



Futures research, communication and the use of information and communication technology in households in 2010: a reassessment

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Abstract

Communication studies pay little attention to futures research, while there is a lack of communication knowledge in futures research. This article discusses the function of futures research and ways to embed domain knowledge in predictions. First, it looks at futures research in relation to the use of information and communication technology (ICT) in households in 2010. Second, it incorporates communication knowledge based on the vision of experts. It is interested in the ways in which the contextual factors of the adoption and use of ICT can be taken into account. Scenarios take social changes, political and regulatory trends into account and draw alternative, divergent pictures of a future context within which the adoption, domestication, use and effects of new technologies will take place. Through the use of scenarios different contexts can be described in which the impact of specific technologies can be analysed, making use of the know-how of communication scholars.

Key words

adoption • communication theory • domestication • futures research • households • ICT • ICT use

INTRODUCTION

Since the changing economic circumstances at the end of the previous century it appears that the tide (but especially public interest) for the information and communication sector is on the turn. After the media has blown up the hype in the public debate surrounding the possibilities of the internet, e-commerce and new technologies such as third-generation (3G) mobile telecommunications to unheard-of proportions, a reverse trend seems to be taking place. According to the same media, developments concerning the internet, e-commerce and mobile internet services seem to be playing a marginal role in the economy (*The Economist*, 2004). In spite of this, real developments and statistical data indicate that information and communication technologies (ICTs) are taking an increasingly important, albeit often almost invisible, place in our society (Central Bureau of Statistics, 2005; Eurostat/Central Bureau of Statistics, 2005; Organization for Economic Cooperation and Development (OECD), 2003).

To a certain extent the ICT sector itself can be held responsible for the cyclical emergence and disappearance of hype. Predictions concerning the use of ICT by consumers are based on over-optimistic expectations. Consultancy firms such as Gartner see this hype as a necessary link between the development of a product and its broad dissemination (see <http://www.gartner.com/pages/story.php.id.8795.s.8.jsp>). Exponentially rising curves often serve a marketing-related purpose. It is by publishing high expectations that companies more or less create a market. Consumers are made to feel that they need to use the latest technologies or services. Basically, this has to do with marketing of expectations (Bouwman and De Jong, 1996). A side-effect is that the stock market value of the companies producing these services and technologies rises. This effect is considered to be the cause of the dot com crisis (Cassidy, 2002; Castells, 2001). In light of the socio-economic consequences, it is important to ensure that future visions regarding ICT take the actual behaviour of users within their specific context into account. Companies that operate in the ICT sector, policymakers and private consumers all have an interest in obtaining (realistic) pictures of possible futures. In a knowledge economy, understanding future developments is an important competence (Peterson, 2002).

There are several ways to draw a more realistic picture of possible futures. On the one hand, we need to look at the reliability and validity of futures research, while on the other hand, we have to find better ways to embed domain knowledge, i.e. knowledge of diffusion theory and (critical) communication theories on the domestication, use and possible effects of technologies. The use of domain knowledge helps to improve the quality and validity of the picture of possible futures. This article attempts to do so in a number of ways. First, it looks at futures research by using multiple methods and by replicating earlier analysis. Second, it incorporates domain knowledge

from the communication domain in an analysis on the adoption and use of ICT in households, using experts with a (critical) communication background, as well as making active use of theories and concepts in the construction of scenarios. This study, which is based on a study conducted in 1998, focuses on the adoption and use of ICT in households in 2010. After the dot com crisis, we repeated the study in 2003. The main research questions are:

RQ1: What were the technology forecasts in 1998 and 2003?

RQ2: How consistent are these forecasts?

RQ3: How can contextual factors be taken into account with regard to the future adoption and use of ICT in households?

To answer these questions, this article begins by looking at futures research and research conducted in the communication science community which is relevant to the future adoption and use of ICT in households. Next, it presents the research approach and core results. Finally, it discusses the conclusions and limitations of the research.

FUTURES RESEARCH, ICT AND DOMOTICA

It was not until the end of the Second World War that futures research became more serious and scientific, a development that even led to an industry of 'futurism' (Rescher, 1998). During the Cold War, futures research received a significant boost as a result of the growing importance of technological developments (Coates et al., 2001) and the need to anticipate those developments. Initially, the methods used were predominantly of a quantitative nature, the focus being on mathematical methods and tools, and the rate of adoption being the main variable used (Williams et al., 1988). The rise of the more qualitative Delphi approach reflected a kind of 'democratization' of futures research. Not only were experts asked for their opinion, but their opinions were compared to each other (Linstone and Turoff, 1975). Nevertheless, Delphi was used mainly to make more accurate predictions about the future. The aim of both of the approaches was to predict the future (Porter, 1980).

However, a growing number of studies demonstrated that most predictions were wrong (e.g. Ascher, 1979; Schnaars, 1989). The ability of Delphi studies to predict future developments proved to be limited (De Bens and Knoche, 1987), the reasons being an over-emphasis on technology determinism and technology push (Brody, 1991; Schnaars, 1989); a failure to take the influence of current trends and social changes into account (Geels and Smit, 2000); the oversimplified linear and convergence-focused nature of futures research (Holtmannspötter and Zweck, 2001); and the prime focus on the adoption of new technologies as a dependent variable. In light of the limited validity of predictions, researchers shifted their attention away from trying to predict the

future, towards exploring that future (Keenan et al., 2003), adopting approaches such as scenario analysis, which sees technology as the outcome of many factors and actors (Bijker et al., 1987). In contrast to the Delphi approach, the scenario approach has a diverging and exploring nature. Scenarios produce various possible developments and display a keener awareness of the uncertainty of trends as well as the role that users play in adjusting technology to their own convenience. Based on a desire to envisage possible developments rather than predict one future, futures research is about trying to understand, capture and describe possible future developments rather than trying to predict the future course of a few selected dependent variables. Nowadays, futures research is integrated with other disciplines to a great extent, combining multiple methods, using software tools, new ways of gathering data and a variety of creative and interactive techniques.

Undeservedly, futures research has been given relatively little attention in communication studies, with the possible exception of the research conducted by Vitalari and Venkatesh (1987) and Klopfenstein (1989). In his study, Klopfenstein criticizes existing forecasting methods and predictions on home video players. Although there is a long tradition of using past developments to indicate what the future may look like (see for example, De Sola Pool, 1977a, 1977b; Flichy, 1995; McLuhan, 1967; Stöber, 2004), the adoption and use of future ICT is as yet a relatively neglected area. Nevertheless, we are convinced that the quality of futures research can be improved by incorporating expertise from communication science. This article argues that this can be achieved by demonstrating how communication science concepts and (critical) communication experts can contribute to futures research – in this case, research into the adoption and use of ICT in households.

TRENDS IN ICT

Although we believe that the development, adoption and use of technology to a large extent depend on individual and social influences and decisions, and therefore are subject to opposing and conflicting interests, it is clear that technological developments will not take place without fundamental research. Fundamental research in the ICT domain can be characterized by a number of general technical trends. At the hardware level, key technical developments are digitization, increased processing power, micro-electronics, reduced use of energy, miniaturization, technical integration and the use of sensors (Bouwman et al., 2005). At the software level, the focus is on compression techniques, increased intelligence, agent technology, security and improved man-machine interfaces (Bouwman et al., 2000). These trends result in so-called 'ubiquitous computing', of which ambient technology is one of the exponents. Peripheral equipment will become increasingly interchangeable. Television, personal computers (PCs), personal digital assistants (PDAs),

laptops and (mobile) telephony will follow their own specific paths towards a multimedia or even virtual reality station (Biocca and Levy, 1995; Van Dijk and Vos, 2001). As far as networks are concerned, we see a development towards ever-increasing capacity. We find a continuing increase in choice and flexibility between networks. The link between peripheral equipment and the type of network becomes less obvious. The network for approaching a service will no longer be automatically the delivery network. Upstream and downstream channels can be separated (Bouwman et al., 2000). All kinds of new mobile networks, such as 3G+, WiMAX (World Interoperability for Microwave Access) and Ultra Wideband, are emerging. The next generation applications and services will be more intuitive and show a trend towards real hypermedia. This intuitive character is expressed in all forms of usage (Dertouzous, 1997). Information services will be characterized by their multimedia nature. People will visit virtual reality sites and communities. The abundance of information produces selection mechanisms such as push media in combination with highly-improved, intelligent agents that increasingly use individual and collective user profiles (Dertouzous, 2001; Kurzweil, 1999). Communication services develop from speech-oriented systems into systems where people can see one another real time. In addition, communication services will focus more on the management of communication flows and intelligent ways to solve coordination problems (Doherty and Miller, 2000). Transaction services will play an increasingly important role, which by 2010 will have taken on a variety of forms. Channels used in transaction processes will be fitted to user needs dependent on the phase in the transaction process. Entertainment services will acquire more characteristics of personalized and individualized interactive gaming. Broadcast will be complemented by on-demand services. Although this is the promise that the developers of these technologies and services make, the question remains as to whether consumers are going to adopt and use all these new technologies, services and applications in their private domain. The next section discusses how these trends work out in a home environment, and how they affect adoption, use and effects in that environment.

ICT AND THE HOME ENVIRONMENT

To gain insight into the adoption, use and effects of these emergent technologies by individual users in their domestic context, it is important to incorporate insights from diffusion, communication and information systems approaches (Bouwman, 2003). We focus specifically on the more limited context of adoption and use within the more confined context of a household. The central element in the concept of household is house. The concept 'house' has numerous associations. It can be defined in terms of space and time, but also as a place where one or more persons ('a household') spend a large portion of their time, in which case 'house' refers to the private

domain, a place to which others have only limited access. In the context of this article this approach is too narrow, as ICT affects the boundaries of the private domain (Avery and Baker, 2002; Frissen, 2000): boundaries between private and public space become blurred. Mobile telephony and wireless data communication allow us to engage in private activities in the public domain, while all kinds of new internet-based applications enable us to bring work into the private domain. We are interested in the adoption and use of ICT in a broad sense for private purposes in the context of a household, although this can be in a public space.

Studies into the adoption and use of new technologies, services and applications are extensive and they are governed by traditional concepts from the diffusion of innovations (Rogers, 1983), critical mass theories (Markus, 1990), technology acceptance model (Davis, 1989) and the unified theory of acceptance of technology (Venkatesh et al., 2003), to the more critical domestication concepts (Anderson et al., 1999; Bakardjieva and Smith, 2001; Silverstone and Haddon, 1996; Silverstone and Hirsch, 1992). Adoption, the technology acceptance model and domestication research look at the adoption and use of the equipment that people need (Venkatesh and Brown, 2001) on (mobile, broadband and internet) networks (Katz and Rice, 2002), and in applications such as e-commerce (Koufaris, 2002) and 3G+ mobile services (Lu et al., 2003). In many approaches, and especially in the technology acceptance model and unified theory of acceptance of technology, technology is still viewed as a black box. As a result, the characteristics of the technology itself are not taken into account, even though the functionality of technology in itself is becoming more and more specific, and therefore can be attuned to specific usage, user profiles and context (Van de Wijngaert, 1999). Generally, users are defined in functional and/or cognitive terms, rarely in a social or cultural context.

The concept of context is in itself an ambiguous one. Schilit et al. (1994) divide context into three categories: computing context, user context and physical context. McCreadie and Rice (1999) draw a distinction between context (the larger picture in which the potential user operates) and situation (the particular set of circumstances from which a need for information arises). Pedersen and Ling (2002) distinguish between the modalities of mobility, work and leisure, specific demographic groups as proxies for distinctions between end-user contexts, and between public and private context and dynamic context. Context refers not only to the everyday context: the situation where the technology is being used, as well as the wider social context. It does seem obvious, then, to take context into consideration when discussing future developments. We specifically used broader descriptions of the home environment as a context (see the more general scenarios as discussed in the 'Results' section), within which we discuss the use of specific technologies, as it is done, for example, for television (see Appendix).

METHOD

The development of futures research has yielded various methods to investigate future developments, examples of which are scenario analysis, backcasting, road-mapping, normative forecasting and foresight. Increasingly, different methods are being combined (Bouwman and Van der Duin, 2003). Combining various methods has led to a higher degree of validity (Makridakis, 1986). Based on a review of the literature, we decided to use technology forecasts to analyse the more general context, i.e. socio-economic, political and regulatory trends, and the scenario method to provide a more detailed analysis of the adoption and use of ICT in the private user, household-related context.

Beginning the study: 1998

The study began in 1998, when the Sociocultural Planning Office, an advisory body of the Dutch government, asked us to investigate which technological, political-legal and socio-economic trends were relevant to the adoption and use of ICT in households in 2010. The workshop began with a technology forecast and organizing a number of 'brainstorming' sessions with expert panels. With regard to the technology forecast, both scientific and popular publications on fundamental and applied technology were used. In addition to desk research, which included internet research, in-depth interviews were conducted with 20 experts in the Netherlands, Japan and the USA. The information gathered was used as input for a workshop attended by experts with a background in communications. They either represented a specific domain, for example media, youngsters, elderly people or minorities, or a specific perspective, for example social developments, legislation or policy. The experts worked for the Government, universities, industry and consultancy firms. They were asked to identify technological and socio-economic trends as well as trends regarding government policy and regulation. In addition, they were asked to indicate which technologies and ICT applications and services were likely to play a role in households in 2010. The expert sessions were supported by Group Decision Support System and facilitated by one of the researchers. Within this set-up, brainstorming (divergence) and voting (convergence) tools were used.

Follow-up workshop: 2003

In 2003 we organized a follow-up workshop. Its goal was to evaluate the results of the 1998 workshop in terms of their reliability, validity and precision. The same approach as in 1998 was followed, and the facilitator and tools being used in the workshop were the same. The same areas of expertise were represented and the participants had similar backgrounds. With one exception, none of the actual participants had taken part in the previous workshop. Although initially we asked the same experts to take part in the second workshop, it proved impossible to involve them again, either because they were

no longer working for the same organization, their interest had changed, they had no time, or they could not attend for other practical reasons.

The 2003 workshop was different from the previous one in that the participants were asked which of the technologies currently being used in households was not foreseen by them five years ago. On the basis of the answers that they provided, we reviewed the results from 1998. We then looked ahead to 2010 in a brainstorming session discussing the main technological, political–legal, economic and sociocultural trends. The participants were invited then to reflect on what technologies might be used in the private domain (households) in 2010. The workshop was concluded by comparing the outcomes of the 1998 and 2003 workshops.

Scenarios

The data collected in the two workshops were used in scenario development. To connect scenarios and forecasting, the following steps had to be taken (Van der Duin et al., 2000). First, the same level of detail had to be established. Scenario stories, i.e. the format in which scenarios are presented, contain descriptions of possible social, economic and technological trends. Second, the points where forecast and scenario intersected were analysed by determining the level of uncertainty for each of the trends, and the impact they have on the adoption and use of ICT in households. Scenarios are created by determining the level of uncertainty for specific trends, on the one hand, and the impact on the domain of analysis, on the other (Van der Heijden, 1996). Combining a predictive method (such as a specific forecasting model) and a more exploratory method (such as scenario-thinking) gives users (or clients) of futures research the flexibility to think in multiple futures instead of just one. In this study we started out from scenarios developed in earlier analysis (Bouwman and Van der Duin, 2003). Third, the four quadrants representing the four different scenarios in more detail were filled in; this involved more than merely listing a number of trends and indicating the direction in which they are heading. The scenarios described the dynamics of the final situation, i.e. the context of the household, in which the adoption and use of ICT in 2010 will take place. Within these scenarios we were able to analyse how the adoption, domestication, use and effect of specific technologies will take place.

RESULTS

The predictions that were made in 1998 and 2003 regarding 2010 were juxtaposed. First, the results will be discussed on a more general level, i.e. forecasts on the broader context, before the scenarios that are more specifically related to the household context are presented. Table 1 presents an overview of the main, more general economic trends that are directly related to ICT. Comparable predictions are listed side-by-side, but in cases where no comparable predictions were made in either year, the entries are left empty.

• Table 1 Technological trends in 1998 and 2003

GENERAL TECHNOLOGICAL TRENDS 1998	GENERAL TECHNOLOGICAL TRENDS 2003
<ul style="list-style-type: none"> • Personalization • Wireless, mobile, wireless application protocol (WAP) • In-home networks, smart home • Intelligent human-computer interface • Convergence of domestic appliances and ICT • Communication applications, more important information • Broadband • Miniaturization • Ambient technology • Context-aware services • Ad hoc networks • Web-TV • Security, time-triggered protocols (TTPs), watermarks, biometric recognition 	<ul style="list-style-type: none"> • Personalization, profiles • Universal Mobile Telecommunications System (UMTS); General Packet Radio Service (GPRS) • In-home networks that connect ICT and appliances, i.e. Bluetooth • Broadband • Miniaturization • Embedded systems, ambient technology • Integration fixed-data to mobile, (TV-PC-voice over internet protocol; VOIP) • Seamless handover and 'roaming' • Open source standards
<p>Expectations concerning television in 1998</p> <ul style="list-style-type: none"> • TV with flat digital screen, stereo and built-in set-top box and video cassette recorder (VCR) suitable for information; transaction and entertainment services available throughout homes (multimedia socket); interactive TV services, on-demand services, pay per view, web-TV • Intelligent space where viewer movements are interpreted and analysed, but also speech function is useful • End of the VCR: all programmes are available online (TiVo) • TV replaced by PC; integration with, for example, digital cameras; development towards games multiplayer 3D, avatars, virtual partners in virtual worlds. • Central place for on-demand services • Visiting places virtually, push media, intelligent agents selecting information, portals 	<p>Expectations concerning television in 2003</p> <ul style="list-style-type: none"> • Less bulk, flatter screens that can be integrated into furniture, walls, etc.; access to thousands of channels • TV that responds to the absence and behaviour of users in a certain space; intelligence in peripheral equipment • Delay TV: programmes can be accessed anytime, anywhere • Integration between TV, PC, VCR, internet
<p>Expectations concerning PC in 1998</p> <ul style="list-style-type: none"> • Adaptive self-learning PC with extended functionality for communication (IP-telephony), cooperation (groupware: shared documents, whiteboard, 3D, virtual group decision rooms), with layered interfaces 	<p>Expectations concerning PC in 2003</p> <ul style="list-style-type: none"> • Use of palm-like devices, connected to GPS and the internet, interface technology allowing people to coordinate their daily lives and synchronize with other sources using their PDAs

(Continued)

• Table 1 (Continued)

GENERAL TECHNOLOGICAL TRENDS 1998	GENERAL TECHNOLOGICAL TRENDS 2003
<ul style="list-style-type: none"> • Mobile PDA including agenda, money, tickets, etc. <p>Expectations concerning mobile systems in 1998</p> <ul style="list-style-type: none"> • Emergence of all kinds of mobile and wireless devices, from PDAs and cameras to watches, wearables and smart vehicles; increased importance of sensors; integration between mobile and PDAs • Tracking and tracing of goods, animals and people (Radio Frequency Identification; RFID) • UMTS, mobile data services, internet via mobile, streaming services for mobile 	<ul style="list-style-type: none"> • More open source instead of Microsoft; thin client; more from server • Projection image independent of actual processor and computing ability; sharing of functionality between devices (wireless grid) • Natural interaction through improved interfaces: speech, motion and text • Always on; more obvious source of information, tablet PC with broadband-like wireless internet connection; PC is above all a gateway to data indoors and outdoors • Continued dominance of a small number of software packages for wordprocessing, spreadsheet, database, etc. <p>Expectations concerning mobile systems in 2003</p> <ul style="list-style-type: none"> • Omnipresent computing, with wireless devices serving increasingly as receiver and local servers manage access to all kinds of services, eventually intelligent clothing • More MMS/i-Mode-like services on mobile phones: downloading music on mobile phone, friends locator, surveillance, mobile tracking, mobile payment, mobile image, streaming video, location-based and context-aware services and applications • Synchronization of mobile devices with PC at home

Economic trends

The trends were divided into macro-economic and micro-economic developments. Many of the trends have an ICT-component or are made possible through ICT, for example globalization, the emergence of global financial flows and the blurring of the boundaries between the public and private domains. It is interesting to see that, while in 1998 the dominance of ICT in all social processes was emphasized and expectations concerning, for instance, e-commerce were high, in 2003 the opinions were less optimistic due to economic recession. At the micro-level in 1998, individualization and mass-customization were considered important issues, whereas in 2003 people had moved beyond that and were looking at production on demand on the basis of customer specifications: a larger part of the transaction part was expected to be virtual. Consumers were expected to be involved proactively

in configuring their own services. With regard to the costs involved in ICT, the 1998 workshop panel emphasized that they expected the price for ICT to go down and total expenditures to remain equal (cf. Carey, 1989). In 2003, ICT-related expenditures were expected to grow.

Social trends

Social trends have to do with the relationship between men and women in the private and public domains, changes in the way that both genders live together, individualization and the erosion of social cohesion, the way in which various cultures manage (or do not manage) to live together, hardening of social relationships and an ageing population. With regard to the ageing population, on the one hand, the experts pointed to the positive aspects – senior citizens as a wealthy, active group with lots of spare time – on the other hand, they mentioned the negative consequences of an increase in the demand for care and the social costs of inactivity. Specific ICT-related choices have to do with the so-called digital gap. In 1998, the experts were convinced that the digital gap first would increase, then decrease. In 2003, the discussion was more about the lack of control over ICT, assuming that users basically are not able to influence the way in which ICT-enabled hardware, applications and services operate.

From trends to scenarios

One of the things that stands out in terms of economic and social trends is a concern for the extent to which end-users actively control ICT or are expected to play a more passive role. Another issue of concern deals with the degree of personalization and the impact that ICT has on social fabric and social coherence. These two issues are related to the axes used in our scenario framework: individual versus collective and active versus passive. These axes were also used in the earlier analysis (Bouwman and Van der Duin, 2003). The difference between individualists and collectivists lies in the degree to which they allow their own interests to prevail above those of the group to which they belong. Individualists have a strong consciousness of self and put their own needs first whenever possible without giving much thought to the needs of the collective. Collectivists are more conscious of the people around them, and strive to achieve a harmonious balance between individual and collective interests. They feel inextricably involved in broader social issues, and this is reflected in their interest in what happens to other people. The difference between active and passive lies in the degree to which people explore and change their environment rather than conform to external influences. Passive people tend to conform to external influences and values. They simply wait for things to happen and suppress their internal impulses. Based on these two dimensions, we present the four scenarios summarized below.

The 'adventure' scenario (active, individual)

This is based on egocentric fun lovers who above all crave more excitement, variety and pleasure in their lives. They want to have a good time with lots of thrills. Life is an adventure and society is the theme park where it is played out. Everyone is shamelessly selfish and unwilling to conform to established social patterns. People are even less prepared to make any kind of sacrifice for others. 'Flexibility' and 'mobility' are the catchwords. Life is all about keeping on the move and unfolds against the background of a booming economy.

The 'budget' scenario (passive, individual)

In this scenario, the European economy is facing problems. The economic bubble has burst, resulting in a period of economic and social decline. Many companies have gone bankrupt and the housing market has collapsed. As a result, economic growth is far more sluggish than it was in the 1990s. People work relatively hard at highly irregular hours in an attempt to turn the tide. With hard work, thriftiness and an occasional lucky break, most people manage to keep their heads above water. Money is a constant worry. The most striking aspect of this scenario is people's extreme price-consciousness, with everyone attempting to squeeze the most out of every last penny. In this world, certain traits are crucial, such as the ability to calculate rapidly and accurately, to be assertive during negotiations, and to network successfully. An extensive network of contacts has enabled people to establish and maintain a system of mutual support, which has all the features of an informal economy.

The 'comfort' scenario (passive, collective)

In this scenario, key words are 'comfort' and 'usefulness'. Its catchwords are 'reduced complexity', 'time saving' and 'rationalization'. After the turn of the century, society responded to an increasingly complex world by expressing a collective desire for control and comfort. Consumers no longer want to choose from a whole range of options, but want companies and organizations to provide products and services that are fully tailored to their needs. The most popular organizations are those that provide a sound service. Resolving day-to-day problems, providing security, dealing with problems for consumers – these are the services that rate high on the busy consumer's list of priorities. Consumers are extremely demanding. High quality and service at affordable prices are key requirements.

The 'durable' scenario (active, collective)

In this scenario, the focus is on quality of life; it is opposed to the idea that progress usually means 'more'. People are tired of innovations and have slotted into a new mindset, giving them more time to enjoy nature and each other.

Success is no longer measured according to income and possessions, but to well-being and social behaviour. Rejecting the constant desire for more has become a valued way of thinking. People no longer want to be manipulated by advertising and promotional campaigns. Consumerism is less rampant. More and more people feel that it is time to re-examine the consumer society. They no longer want to be pushed, but want to live life at a slower pace.

These scenarios are four examples of households that serve as a context for describing the further adoption and use of specific technologies to be used in the context of those households. Before elaborating further on the way in which specific technologies fit into the four specific scenarios, we discuss relevant technological trends as foreseen by the experts, using these trends in specifying the scenarios for certain technology domains.

Technology trends

The general technological trends mentioned in the brainstorming sessions in 1998 and 2003 were pretty much the same: personalization, next-generation broadband, mobile and wireless networks and applications. In-house networks were high on the agenda, as were embedded systems and ambient technology. Interestingly, in 2003 there was a greater emphasis on the operability and convergence of existing networks, as it became clear from the attention on open-source standards. In the discussion of general technology trends certain issues, such as web-TV and ad hoc (mesh) networks, were no longer all that prominent. Whenever mobile technologies were discussed in 2003, it was assumed that there was a natural connection between context-awareness and mobile services and applications.

It is interesting to see that television, an important medium in the domestic context, was seen in a more optimistic and technological light in 1998 as compared to 2003. Television is a medium that can be plugged in anywhere in the house, it is to a lesser extent based on broadcasting and more on on-demand access through new devices such as TiVo. In 2003, the video cassette recorder (VCR) was expected to become obsolete. When people want to see a programme after it has aired, they will use delay television as available via the internet. Whereas in 1998 the experts predicted a link to game-like applications, in 2003 they only predicted the integration of television, the internet and PCs. Although games were mentioned in relation to television, no particular attention was paid to these rapidly emerging and pervasive markets. It is interesting to see that, especially with regard to the man-machine interface of television, the experts envisaged a revolution: they expected the device to be controlled by people moving around in the living room.

The way in which the experts saw the role of the PC evolved between 1998 and 2003. While the 1998 experts were thinking of adaptive PCs and PDA-like devices supporting all kinds of functionalities, in 2003 that vision

included the coordination and synchronization of an increasing number of various devices and applications. There was also an emphasis on open source, the expectation being that Microsoft and its Office Suite would play a less dominant role. The connection of the PC to the internet was seen as a 'natural' one.

Finally, we discussed mobile devices and applications. In the previous section PDAs and standards such as wireless application protocol (WAP), General Packet Radio Service (GPRS) and Universal Mobile Telecommunications System (UMTS) were discussed. In addition, the synchronization of various devices was seen increasingly to be a problem. Although in 1998 the experts were aware of context-aware systems, we have the impression that, when discussing mobile communication in more detail, the 2003 experts displayed a clearer vision of its possibilities.

Interestingly, whereas in 1998 embedded systems received greater attention, in 2003 the PC as an access point to the internet was discussed in more detail. Furthermore, we have the impression that the importance of the technology push was considered to be stronger in 1998 than it was in 2003. In 2003 the experts had a more realistic, sometimes even a negative view of the use of technology. In addition, we wish to point out that a number of items that were discussed in 1998, in particular with regard to e-commerce, had more or less become a reality in 2003. The ideas and topics discussed by the experts were used to work out the scenarios for a specific technological domain. The Appendix to this article provides an example of the way in which trends with regard to television would fit into the four specific scenarios. Similar scenario descriptions are available for PCs and mobile systems (see the Appendix).

DISCUSSION AND CONCLUSION

First, the predictions from the 2003 experts appear to be much less optimistic and technology-driven than the ones made in 1998. Especially with regard to the general economic context, we can see that the tone of the discussion concerning the role of ICT has changed. We assume that this is largely due to the dot com crisis. With regard to technology, we see a shift in focus away from devices that depend on a physical context – television and PC – towards more portable and mobile devices. In addition, there are high expectations with regard to the synchronization of various appliances and applications, supported by a home server. At the level of services and applications a complete disconnection of application and network is predicted. TV images can be downloaded through a PC or even a mobile phone, while the internet can be accessed via a television channel. Man-machine interfaces, services and applications are increasingly adapted to individual users in their context. To see how this technology forecast works out within the context of a household, we developed scenarios on the basis of two dimensions

(individual–collective and active–passive). We used these dimensions in earlier research, and their relevance was confirmed on the basis of the expert discussion on economic and social trends. We developed four scenarios to specify the context in which the adoption and use of specific technologies take place. The scenarios enable us to illustrate, as we have done for television, the way in which specific technologies can be adopted and used within a specific context.

The question that remains is what the value of futures research is, i.e. the technology forecast for the more general context and scenarios for the more specific context. Although the scenarios may be the result of a more qualitative approach, they are important to help application developers, business development, decision-makers as well as service and content providers to think about possible futures in which people can use their technology, applications, services or content. Knowing the different types of users and understanding how technology is used within the context of households, as portrayed in the scenarios, makes developers more aware of the choices that users face in adopting specific applications, content and services in combination with different types of devices.

From an academic point of view, futures research has been rightly criticized sometimes for its lack of theoretical foundation. To remedy this state of affairs, we attempted to incorporate academic expertise into our approach and we invite communication scholars to do the same. Futures research, both in the form of technology forecasting and scenarios, helps us to understand possible future developments and allows scholars to define research agendas. Scenarios take social changes into account, drawing alternative, divergent pictures of a future context within which the adoption, domestication, use and effects of new technologies will take place. Through the use of scenarios different contexts can be described in which the impact of specific technologies can be analysed, making use of the know-how of communication scholars. However, communication scholars are inclined to focus on the present, ignoring future developments that may have a tremendous impact on the media landscape. Starting from the scenarios we have presented, road maps can be developed and decision-makers can use the scenarios to test their views and decisions.

One of the things that emerges from this research is that, by and large, the pictures that emerged both in 1998 and 2003 were fairly coherent and of uniform focus. At a more detailed level, a more nuanced picture emerges: in 2003, there was a greater degree of realism and awareness of actual developments. However, the overall picture is unchanged. The importance of ICT and, in particular, mobile applications, will continue to grow in the future. We are not concerned with exact quantitative predictions in this study, but more with the coherence and consistency of the overall visions of a future where there is room for users to decide on the adoption and use of new ICTs that match their specific context.

We are fully aware that this research has a number of limitations, not only in terms of the time that has elapsed and the specific geographic location. Would we have the same results if we replicate our research, and do the results of our study apply to other cultures as well? Further, with regard to time we are aware that in 1998 it was much harder to foresee what the developments may be in 2010 than it was in 2003. Furthermore, this research is based on the input provided by a selection of expert participants. As Loveridge (2004) argues, although expert opinions are helpful in offering fundamental foresight, their underlying nature is poorly understood. Input from experts is indispensable, as has become clear from similar exercises in England (Keenan, 2003), France (Durand, 2003) and the USA (Wagner and Popper, 2003). As far as we are concerned, this type of research where experts play an important role is not a final stage, but rather a starting point for more nuanced scenarios that pay attention to the context for adoption and use on a more specific level.

Finally, the step from trends to scenario axes and to the development of scenarios and the specification for specific technology domains is a creative process. Whether or not we have succeeded in building a convincing, coherent and internally logical vision is up to the reader to decide.

Appendix: elaborated scenarios for television

Currently many households have a stereo TV with teletext connected to a VCR or digital video disc (DVD) player. Technological forecasting states that in 2010 there will be households which will have TVs with flat digital widescreens and built-in set-top boxes. However, this forecast fails to give us any idea about the (approximate) number of households where this will be the case, how TV sets will be used and what role it will play within the context of a household. Combining the technological forecasts with the scenarios give us more insight in possible adoption and use patterns.

Adventure: since the 'Adventure' scenario consists of households (many of them single-person households) that have a very innovative attitude, an interactive digital TV is a regular phenomenon. People's homes are filled with TV screens and some already have TV with ambient technology-type services (i.e. wherever they are in the house, the screens 'recognize' them and immediately start broadcasting their favorite TV shows or give information regarding these programmes). People who cannot afford ambient technology have intelligent agents programmed into their TV set which keep them updated on shows to come and provide links to other types of media. TV is no longer a large, fixed device situated only in people's homes, as they also watch TV on mobile devices. Satellites are very popular and watching the 6 o'clock tango show broadcasted in Argentina is just as normal as the 8 o'clock news broadcasted in the Netherlands. All of this does not imply, however, that the people in this scenario watch TV all evening. That would be too boring for

them. Because of their busy lives they only watch selectively, which means that the TV guide follows them and the 'adventurous' TV-watcher decides which pre-selected (intelligent agent) programmes their TV will transmit, using all kinds of new interactive and digital services, such as recording live broadcasts simultaneously to ensure that the viewer does not miss a thing.

Budget: due to bad economic times people are not very eager to adopt all kinds of new technology, so the good old TV set is still one of the most important sources of entertainment in this scenario. Screens are almost the same size as 10 years before and the remote control has gained some extra intelligence. People are not prepared to invest a great deal of money in sets with special features because they consider them to be devices that are only suitable for transmitting TV signals. TV and VCR or DVD players are not integrated as yet, neither is TV integrated with other devices. Because people are mostly busy solving their own problems they do not have a very broad social and cultural orientation: national programmes are more popular than foreign ones. End-users make deliberate choices constantly about what to spend money on, and therefore they only want to pay for those channels that they watch regularly. There is relatively little demand for exotic and interactive TV channels. TV is considered to be amusement and a way for people to forget their everyday worries at a price they can afford.

Comfort: As people consider all the various communication and information devices in their busy households to be too much of a nuisance, a device has been developed that combines TV, VCR/DVD and PC. The result is a kind of central controlling unit that is used not only for watching TV but also for sending emails, video-mails, shopping, agenda coordination and domestic services such as regulating the in-house temperature. The display screen occupies a place at the centre of the household more than ever and it combines many functions, of which saving time and making the daily routine as easy as possible are two of the most important ones, more important than watching television. Just as in the adventure scenario there are TV screens in many places in the house. Most of them are nicely designed, flat screens with speech-recognition interfaces, guaranteeing up-to-date information tailored to the user's needs.

Durable: Watching TV is a family affair and parents try to make sure that their children do not watch too much. Because people value other things, such as having personal (and local) contacts, adults also try not to watch too much TV. If they do watch TV, they do so in a very deliberate way: information programmes are the most popular. Many TV's have 'filters' that prevent children from seeing pornographic and violent programmes. An important function of the TV is to provide background information regarding TV programmes. Because people watch TV in a conscientious way, it does not occupy a central place in their homes, but is located somewhere in a corner so that people who really want to watch, have to make an effort.

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