide an effective and economical system uses precise control of temperature and heating. To minimizing energy wastage an automatic feature operates when the windows are opened, the radiator valves close. Pre-programmed settings for individual room temperature control would also be added. The systems energy efficiency is promoted to have savings of up to 30%. Energy saving devices of any kind are very important in society today as

we approach the third millennium, therefore Siemens took it upon themselves to develop and promote both an energy and economically efficient system.

A further motivation, that of convenience, helped shape many of the functions of the system. Siemens elevates four points in particular on their Web site in regard to convenience and the simple selection of lighting and heating settings:

- **Highly convenient: Lighting 'moods' are programmed with the HomeAssistant® and can also be called up via the light switch.**
- **Reducing the burden of routine tasks: Automatic opening and closing of blinds.**
- **Free timer settings, e.g. for cooker, dishwasher and home laundry appliances.**
- **Heating when you want it. Control of the entire heating system for pleasant temperatures in the room you desire.**

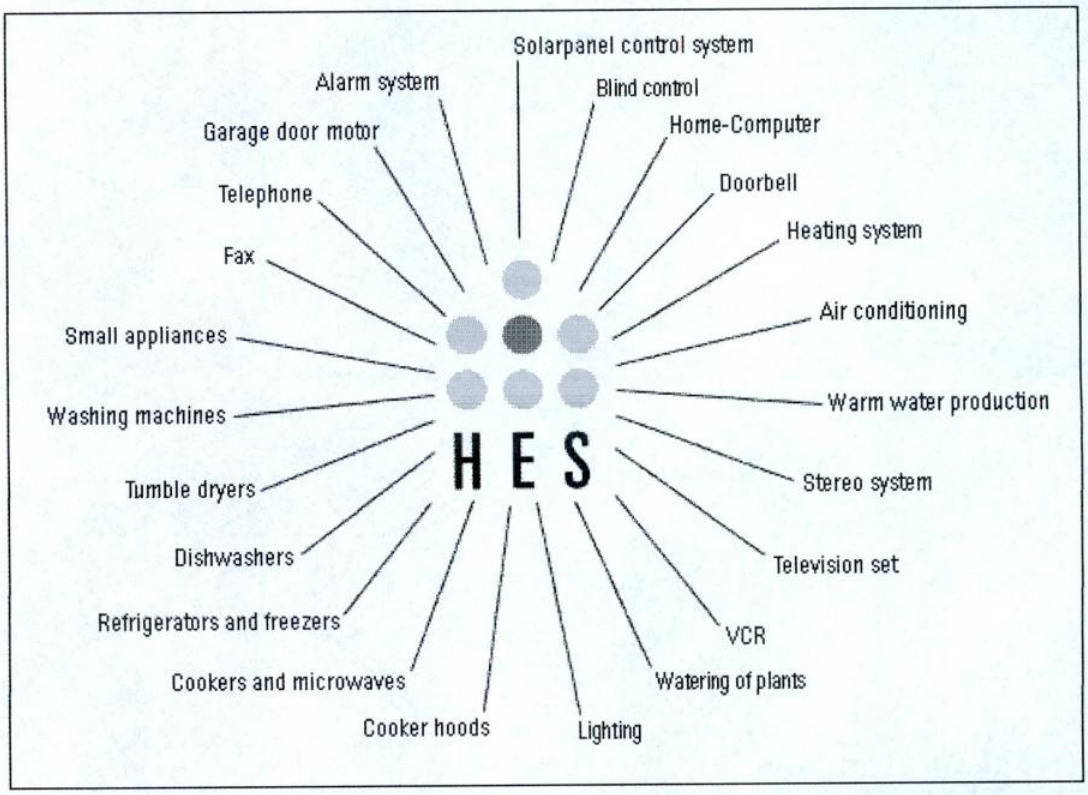

Figure 3.2 **Diagram of HES device controlled network**
Diagram form Siemens web site

3.2 Describing the system

The operating element of the Siemens Home Electronic Systems is the HomeAssistant. Operation is simplicity itself and there is nothing to learn. This allows anyone from a child to an elderly person to operate the system with ease. Simply touching the symbols on the screen is all that is needed to control any function. And operation is really convenient, because with the Siemens HES, all appliances in the home feature the same operating philosophy. HomeAssistants can be set up either in a single location or spread around the house. Not just in the kitchen, but in the living room and the hall too - wherever it makes sense. In addition to its control functions, the HomeAssistant also handles telephone communications, outgoing faxes, musical entertainment, television and games. It also serves as a home-banking terminal, health care advisor, "in-house" emergency help line, and plenty more. The HomeAssistant software and its installation program are supplied on CD-ROM. The Siemens Partner Installation Engineer handles its installation on the PC. The only system requirement for the installation of the HomeAssistant software is that your PC runs the Windows 95 operating system or a later version such as Windows 98 or Windows NT. The modular structure of the HomeAssistant software enables the customer to install only the modules that are required for his particular installation.

Table 3.1 Operating System Requirements

PC Specification:	Windows 95 operating system: 100 MHz Pentium 8 MB RAM 1 MB video memory Modem Keyboard Mouse 1x256 synchr. cache FAST MovieMachine2
Control of:	Basic system, Individual room temperature control, Blind control, TV options
Application examples:	Built-in cooker, Freshness centre, Built-in dishwasher, Water heater, Automatic washing machine

3.3 The Home Assistant Module

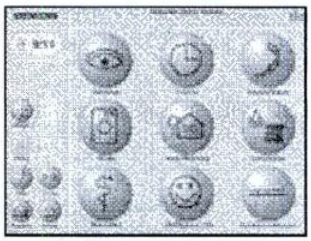

Figure 3.3 **Main control interface screen**
Image from Siemens HES web site

Basic system

The &Monitoring application provides the homeowner with a functional overview of the instabus nodes throughout his home, and the appliances they represent. Starting from the Overview button in the HomeAssistant starting window, the user can move directly to the &Monitoring Functions window. In this window, he can choose further options, such as Window Open, Hall Light On, Motion Detector Activated, plus fault messages, such as Heating Malfunction, etc. Also, critical alarm messages pertaining to acoustical warnings or flashing lights

are signaled via the HomeAssistant. By marking the appliance list, the user himself determines which appliances and systems are to be monitored.

Changes can be made, and/or status information queried from the HomeAssistant at any time by telephone, whether the user is at home or travelling. It is also possible to activate or deactivate the monitoring function - either at a terminal in the home or from the outside by telephone. Lights within the home can be operated and/or monitored, either individually or in groups. Complex settings can be set up as "Ambiences" and stored under an appropriate name. They can be called up via light-switch or HomeAssistant at any time and in any order, even automatically. The application "Communication" enables the sending and receipt of written messages via fax, remote inquiry by phone, as well as providing certain convenient telephone features. For example, for sending fax messages to notify the technical maintenance service in the event of a fault, the HomeAssistant provides ready-made fax form templates. With the aid of the HomeAssistant, the user can read incoming fax messages, formulate his response, and return a fax to the initial sender. Using its integrated telephone/address directory, HES dials numbers automatically. The HomeAssistant is protected against unauthorized external access by a "firewall" function. The "firewall is an encryption system which will only allow the end user to access the information. The communications module is necessary when there are remote inquiries via HES, or when external companies are to be enlisted into the monitoring process.

Multimedia applications in the household:

Household multimedia applications will provide easy-to-understand-operating instructions on CD-ROM with video sequences. Easy corrections of

simple errors. Remote inquiry and actuation from anywhere in the world. Cookbooks and information on CD-ROM. Oven settings are selected automatically from the recipes.

3.4 Add-on Packages

Add-on package 1: Individual room temperature control

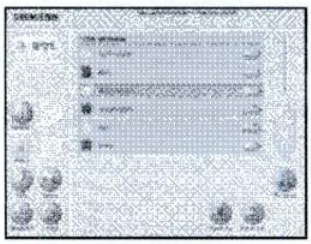

Figure 3.4 **Temperature Control Interface**
Image from Siemens HES web site

Using the Individual Room Temperature Control application, the room temperature can either be freely selected, or temperature/time profiles preset. Dependent upon the configuration of the type of temperature regulator being used, three or four fixed temperature settings - predefined Comfort setting, plus Daytime, Night-time, and Anti-Freezing - may be preset for each room. Using the Variable-operating mode, different temperature settings can be assembled in a random sequence, to be stored as a temperature/time profile. Such profiles can then be assigned to particular 'day categories,' i.e., working days, weekends or vacation. They may also be assigned to particular rooms or groups of rooms.

It is thus possible to adapt the temperature of the dwelling to the lifestyle of its occupants. On working days, for example, either all or only certain rooms may be heated to a specific morning or evening temperature, while allowing them to cool down during the day. On working days, for example, all or certain rooms might be heated to a specific temperature in the morning or evening, while during the day they are allowed to cool down. The selection of the temperature level for

each individual temperature regulator is effected via the appliance list. The HomeAssistant displays the selected setting for each individual room temperature regulator, and monitors compliance. The Temperature application module not only ensures a pleasant temperature within a room, but, most importantly, helps you to save energy costs.

Add-on package 2: Blind control

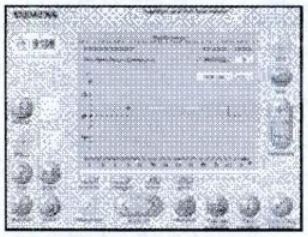

Figure 3.5 **Home Blind Interface control**
Image from Siemens HES web site

Blinds, roller shutters and awnings can be operated via HomeAssistant. They can be actuated either singly or in groups, both at particular times of day or depending on sunshine levels, manually or automatically, manually or automatically, in accordance with freely definable scenarios, which may then accommodate the operation of window blinds. Blinds can then be incorporated into the basic system scenarios. The Blind control add-on module, used in conjunction with the basic package provides a plausible and realistic simulation of an occupied house when the householder is actually away from home.

Add-on package 3: TV Option

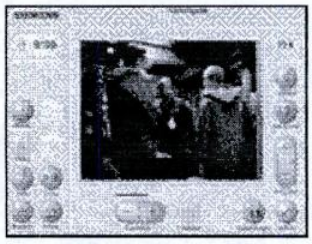

Figure 3.6 **Television Interface control**
Image from Siemens HES web site

The TV Option module controls television functions within the HES. Required system hardware includes the FAST MovieMachine2 TV card for the host PC of the HomeAssistant. Channel selection and all settings are performed via the touch-screen interface of the HomeAssistant. The TV picture can be switched from HES screen representation to full screen image.

3.5 HES applications for domestic appliances

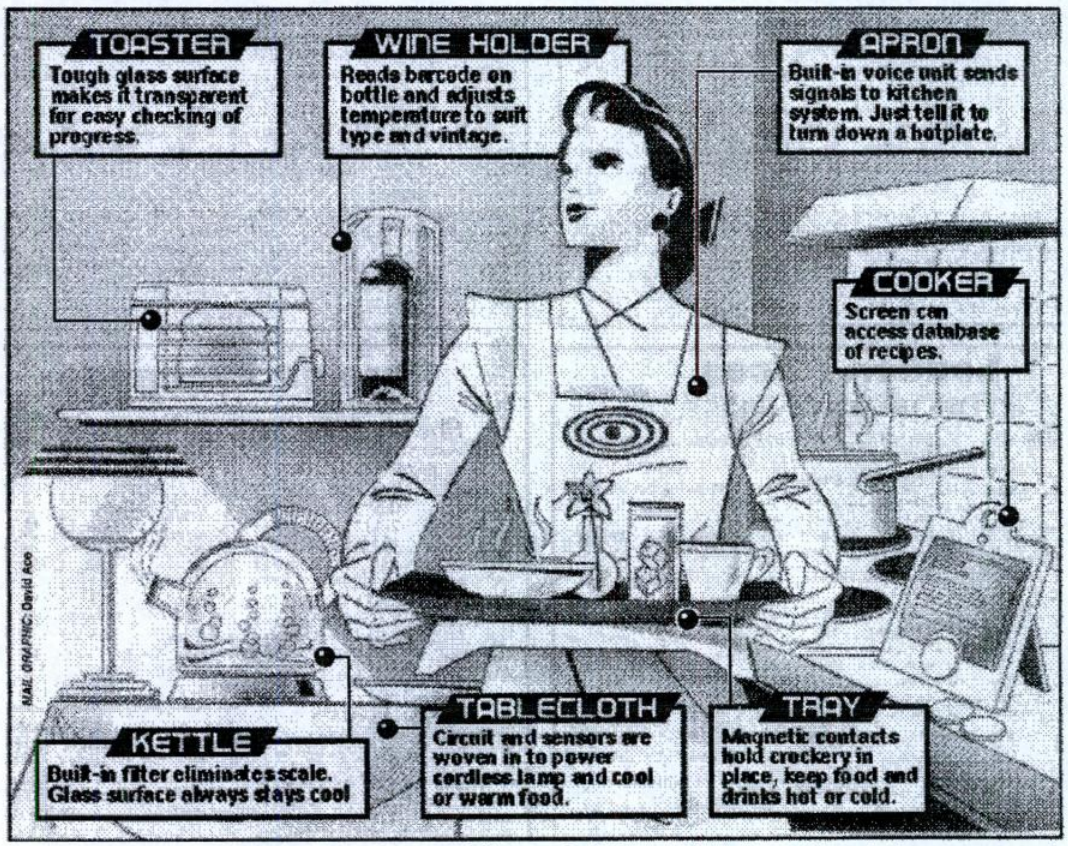

Figure 3.7 **A kitchen that helps you cook**
Irish Independent, February 1999

Built-in cooker sample application

The HomeAssistant facilitates remote monitoring of the oven of a cooker that is HES-capable. In addition, the cooker can be operated remotely, for example by starting a particular program. Recipes from the CD-ROM can be adapted according to the number of diners. Video animations help explain preparation, and the integrated automatic cooker controls handles all oven settings.

Freshness Centre sample application

With the aid of the HomeAssistant, the homeowner can query the status of the freshness centre along with its four temperature zones, and perform specific actions by remote control. The program notifies the householder in the event of malfunctions. Thanks to the HomeAssistant, equipment breakdowns that were previously noticed by chance alone are now detected immediately. If large quantities of fresh foods need to be frozen, the freezer compartment temperature can be lowered in advance via remote command by telephone, or as commanded by the HomeAssistant.

Sample application Built-in Dishwasher

The HES application for dishwashers encompasses remote monitoring and status indication, plus remote operation. Up to 6 special programs can be called up via the HomeAssistant (Intensive 70 °C, Normal 65 °C, Normal/ECO 55 °C, Quick 55 °C).

Water heater sample application

Water heaters too are integrated into the HES with the following applications: Remote monitoring and status display via HomeAssistant and temperature setting via HomeAssistant. To ensure proper operation of the HomeAssistant, the regulator setting on the water heater must be neutral. Particularly economical applications are possible if the electronic water heater is used for the supplementary heating of water from solar installations. This system provides integration into the HES energy and load management, temperature-setting on

HomeAssistant and Calling up selected temperatures at the water outlet location via EIB switch

Automatic Washing Machine sample operation

The HomeAssistant indicates the operating status of a washing machine, complete with program sequence, Start time and Time Remaining in the program cycle. Remote control of the appliance from the HomeAssistant is also possible. In the event of an appliance malfunction, the HomeAssistant provides the user with context-sensitive fault correction information. Messages such as "Washing ready" can be indicated via displays located around the house. The HomeAssistant will also allow pre-selection of start and end times and, will be displayed on the HomeAssistant and on an unlimited number of displays around the house, the Time Remaining of a given programme cycle.

SE 5929H Dishwasher, for built-in installation, white;

Figure 3.8 **Integrated System Dishwasher**
Image from Siemens Web site

Support during operation by means of interactive prompts, selective help and information material, and plain-text fault indication. Remote monitoring and status indication via HomeAssistant is allow provided. The dishwasher has a top-

basket dishwashing function, plus selection of 2x6 programs and an electronic start time selection via HomeAssistant.

Basic functions/ features

- 4 programs on appliance
- Aqua-Sensor
- Top-basket dishwashing
- Electronic sprinkler
- Spray arm with 5 spray levels
- Heat exchanger/water heater
- Water and energy consumption in standard operation,
- Normal program at 55 °C, only 14 l / 0.9 kWh.
- Extremely quiet

KD 32F70 Electronic

Fresh Food Center with Super Insulation, white;

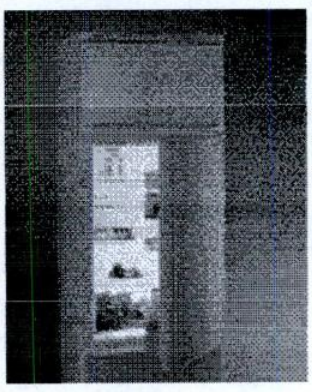

Figure 3.9 **Integrated System Fresh Food Centre**
Image from Siemens HES web site

Remote monitoring and status indicator via HomeAssistant, notification of appliance malfunctions when the user is not in the vicinity. Remote operation and

temperature setting via HomeAssistant. Presetting of time for "Superfreeze" function

HE 68E20 Built-in cooker, white;

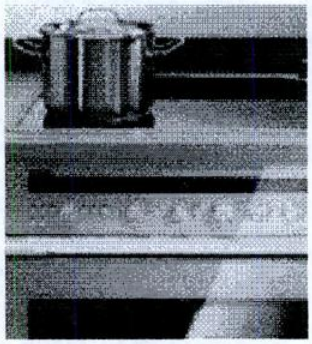

Figure 3.10 **Integrated System Cooker**
Image from Siemens HES web site

Remote monitoring and status indication via HomeAssistant. Full remote control of oven via HomeAssistant and hob power-off feature. Automatic program setting from interactive cookbook (cooker CD-ROM as optional extra)

Basic functions/ features

- Automatic (catalytic) self-cleaning function
- Universal Plus oven
- Plain-text legends
- EPS feature
- Quick-start oven heating system with heat-up monitoring
- Electronic clock, automatic "oven-on" facility
- "Key switch"
- Memo function
- Electronic boil-start function
- Automatic safety cutout for oven and hotplates
- Roll-out baking trolley

- Retractable rotary controls
- Quartz-halogen lighting tube
- Cool-touch front
- Cooling fan

Automatic Washing Machine with Aqua-Stop

SIWAMAT WM 61431

Figure 3.11 **Integrated System Washing Machine**
Image from Siemens HES web site

Remote monitoring and status indication via HomeAssistant. Remote-controlled time setting for wash programs and starting from Pause position.

DE 24110

Electronic Water Heater

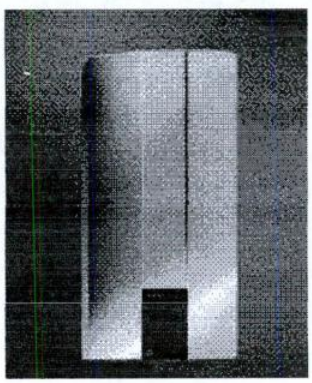

Figure 3.12 **Integrated System Water Heater**
Image from Siemens HES web site

Remote control from all draw-off points. Fault messages on HomeAssistant. Optional integration in energy management system

Basic functions/ features

- FuzzyControl, max. feed temperature up to 50 °C, thus providing solar capability
- Maximum constant temperature thanks to regulation via all 4 heating elements
- Low-limescale bare-wire heating system
- Spray protection IP25
- Built-under installation with plumbing kit

3.6 Consulting – Implementation – Service

The Siemens Partner Installation Engineer

The Partner Installation Engineer is not just responsible for consulting, and for installing and commissioning the HES, but will in future increasingly become a service partner, available, for example, to receive and deal with automatic fault messages. Ask for a list of Siemens Partner Installation Engineers in your vicinity. On this you will find not only electrical installation companies, but also expert builders and manufacturers of prefabricated buildings, who offer the Siemens instabus.

The Siemens Customer Service

Together with the Siemens Partner Installation Engineers, the Siemens Customer Service forms a service network capable of solving even the most difficult challenges that may be associated with the integration of the various applications.

Instabus

As a prerequisite for HES functionality, all domestic appliances and systems must be interconnected by the Siemens instabus "data communications highway." Once installed, it provides the multidirectional information transfer required by the HES partner appliances throughout the home.

New construction projects

In the case of new construction projects, cabling with the twin-wire copper cable of the Siemens instabus is ideal, because cabling effort remains low, risk of fire is

reduced and an efficient, flexible network is built up. Such cabling is installed wherever measurement, control and regulation operations must be performed. The control bus comprises a closed system providing absolute security and protection from harmful external influences. The 230 V mains circuit mains circuit supplies only the consumer appliances.

Old buildings

When renovating old buildings, however, transmission of the Siemens instabus signals via the 230 V mains circuit mains circuit represents an interesting alternative. Only the switches and relays need to be replaced by intelligent EIB components. This helps prevent the inconvenience associated with installing new cables.

EIBA Guidelines

The Siemens instabus complies with the guidelines of EIBA (European Installation Bus Association). EIBA is a multi-vendor body that aims to establish a standard for building system technology on the European market. Today, more than 100 manufacturers from across Europe are already offering 5,000 EIB-components with HES capability. If you intend using the advantages of HES in the future, you should have the Siemens instabus installed right now.

3.7 Will the system be Successful?

The evolution of technology has provided the designer with the creativity which has been utilised in the Siemens Home Electronic System. The question remain whether such a system will be successful in our society today and in the future. The answer is quite simply, yes. But we must look at our surrounds for that answer. We are learning to see the world as a single system, however, that system seems in many ways out of balance. Every night, through the medium of television, we become eye-witnesses to what is going on around the world, both good and bad. Our knowledge of events creates a mental environment from which we can never escape for long. At the same time, though, it stimulates us to look for ways of improving the situation. Perhaps if such instability on a global level were balanced by stability on a local level, it would be easier to deal with. But life at home and at work are also changing at an increasingly rapid rate, the individualisation of society having loosened national and family ties.

Increased mobility has weakened our sense of community, of belonging to a particular place. And work calls for flexibility: nowadays, few people can expect to stay in the same line of work all their lives. All of this means that the search for new models and new qualities of life is never-ending. Maintaining a sense of identity and stability through all these changes is not easy. Yet that is what we must do if we are to retain our equilibrium, our self-respect and, above all, our humanity. Despite occasional lapses, in advanced societies we are gradually coming to our senses. We are realising that it is time to concentrate on the important things in life, on basic values and qualities. There is a growing awareness that the society of the future will need to be more ecologically and socially balanced - in other words, a sustainable society. It is on this basis that a

system such the Siemens HES will shape our local society and can become an integrated part of that society.

We have grown up in a world based on the Modernist vision of relentless industrial progress. We are now beginning to appreciate that we need to take a more holistic, more global view of progress. A sustainable society would be one capable of developing new and renewable sources of energy, conserving finite resources and re-specting the natural and man-made environment. It would also be a society with the human being at the centre, one in which everyone would be able to climb the 'ladder of needs' indicated by the psychologist Abraham Maslow. By satisfying first physical needs, then intellectual and finally spiritual needs, people can attain the ultimate form of self-fulfilment - what Maslow called 'self-actualisation'.

This society would be one in which our psychological need to expand our experience and to achieve goals would be fed and met. It would be a world where 'travelling' was as important as 'arriving', where the process of making a cup of coffee was as important - and enjoyable - as the cup of coffee itself. It would also recognise that, as social creatures, we place a high value on qualities such as peace of mind and community, happiness and fulfilment, and it would accordingly further their realisation in everyday life.

Chapter 4 Social Impact of Integrated Systems

Introduction

This chapter is concerned with an evaluation of the social impact of the technologies and the change brought about by their use. This chapter will briefly outline how integrated design has impacted on peoples lives in the past, how we are affected presently and will speculate on future impact of integrated design and related technologies. The change in society and change in social interaction as a result of technological developments will also be dealt with. In addition, our perceptions towards new technologies and how we perceive the technologies will change our social circumstances shall be discussed.

User and promoter interaction: new products and technologies must be presented to the consumer in a manner that will grab their attention. Communication of information to the consumer is important when attempting to launch a new product or system. We will therefore look at various methods of communicating or presenting information about a new product. This shall only be a brief look at advertising communication as a full analysis of such a subject is beyond the scope of this thesis.

4.1 Change and Perception

In order to establish how change affects society we must firstly examine change itself. Implementation of change is dependent on the nature of change envisaged. Change, which is planed, may be executed in the form of incremental or fundamental change.

Incremental change may be a series of small or separate changes, which may be undertaken from time to time. A major change that is planned to

implement in stages may also be described as incremental change. It may take the form of a phased programme building layer upon layer until the full change is implemented. There are advantages in this approach in that smaller chunks of a change are being considered at a time and as progress is made confidence in the process assists in moving from each stage on a progressive basis. The S-Link system discussed in chapter two could be considered to have been launched as part of an incremental change programme. Fundamental change or step change is different from incremental change in that it may impact on people's security by dramatically altering their social needs. This form of change imposes major transformation in a social environment over a number of steps. Each step brings significant conversion until eventually after a certain period of time complete change is accomplished. Incremental change can be used over a particular period to fully implement a fundamental change plan. The "Visions of the Future" project, run by Philips Electronics research and development team, is a good example of planed change. (A discussion about The "Visions of the Future" project will be forthcoming in chapter five.) Because it is difficult to predict the future, and because people's perspectives are changing and new technologies are developing and merging, the "Visions of the Future" project was set up.

> **Traditionally, new products have been introduced mainly through technological innovation. Today, however, to make products and services which will come closer to meeting human needs and desires, we need to redress the balance, looking more carefully at this increasingly complex relationship between people and technology. The Vision of the Future project was initiated to investigate possible developments over the next ten years, because we have to look far enough into the future to be able to see the steps we need to undertake next. (www.design-philips.com/vof)**

We can see here that there is a clear and conscious decision to take steps which will evoke fundamental change over the next ten years. The project itself does not contain a list of steps to be taken, but is a research engine that will provide information allowing designers to formulate a list of steps to take to implement change.

There is another approach to change, which is known as the 'Emergent approach'. The emergent approach starts from the assumption that change is a continuous, open-ended and unpredictable process of aligning and realigning a society to its changing environment. Advocates argue that:

> **It is more suitable to the turbulent environment in which modern firms now operate because... it recognises the need for organisations to align their internal practices and behaviour with changing external conditions. (Burnes, 1996, p. 171)**

Although Burnes is referring to 'firms' and 'organisations', we can apply what he says to our everyday lives and to our society. Our behaviour and practices within society must be aligned and realigned as developing technologies emerge and conditions in our environment shift.

Change of any kind can be blocked and our willingness to move with the change can be deterred. Victor Papanek points out seven inhibitors, which often can keep us from being innovative, also form receiving this innovation and accepting it as part of our daily lives. They are as follows:

1. Perceptional Blocks
2. Emotional Blocks
3. Associational Blocks
4. Cultural Blocks
5. Professional Blocks
6. Intellectual Blocks
7. Environmental Blocks (Papanek, 1985, p. 158)

The first of these is very important in order for any change to take place. Our perception of how a product or system will evoke change in our lives is of great importance in the success of that product or system. If we perceive something as useful or beneficial to our daily lives then it is integrated into our society and routines. It becomes quite important thus, for the promoter of a new product to appeal to our perceptions. Through advertising the promoter can provide us with a perception of a product and often can instill this perception in our minds. If the promoter can achieve this then the product will become success and will be integrated in our society.

Cultural also has implications on the way we perceive a product or system. In the case of integrated design, and the various products that enable media to be integrated, our perceptions of global positioning must change so that these products can be used as a universal form of global communication. Map layouts of the globe differ from continent to continent. This is directly associate with peoples' perception of where they are relative to the rest of the world. Figure 1.1 shows two different map layouts one perceived by the Japanese and the other by the Europeans. Both cultures perceive themselves as inhabiting the centre of the globe with their competitors on either side. Fully integrated and interactive communication will continue to be developed and will prosper, if the various perceptions are themselves integrated and global positioning in terms of communication and cyberspace is in essence eliminated. When this happens, a state or sense of omni-presence will be perceived and through communication will in theory be practiced. Figure 1.2 attempts to illustrate this perception.

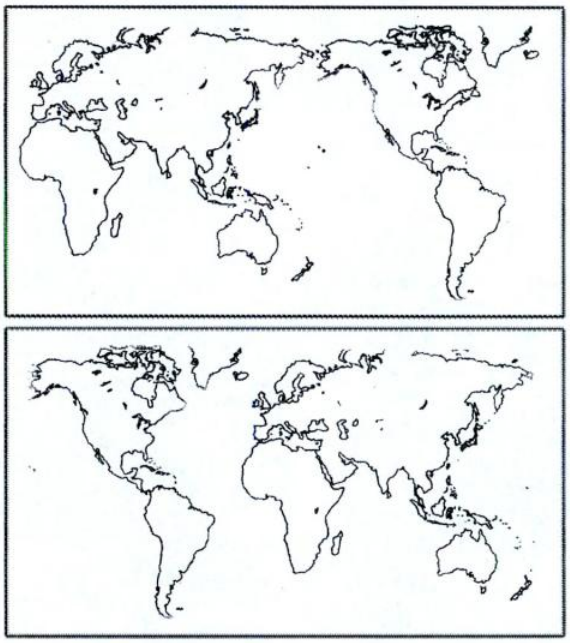

Figure 4.1

The perception of global positioning
Map layout perceived by Japanese on top and the European perception below.

Re-sampled images taken from
Japanese Design and Development
(Ohtani, 1997, pp. 5 and 123)

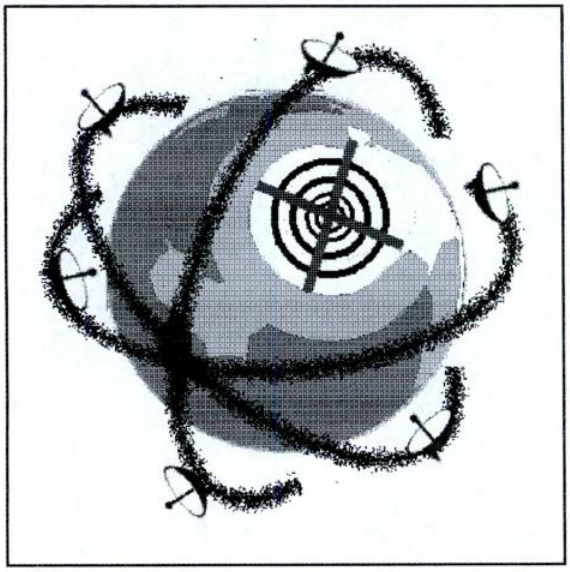

Figure 4.2

Global Positioning - A Change of Perception
Omni-present perception of global positioning by communication through cyberspace.

Image by author, 1999

However we, as people, like to have our own clearly defined space. We need to be able to trace its borders, to make it comfortable and recognisably our own. This is a development that can be seen on many levels. With the break-up of former Communist states, we have seen the resurgence of many national and ethnic identities which had been suppressed for decades. Religious fundamentalism may be considered a similar assertion of group identity, although

less geographically defined. On a more personal level, we see a tendency for people to withdraw into the security of their own home and social group, rather than participate in community activities and projects. Personalising one's own space like this leads naturally on to the personalisation of other possessions as a statement of identity. It is here on the personal level that designers must appeal to allowing their designs to be personalised or customised.

Nonetheless, while some identities are being reasserted, in other contexts they are being merged. On the political level, we see increasing cooperation, as shown in the gradual integration of Europe and the establishment of large free trade areas in America. On an individual level, cooperation and integration is also increasing. Thanks to telephony, e-mail and remote technologies, we can effectively be present in places far away. We can communicate over vast distances with an immediacy and ease that were unthinkable only a few generations ago. We can also join together in 'virtual' communities while remaining members of our own local physical community. As a result, our subjective experience of distance has changed, and physical borders no longer limit our ability to communicate with people in distant places. These perceptions of time and space are two major parameters which will determine how people act and think in the coming years. Figure 4.3 illustrates the possible global communication network by 2009.

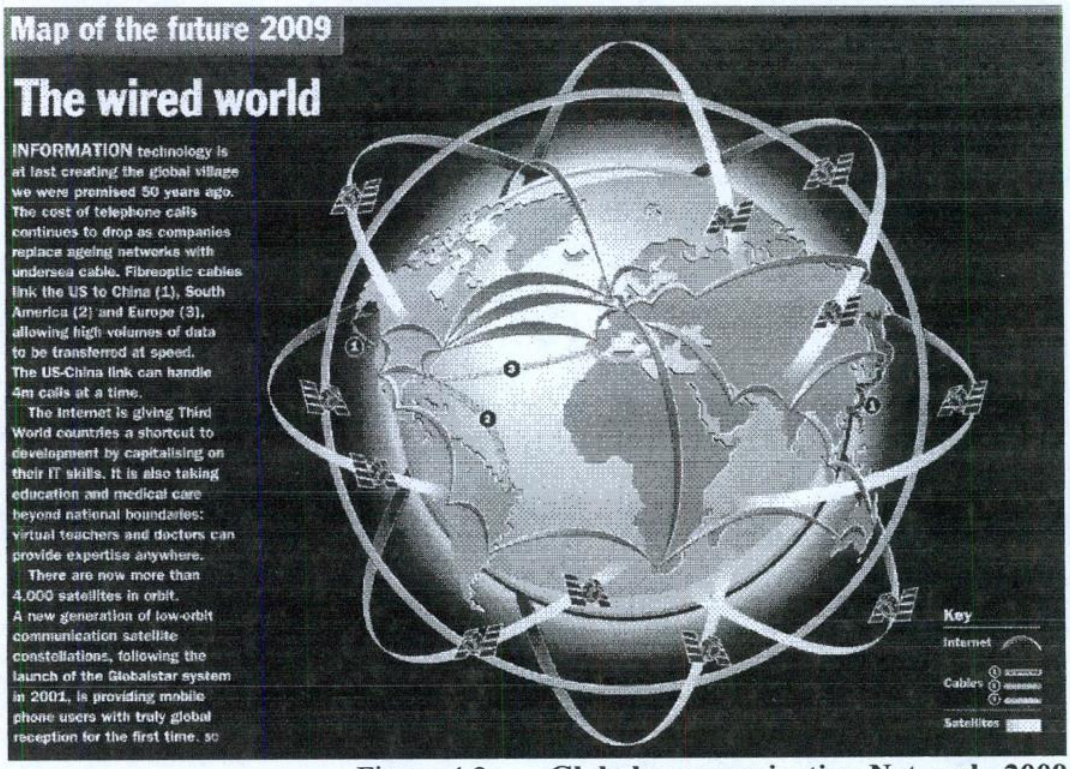

Figure 4.3 **Global communication Network, 2009**
Courtesy of The Sunday Times: 'Chronicle of the Future' Part 1, February 1999

Conclusions

Our perceptions of the future will inevitably impact on the development of our societies. Thus our societies will change as we look forward and perceptions will change with them. We can look on this as a reoccurring loop which will shape our designs. Our culture and society at this point in time must seek integrated design as the way forward. We must recognise the artificiality of a divorce between outer perceptions and the inner responses in main, for it gravely jeopardizes any unified human and humane factors study. Design should become an extension of the human being, perhaps an organic substitute. Society should view integrated design as a series of functions which occur simultaneously, not in a linear sequence. These events should be thought on as developmental growth and evaluation, the latter leading to reinitiation or regeneration or both thus forming a closed feedback loop.

Chapter 5 Future of Integrated Design

Introduction

As discussed previously the conversion from analogue systems to digital systems will play an important role in the future of integrated design and the forms of communication both locally and globally. It's likely that there will be multiple paths for high-speed digital data into the home, both wireless and wired, and while they may head towards the television and the PC, a local-area network will permit other things in the home to communicate with one another and with the world. This is the concept that Siemens has been working on and is constantly developing. The Siemens system however, is quite specialised and is currently only compatible with their own products. The new millennium should see consumer electronics manufacturers and various service providers co-ordinating their efforts. If this happens the consumer shall end up Internet-connected in a way that is richer, more useful, and less noticeable than the current way. Rather than having to use the PC (or even the TV) to access information, consumers are going to find that our telephones know the number listings, the kitchen appliances know the recipes featured on the cooking programme they have just been watching, and our medicine cabinets know the directions for taking medications. Along these lines, NCR, the Japanese electronic giant, in London last year unveiled a prototype of a modem-equipped microwave oven in which the usual glass door is replaced with a flat display panel, so that it's possible to surf the Web while reheating last night's leftovers. Like many apparently gloriously bad ideas, this one deserves a second look once everyone stops laughing. NCR didn't

really have to put a Pentium chip and Windows NT into a microwave; the sort of low-end processor already contained in microwaves is probably powerful enough to access recipes, news, and weather information through a simple interface. Figure 5.1 shows a similar idea, which uses an LED display on the microwave door to transmit television images to the consumer. If the house has a high-speed network interface somewhere, then this microwave does not need to act globally, just locally; any messages that need to go beyond the confines of the house will pass through the gateway.

Figure 5.1
Microwave Television

Image from Cosmopolitan Magazine, Interiors, January 1999

In the future, the television receiver rather than the PC will be destination for most of the digital data coming into the home. But increasingly the difference between the TV and the personal computer is going to be largely a façade. A façade created by designers to provide a distinction between the products for business and social markets. Both the TV and PC will be able to speak to the same networks using the same communication protocols, and both will have similar internal hardware architecture. However, this does not imply that the television needs a keyboard unless it's the only Net-connected device in the house. The TV is more of a social device, both by design and by typical

placement in the home, and is the appropriate venue for activities that can be enjoyed with others and do not involve the intensive interface of the PC.

5.1 Technologies and Communication closer to Home

At the NUI College in Galway a group of Electronic Engineers are developing a new form of Internet communication which uses electrical wiring rather than phone-line technology.

> **In the same way that electricity transformed gramophones into stereos, ice boxes into refrigerators and lanterns into lightbulbs, the internet will revolutionise consumer appliances, from computers and TVs to fridges and cars, says Dr. Peter Corcoran. (The Sunday Business Post, Jan. 1999)**

A proposal has been made to use this technology to transform the average Irish house into what has become known as the 'smart home'. "The internet is predicted to reach a billion people by the year 2000, by going beyond computer users to reach ordinary consumers". (S.B.P., Jan. 1999) In order to achieve this, appliances will have to come internet ready and on appliances that the consumer will be comfortable with. The use of existing wiring in homes to create an integrated home system could prove very useful and economical. The upgrading of a great deal of Irish homes from little or no internet use to a full integration of house appliances via internet and electrical wiring could happen very quickly. Certainly looking at this last decade, the Irish culture has taken a firm grip of technology and will continue to do so in the next decade. "With the smart home just around the corner, daily chores would be automated as consumer appliances become a gateway for a whole spectrum of extended services". (SBP, Jan. '99)

The NUI research team led by Dr. Corcoran, have been working on this technology for the past five years, will provide a means of integrated

communication that could encompass all services furnished by the Siemens Home Electronic System and would probably be much more advanced. Although the team is currently concentrating on internet access through the television. Control of television and video signals can be controlled and managed over cables or even optic fibres through the home network technology – known as the 'Home Bus'.

It is hoped that the technology will allow the consumer to access and communicate with the 'smart home' systems from a mobile external source such as their car or while on the train. The engineers have already developed a way of managing the home's information flow to prevent an information traffic jam which would result form multiple external information sources converging on the same household device. Corcoran describes ways that the technology may be used:

> **The toaster of tomorrow will know how to toast each type of bread and will know from the alarm clock when to put the toast on in the morning, and its thermal sensor could double as a fire alarm in the kitchen! (SBP, Jan. '99)**

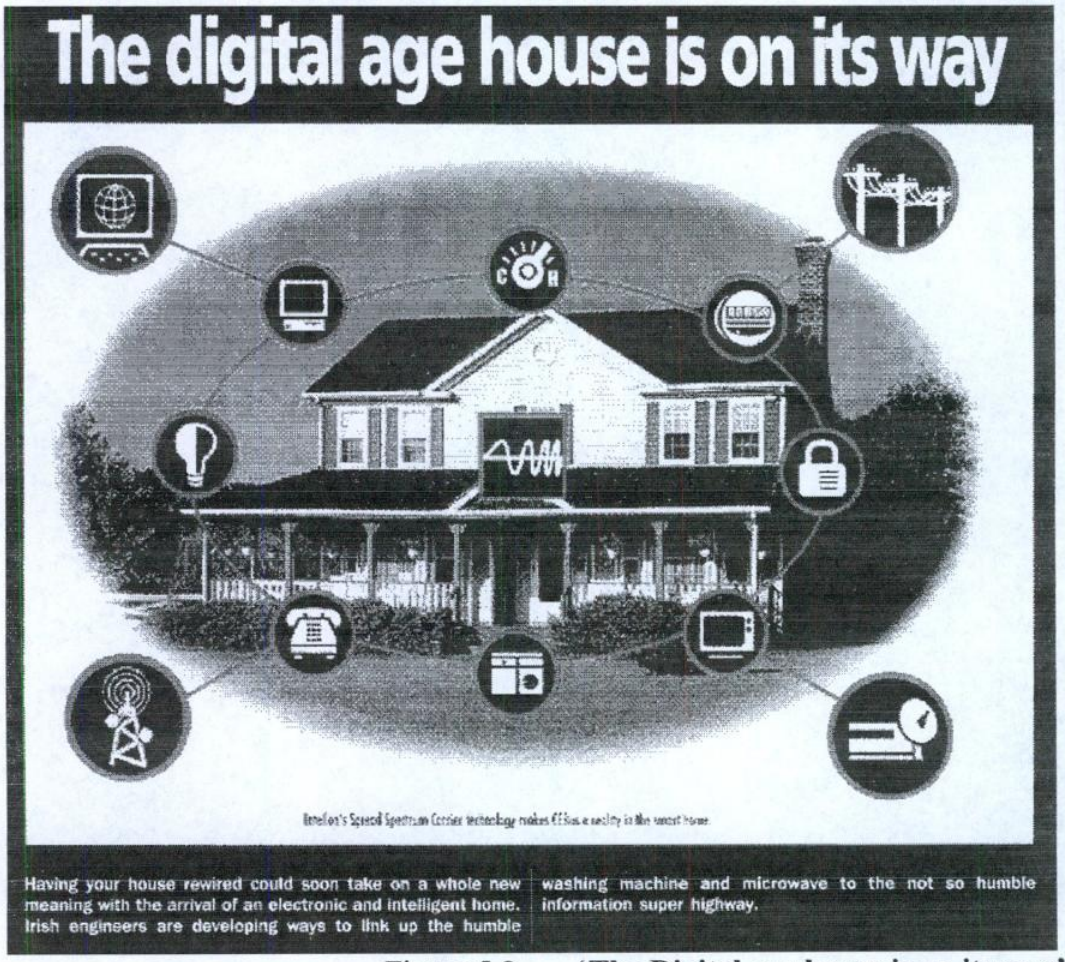

Figure 5.2 **'The Digital age house is on its way'**
Image courtesy of the Sunday Business Post, Jan. '99, p.1

5.2 Visions of the future

Five years ago, Philips Electronics launch their "Visions of the Future" project. The project is research based, gathering insight from design experts around the world, respected futurologist and ordinary people's perceptions. Socio-cultural trends and the change in these trends is the main focus of the project. Philips hope to gain a complete picture of what people will need in the many diverse societies around the world. The project looked at socio-cultural developments only in societies, which lead in the adoption of new technologies, such as North America, Europe, Japan and Australia. They also limited themselves to areas of focus within Philips. Within this scope, the Vision of the Future project was set up to meet four specific objectives:

- **To demonstrate Philips' commitment and ability to make a positive contribution to the future by offering products, services and software that enhance the quality of people's lives;**
- **To further stimulate the imagination and creativity of the Philips community as a whole;**
- **To explore the opportunities provided by merging technologies and the significance of socio-cultural developments in determining how they can be used;**
- **To show the benefits of shifting from the model of quantity and complexity towards a greater focus on quality, simplicity and customer satisfaction.**

(Www.design-philips.com/vof)

Figure 5.3 illustrates the global network of scope as part of this research project. Although this project is still on-going a extensive amount of results that have already been collected. Philips provided their designers, in their Research and Development department, with access to these results. Among these were Khodi Feiz and Roger Swales who are both product designers. Pat Lonlande-Dade is a trend forecaster in the UK – he work on the concept of Interactive Wallpaper

which will be looked at shortly. Derrick De Kerckhove a futurologist working in the University of Toronto Canada also played a part in the conceptualisation.

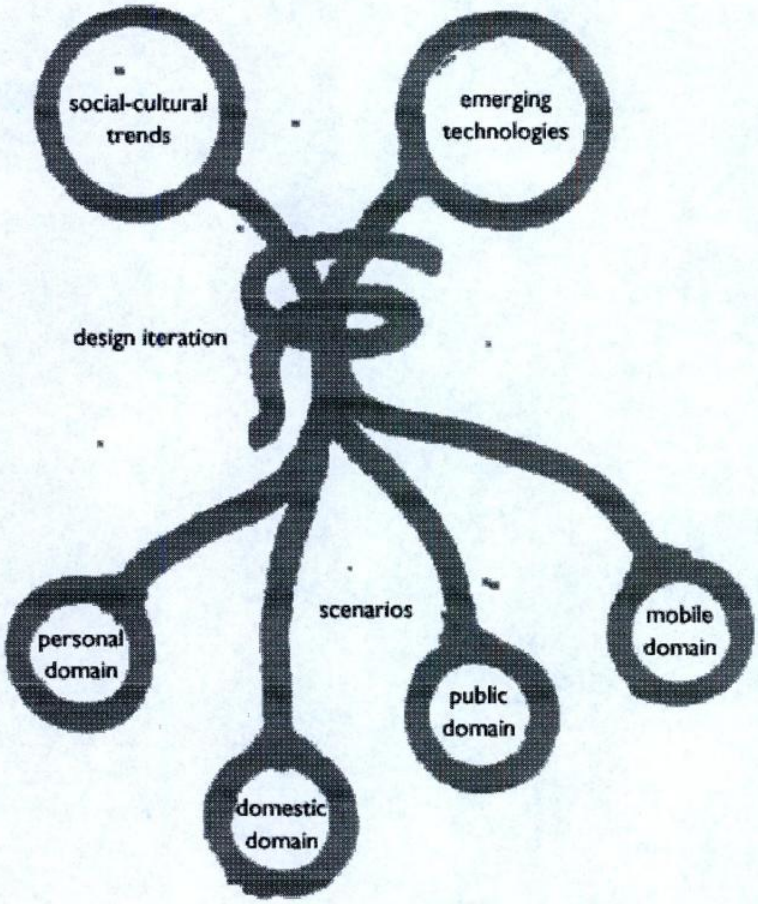

Figure 5.3 **Visions of the Future – Global Diagram**
Image from VOF web site

Miniature remote cameras

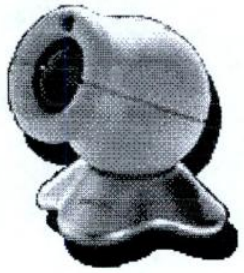

Figure 5.4 **Miniature Camera**
Image from VOF web site

Remote eyes are small video cameras for the home. Once charged they are nomadic, the only limitation being the signal-transmission range. These cameras are ideal for security applications, remote monitoring of young children in the playroom, or checking the progress of a meal in the kitchen while in the garden. The applications are numerous. For children, it is a fun and engaging toy to play with. The domestic environment will contain a number of these small, wireless cameras. The user can select and view each one on a hand remote or on fixed screens in the domestic environment via simple commands. Like the telephone which made communicating at a distance possible, the 'remote eye' allows you to be somewhere you're not or to look into places you can't. It's all about the extension of the senses.

Garbage Disposal

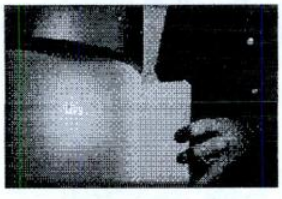

Figure 5.5 **Intelligent Garbage Bin**
Image from VOF web site

The Intelligent Garbage Bin will optimise waste disposal by sorting, compacting and removing odour ready for collection. As the problems of waste increase and landfills become less attractive as a solution for waste management, more pressure will be placed on individuals to sort their waste into its constituent parts so that

these may be recycled more easily and more efficiently. The Intelligent Garbage Bin will aid this process by making sorting more convenient. Responsible household waste management and disposal should be simple and straightforward, without the smell. That was the starting point. The design solution expresses the process, while retaining a minimal simplicity.

Interactive Goggles

Figure 5.6a
Interactive Goggles
Image from VOF web site

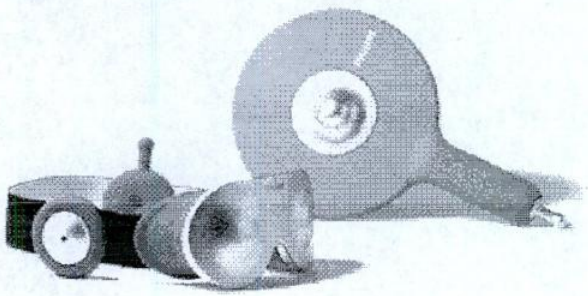

Figure 5.6b
Interactive Goggles
Image from VOF web site

Improvements in computer power and display technologies will offer the opportunity to experience many activities as virtual reality. Immersion Goggles could have two broad areas of application. The first is entertainment, in the form of enhanced interactive games, discovery programs and 'edutainment' packages. The second is the field of work, such as simulation programs for training, architectural tools and control of robotic systems. 'Ping-Pong For One' is played and experienced by wearing virtual-reality headgear and an interactive table tennis bat which includes motion sensors. 'Ping-Pong For One' enhances the physical aspects of game playing, compared to existing video and computer games. It can

be played on your own and may improve physical coordination skills that are directly related to the real sport.

Wallpaper

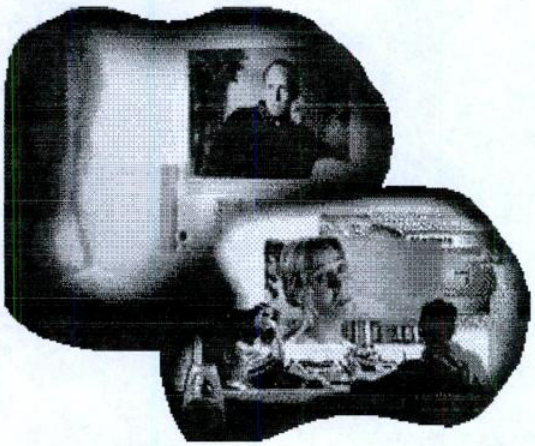

Figure 5.7
Interactive Wallpaper
Image from VOF web site

As technologies merge and miniaturise, we will have flatter displays and sound systems, possibly becoming a 'living wallpaper' of sound and vision. This would create a living room with less clutter, where there are no 'black boxes', but only the sound and vision we wish to experience. These large, flat displays will be able to show multiple images at any size and in any position. Sound and light would also be intelligently controlled to optimise the ambience in the room. We can have a transparent telephone. We could have a telephone that looks like a tabletop sculpture. We can have a choice to have beautifully sculptured machines or transparent machines. "I am not sure that I want my TV, which is my window on the world, to be anything other than a window. Don't give it to me with pink stuff on it, it's a window and windows are made of glass." (Pat Lonlande-Dade, trend forecaster, 1998)

Multifunctional Jewellery

Figure 5.8 **Earphone / earring combination**
Image from VOF web site

As miniaturisation continues, it will be possible to embed functional technology into jewellery and body accessories such as rings, necklaces, earrings, glasses and watches. This responds to two needs - for body adornment and for more intimate and discreet communication, information gathering and entertainment. Display Glasses complement normal sight with a projected layer of information. This allows the user either to look normally through the glasses or to refer to a text display. Controlled via a watch interface (Figure 5.9), it is possible to be connected to personal agendas or messaging services. This can discreetly remind us of important information, names, addresses and appointments.

Figure 5.9 **Watch Tele-phone**
Image from VOF web site

It's a great idea and it's a use of miniaturisation and of friendliness, as long as it's easy to use. There's a little bit of magic there. Ear-ins are small cordless earphones (Figure 5.8) which discreetly receive and relay messages from our agenda or paging service, to remind us of appointments or things to do during the day. They can also provide simultaneous translation from another language into our own. Made from flexible `memory materials', they adapt to the shape of our ears for optimum comfort.

See me / Hear me

Figure 5.10 **Spectacles with fitted miniature ear-piece, camera and display screen**
Image from VOF web site

As processing power grows, handheld products based on technologies such as speech and text-recognition are conceivable. People whose ability may be impaired by age or disability can be empowered to accomplish tasks more easily. For people who have impaired eyesight, a reading aid can be imagined. Based on a hand scanner, this unit acts like a portable eye, translating textual information into spoken words. It can be used to read letters, newspapers and even screen displays. An adaptation of this could also be used for deaf people: a handheld device, which uses speech-recognition technology to turn, spoken words into text. This is ideal for use in public places such as shops, or when travelling. This technology could also be added to videophones used by deaf people to provide a simultaneous translation of spoken words into subtitles.

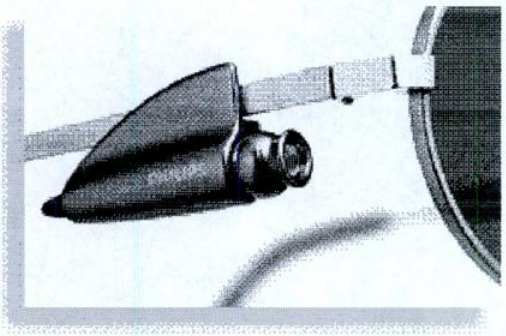

Figure 5.11 **Close-up of miniature camera**
Image from VOF web site

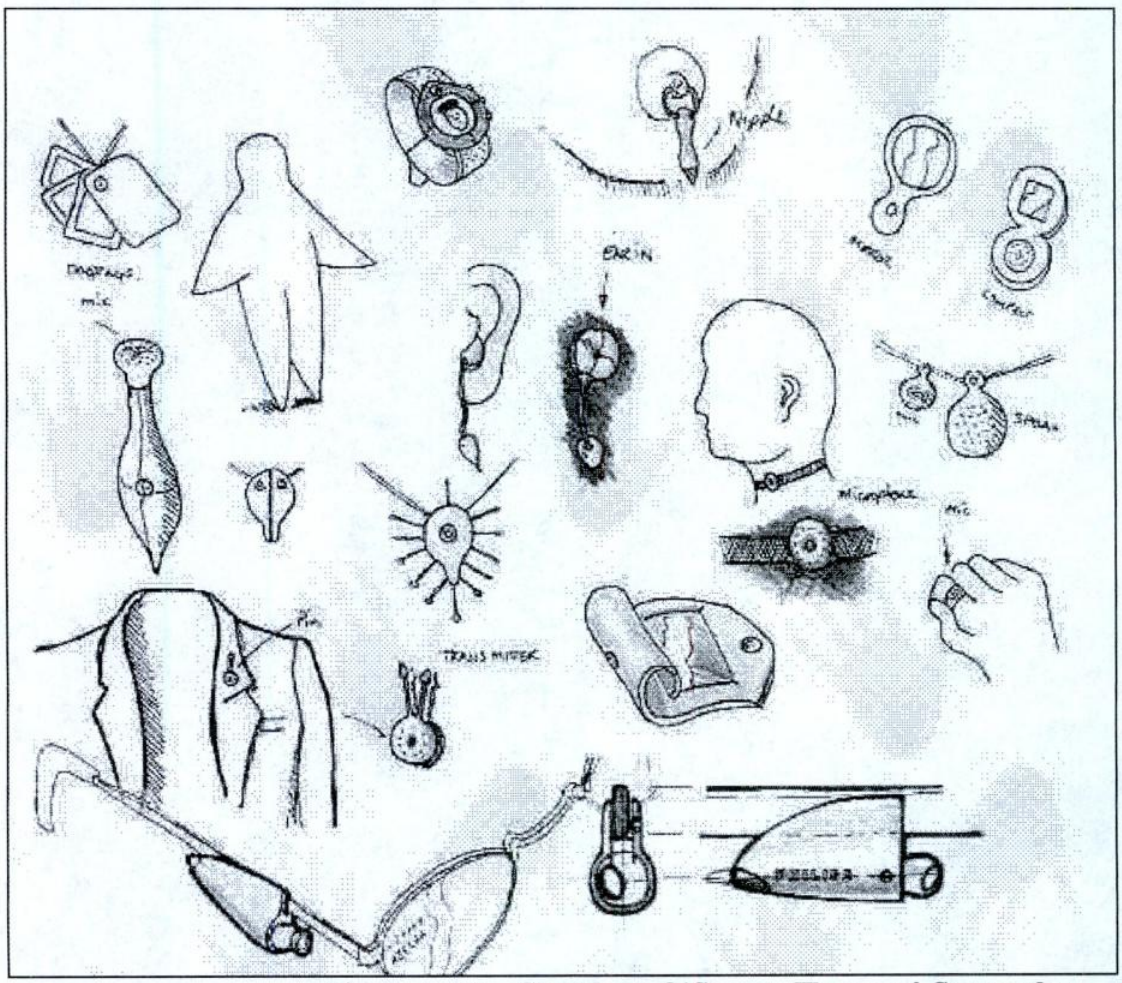

Figure 5. 12 **Sketches of 'See me Hear me' Spectacles**
Image from Philips VOF web site

Concluding Remarks

As a millennium comes to an end we will leave behind some of our technology to make way for the new millennium which will bring with it new technologies and new ways of thinking. This thesis has touched on the possible changes in society and design that may come about with the turn of the new millennium. We have examined existing and past technologies which have shape much our thinking and everyday lives. The 'smart home' seems to be the way our future societies will be enhanced. This integration of products, technology and the human being is undoubtedly the way forward. We have seen that the possibilities for such systems our limitless. Multimedia products like the S-Link and DVX 8000 are only on the verge of something great. Similarly the Siemens Home Electronic System is only in its preliminary state. The author believes that this type of system is the way forward for designers and society to develop. It will be interesting to actually see how these systems and their technologies are developed and how they may enhance our everyday living.

Bibliography

Books:

Armstrong, M.,	*A Handbook of Management Practice,* 6th Ed.,	London, Kogan Page, 1996
Burnes, B.,	*Managing Change* 2nd Ed.,	London, Pitman Publishing, 1996
Daft, R.L.,	*Organisation Theory and Design,* 5th Ed.,	Minnesota, West Publishing, 1995
Dietz, Matthias, Mönninger, M.,	*Japan Design*	Germany, Benedikt Taschen Verlag, 1992
Evans, Siân,	*Contemporary Japanese Design*	London, Collins & Brown Ltd., 1991
Feldman, Tony,	*Introduction to Media*	London, Routledge, 1997
Ferguson, M.,	*New Communication Technologies And The public Interest*	London, Routledge, 1986
Fiske, John,	*Introduction To Communication Studies*	London, Routledge, 1988
Forty, Adrian	*Objects of Desire* Design and Society since 1970	London, Thames & Hudson Ltd., 1986
Fullan, M.,	*Change Forces*	London, The Falmer Press, 1993
Hall, Eamonn,	*The Electronic Age* Telecommunication In Ireland	Dublin, Oak Tree Press, 1993
Martin, J.,	*Cybercorp the New Business Revolution*	New York, AMACON, 1996
Ohtani, Nobuoki, Duke, Suzanne, Ohtani, Shigenobu,	*Japanese Design And Development*	Hampshire, Gower Publishing Ltd., 1997
Papanek, Victor,	*Design for the Real World,* 2nd Ed. Human Ecology and Social Change	London, Thames & Hudson Ltd., 1985

Sparke, Penny,	*An Introduction To Design & Culture In The Twentieth Century*	London, Routledge, 1994
Turkle, S.,	*Life On The Screen* Identity In The Age Of The Internet	London, Weidenfield & Nicolson, 1995
Watson, James,	*Media Communication* An Introduction To Theory and Process	London, MacMillan Press Ltd., 1998

Periodicals / Articles:

Basic Technology: Communication for Self-Reliance	*Mimar*	No. 20, Apr/June 1986, pp. 60-7
Coming to a new awareness of culture	*Management Review*	Winter 1984
Designing by Long Distance	*Architecture*	V. 83, February 1994, pp. 117-19
Electronic Communications and Communities	*Antiquity*	V. 71, December 1997, pp.1049-51
Participating in the Global Communications Link-Up	*Museum-News*	V. 66, May/June 1988, pp. 54-5
Special Communications Experiences Of Online	*Visible-Language*	V.31, no2 1997, pp.158-81
Internet Creates Smart Homes	*Sunday Business Post* Computers In Business	No. 1, January 1999, p. 2
A kitchen that helps you cook	*Irish Independent*	26th February 1999, p. 13

Web Sites:

Philips Electronics: "DVX 8000 Home Entertainment Theatre"	www.mmhometheatre.com/
Philips Electronics: "Visions Of The Future"	www.design-philips.com/vof/
Siemens: "Home Electronic System"	www.hausgeraet.de/english/hes_online/
Sony Electronics: " S-Link System"	www.sel.sony.com/sel/consumer/s-limk/