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Designing ICT for Mothers

User Psychological Approach

JYVÄSKYLÄN YLIOPISTO

ABSTRACT

Today there are several technologies that can be used in work and in private life, and new technologies are being developed continuously. However, it seems that studies that consider the use of technologies in intra-family informational and communicational activities are lacking. This thesis deals with the relationship between family and information and communication technology (ICT). The aim of the study is to find out about families' information and communication activities and how that knowledge could be utilized in the design of technologies. In addition, mothers' ICT demands are explored. Qualitative research methods such as a diary study and thematic interviews are employed; some quantitative methods are utilized; the results of a field trial are analyzed; and the adequacy of the number of participants is evaluated. The first main finding is a classification of families' information and communication actions. The results suggest that the classification can be used in design of new ICTs and, therefore, supports designers' work. The end users benefit from the classification also, because of utilization of transfer. The second main finding is a collection of 37 requirements for the technology used in the context of the research subject. The results are the first step in the development of Demands for Technology Model, which may provide a contradictory viewpoint for Technology Acceptance Model. Third, the study introduces an approach to define a reasonable saturation in research with the same kinds of research problems. All in all, this research offers an overall view to family as an environment of ICT. These concepts introduced here should guide the development of ICT.

Keywords: action oriented research, action schema, demands, design ICT, family activities, service development, user psychology

ACM categories: H.1.2 USER/MACHINE SYSTEMS –– Software psychology

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1   INTRODUCTION

Everyone has a mother, and some may have more than one. For most of us the mother has been a very important person in our life. According to several studies (Anderson et al. 1999, Haddon 1997, Perry-Jenkins, Pierce & Goldberg 2004, Pääkkönen et al. 2005, Tollmar & Persson 2002) the mother is the family member who has the main responsibility for household work and family communication. Of course, in some families this role may be played by the father. Generally, however, the mother manages the household and often also has full-time work outside home. There she has other responsibilities which might not accord with the family's needs. In spite of these requirements of family and work life, some mothers succeed also in arranging time for themselves. Because of these duties the mother often has lots of appointments to keep and work to organize.

Information and communication technologies (ICTs) have developed rapidly during the last decades (Ipsos 2004, Nurmela & Ylitalo 2003, Venkatesh 1996). People use different kinds of ICTs at work and in their private life. There are many studies concerning the use of ICT in organizations. Workplaces and private life differ as a context for technology, for example, by users' goals and adoption criteria (Plaisant, Druin & Hutchinson 2002). There are very few studies in the household context (Brown & Venkatesh 2005, Hughes & Hans 2001, Jennings & Wartella 2004). However, to develop technologies for families it is necessary to understand this context of use also (Plaisant et al. 2002).

Family is a very problematic concept to define especially in a universally congruent way. This study applies Morgan's (1996, 1999) idea which sees family as a continuous process in relation to its environment. The definition leaves space for participants to define who belongs to their family. In this study this family context is referred to as *family life*. It includes all kinds of actions, feelings, situations and other things that are related to a person's family. These events may take place at home or elsewhere, for example in the form of family communication at work place. Family life may occupy any moment and is not tied to any specific time lapse spent at home.

Plaisant, Druin and Hutchinson (2002) defined two components where technologies for families are considered: design techniques and technologies. The design techniques component considers how families can participate in the design process, whereas the technologies component discusses the properties of technologies, acceptance and their marketability. This division seems to be technology and design oriented and excludes the human viewpoint.

Plaisant, Druin and Hutchison's (2002) division can be complemented by adding the human component, the family, and a new definition of the other components (FIGURE 1). The first component, human, considers human systems and properties. Family is a kind of a human system that includes e.g. activities, social systems, people's attitudes, and goals. The second component, technology, considers characteristics of technology (e.g. devices, software, standards, protocols, and properties), and the third component, design techniques, studies the development process of technologies (e.g. methods and techniques of design). This study focuses on all of these three components. The focus varies between the components according to the research stage.
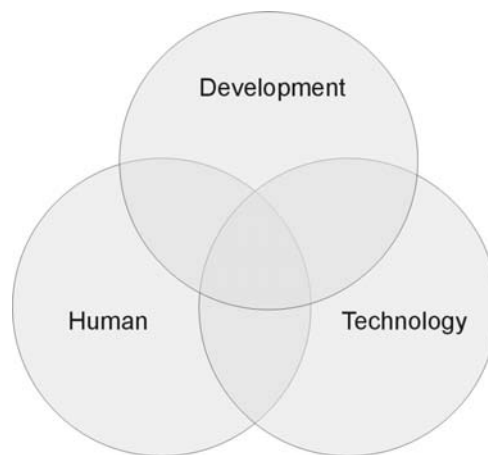
FIGURE 1   Three aspects of research on technologies for families

Technologies used in a family context form a quite a wide research area. This is due to the fact that there are several kinds of technologies that can be used in families or in the domestic context. These can be roughly divided into two:

1) Technologies for housekeeping (washing machine, vacuum cleaner…) and real estate management (air conditioner, security systems…)
2) Technologies for social and cognitive needs of people (telephones, TVs, games…)

This study focuses on technologies used in intra-family information and communication activities, which is a sector of the latter part (2). The aim of the study is to acquire more knowledge of this issue, and qualitative methods are applied to achieve this goal. The results of the study provide useful knowledge about family as a domain for the developers of ICT. However, the developers are not the only winners. Once the developers can understand family needs it is

more likely that the families will have better devices and services to support them in their daily life. In addition to these practical results, the research also creates new scientific knowledge of family activities and of users' requirements for technologies.

Before it is possible to discuss the demands or requirements for ICT in more depth, the central concepts have to be defined. The word *technology* is understood here in its wider meaning as *"the diverse collection of processes and knowledge that people use to extend human abilities and to satisfy human needs and wants"* (ITEA 2000, p. 2). The concept of technology thus includes software, hardware, services, the ways that people use these, and the skills that people need to have to use them. Thereby, *ICT* refers to technology used for information and communication activities, for example to support discussion or time management.

Words are not used that precisely in daily life and a layman may not be interested in nor capable of considering these different components of technology. Nevertheless, even more exact concepts such as *device* and *service* are needed. *Device* refers to hardware (e.g. computer, mobile phone, and physical networks) that is needed for the implementation of some technology. In this research device is defined very widely to include such earlier products as pencil and paper.

Service is a facility which a person uses to reach her/his goals and consists of applications and usages. The user sees the service as an application, has a mental model of it (Payne 2003), and apperception (Saariluoma 2003, 2005a) about its use, i.e., the user has an image of how the service can be used and what it can be used for. S/he has based this image on perceptions as well as on the knowledge that s/he has gathered by other means. Examples of services include short message service (SMS), multimedia messaging service (MMS), phone call, e-mail, and calendar. These services can be used via different devices. The definition here may differ slightly from the definition of service in the context of economical sciences (e.g. Grönroos & Tillman 2001, Saariluoma 2005b), because here the issue is considered from the user's viewpoint in the information system (IS) field.

This division into devices and services is needed in the IS field, because devices and services can be combined in various ways. Three different kinds of combinations can be found (FIGURE 2): A) A service is used by a device, B) Many services are used by a device, and C) A service is used by many devices.
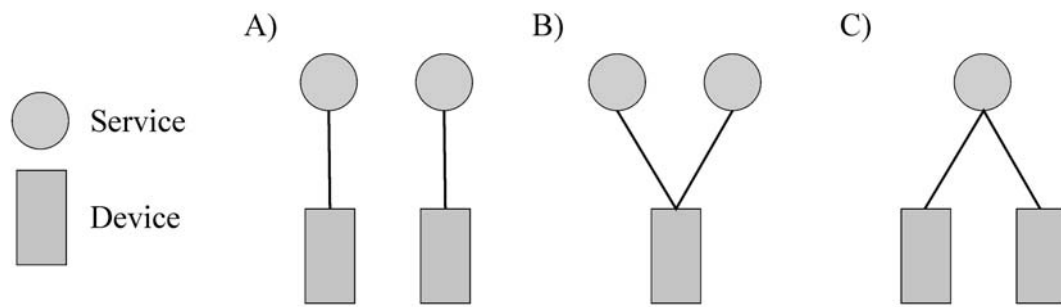
FIGURE 2   Relationships between services and devices

However, it is not always necessary to discuss devices and services separately. Adoption or use of a service depends both on devices and on services as well as on the ways people use them. For example, usefulness of e-mail depends on the usefulness of a device (e.g. mobile phone) and service (e.g. e-mail program) as well as on the person's skills in using them. If the screen of a mobile phone is too small it may inhibit the use of e-mail in that device. The use of e-mail via mobile phone is impossible for a person who cannot configure the required settings for the connection. In addition, cognitive, emotional, or behavioral aspects such as the user's ignorance, prejudice, or use routines may have their impacts as well. In this work the term technology is used in many different situations and, in occasions, may be replaced by the words device or service.

This study is a multidisciplinary research project mainly dealing with the information system field and psychology. During the process of investigation, theories and concepts from both fields are applied. In addition, new knowledge is created for the fields. The field of IS is multidimensional, and the present study is related to some of its research areas including Computer Supported Cooperative Work (CSCW), Computer Mediated Communication (CMC), and different human-centered approaches such as human-computer interaction, HCI. However, the closest reference area is the user psychological approach introduced by Saariluoma (Saariluoma 2004, 2005b). It is one of the human-centered approaches and refers to a research culture where the user is considered more widely than is the case usually in traditional HCI research. The aim of the user psychology is to understand how humans act when using a system. The methods and theories of psychology are applied and developed during the research. This knowledge is brought to the design process from the very beginning. The approach has been applied in recent studies of Oulasvirta and Saariluoma (2004, 2006) as well as that of Niemelä (2003).

The ideas of human-centered approach and cooperation between different sciences were emphasized when the Family Portal Project was established in 2000. The goal of the project was to study the significance of ICT in families, and to create new ICT services for family use. The project venue was the Agora Center, a multidisciplinary research center at the University of Jyväskylä. The project was lead by Professors Pekka Neittaanmäki and Lea Pulkkinen.

This research project on families as a domain for ICT started as a part of the Family Portal Project and has continued after the Family Portal Project ended in 2004. The user psychological approach is applied in this research, the idea of the study being to increase knowledge about users by a holistic manner, and not merely to study user-computer interaction that is necessary in system development (Isomäki 2002, Koskinen et al. 2005). The user is seen as a member (the mother) of a social group (the family) and also has connections to other groups at work, school and among friends. The user has physical, cognitive and emotional dimensions as well.

This complex system is considered in Chapter 2, which reviews some family life phenomena and discusses the kinds of relations that may exist between family life and ICT. The second aim of the chapter is to introduce different kinds of research approaches and results found in the field of IS. The third goal of the chapter is to present what knowledge there is about the relationship between ICT and family life. Attitude and other viewpoints (demands, motives, choosing, and gender) related to it are central concepts.

Chapter 3 introduces user psychological approach used in the study. The goals of the study as well as the basic methodological viewpoints for the research work are also discussed, in general terms, in this chapter. The methods of the study procedures are explained more thoroughly in separate articles.

The results of the study are collected in Chapter 4, which introduces six research articles. The chapter includes all the findings of the study. It also demonstrates the nature of the study process that started with a wide focus and data gathering and focused into more detailed questions later.

Finally, the whole work is concluded and evaluated in the last part of the thesis, in Chapter 5. This evaluation is done from the viewpoints of the results and methodology. Also future directions for research work are suggested.

2 PREVIOUS RESEARCH

The relationship between technology and people is widely studied in organizational settings and even in intra-organizational settings (e.g. field of CSCW). It is more difficult to find knowledge about human-technology relationship in the context of intra-family information and communication activities. In this chapter, previous research on the subject is reviewed. The review is not meant to be exhaustive and mainly deals with the most central studies that have been done.

The review is divided into three parts. First, the concept of family and its relationship with IS research is introduced. Second, different kinds of studies on the use of ICT in family context are discussed. The third part considers different factors that may influence the relationship between family and ICT. Finally, the main viewpoints are brought together and future research needs are discussed.

2.1 Family in ICT research

Family has been the focus of research and debates for a long time but still there is no universal definition of family. Recently, an approach to understand family as a continuing process including practices of "doing family" as in Morgan (1999) has been introduced. Morgan points out that family is not a separate unit of society. Family research becomes particularly interesting when it is combined with other phenomena like work, gender, or stratification. In addition to these external relationships, there are family relationships between the spouses, between the children and between the parents and children. Family is thus a dynamic process of negotiation and re-definition (Morgan 1999).

This study considers a family member as a user of ICTs and families as a domain of ICT. Knowledge about family system is needed in order to develop ICT services for families. It is necessary to be aware of the different kinds of relationships, tasks, and problems that can occur in families and consider what

kinds of roles ICT can play there. Next, some central issues of family life (from the viewpoint of ICT development) are discussed.

Several relationships may form between family members. As it is impossible to review all of them in one study, only some interesting results are presented in this work. Rönkä et al. (2002) have studied adolescents (13-14 years of age) and what they expect from their parents. They found that the youngsters in this age group hope for care giving, support (advising and guiding), and spending time together. It is also important for the child to know that parents are available when needed. From the viewpoint of ICT research it would be interesting to find out how the available technologies reflect these expectations. For instance, Vestby (1996) has considered mobile phone as a technology which affords autonomy. In her summary she points out that technology may support children's development of autonomy but may also restrict it. This depends on how mobile phones are used in a family. The mobile phone can provide access to family support to a child when the family is somewhere else. For example, if a child is returning from a music lesson and the bus s/he is waiting for has not turned up, s/he can phone the father / mother and ask what to do.

The relationship between two people depends on the personal characteristics and roles of the participants. Adolescents' relationships with mothers differ from those with fathers. Adolescents play with their fathers or discuss practical things, whereas housework, shopping and discussions about school issues and sensitive issues is usually done with mothers (Rönkä et al. 2002). The parents think that both of the parents have to participate in parenting equally even though there are differences in the relationship types between mothers and fathers (Reuna 1999). However, the Finnish results still show that there are differences between genders in performing household work: females usually look after laundering, cooking and cleaning whereas males are in charge of do-it-yourself tasks within the household (Kinnunen et al. 2000). These results do not consider psychological issues such as security, love, and trust related to family tasks. ICT can support equality of parenting by providing connections to both parents. The role of ICT may be especially prominent if one of the parents is elsewhere and the child can get in contact with her/him via ICT. Of course, technologically mediated ways to communicate cannot completely compensate face-to-face communication, but they can make communication possible between people who cannot be together in the same place.

There are differences also in the ways how familial relationships can influence a person. Females feel, more than males, that parenthood restricts their lives. This effect is the strongest in children under 12-years-old (Kinnunen et al. 2000). The relationships between parents and children change when children grow. Adolescents start to grow apart from the parents, and the parents should give them more freedom and responsibilities (Rönkä et al. 2002). From the viewpoint of parents, ICT may make it easier to give more freedom and responsibility for the children. The parents feel more comfortable if the child carries a mobile phone to contact them in case of an eventuality when spending a night with friends in the city. However, the children may experience

this commitment to use mobile phone negatively and think that the parents want to be able to control their doings (Kasesniemi & Rautiainen 2001).

Of course, there are other relationships in families in addition to this parent-children relationship. There is a relationship between the parents as well as between the children. The issue of marital relationship is a widely discussed area in psychology. However, psychological studies seem mainly concern the problems of that relationship. In addition to intra-family relationships, there are connections with more or less close people outside the nuclear family. One issue that has been discussed is who provides support for the parents. Greenberger and O'Neil (1993) found that fathers' well-being is related to the support they get from their spouses. Crnic and Greenberg (1990) found that, for mothers of young children, emotional support from friends is more important than emotional support from husbands. Also the number of contacts with older generations has been a subject of study. Parents of little children have contact with their own parents frequently, and a third of them think that they have more contact with their parents after having children than before having them (Reuna 1999). ICT provides means to manage these contacts between spouses, generations and friends. The pace of life can differ between people: it may be difficult to arrange meetings with friends at certain times, or grandparents may live out of town. Different ICTs help to overcome these temporal and spatial difficulties. E-mail and text messages can be used for communication with other persons who are not available for synchronous communication; phone calls can be made over any distances. Again, ICT allows connecting people when face-to-face meetings are not possible.

Even though discussing different kinds of intra-family relationships is complex enough, it is necessary to remember that family is not a separate unit in a society (e.g. Leinonen, Solantaus & Punamäki 2003). From the viewpoint of family members it is not easy to combine family life with other life areas. A complex relationship exists between work and family. Dual-career families are common nowadays and parents may experience difficulties in balancing between requirements of work and family life (Higgins, Duxbury & Lee 1994, Reuna 1999). Reuna (1999) studied Finnish parents' opinions of their families' daily life with children in an age group attending day care center. Most of the respondents (88 %) were mothers. She found that one third of the respondents experienced life with little children as very demanding (Reuna 1999). Kinnunen et al. (2000) have found that white-collar mothers especially have problems in combining work and family life. Correspondingly, the number of children correlates with the number of problems perceived in the work-family relationship. A closer look at the correlation indicates that the number of children and the number of parents' working hours are related to each other. The parents with more children also work more. The age of the youngest child was not related to parents' working hours. (Kinnunen et al. 2000) Most parents think that the needs of families are not understood sufficiently well at work. However, they also think that it is possible to combine work and family life. (Reuna 1999) ICT may provide means to reduce these stress factors, too. For example, for the children spending afternoons alone or with friends (without

day care or afternoon care) it is good to know that they can contact their working parents if needed.

A person may be oriented to work or family issues. In a Finnish study (Kinnunen et al. 2000) most participants had committed themselves mainly to their family (77-81 % of females and 74-75% of males) whereas 16-26 % of participants had a greater commitment to their work. The number of children they had did not correlate with the commitment to the work or family. However, their commitment to work increased when the youngest children of the family grew older. (Kinnunen et al. 2000) Work is not the only institution which is connected to the family life. Schools and clubs have their influences on families and individuals as well.

Family plays many kinds of roles in an individual's life. It can be a source of stress and, equally, a source of support. In addition, it is a place for socialization (e.g. Goodnow 1988). In the case of young children the family is the crucial environment of that process where an individual is trained to adapt to the culture (Mäkelä et al. 2000). This also has to do with the habits and values related to ICT. The parents (or adults of the family), by their own values and choices, exert influence on children's attitudes, skills, manners and other characteristics related to ICT. For example, Chesley (2006) found that husbands' use of mobile phone and pager induces wives to adopt them too. This gives some indication about why it is interesting to study families as an application area of ICT. The focus of this study is on the role of ICTs in this system and the prerequisites for their use.

In ICT research, family can be approached from the viewpoint of separate family members or from the viewpoint of the whole family system. In the context of this research a person has to be considered as a family member and as a user of a device or a service. As a user of ICT the person has a goal and s/he uses a technology to achieve that goal (Carroll & Campbell 1986, Saariluoma 2005b). A person may have several different kinds of roles in a family (e.g. Gamble & Gamble 1998, Nye 1974) and her / his goals are partially defined according to her / his roles. A 10-year-old girl may be a child of a family, the oldest child of the family, a daughter, a schoolchild, a sister, a technical supporter, a helper with domestic tasks, a pet owner, a decorator of the home etc. The other members of the family have several roles as well. These roles vary between the cultures but they also vary between the families, person's life stages, and stages of a family life (Gamble & Gamble 1998). This is easy to see when the development of children is considered. Children have different kinds of roles at different ages. Personal properties and circumstances at work may also influence the role of a person in a family. There are other factors also, which may influence these roles. For example, Anderson et al. (1999) have found that implementation of technologies creates a role for monitoring the use of those technologies.

The role of the mother seems to be central, at least in Nordic societies when families' information and communication activities are considered. In Sweden, Tollmar and Persson (2002) found that all participants of their study (3 families, 6 households) had a strong link with their mothers. Mothers are still

responsible for 54–63 % of household work whereas fathers take care only of 23–33 % of it in Finland (Pääkkönen et al. 2005). In addition, the responsibility for negotiations regarding work distribution seems to belong to women (Perry-Jenkins et al. 2004). Studies have also shown that the role of women includes maintaining the household's social relationships (Haddon 1997) and that the females communicate more with relatives than the males (Anderson et al. 1999). The emphasized role of the mothers in families does not mean that the fathers do not have responsibilities. In fact, a Canadian study (Higgins et al. 1994) of dual career families indicates that fathers have increased the time they dedicate for child care activities. Mothers, who are still perceived to be mainly responsible for child care and home chores, experience tension between work and family as more problematic. From this viewpoint it is interesting to consider the relationship between mothers and ICT in the context of family life.

Needs and attitudes of family members seem often contradictory. Someone in the family may want to have more communication whereas another family member may find it undesirable (Tollmar & Persson 2002). Same kinds of conflicting situations have been found with mobile communication (phone calls and text messages). From the viewpoints of children, parents' communication may seem controlling rather than affective, the latter kind of which the children would like to have more (Kasesniemi & Rautiainen 2001). This perception may be a consequence of different interpretations: children may experience communication to be more controlling than the parents have interpreted it to be.

There exist a very few studies that consider families as a whole in the field of ICT and only two classifications concerning technologies in family context were available. Venkatesh (1996) has considered household activities that can be performed using ICT. He listed 14 activities (TABLE 1) and classified them chronologically into three groups: those that were considered important in the use of domestic technologies in the 1980s, those of the 1990s, and those of the future. The classification is based on business lines (food industry, finance, retail trade and so on) and provides information on what kinds of interest groups may be potential partners for developers. The classification includes both activities in the area of our research focus and activities outside it.

TABLE 1   Activities of household in cyberspace (adapted from Venkatesh 1996, 50)

Time period	Activity
1980s	Food Preparation & Management
	In-store and Other Purchases & Cash Management
	Home Shopping
	Home Banking & Financial Management
	Family Records (Health)
	Family Travel & Recreation
	Reading News & Relaxed Reading
	Family Communications & Correspondence
	Children's School Work & Education
	Adult Remote Education at Home
1990s	Word Processing & Document Preparation
	Telecommuting & Teleworking
	Children's Games and Recreation
Futuristic	Household Automated Tasks

Another classification of domestic technologies at about the same time is Bushnell's (1996) classification of software. This is an environment oriented classification (TABLE 2) and based on the location where the domestic technologies are used. The classification may inspire developers of technologies to adapt their products to special kinds of environments such as the bathroom or the kitchen. Even though the classification is done for domestic context it does not provide viewpoints of activities that take place within families' information and communication system.

TABLE 2   Bushnell's (based on Bushnell 1996, 33-34) environment oriented classification of domestic software

1	Deskware
2	Couchware
3	Kitchenware
4	Bedroomware & Bathroomware
5	Autoware
6	Storeware
7	Bankware
8	Gameware

From the viewpoint of ICT development, a classification of family's information and communication activities would be useful. It could provide a starting point for service development. However, this kind of classification cannot be found from previous research in the fields of IS or psychology. This finding supports the conclusion of Whittaker et al. (2000) according to which there are no "accepted bodies of knowledge about everyday computer activities" (p. 79).

One research area in the field of IS is user centered design. The concept covers different kinds of methods applied on users in design process. Even though there are only a few studies on the use of ICT in families, several articles that consider families as design partners can be found. A way to cooperate with families in design is by using scenarios. A scenario typically refers to practical descriptions of concrete interaction processes (e.g. Jarke 1999, Röcker et al. 2004, Tollmar & Persson 2002, Torgny 1998). A problem with scenarios is their multiplicity, because they operate on a relatively concrete level. They are

specific and detailed. Therefore, quite a many of them are needed for the development of one service.

Another tool is cultural probes. There, different kinds of objects (e.g. postcards, maps, and photos) are used to gather and to share, among others, information, experiences, and feelings between participants and designers (Beaudouin-Lafon et al. 2001, Gaver, Dunne & Pacenti 1999, Hemmings et al. 2002a, Hemmings et al. 2002b, Westerlund, Lindquist & Sundblad 2001, Westerlund et al. 2003a, Westerlund et al. 2003b). For example, cameras can be given to family members for taking photos of certain subjects. Then these photos are discussed together with the developers.

2.2 ICT use in families

We can find two kinds of studies that consider the use of ICT in families: statistical analyses of user demographics and case studies of separate technologies. These are briefly introduced below.

2.2.1 User demographics

Today, different kinds of technologies are used in families. Most studies consider the use of different technologies in private life as a counterpoint of their use in a work context. The results of these kinds of studies do not differentiate between technologies applied for intra-family communication or for some other purposes.

Nurmela and Ylitalo (2003) studied the development of Finnish information society from 1996 to 2002 by interviewing people aged ten years and older all around Finland. At the end of 2002 they found that 86 % of males and 78 % of females had a mobile phone, and 77 % of them made or received daily mobile phone calls. Of these people, 40 % used text messages on a daily basis. Rather than letter or computer or other means, phone call was also the most popular way to carry out tasks. However, the use of SMS has increased and it was found to be almost as popular as the use of phone call. (Nurmela & Ylitalo 2003)

Changes in penetration and use of different technologies have been fast during the recent years, and the statistics are undergoing rapid changes. According to the statistics produced for the European commission (Ipsos 2004), Internet access in households has increased from 36 % to 39 %, broadband Internet access from 6 % to 14 %, and subscriptions of at least one mobile telephone from 86 % to 90 % during a period of one and a half years (from the second half of 2002 to the end of 2003). Penetration of personal computer (52 % of households) and overall telephone access (98 %) seemed to remain stable during this period but penetration of fixed telephone lines decreased from 69 % to 65 %.

Even higher numbers of penetration can be found from the statistics of Eurostat (Demunter 2005). For the second quarter of 2004 they found that 57 % of households had a personal computer (PC), 51 % had access to Internet, and 21 % a broadband connection at home. The rate of penetration was even higher in households with children (PC 85 %, Internet 77 %, broadband 36 %). The degree of urbanization of residential areas seems to correlate positively with the penetration of ICTs as well. The results from the European commission (Ipsos 2004) indicate the same kind of positive correlation between household size and penetration of fixed telephone lines, mobile phones, PC, Internet access, and broadband Internet access. Age, education and employment correlate with the use of computers and Internet: young people use computers and Internet more than older people do, people with higher education use them more than people with lower education and those employed use them more than the unemployed (Demunter 2005). These results confirm Nurmela's (2002) observation that a person's lifecycle attributes play a very important role in the use of Internet.

The previous results have focused mainly on devices (mobile phones and computers) and technologies such as phone call and Internet use. However, there are also interesting results from studies concerning the use of different services with mobile phone. Nurmela and Ylitalo (2003) have found that almost everybody uses contacts facility to save phone numbers. Use of SMS, group messages, and home calls increased, missed call callbacks and call divert decreased, and use of voice mail and conference calls stayed at a low level between 1999 to 2002.

There are also quantitative studies, although not many, that consider the use of technologies (more than one) in intra-family communication. Siitonen et al. (2002) studied the use of ICT in families at the end of 2000 and during the summer of 2001 in Central Finland as a part of the Family Portal Project. They found that paper messages and telephones (fixed telephones and mobile telephones) were the most often used technologies for family communication. Answering machine and e-mail were used the least. Of the participants, 10 % also mentioned text messages, but it is possible that many of the people surveyed classified these as use of mobile phones. One quarter of the mothers also used common family calendar or information folder but only 5 % of fathers and 7 % of children mentioned them.

Based on these kinds of studies it is possible to get an idea of what kinds of technologies are used and how much they are used in family life. However, the results do not tell us why people use them, what their motives are, what they use them for, what they think about the use of technologies, or why they choose a particular medium. These kinds of studies can show whether people have access to technologies and if so, whether they have already started to use them. Today, telephone is available for almost everybody, and it will be the same in the case of Internet access soon. But how do these technologies influence people's life: what are the opportunities they provide and what are the threats?

2.2.2 Case-studies

Another typical approach in ICT research is to start from a viewpoint of a technology. These kinds of studies focus on how a technology is used, what are its advantages and problems, or how it fits to the user's goals. These studies, consider use of telephone (Haddon 1994, Haddon & Silverstone 1995), choosing between mobile and landline phone (Haddon & Vincent 2004), mobile phones (Abascal & Civit 2001, Aoki & Downes 2003, Haddon 2001, Haddon 1998, Kasesniemi & Rautiainen 2001, Oksman & Rautiainen 2003, Palen, Salzman & Youngs 2001, Palen 2002, Pertierra 2005, Rakow & Navarro 1993), calendar (Beaudouin-Lafon et al. 2002, Fleuriot, Meech & Thomas 1998), organizing tools (Beaudouin-Lafon et al. 2002), coordinate displays (Crabtree, Hemmings & Rodden 2002), communication boards (Beaudouin-Lafon et al. 2002, Helal et al. 2005, Hindus et al. 2001, Hutchinson, Plaisant & Druin 2002, Park et al. 2003), digital image messages (Mäkelä et al. 2000), mirror with video link (Beaudouin-Lafon et al. 2002), gate reminder (Park et al. 2003), photo album (Park et al. 2003), smart refrigerator (Helal et al. 2005, Park et al. 2003), interactive television (Baillie & Schatz 2006), telepresence /awareness (Hindus et al. 2001, Itoh, Miyajima & Watanabe 2002, Oulasvirta, Raento & Tiitta 2005, Park et al. 2003, Tollmar & Persson 2002, Tollmar & Persson 2002), private networks (Beaudouin-Lafon et al. 2002), tablet device (McClard & Somers 2000), social robots (Markopoulos et al. 2005), intelligent user services (Röcker et al. 2004), and location-aware mobile services (Kaasinen 2003) among others.

The types of studies vary from paper prototypes to field studies with real products, and their goal is mainly to provide information for developers of the technology or to study attitudes towards technology. Some of them also consider the family as a domain of ICT or co-operation with families in developing process. It also seems that some technologies (e.g. mobile phones and communication boards) are studied more than others. To make a distinction between these technologies is not easy, because some of them are devices (e.g. mobile phone, smart refrigerator, and private network) and some are services (e.g. calendars, digital image messages, and telepresence). For example, mobile phone (a device) can be used with services such as phone call, text messages, digital images, calendar, and location-aware mobile services. However, mobile phone studies seem to focus mainly on SMS and phone call type communication services.

Based on the available case studies it is difficult to create a more general understanding about people's communication needs in their daily life; these studies mainly deal with technologies, and there is a lack of meta-studies summarizing the findings. Today it is possible to select among a very wide variety of technological solutions to fulfill people's needs. The problem is not about technologies as such but about the knowledge of technologies that people need.

2.3 Relationship between family and ICT

In addition to demographic information, the statistical analyses and case studies referred to above also consider different kinds of factors or phenomena that are related to the use of ICT. Attitudes, adoption, demands, motives, media choice, gender issues, and the bidirectional relationship between technology and family are considered below.

2.3.1 Attitudes to and adoption of ICT

Attitudes are frequently studied in psychology, and the subject's relevance in IS field has been recognized since the 1970's (Igbaria 1989). In the field of IS, most studies that discuss attitudes seem to be case studies related to some technology, and the phenomenon of attitudes represent only a part of a study. It is also possible to find studies that clearly focus on attitudes in IS. A search in the ACM digital library in June 2006 produced a list of 104 articles that includes the term 'attitudes' in the title. Some more studies about attitudes can be found from other databases and journals. However, there are only a few studies that consider attitudes to ICT in private life (e.g. Hou et al. 2006, Lederer et al. 1998, Little 2003, Patil & Kobsa 2005) or attitudes to ICT more commonly (e.g. Morrison 1983). And even fewer studies consider attitudes in the context of intra-family information and communication system in family life. Another group of attitude studies in the field of IS is research that concerns technology acceptance or diffusion, also in the context of private life.

Goodhue (1988) stated that "*only a very few studies hypothesize the structure of the attitude construct based on underlying theory*" (p. 6) and that seems still to be the case. On the other hand, conceptualizations and operationalizations of attitude differ among studies (Igbaria 1989). This lack of theoretical bases may explain contradictions between the results found (Goodhue 1988). As long as there is no shared concept of attitude the comparisons between the results are difficult or even impossible to make.

However, some authors have also considered the concept of attitude in their articles. Aoki and Downes (2003) studied American students' use of and attitudes toward mobile phones. They did not define the concept of attitude explicitly, but it seems that a) motives to use and b) perception about the dependency on mobile phone were included in the concept.

Igbaria (1989) considered definition of attitudes more precisely, but he did it in the context of organizations. However, he concluded the previous work on attitudes toward information systems and refers to the earlier psychological theorists' (Ajzen, Fishbein and Swanson) definition of attitude, stating that "*attitudes indicate an individual's reaction to or evaluation of an object on a like-dislike or favorable-unfavorable continuum*" (Igbaria 1989, p. 16). Fortin, Westin and Mundorf (1997) included cognitive and affective components in attitudes, which has similarities with the Igbaria's definition, whereas Bhattacherjee and

Premkumar (2004) consider beliefs (e.g. perceived usefulness) and attitudes separately.

The concept of attitudes is not an isolated phenomenon in the field. There are several studies that combine attitudes and other psychological theories like absorption (Agarwal & Karahanna 2000), Bandura's Social Cognitive Theory (e.g. Compeau, Higgins & Huff 1999), Cognitive dissonance theory (e.g. Bhattacherjee & Premkumar 2004), Expectation-disconfirmation theory (e.g. Bhattacherjee & Premkumar 2004), and Theory of reasoned action (e.g. Little 2003). A prevalent research issue seems to be the relationship between attitudes and use of technology (or intention to use technology).

Aoki and Downes (2003) studied the correlations between attitudinal factors and behavioral factors such as place, time and amount of use. These factors also include information about with whom the American students talk by mobile phone, and who pays the bills of these students. The authors found some statistically meaningful correlations between attitudinal and behavioral factors. People who think that mobile phone is a necessity in today's world have possessed it longer ($r = 0,27$; $p < 0,01$), used it more ($r = 0,29$; $p < 0,01$), and are more dependent on it ($r = 0,25$; $p < 0,01$). The length of mobile phone usage correlated with the frequency of calls received ($r = 0,20$; $p < 0,05$) and the feeling of dependency on mobile phone ($r = 0,21$; $p < 0,05$). The length of ownership did not correlate with usage (frequency of calls sent).

Because it is not always possible to measure behavior as Aoki and Downes did, in some models 'intention to use' is added between 'attitudes' and 'behavior'. Fortin, Westin, and Mundorf (1997) define it as desire (conative dimension) in their cross-cultural study on predispositions toward information technology (FIGURE 3). They also consider the influence of age and gender in desire to use. As a result they found that especially familiarity facilitates adoption of IT. Ling, Haddon and Klamer's (2000) results support this model; they found that non-users do not always understand what kinds of advantages a mobile phone may provide to them unless they test use it.
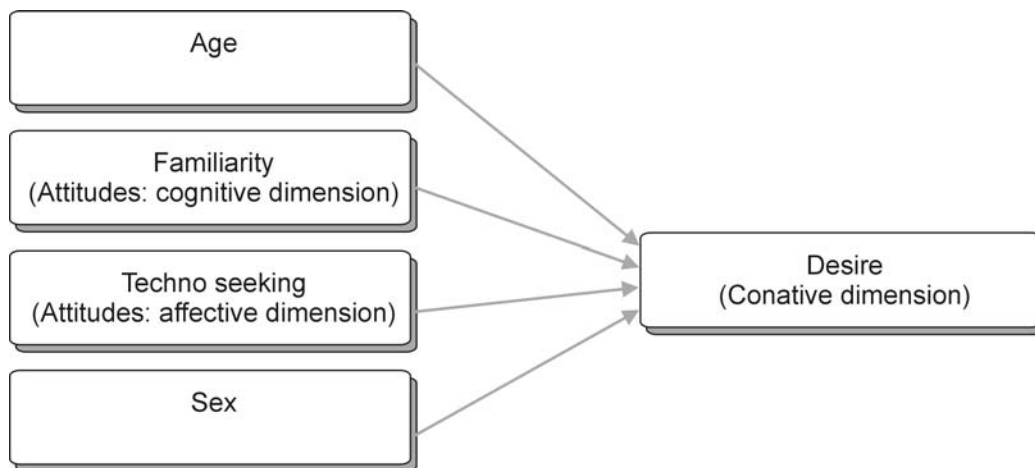
FIGURE 3   Relationship between attitudes and desire to use IT (modified from Fortin, Westin & Mundorf 1997, 150)

Based on a quantitative survey, Igbaria (1989) accepted a model of relationships between microcomputer attitudes, user satisfaction, and system usage in organizational context (FIGURE 4). In this model users' experiences (User satisfaction) are added to the system of attitudes and behavior. The idea of the model is to show that attitudes influence system usage and user satisfaction, and an increase in user satisfaction leads to an increase in system usage. An interesting finding was that an increase in system usage did not lead to greater user satisfaction. This discredits the idea that more use leads to better familiarity with the system which, in turn, would increase user satisfaction. Therefore, Igbaria's results are partially contradictory with the results of Fortin, Westin, and Mundorf (1997).
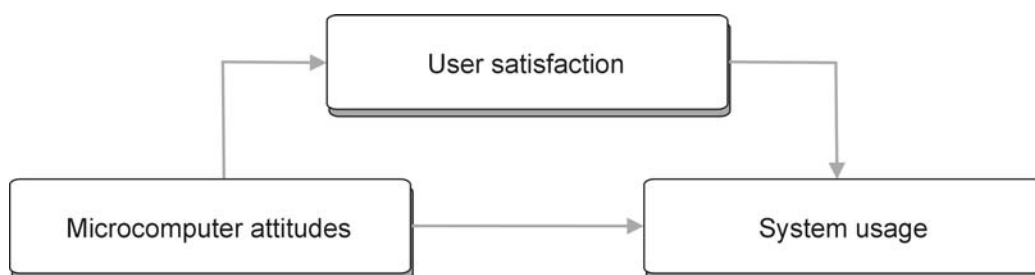
FIGURE 4   The impact of microcomputer attitudes on user satisfaction and system usage (adapted from Igbaria 1989, 17)

A widely studied application of attitude theories is the Technology Acceptance Model (TAM, FIGURE 5) introduced by Davis in 1986 (Davis et al. 1989). TAM is based on the Ajzen and Fishbein's Theory of Reasoned Action (Lee, Kozar & Larsen 2003). The main factors of TAM model are user's beliefs (perceived usefulness and perceived ease of use) and external variables (e.g. individual, organizational, and task characteristics, culture, gender, user type, and IS type). They are used to predict user's attitudes and user's computer acceptance behavior (Davis, Bagozzi, & Warshaw 1989, Lee et al. 2003). TAM is considered

mostly in organizational contexts and only occasionally in a family context (e.g. Jantunen 2006).
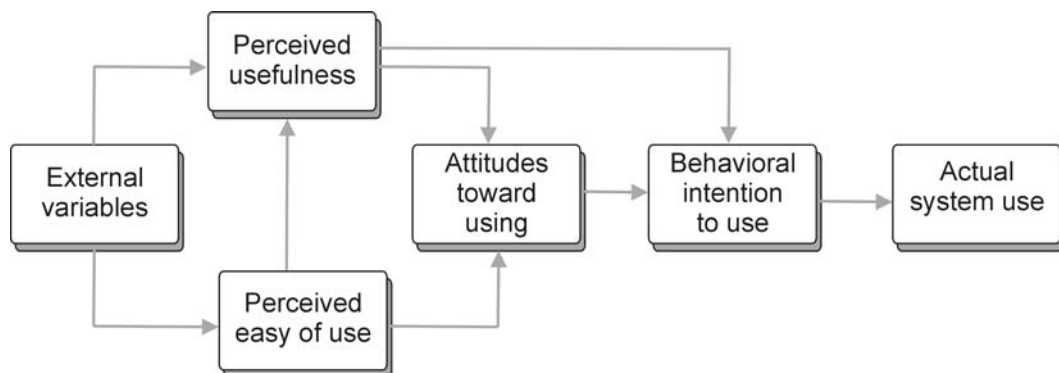
FIGURE 5   Technology Acceptance Model (adapted from Davis, Bagozzi, & Warshaw 1989, 985)

Venkatesh and Brown (2001) introduced the Model of Adoption of Technology in Households (MATH). It is based on the theory of planned behavior. Even though the context of the research was domestic, the initial model was created by the study that focused on the use of PC, not on ICTs in intra-family communication (more about MATH in Brown & Venkatesh 2005, Venkatesh & Brown 2001).

It seems that the idea behind the TAM model and other models of the same type is to weigh the attitudes and feelings of a user prepared to adopt a technology: the user has to think that a technology is useful and s/he has to believe that it is easy to use. In addition, the external conditions have to be favorable for it.

Another widely used theory of technology adoption is Diffusion of Innovations introduced by Rogers in 1962 (Rogers 1983). He defines four main elements of diffusion: 1) innovation, 2) communication channels, 3) time, and 4) social system. Diffusion occurs as a process with five stages: 1) the person becomes informed of the innovation (knowledge), 2) the person evaluates information and forms attitudes (persuasion), 3) the person makes a decision (decision), 4) the person implements the innovation (implementation), and 5) the person evaluates the reasonableness of the decision (confirmation).

TAM and similar models can be combined with the Diffusion of Innovation model where different factors of attitudes get values and influence other attitudes via communication channels in a social system. This process of change is presented in the Roger's (1983) book.

The division into cognitive and affective factors complemented by external factors creates a useful framework for considering the results related to attitudes. Cognitive dimension includes experiences about whether a technology is conducive for achieving goals or whether it hinders this process. Mobile phones, for instance, have been found to enhance quality of life (Ling et al. 2000) and perceived safety (García-Montes, Caballero-Muñoz & Pérez-Áɪvarez 2006, Nurmela & Ylitalo 2003, Sarker & Wells 2003) as well as to

facilitate coordination of activities (García-Montes et al. 2006, Ling et al. 2000), planning, and communication (Ling et al. 2000). In the context of PC use, the researchers found that both utilitarian and hedonic outcomes support the use of PC (Venkatesh & Brown 2001).

Sometimes these experiences may be contradictory with each other. For example, mobile phones have been perceived to be both binding (Ling et al. 2000, Palen et al. 2001) and releasing (Palen et al. 2001, Sarker & Wells 2003). There are also results that indicate that mobile phones might be disruptive (Ling et al. 2000). However, in a Finnish study only a little over one quarter of mobile phone users sometimes turn off their mobile phone to assure some peaceful moments (Nurmela & Ylitalo 2003).

Nurmela and Ylitalo (2003) found that about a half of the Finnish people believe that the use of technologies will provide economical or time related advantages. Younger people had more positive attitude than the older ones. On the other hand, it is also stated that ICT is not adopted because of possible time saving consequences (Ling et al. 2000). Still, in Finland it seems mobile phones have to be seen as necessary for communication (Nurmela & Ylitalo 2003). However the main reason for the non-use of mobile phones has been found to be the lack of need when other existing communication systems can provide the service needed (Ipsos 2004). These kinds of contradictory results show how quantitative research sometimes over-generalizes. The results in these cases often hide the variation that is there.

An affective dimension can be defined according to which a person either likes or dislikes a technology (e.g. device, service, use, or ways of use). Previous studies indicate that feelings influence use or desire to use. Therefore, it is good to consider feelings also in technology development. For example, a person's feelings about mobile phones influence her/his desire to call to mobile phone numbers (Palen et al. 2001). Also voice mail is not a desired means of communication. About 70 % of Finnish people are reluctant of leaving a voice mail message (Nurmela & Ylitalo 2003). The researchers did not try to explain the phenomenon but there can be both cognitive and affective factors at play. Overall, it is much more difficult to find results concerning emotional factors than cognitive factors.

Several external factors have been found to have influence in the use or desire to use ICT. Age as well as technology self-efficacy have been found to influence the adoption or use of mobile phones (Sarker & Wells 2003). Inadequate mobile coverage in a geographical area slows down the rate of acceptance and implementation of mobile phones (Ipsos 2004), inhibiting the growth of a critical mass of users (Sarker & Wells 2003). There are also studies concerning economical factors and their influence on mobile phone use. Economical situation of a person has been found meaningful in the context of mobile phone use (Ipsos 2004, Sarker & Wells 2003). Other economical factors include pricing principles of mobile services (Sarker & Wells 2003) and PC related costs (Brown & Venkatesh 2005, Venkatesh & Brown 2001). SMS is felt to be cheaper than phone call (Nurmela & Ylitalo 2003). However, the influence of economical factors is changing. A Finnish study in 2002 (Nurmela & Ylitalo

2003) indicates that telephone costs are not considered as high as was the case earlier, in 1999. Also, phone call prices have now smaller influence on the length of the call or time of the day when a call is made. Today the difference between the use of mobile phone and fixed line phone is not nearly as sharp as before.

There are also situational factors like traffic jams that have increased the use of mobile phones, for example in Thailand (Sarker & Wells 2003). Sometimes these situational factors may persuade a user to choose another technology. For example, a reason for the use of SMS was mentioned to be its suitability to various situations (Nurmela & Ylitalo 2003). In addition, cultural factors seem to influence the use. Expectations of continuous availability seem to have an increasing influence on the use of mobile phones (Sarker & Wells 2003). Mobile phone may also enhance the sense of self-importance in societies with lower penetration of mobile technology (Sarker & Wells 2003). Also, power distance between communicators influences the use of SMS (Sarker & Wells 2003).

Desire to use some new technologies has been studied by directly asking people. In studies about the use of ICT in the area of European Union (Ipsos 2004) the main reason for not having a mobile phone was found to be the lack of desire to have it (48 % of non-owners). It would be interesting to know how many mobile phone owners really want to use mobile phones.

Siitonen et al. (2002) presented ideas of new ICTs for the participants and asked if they would be willing to use the related devices in the future. They found that children are the most interested in new devices for family communication and fathers are the least interested in them. On the second inquiry, both the fathers' and the children's opinions were closer to the mothers' opinions. Therefore, Siitonen et al. concluded that the mothers seem to be the attitude leaders concerning the use of ICT in families.

As it can be seen from the results discussed the user is not the only person whose attitudes are meaningful in the context of technology use. Also the attitudes of other people, whose relation to the user is meaningful and significant, influence the relationship between the user and technology. Here, the connection to socialization mentioned before in Section 2.1 is apparent. The family and a person's relationships to other people have influence on her/his attitudes and behavior. And this influence and change continue over her/his lifetime.

There is also evidence that in a domestic scene the existence of children in family correlates with the penetration of computers, Internet, broadband, and mobile phone - in families with a child or children this penetration is higher (Ipsos 2004, Demunter 2005). However, Selwyn (2004) states that children's role in adoption of computers is more like an "official" factor used in discussions than the main argument. However, from the statistical viewpoint this "official" factor seems to be significant.

The results presented above are only a part of the knowledge resulting from several studies. That knowledge is very fragmented, and studies that would consider more focused attitudes and their influence on desire to use ICT

are still lacking. On the other hand, different studies have considered different technologies and different kinds of use. For example, PC (with Internet connection) can be used for searching of information, word processing, communication, drawing, gaming etc. If the discussion concerns people's attitudes to PC, the purpose of use should be defined also. Attitudes to prices may vary depending on what people think to use the PC for.

When the relationship between the user and technology is considered it is inadequate to define it just by what a person should think about ICT. That is an interesting viewpoint, but the development of technology cannot be based on considering user attitudes and then trying to change them. Instead, requirements for ICT have to be defined from the user's viewpoint. It is necessary to ask what the technology should be like in order to make it acceptable for implementation and use.

2.3.2 Demands for ICT

Users' demands for ICT can be studied from two viewpoints. Firstly, they can be studied from the viewpoint of a particular device or service. For example, Mäkelä et al. (2000) studied the use of digital images in communication and gave some recommendations for the developers. The devices for image messaging should enable users to create a series of images, edit them, add text or/and audio to the image, store and print them, send and receive them with other applications and devices, and share them.

Some requirements are related to use situations. A requirement may consist of a demand for a proper size for a certain device. Sarker and Wells (2003) studied the use and adoption of mobile handheld devices. They found that the proper size of mobile communication devices is more important when traveling than when wandering. They explained this difference by need of larger reach of technological network when traveling or visiting. According to their study, the users appreciated also reliability and interactivity (e.g. confirmation of a message) of wireless technology.

Secondly, requirements studies can be conducted independently of devices or services involved. There is a lack of these kinds of studies. If meta-level requirements for ICT in a family context can be found it may be possible to create rules to guide the development of new technologies for families. As is the case with knowledge of attitudes also knowledge of requirements or demands is fragmented and has to be gathered up from numerous studies that are often case studies of a particular technology. This could be done by a wide meta-analysis of other studies or by a study that focuses on solving this issue.

As it can be seen from the results of Sarker and Wells (2003), the user demands and attitudes are closely related to each other. E.g. proper size and interactivity probably influence perceived usefulness as well as reliability. As Igbaria (1989) defined, attitudes are person's reactions to things, and also include properties of a technology.

2.3.3 Motives for the use ICT

A factor that is also related with attitudes and properties of a technology is person's motives (or the lack of motives) to use the technology. The person has to have a motive to use the technology in order to implement it (Carroll & Campbell 1986, Saariluoma 2005b). However, the number of studies that focus clearly on those motives is surprisingly small. Studies considering the motives to use ICT or different technologies in the context of family communication are even more infrequent.

Anderson et al. (1999) studied the use of ICT in families. They found that phone calls were mainly used for duty, maintenance, pseudo-maintenance, grapevine, news, or information. Of course, the same call could include two or several of these objectives. However, these are not the specific motives for using phone calls, they just form the contents of those calls. Anderson et al. (1999) also listed call types by situational factors: batch calls, shared calls, inter-generation calls, and domino calls.

Aoki and Downes (2003) studied the motives for the mobile phone use by two methods, a qualitative group interview and a quantitative survey with seven-point Likert-type statements and factor analysis. The motives they found are listed in TABLE 3.

TABLE 3   Motives to use mobile phone found by Aoki and Downes' (based on Aoki & Downes 2003, 353, 359)

Motives found by a qualitative group Interview	Factors found by a quantitative survey
Personal safety	Necessity in modern times
Financial incentive	Cost efficiency
Information access	Safety / security
Social interaction	Dependency
Parental contact	Negatives
Time management / coordination	Functionality
Dependency	
Image	
Privacy management	

Among other issues, Nurmela and Ylitalo (2003) have also studied the motives for using phone calls. They found that people call for a particular reason rather than as a result of a spontaneous thought. They also found that over 80 % of Finnish people try to handle that task quickly and effectively.

Motives for using ICT in families should be an issue to focus upon. Discovering motives for using a particular technology or using a technology instead of face-to-face communication would increase our knowledge of attitudes and requirements for technologies. One of the results points towards a conclusion that families would like to have better solutions for communication and organizing activities (Beaudouin-Lafon et al. 2002). Motives could be studied by focusing on the selection between the use of different technologies and, in many cases, on decisions to handle a situation without the use of any available technology.

2.3.4 Choosing a medium

Today, when people have so many different technologies available, choosing a medium for communication or information transfer is an interesting issue. A message from a child to the mother can be transmitted e.g. by phone call, SMS, MMS, e-mail, written note left on the table, or orally.

There are not many studies that have considered this issue recently. The existing studies indicate that goals of action influence the choice of medium (Sarker & Wells 2003). For example, SMS is used for transferring small amounts of information but to a lesser extent when discussion is needed. It may also be the case that the moment for communication is more suitable for SMS than for a phone call (Nurmela & Ylitalo 2003). Here it is probably not a question of temporal moment but of situational factors. For example, a child may be at school when the mother would like to transmit a message to her/him. A phone call is out of question, but by SMS the child can open the message whenever the circumstances are suitable for it.

Also location influences the use of ICT in family context in many ways. E.g. adolescents do not like to call a boyfriend or girlfriend in shared spaces like living room or kitchen as there are privacy issues involved (Anderson et al. 1999). In the same study the researchers also found that phone calls made in physically comfortable places were longer than phone calls in uncomfortable places.

The issue is not totally unexplored and there exist even some theories concerning media choice, e.g. cost minimization (Reinsch Jr. & Beswick 1990) and media richness (Daft & Lengel 1986, Daft, Lengel & Trevino 1987). In addition, the issue was studied by Yates and Orlikowski (1992). However, these studies consider the choosing criteria in organizational context. Family is a unique group type (Daly 1992) and scientific knowledge created in organizational context cannot be directly applied in family settings. Therefore, more research on the choosing process within family context is needed.

Perhaps the Diffusion of Innovations model (introduced in Section 2.3.1) could be adapted to this choice situation too, even though the context of new innovation is assumed. However, if the word "innovation" is replaced by the word "technologies", the model could represent a choosing process. Then, those four elements could model the choosing situation.

2.3.5 Gender issues in ICT

Technology is used by men, women, boys, girls, grandmothers, and grandfathers among others. In other fields such as psychology and sociology, gender differences in behavior are well studied. However, in the field of IS there is a lack of studies that would consider the influence of gender on information technology development and diffusion (Adam, Howcroft & Richardson 2004, Gefen & Straub 1997). There is evidence that technological development is guided from the viewpoint of 20-30 year-old males who are typically white, functionally normal, well-educated, and technologically savvy

(McDonough 1999, Pulkkinen 2000, Rommes 2000, Tiainen 2002), and that IS development is an area dominated by males (Vehviläinen 1997). One of the results indicates that a typical author in the HCI journal is an American male psychologist (Clemmensen 2006).

However, there are results indicating that males and females are different regarding their use of ICT. It seems that females are more interested in technologies used for communication (Kraut et al. 1999, Siitonen et al. 2002) or for other useful purposes (Pekonen 2003) whereas males prefer entertainment technologies (Pekonen 2003). Hou et al. (2006) found the same kind of a difference in the use of technology between girls and boys in the middle school age bracket in the USA: girls used technology for communication whereas boys used it for entertainment and fun. Boys were also interested in a wider repertoire of functions than girls who focused only on the functions they needed.

Genders also experience different communication via different media in different ways. Gefen and Straub (1997) studied the influence of gender in using e-mail. They found that females experience higher social presence in e-mail communication than males and higher perceived usefulness as well. The males' rating of perceived ease of use was higher.

In addition to experiences, there seem to be differences in contents that are transferred via technology. Rakow and Navarro (1993) found differences in the ways males and females use telephone. They summarize their findings as follows:

> That is, men use it to bring the public world onto their personal lives. Women tend to use it to take their family lives with them wherever they go. There is nothing inherent in the technology that requires women and men to use it differently. It is gender ideology, operating within a particular political and economic context that leads to women and men living different lives and using technology differently. (Rakow & Navarro 1993, 155)

The same kinds of results were found by Anderson et al. (1999). They indicate that males use phone mainly for making arrangements and acquiring information whereas females use it more for diverse social communication. Also findings of the Finnish study (Nurmela & Ylitalo 2003) indicate that females use SMS more for gossip, greetings, questions, intimate issues, and informing than males do. Both genders use SMS equally for reminders and contact requests. Perhaps these differences in use can be explained by the differences in roles that people have in family and society. However, studies that consider this viewpoint are difficult to find.

The use of different technologies (choosing a technology) also seems to correlate with gender. When studying what technology is preferred in communication generally, Nurmela and Ylitalo (2003) found that females are readier than males to use Internet for communication tasks. Females also use SMS more than males. Hutchinson, Plaisant, and Druin (2002) studied the use of message board for family communication and coordination and found that mothers prefer phone calls to written messages. The results seem to be

contradictory, but on the basis of these studies it is not possible to define any particular reasons for that.

Gender differences can be found also in the ways people talk about technology. Hou et al. (2006) found that females tend to talk about the use of technology without worrying about whether they use the right terminology. Males are more interested in technical properties, and they talk more about modifications and other things related to what they have done, and they are also conscious about the terminology related to these things. Also, females experienced more increases in self-efficacy than males did during the training session (Hartzel 2003). However, this result was not in the context of family or private life. It is even harder to find results that consider gender differences in intra-family communication.

After these examples of gender issues it is easy to understand that development of new technologies cannot be based on viewpoints, intuitions and experiences of one or the other gender. It is necessary to consider needs, desires, use experiences and use purposes of both genders. If the development is now male-oriented, it might be useful to emphasize females' viewpoints for a while to obtain more versatile viewpoints for the future. It is necessary to be conscious about the fact that the users differ in many ways, and that gender is an independent variable.

2.3.6 Bidirectional relationship between ICT and people

Based on the issues presented above, it can be concluded that ICT influences people. For example, mobile phones may allow a person to be out of home more frequently and for longer periods, but they can also reduce the need for traveling (Ling et al. 2000). Technology provides possibilities to control other members of the family (Ling et al. 2000, Vestby 1996) but it may also support children in their quest for independence allowing them to get in contact with their parents if needed (Vestby 1996). In fact, all studies that consider people's attitudes to technology and focus on cognitive (how a person supposes that technology influences her life) or affective (what a person likes about it) issues consider that viewpoint: how technology changes our mind or life. There are many of these kinds of studies. But studies on real influences of technology use in our life (social system) are difficult to do and, perhaps as a result, only a few if any exist.

However, people also influence technology. They define what kind of properties they desire to have. These ideas influence their behavior (use of services like SMS or a decision to buy a computer). The ideas can be considered also from the very beginning of the development process, which is aimed at user psychology. These behavioral factors influence the producers of services and devices and their technological development. The case studies of a product are representatives of this kind of approach, but they consider only a particular technology at a time. There is a lack of more general models like TAM and diffusion of innovations.

There are also some studies that consider this two-way relationship between technology and people. García-Montes et al. (2006) have studied the relationship between personality and technology. They found that mobile phones influence a user's personality but that the influence depends on factors like urbanization, cultural practices, occupation, and income. Thus, use of mobile phones varies according to personal variables.

Also Venkatesh (1996), and Venkatesh and Nicosia (1997) have elaborated on the issue. They divided the household into two spaces – social and technological – that are linked together. The social space includes family's behavior whereas technological space covers different technologies and their use (including also attitudes to technology). These spaces interact with each other. Combination of technologies and their use in the same technological space, however, seems ill-justified. It is difficult to understand why person's attitudes are situated in technological spaces. The other way to define these dimensions could be according to the model suggested in the introduction (FIGURE 1). Human and technological spaces are defined there with a common overlapping area. Attitudes to technology and other person's properties related to technology can be included in this overlapping area of human dimension.

Many more references on bidirectional nature of relationship between human being and computer are available. In the context of this study, it is enough to know that it is not insignificant what technologies if any are used. On the other hand, it is also important to be aware of that the users are not at the mercy of technology and that they can influence it.

2.4 Unanswered questions

This chapter offered a glance to previous research done in the context of ICT use in families' information and communication activities. Even though this study focuses on intra-family information and communication activities the review considered the relationship between family and technology with a wider approach and even included some digressions into the organizational context. The adoption of wider approach is necessary because very little research on the issue of the study is available.

Based on the previous review it is possible to see that the relationship between family and adoption of technologies (or rejection of technologies) is a very complex, multidimensional phenomenon (Emery & Lloyd 2001). The concept of attitudes is poorly defined in studies close to ours and there is a lack of studies that would focus clearly on attitudes towards ICT. Often the results concerning the attitudes are available as spin-offs of other studies. Therefore, the concept of attitude has to be defined in the IS field more strictly in the future and more studies based on this common definition should then be done.

The review also indicated that the widely studied TAM model and models of its kind apply a one-sided viewpoint to the relationship between a person and technology. They consider the person's perceptions and what these should

be like in order that s/he would implement a technology. In addition to that, influences of external variables are considered to some extent. The other thing to consider is what kind of technology it is that the person would like to utilize. However, models reflecting this viewpoint do not exist. The demands are probably closely related to the media choice, and this issue is little studied in family (or even private) context. In addition, gender seems to have influence in almost all of the issues discussed above. If it is true that the development of technology has been male-oriented so far, it is important to emphasize these gender differences and consider them in ICT development in future.

Overall, knowledge of the issues focused upon here is still lacking in many respects and more research is needed to get wider and deep enough understanding of it. The conclusion is convergent with Whittaker's et al. (Whittaker et al. 2000) considerations about the lack of cumulative research and clear understanding of core user tasks, interactive technologies, and techniques. In addition to future research issues mentioned above, Hughes and Hans (2001) suggest that there should also be more studies on 1) who are the family members communicating with, 2) what role does computer-mediated communication play in families, and 3) how computer-mediated communication differs from other forms of communications. These questions can be extended by changing the word computer into the word technology in them.

In addition, it is also possible that a person may choose to get on without any new technologies. Research done from the viewpoint of IS very often adopts the attitude that technology advantages people. It is often thought that the change is positive if the use of technology increases. However, it still has to be left for the users to choose whether they want to apply these technologies or not. Consequently, it would be interesting to know, for example, if there exist unfulfilled needs of supportive technologies in families. It would be interesting to study the kinds of information and communication systems families have and the possible problems in carrying out some of these families' information and communication tasks. However, it is possible that layman will not be able recognize potential solutions. Who would have been able to imagine in 1980 that there will be SMS in daily use and, moreover, that it might prove very useful in family communication? These kinds of projections create challenges for the study.

From the viewpoint of this research project, the problem with several previous studies has been their focusing on a particular technology. These kinds of studies create knowledge that is fragmented and useful only for the particular technology in question. It would be interesting to consider a possibility of doing research on previous issues of technology independently and find more general models for demands as it was done with attitudes in TAM.

3 USER PSYCHOLOGICAL APPROACH WITHIN FAMILIES

3.1 Defining research questions

Based solely on the existing pieces of information on the subject it is difficult to create a clear idea of what kind of phenomenon is the relationship between ICT and family's information and communication system. The aim of this study is to connect these separate pieces together, merging the previous knowledge and making clear what is still missing. After that (done in Chapter 2), the goal is to fill the gaps in the knowledge of the research issue.

Many previous studies have been clearly technology oriented. In these types of studies research starts from a technology. The results are then considered also in the context of use. This study approaches the relationship between people and technology mainly from the human viewpoint – in a human-oriented way (Isomäki 2002, Koskinen et al. 2005). There are several ways of applying a human-oriented (or human-centered) approach. A widely used approach is HCI that concerns "*how people make use of devices and systems that incorporate or embed computation, and how such devices and systems can be more useful and more usable*" (Carroll 2003, p. 1). Many case studies introduced above have applied this approach. The problem of the approach is that it starts from the technology. There is a particular technology and researchers want to know how it is used and how its usefulness could be enhanced.

This research is situated at the very beginning of the development process (FIGURE 6). The intention of the study is to start from the people and their actions –what people do in their daily family life and whether it is possible to use technologies to support these activities? The idea is to get to know the use context before developing new technologies.
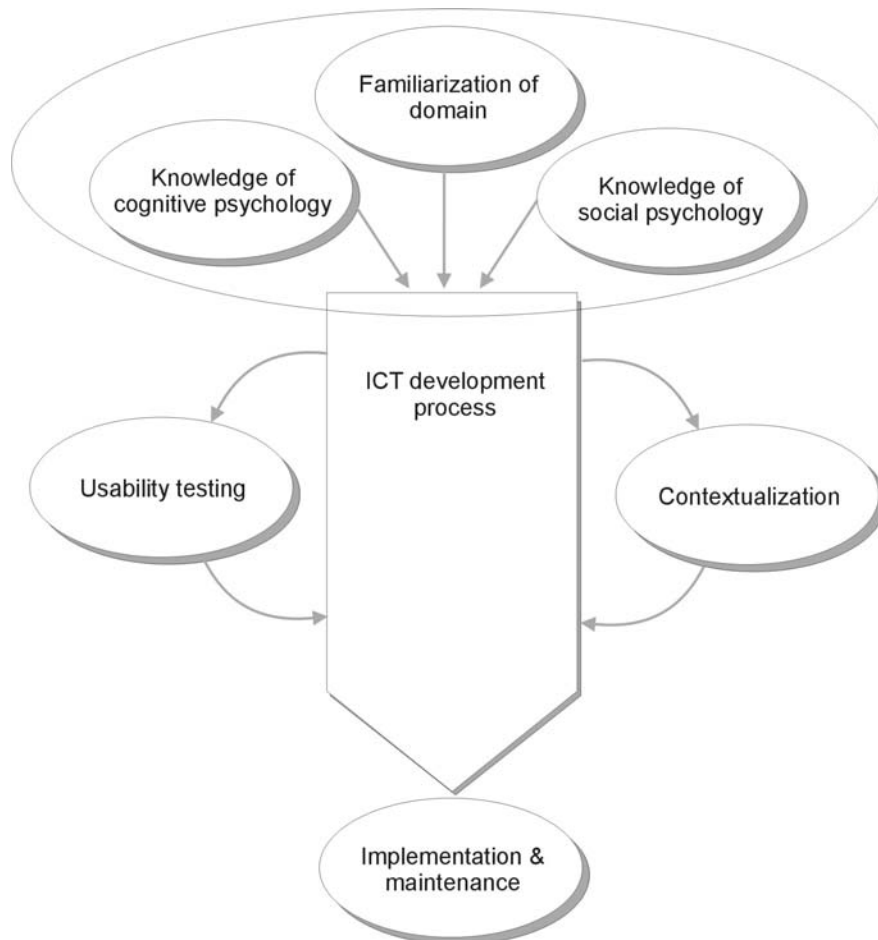
FIGURE 6   Position of the study in the development process of ICT (a simplified presentation of the process)

User psychological approach is implemented in the study. In user psychological approach the person is considered more widely than has been the case in traditional HCI research. The idea of the approach is to understand how a human being acts in a particular environment (Saariluoma 2004, 2005b). Norman (1998) has called for this kind of activity driven approach in his discussions on usability problems with technologies.

User psychological approach applies psychological methods and concepts in research and develops them further (Saariluoma 2005b). Then, that knowledge is brought to design process as actual models from the very beginning (Saariluoma 2005b). In this study it means that possible users (family members) are approached holistically in order to gain a better understanding of them: about what they are doing, what kind of attitudes they have, what they are thinking and feeling, what are their physical environments like, what kinds of relationships they have, etc. The development of ICT for families can be based on this knowledge.

The research process starts by studying family's information and communication system as an environment for ICT. From this viewpoint the main research question is: *What kind of environment for ICT is intra-family information and communication system?* The answer to the question will tell us

about what kinds of phenomena are encountered when families' internal information and communication activities and ICT are combined.

To answer the main question it is necessary to consider *what kinds of information and communication actions occur in families*. By answering this question it is possible to define more exactly the use context of ICT. In addition to the use context, this study focuses on *what kinds of demands there are for ICT*. The answer to this question forms a starting point when we start to develop a new model for technology requirements.

Answers to the questions above provide new scientific knowledge about the relationship between humans and technology: about family's information and communication system, and about users' attitudes and demands for ICT. This knowledge can then be used in the development of new ICTs, and new technologies can be developed from the viewpoint of family needs. This is likely to support intra-family communication and information systems, and the existence and welfare of the family.

However, the focus of the study has to be defined more clearly to enable the research process, because it would be too large a project to study all kinds of information and communication systems in every kind of family from the viewpoint of each family member. This study focuses on technologies used for intra-family information and communication activities. However, these cannot be considered separately from other information and communication activities in families (extra-family information and communication activities), because the family members will not purchase different technologies for intra and extra-family use. It should be possible to manage both uses with the same technologies. Consequently, data is collected and also analyzed with a wider focus than what might be expected considering the research questions.

Similarly, the term technology is defined with a wide scope. As considered in Chapter 1, technology refers to all kinds of tools used in information and communication activities. This means that traditional tools like paper and pencil are also considered as ICT.

Family is not a stable system: the number of family members changes, the people grow up and change, the environment of the family changes, and all this has influence on the family. It is obvious that family information and communication system varies accordingly; the system works differently in a family of two adults and that of parents with 5 children of various ages. It is not possible to consider all kinds of families in a study, and it is necessary to choose some of them. Fingerman, Nussbaum and Birditt (2004) have demonstrated that middle-aged adults' social networks are more wide-ranging than those of the younger or older age groups; middle-aged adults keep contact with both their older relatives as well as with younger ones. These relationships are also more intensive than contacts in other age groups. In addition to family roles, middle-aged adults' have responsibilities in working life. Due to these versatile engagements and roles, middle-aged adults need to utilize different ways, styles, and techniques in their communications. Also, the roles and behavior of people differ in a family. Based on previous research it seems that the development of ICT emphasizes male viewpoints. Female viewpoints seem to

be in minority in the development of ICT and in ICT research. However, the evidence suggests that mothers are opinion leaders in the attitudes of family members towards the use of ICT (Siitonen et al. 2002) as well as central communicators in families (Anderson et al. 1999, Haddon 1997). Therefore, by choosing middle-aged mothers as the focus group of the study, it is possible to gain the most extensive understanding with the available resources.

3.2 Choosing a qualitative approach

All research questions start by asking "What kind is …" and the aim of the study is to expand understanding related to family as a domain of ICT. The intention of the study is to know the phenomena better. Earlier quantitative research can provide demographic information but they may generalize too much so that it is difficult or even impossible to recognize the variation of phenomena anymore.

A qualitative approach provides tools to isolate and define categories and assumptions based on cultural constructions of the world (McCracken 1988). The relationships between the categories are the main focus of qualitative research (Dey 1993, McCracken 1988). Saariluoma (2004) emphasizes also the significance of individual differences in design and usability testing (in HCI). Instead of focusing on the most common types of users, actions, or goals, it is good to be aware of all types of them. For example, blind people are a minority among mobile phone users. However, they have to be considered in the design phase to enable them to use mobile phones. When systems are developed the changes often are qualitative and can be found by qualitative means (Saariluoma 2004). It is not only a question of number of buttons in the interface but also how they are located and what kinds of labels they have. User psychological approach focuses on how people act. It is not so important how often people perform a task or use some device. It is important to know what they want to do and why they act as they do. In this research qualitative means are essential.

The aim of this study is to find and understand different kinds of aspects of the relationship between family and ICT. Creating questionnaires and collecting data from as many people as possible cannot achieve this. The problem is that the questions cannot be defined without previous knowledge about phenomenon. The goal of the study is to create a better understanding and for this reason qualitative approach has been chosen. The study concentrates on the mothers' viewpoints of families' information and communication system. This choice enables gathering more extensive data than would be possible with quantitative methods or wider focus groups.

However, choosing qualitative approach as the main approach does not mean that quantitative methods would be useless. By utilizing different approaches and methods different viewpoints can be obtained. Also, different stages of research and different research questions need different tools to solve

them (Carroll & Campbell 1986, Saariluoma 2004). Some quantitative methods can be used with very little data (Metsämuuronen 2004). Also, categories and concepts found by means of qualitative research can be applied in quantitative research later (McCracken 1988).

The study process starts and progresses with an open mind. The approach is close to the idea of the Grounded Theory where "*the researcher begins with an area of study and allows the theory to emerge from the data*" (Strauss & Corbin 1998, p. 12). The findings will then direct the next steps of the research project. These steps are described later in more detail.

3.3 Family's information and communication system as a research subject

Family forms a unique type of group. Daly (1992) states that its characteristics are e.g. privacy, collective consciousness, relationships rooted in blood ties, adoption, or marriage, pursuit of permanence, shared traditions, intense involvement, and combination of personal interests, experiences and characteristics. These characteristics separate family from other groups such as business organizations or clubs. Of course, there are differences also between families. While communicative activities seem to be the main types of activities in a family (Crabtree et al. 2003), the life stages of the family and demography of the household have an influence on time use within families (Ling et al. 2000).

However, family is a challenging research context. Typical challenges of family research include accessing family as a private community, deciding whether to focus on family as a whole or piece by piece, the researcher's role, the influence of the researcher's own personal experiences, and different kinds of ethical questions. The ethical challenges in family research are e.g. privacy, material related to outsiders, and unexpected disclosures that are possible during the interviews and observation. Regardless of the challenges, qualitative research is needed also in the family context in order to understand the family members' mental constructions and subjective experiences. (Daly 1992)

When the use of ICT is connected to the family, the research is focused on an even more complex system. This extra challenge occurs because ICT is used in intra-family communication, typically when the members of the family are not in same place or there exists a temporal distance between communicators. From the researcher's viewpoint this means that the phenomenon under focus is temporally and geographically separated and distributed and thus very hard to observe.

On the other hand there are several possible technologies that can be applied in intra-family information and communication activities. This means that in order to gain a holistic picture of the system the researcher should collect data from the use of all of the technologies involved, e.g. SMS, phone calls (land

line and mobile), e-mails, and message papers, as well as of the situations where those technologies are not applied.

This study focuses on mothers' viewpoints and this helps in solving many problems related to family research. There is no need to collect data from several people and in different places at the same time. Thus, the available resources for the research project are in balance with the requirements. Of course, this kind of a solution is a compromise of a kind. Nevertheless, it is a realistic starting point: deeper studies can be done later when different kinds of dimensions of the phenomena have been found and when it is possible to focus on them.

4 RESULTS

In this chapter the results of the studies are introduced. The first two studies aimed at finding out the versatility of phenomenon. This was also done in the initial analysis of the thematic interviews. After these, in the consequent studies, the research is focused on information and communication activities and on their use in ICT development as well as mothers' demands for ICT. Finally, the results of the methodological analysis of a classification study are discussed in Study VI.

4.1 Study I: Finding out versatility of phenomenon I

Parkkola, H. (2003). Observations about the use of technologies in family communication. A paper presented at Social and Cultural Dimensions of Technological Development Symposium, 3.-4.11.2003, Jyväskylä. University of Jyväskylä, Agora Center: Jyväskylä, 52 - 60. Available from http://www.jyu.fi/~hanpark/publications/Obsuse.pdf, 17.11.2006.

The first goal was to find out the versatility of phenomenon under focus. A diary study method was used to collect ideas of all kinds of issues related to technology mediated intra-family information and communication activities. The researcher acted as a participant and wrote down events. By having the researcher as a participant it is possible to overcome obstacles of family research and diary study. Firstly, a wide enough focus of data collection and deep enough analysis of situations in a diary can be ensured. Secondly, the researcher of the subject is her-/himself motivated enough to collect data and write up diary entries at any time of the day. Thirdly, by this arrangement it is also possible to consider the focus and remodify the structure of a diary during the data collection if necessary. Fourthly, the researcher is capable to observe her-/himself at any temporal and geographical space needed. And fifthly,

questioning one's own routines and attitudes during the diary study increases the researcher's awareness of the characteristics of the phenomenon in question.

The results of the study indicate that several different technologies are used in family communication, in line with what was stated earlier. In addition, the study shows that there is still a place and a need for new technologies for the support of family life. The diary study also highlights a tendency of communication events to create chains. When a relationship between some events occurs, more than one communication action might be required to achieve a goal. However, it seems that there is a tendency toward short communication chains; the family members tried to choose a technology that enabled the communication task to be handled by as small number of events as possible.

Motives of communication are discussed in a project report *Muistio yksittäisen perheen arjen seurannan tuloksista* (transl. Report of results of tracking a family's everyday life). Five classes of communication motives were observed (FIGURE 7). Also the importance of a motive as a reason for communication was investigated (main motive for the event, other contents of the events). The goal of informing is to transfer information from one person to another. By means of organizing, a person aims to influence another person's activities. Transferring feelings is a special kind of informing activity but is considered as an individual class because transferring feelings is supposed to be a special characteristic of family communication. The aim of reminding is to ensure that a person remembers what s/he has been informed about earlier on, and acknowledgement is a feedback about the arrival of information.
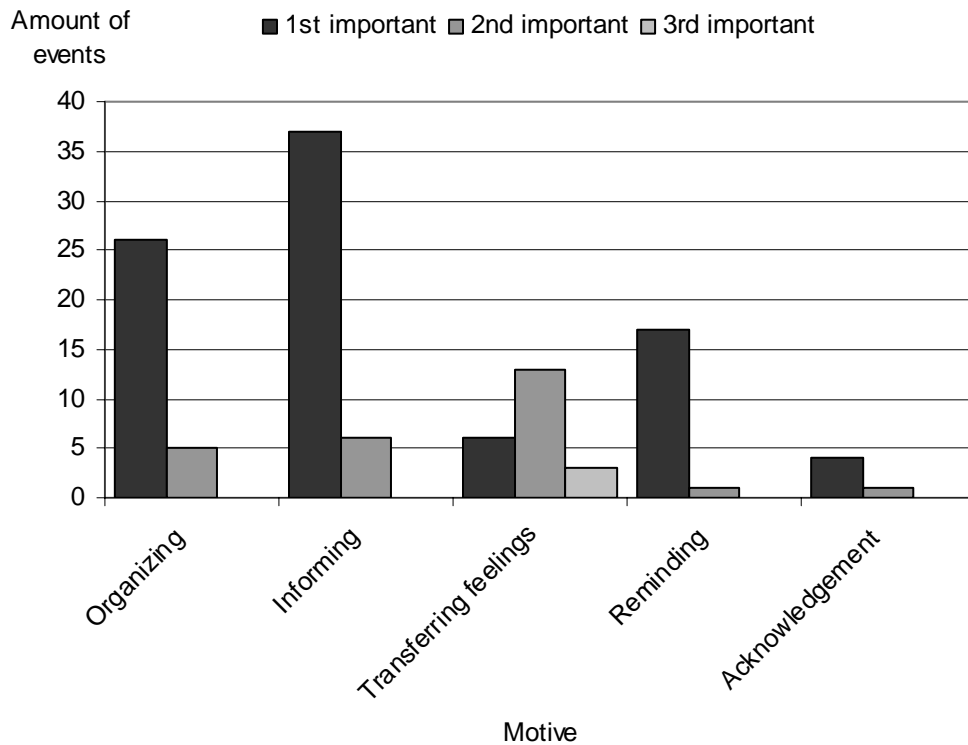
FIGURE 7   Communication motives and their importance

As it can be seen from FIGURE 7 the most common prime motives are informing and organizing. However, transferring feelings (or expressing feelings) are the most common content when considered in the other contents of the communication event. Feelings are also the only content that occurs as the third most important content of the message.

The focus of the diary study also includes selection criteria used when a suitable technology is selected for a communication need. The analysis of these criteria found seven factor classes. The result indicates that the sender may consider a very complex group of factors when s/he is selecting a suitable technology for communication. The factors s/he tries to consider are not only related to her/ himself but they are also related to the receiver. In family context this is possible because the members of the family may know the approximate schedules and plans as well as the skills and characteristics of the other members. In addition to the previous results, this short but very interesting study proved again that technology has an influence on family communication by changing behaviors and even causing problems.

It is obvious that the findings of this kind of case study cannot be regarded as unquestionable truths. However, they provide interesting viewpoints and initial theories that can be studied in more depth in the future. For example, now the seven selection criteria were recognized but they still have to be validated by new studies. It would also be useful to define the importance of different criteria in order to emphasize them in the development of new

technologies. In fact, here there is a connection to affective, cognitive, experiential and behavioral factors that were considered earlier on in the context of attitudes.

In summary, it can be seen that the first study provides some answers and new viewpoints but it also raises several new questions related to the research issue. If this little study can create so many viewpoints and new questions, the phenomenon must be really complex and understudied. This approach seemed to be a reasonable choice at the beginning of the research process.

4.2 Study II: Acquiring more experiences and data

Parkkola, H. (2005). Finnish Mothers and the Electronic Message Board in Family Communication. In H. Isomäki & A. Pohjola (Eds.) Lost and Found in Virtual Reality: Women and Information Technology. University of Lapland: Rovaniemi, 297 - 314.

A field trial of an electronic message board was organized for eight families. The goal of the study was to investigate the users' experiences with the appearance of the program, its ease of use, usefulness, and mothers' desire to apply new technologies in family communication. In other words the aim of the study was to acquire knowledge about the relationship between family and ICT by means of experiments. On the other hand the study contributed as a user test in the development process of the service.

The results of the study indicate that mothers' experiences in the appearance are contradictory: what is simple for someone may not be that simple for another person. This finding supports Saariluoma's (2004) idea, which states that it is good to be aware of variation and not only of the viewpoint of the majority. Secondly, it is interesting to note that the mothers found the system more easy to use immediately after the training than at the end of the trial. The result can be explained by positive effects of training on self-efficacy suggested by Hartzel (2003) and the low amount of use later. It also seems that the system did not sufficiently communicate with the user after the actions making the user unsure about success.

From the viewpoint of the research questions, an interesting issue of this field trial was the mothers' experiences about the usefulness of the system in family life. At the beginning of the trial they believed that the system would be useful in family life. This can be interpreted to be a signal indicating that there were unfulfilled needs as regards supportive systems in families. However, the system could not realize these expectations. The mothers found two main reasons for that. Firstly, the system was too slow to use (slow booting of the computer, slow sending operation), and there were other means to do the same task quicker. Secondly, the availability of the system was poor: the computer was not in the same place as people, and not everyone was able to send

messages from their mobile phones to the system at home. These factors decrease the usefulness experienced.

The results suggest that there may be at least three more explanatory factors that decreased the usefulness experienced: 1) The system was too simple and booting it just for sending messages seemed unreasonable; 2) Mothers may prefer phone calls to other technologies as Hutchinson, Plaisant, and Druin (2002) found; 3) The higher perception of usefulness at the beginning of the trial might be explainable by enthusiasm generated by the new technology or by the closer contact to the researcher.

The study indicates again that there seems to be a need of supportive systems for family information and communication activities and that mothers are interested in them. When this kind of system is implemented in families, the mother's experiences of its ease of use can probably be further supported by training. But even this is not enough for the success of the system. The system itself has to be quick and effortless to use and it has to be available wherever people are. Many of these requirements are met with mobile phones today.

4.3 Thematic interviews: Finding out versatility of phenomenon II

In addition to the previous two data collections, more data was needed to get a deeper understanding of phenomenon. The earlier diary study provided a background to plan and perform interviews. During the diary study several new research questions emerged, and it became obvious that even more will appear in future. To enable finding of new characteristics of the phenomenon the thematic interview (see more Hirsjärvi & Hurme 2000) method was selected. This method enables collecting data about interesting issues, and it also enables raising of new viewpoints. An outline of an interview (Appendix 1) was created to ensure that all interesting issues would be covered.

The study was a part of the Family Portal Project lead by professors Lea Pulkkinen and Pekka Neittaanmäki. Before, Siitonen et al. (2002) did a study about families and use of information technologies in the Jyväskylä area. They collected data from 57 families who had a child in the upper level of a comprehensive school (13 – 16 years of age). It was decided that the same sample should be used in this study. However, some rejections were necessary, because some of the children had left the secondary school already and our focus group was families with school age children. Therefore, the families with a child in the youngest age group (13-14 year of age, at the seventh grade during the first study) were chosen to participate. After the pruning there were still 19 families with a child in the ninth grade left (two years later than the previous study). Two more families were discarded because they had participated in a field trial after the previous study and might have felt inconvenienced by that extra requirement. Invitations were then sent to 17 families to participate in the study (an interview for the mother and a field trial

with the whole family after). Finally, ten of those 17 families accepted the invitation.

The ten mothers were interviewed during the spring 2003. Interviews lasted from a half an hour to two and a half hours. The mothers expressed their thoughts, and told about their experiences and practices. They also told stories related to family activities and the use of technologies. A tape recorder was used to save the interviews. In addition, some memos were created during the interview session to support the discussion.

After the interviewing period the interviews were transcribed and analyzed. Ideas from the grounded theory (see more e.g. Glaser & Strauss 1967, Strauss & Corbin 1998) were applied in the analysis and the interview was plucked for a more careful consideration. The interview was read and ideas for future analyses emerged. The first reading and coding round resulted in 440 data bits (nodes) about the family's information and communication activities, life of the family, technologies, or the relationships between these two concepts: e.g. reasons to implement a new technology, advantages of technologies, people and their characteristics, process of implementation, family's interaction manners, home environment, and desires for development. The nodes indicated again how versatile a phenomenon the relationship between family communication and ICT is, and it is necessary to focus on this area more in future research activities.

4.4 Study III: Information and communication actions in families

Parkkola, H., Saariluoma, P. & Berki, E. (2006). Action oriented classification of families' information and communication actions: Exploring mothers' viewpoints. (Resubmitted to the journal of Behaviour and Information Technology)

Previous studies did not provide any model of families' information and communication activities. A model of this kind could provide ideas for the development of new services for families. The data gathered by thematic interviews was used for the creation of this model. In the analysis, 18 different action types were found (FIGURE 8). Based on the goals of the actions they were classified into six main clusters. In practice, information flows from one action type to another between the various types of actions.
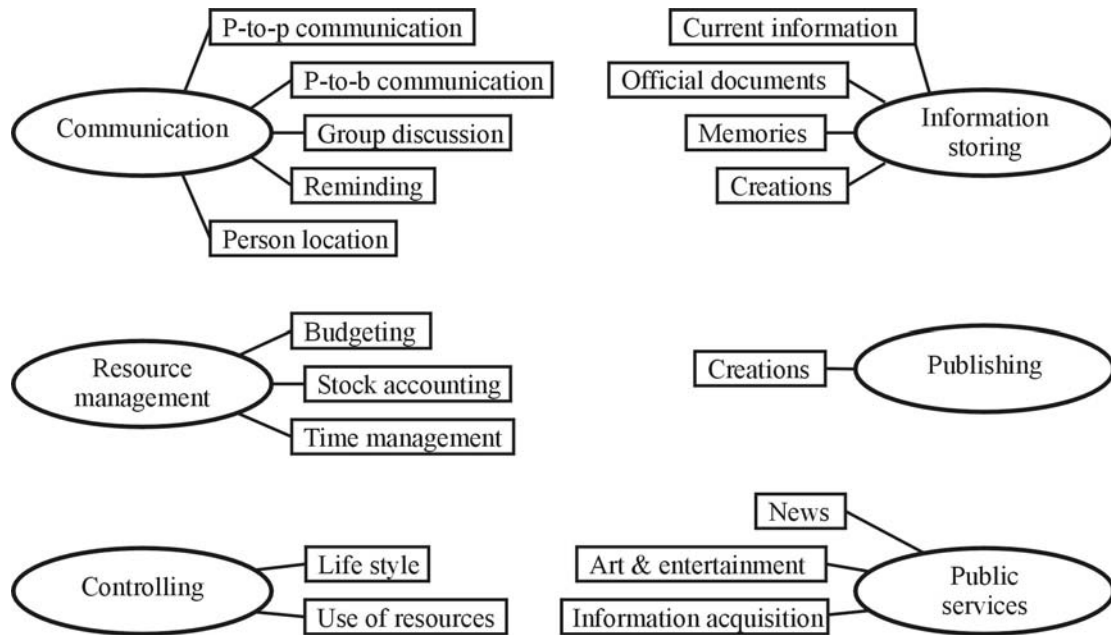
FIGURE 8   The family information and communication actions, action schemata

It is obvious that the classification is not the whole truth. In fact, an all-inclusive list cannot be created because life changes and new needs and activities develop, and are developed. However, the model gives a clear idea of what kinds of information and communication activities occur in family life. They are the action schemata of families' information and communication actions and describe these actions in an abstract level. That is the most important contribution of the paper, because this same kind of knowledge could not be found earlier. The action schemata can be used in the development of ICT. The issue is discussed in more detail in the next study.

4.5 Study IV: From scenarios to action schemata in design

Saariluoma, P., Parkkola, H. & Kämäräinen, A. (2006). User psychology and action-oriented design processes. (Submitted to ACM Interactions)

The study introduces the idea of user psychology and action-oriented design. As an example, it considers the use of the action schemata of families' information and communication actions in the design process. The concept of transfer is combined with the use of action schemata, and the advantages of the approach in ICT design are discussed.

The article applies the idea that learning of a new system is easier if the user can use her/his earlier experiences with other systems. This benefit can be attained when common characteristics of action types (information and communication services) are recognized and utilized in interfaces. In addition to these common characteristics, there are action type specific properties. By identifying and applying the characteristics of action classes in interaction

design the developers can support a learning process when new services are implemented. On the other hand, the idea provides a tool for the developers too. They can apply the same basic structure for services in the same clusters and add only action type specific components to the basic structure.

4.6 Study V: Mothers' demands for ICT

Parkkola, H. (2006). What do mothers demand from information and communication technologies? In J. Multisilta & H. Haaparanta (Eds.) Proceedings of Workshop on Human Centered Technology HCT06, 11.-13.6.2006, Pori. Pori Publication 6. Tampere University of Technology, Pori, 143–151.

The second more focused question of the wider study considers mothers' demands for ICT in the context of families' information and communication activities. In this article the interviews are analyzed from this viewpoint. The aim of the analysis was to find meta-level demands that can be used in the development of several new technologies for the context of families' information and communication activities. Earlier studies have mentioned some of these technologies, which are often considered in the context of some particular device or service.

For ICT in family context (TABLE 4) 37 demands emerged. Some of these seemed to be more relevant for some specific actions than others and the next stage was evaluating these demands action by action. However, some of them are easy to imagine being congruent with different ICTs. Obviously, also the importance of demands varies, and mothers emphasized some of them more than others. The central demands were usefulness, effortless to use, fast use, and learnability.

TABLE 4   Demands for ICT according to themes

Appearance and soundscape	Availability	Functionality
Proper size	Knowledge of	Interactivity
Distinct	Availability of devices	Adequate quality
Aesthetic	Availability of services	Savability
Undisruptive	At hand when needed	Organizable
Noticeable	Accessibility	Versatility
Adaptable to the needs	Learnability	Reliability
Suitability to use context	**Time factors**	**Other factors**
Suitability to physical environment	Fast use	Useful
Suitability to user	Time independent	Interesting
Suitability to task	Up to date content	Effortless
Adaptability		Continuity
System architecture		Support from others
Centralized information stores		'Tryable'
		Controllability
Component based		Economical
User management		Safe for health

If these results are compared to the results of the previous field trial it can be seen that some of the issues figured prominently in both of them. The visual appearance (aesthetic characteristics) seemed to be meaningful for the technology. Both of the studies indicated that ICT has to be at hand when needed. Also, in both of the studies aspects of usefulness were considered with other factors that were closely related, like effortlessness and quickness of use. These demands are mentioned in previous studies, but this kind of fairly comprehensive list could not be found earlier. Designers can also utilize the finding that component based architecture provides a solution for families' needs.

This study is the first step in creating general guidelines for the developers of new technology. Next stages of this work are testing these demands with other user groups (fathers, grandparents, and children) and measuring their importance and priority in development in relation to user groups and actions. If the relationships between the demands were to be inspected more carefully it might be possible to create a new model – Demands for Technology Model – that would depict the meaning of properties of ICT for their implementation and use.

On the other hand, these findings still need to be defined more strictly. It does not help the developer to know that a service has to be learnable, adaptable, useful, or accessible. More concrete definitions are needed to create guidelines.

4.7 Study VI: Would ten participants be enough?

Parkkola, H. & Saariluoma, P. (2006). Would Ten Participants Be Enough in Design of New Services? In A. Ruth (Ed.) Proceedings of 3rd International Conference on Qualitative Research in IT & IT in Qualitative Research, November 27-29, 2006, Brisbane. (In press)

The interviews of the ten mothers were utilized extensively during the research process. This article considers whether the number of participants were sufficient. The earlier study of action types was used as a test material, and the occurrence of activity types was inspected.

The article introduces an approach to consider the adequacy of a small number of participants. It also concludes that all previous suggestions, like Nielsen's (Nielsen 2000) suggestion to use five participants, are not useful in all cases because there are different kinds of ideas regarding research processes and goals. McCracken's (McCracken 1988) suggestion of eight participants is closer to the findings of the study. In this study, a reasonable saturation of data was achieved after the seventh interview. However, all interview situations were not equally productive and in "the worst case" data would have been saturated only after the tenth interview. Therefore the conclusion is that ten participants were enough in our case and this number of participants could be recommended also for cases with the same kinds of research goals.

4.8 Contribution to collaborative research

Three of the six articles were co-authored with others. Article III was written in collaboration with Professor Pertti Saariluoma and Assistant Professor Eleni Berki. They participated in the analysis by reflecting upon and discussing the classification ideas. The final categorization is the result of that co-operation. Also, the article was written so that each author is responsible for the issues in her/his field. Each author also commented on the texts of the others and on the article as a whole.

Article IV is based on the idea of use of classification in design. The idea was developed by Saariluoma. Parkkola is the main author of the method and results sections of the article and she also wrote a part of conclusion. Anna Kämäräinen, MSc, completed the article by adding texts considering underuse and object oriented programming.

Article VI was written by Parkkola and Saariluoma. The idea, analyses, and the design of the article were mostly produced by Parkkola. Saariluoma expanded the introduction and conclusion parts by user psychological viewpoints and introduced also the idea of utilization of "the best case" and "the worst" case in analysis.

5   GENERAL DISCUSSION

This study focuses on families as a domain for ICT. This is a current research issue, which takes into account some of the contradictory pressures under which families live nowadays (Higgins et al. 1994, Kinnunen et al. 2000, Reuna 1999). However, there is still a lack of studies in this area (Brown & Venkatesh 2005, Hughes & Hans 2001, Jennings & Wartella 2004). An overall goal is to find out whether technologies could provide some support for families. This study is a starting point of this process and aims to define what are families like as an environment for ICT and how this knowledge can be used in the development of new technologies. User psychological and action-oriented approaches are applied in the study. The focus is on mothers' viewpoints, and new knowledge of family actions and relationship between family and technology was created to support the development and design of ICT in future. Because this area forms a fairly new context for ICT research, some methodological issues were discussed during the process also. The main findings, methodological viewpoints and suggestions for future research are presented below.

5.1 Main findings

The aim of this study process was to consider what intra-family information and communication systems as an environment for ICT are like. Two focused research questions were defined to further direct the research: 1) What kinds of information and communication actions occur in families? 2) What kinds of demands are there for ICT? In addition to these two content-focused viewpoints the methodological choices concerning the number of participants were discussed.

A basic assumption behind this research project has been the idea that design of new technologies (devices and services) should be based on the psychological knowledge about the users and use contexts (Saariluoma 2004, 2005b). Family is a unique type of group (Daly 1992) and provides a complex

environment for technologies. The family members have goals and they perform actions to achieve those goals. Technologies can be used to support those actions (Carroll & Campbell 1986, Nurmela & Ylitalo 2003, Saariluoma 2005b). Therefore, it is important to know more about the actions that occur in family context. This study concentrated on discovering information and communication actions from the viewpoint of mothers who are central actors in families (Anderson et al. 1999, Haddon 1997, Perry-Jenkins et al. 2004, Pääkkönen et al. 2005, Siitonen et al. 2002, Tollmar & Persson 2002).

To find answers to our research questions three different data collections were obtained: a diary study, thematic interviews of ten mothers, and a field trial of an electronic message board. Based on these data, seven study procedures were executed and six articles were written. The analyses add to the knowledge about families' as a domain even though the issue was considered only from the viewpoint of mothers. The results indicate that there is still a need for new technologies and/or that existing technologies can be improved.

The first of the two main findings related to the data content is a classification of families' information and communication actions (Study III). The classification gives answers to the question of what kinds of action goals families have from the viewpoint of mothers. The model provides a meta-level classification of those action goals. For example, person-to-person communication includes communication for care giving, supporting, emotion transferring and controlling. These all have been found to be contents of communication also in other studies (Crnic & Greenberg 1990, Greenberger & O'Neil 1993, Kasesniemi & Rautiainen 2001, Reuna 1999, Rönkä et al. 2002, Vestby 1996). This kind of model is an answer to Whittaker's et al. (2000) request to have more general models of users' tasks. This is very important in ICT development, because technologies are often used for achieving goals quickly and effectively (Nurmela & Ylitalo 2003).

Now that the action goals of families are better known, it is possible to consider what kinds of ICTs are needed. The model of families' action goals (action schemata) can be used in the design of new services. This possibility was considered more in Study IV where user psychological and action-oriented design approaches were introduced and the meaning of action schemata for ICT development were discussed. Common characteristics of services enable the use of transfer. They support users in implementation as users' existing skill can be used with new services. In addition, recognizing these common characteristics enables designing meta-level characteristics for services and, therefore, supports designers' work.

The second main finding was a collection of 37 demands for ICT (in Study V). Previous studies concerning requirements and properties of technology have provided only very fragmented knowledge. During this study user demands were listed comprehensively. The 37 demands represent properties that a technology (device or service) should have in order for a user to implement it. Some of those demands were mentioned also in previous studies. These include proper size (Sarker & Wells 2003), interactivity (Mäkelä et al. 2000, Sarker & Wells 2003), reliability (Sarker & Wells 2003), and savability

(Mäkelä et al. 2000). The contribution of this work is the creation of a comprehensive list of demands.

The list of demands is a starting point when meta-level requirements for ICT in a family context are created. By defining those meta-level demands it is possible to create rules to guide the development of new technologies and it is the first step in creating Demands for Technology Model (DTM). DTM would provide a reversed approach to the TAM model (about TAM Davis et al. 1989, Jantunen 2006, Lee et al. 2003) and together they can provide a more comprehensive model of the bidirectional human-technology relationship.

In addition to these main findings, other interesting findings concerning e.g. attitudes to technology and media choice emerged. For example, Study II indicates that mothers are willing to use technologies and even implement new ones if they can obtain benefits with them. That means that those technologies should be useful. The mothers' positive attitude was slightly surprising taking into account that the previous results found women to be more negative (Gilroy & Desai 1986, Oksman 2003, Tiainen 2002).

It is obvious that demands and attitudes are closely related to each other but they are also related to other relationship factors introduced in Chapter 2.3 (Relationship between family and ICT). Motives to use some specific ICT are based on needs (actions to perform) and characteristics of available technologies. Also, existing characteristics of technologies and demands for ICT influence a person while choosing a medium for the action. It also seems that gender has influence on the previous issues, and this influence is good to know and consider in the development of ICT. All this knowledge is useful when new ICT is developed for family context.

In addition to content-focused findings, the research project considered a central methodological issue in Study VI where the topic of discussion is the minimum number of participants needed in ICT research. The study introduces a way to analyze and approach the issue and concludes that with ten interviews it is possible to recognize central action types of families' information and communication actions. These results can be used when other studies with same kind of research goal are planned.

In this work, knowledge about the relationships between family and technology is brought together and incremented. There are indications that this relationship is a multidimensional phenomenon. There exist several sub-phenomena that are related to each other. Attitudes depend on properties of technology, personal variables, situational factors, person's beliefs on the consequences of use and so on. Attitudes are thus related to the motives of use. The motives could probably be studied by focusing on the choosing behavior and by defining the reasons why people choose a particular technology for a situation or decide to continue without it. In addition, the significance of action goals is emphasized among other viewpoints. The phenomena discussed during the work forms a complicated network. Even this study could not consider all of those phenomena in depth. However, the study combines together several viewpoints, discusses their relationships and addresses new viewpoints.

These results have increased the amount of scientific knowledge both in the field of psychology and IS. In addition, this is one of the first studies that have introduced and applied user psychological approach in combining these two fields of science. The action schemata found during the study can be used in the development of new technologies in future. This development work does not need to consist of coincidental trials of separate services anymore. Instead, it is possible to approach development of services in a more conceptualized way and consider the relationships (differences and congruencies) between the services.

The results have a contribution to make also for practical family life in future. Family context provides several possibilities to develop and implement ICT. The developers can benefit from knowledge related to that context while developing new ICTs for families. Hopefully, these technologies will better meet families' needs in future. It is useful to know what kinds of needs (actions) there are even though it is possible to create new needs too. However, the needs are not the only important factor and it is good to be aware of other factors, like demands and attitudes, too.

In fact, there is still one more contribution. Researchers as well as developers can apply the knowledge about optimal number of participants and process of classification if they themselves want to map actions in future. This approach to gather knowledge for service development can be used in other contexts, too. For example, if new services are developed for schools the actions of this use context can be first explored and classified. Then, the resulting new action schemata can be used in development.

But what roles then can ICT have in family life? Higgins, Duxbury and Lee (Higgins et al. 1994) suggest that employers should pay more attention to different mechanisms that support their employees in balancing work and family demands. This suggestion should be given serious attention, because some of the results indicate that parents with children work more (Kinnunen et al. 2000). However, most of the parents think that it is possible to combine work and family life (Reuna 1999). ICT could provide the supporting tools by enabling communication between the parents and children subject to this being accepted by the organizational culture. This would be important not only for female workers but also for males as they keep increasing their share of responsibilities in family life. Thus it might be possible to reduce conflictin demands between the family and other life sectors (Higgins et al. 1994, Kinnunen et al. 2000, Reuna 1999). Perhaps this kind of a study will also trigger discussion about how different working cultures can support families, making it easier to bring family life to work places mirroring the way that work is brought home nowadays. There are always at least two parties when flexibilities in working life are discussed, and reciprocity may be a more successful approach than one-sided flexibility. For example, the existing instant messaging systems could be used to connect parents and children during day time.

In family life, many actions take place because of the need to organize or transfer information or emotions (Study I). Not all of these actions are supposed

to be done via ICT, but ICT can be used as a support whenever performing these actions face-to-face would be impossible or too complicated. For example, let us suppose that a mother has to do overtime and needs to inform all the family members about the fact. She knows that the father is still at work, and she is able to call him. However, she should inform the children, too. One of them may be taking a music lesson, another might still be at school and the third might be at home or with friends. If she informs just one family member, it is not guaranteed that the person will remember to tell others about the message. So, she needs a service that would mediate the message to all family members at once.

Even though market forces direct the development of technologies a lot nowadays, by producing knowledge of family life and needs their wellbeing can be supported if more useful and comfortable devices and services for them would be available. It does not mean that the families have to start to use technologies. It is a human who ultimately decides whether or not to use technologies. At least until this research, the mothers seem to be critical when use of technologies is considered in family context. Probably this correlates with the resistance when new technology is introduced. On the other hand, it can also be seen as a protective mechanism against the possible technocracy. The mothers act as gatekeepers and define which technologies can safely be introduced in families. However, if there exist useful technologies for families they have more possibilities to choose the most suitable and comfort ways to organize their life.

5.2 Methodological evaluation

Similarly to some previous studies (Niemelä 2003, Niemelä & Saariluoma 2003, Oulasvirta & Saariluoma 2004, 2006) this study applies user psychological approach and is one of the first studies based on this approach. User psychological studies consider different kinds of research issues related to users or potential users of ICT. This study is the first user psychological study that focuses on people's social actions and on the use of this knowledge in design. The fundamental idea behind this study is that it is necessary to know the domain of technology before any development work can start. Thus, it is possible to find needs and characteristics of ICT from the users' perspective and create services that better fulfill users' needs. The success of this approach can not be proven based on these few studies, but this kind of an approach has been suggested as a solution for usability problems earlier on (Norman 1998).

Different research methods were implemented at various stages of the research project. However, the main approach was a qualitative one because the goal of the study was to identify characteristics and phenomena related to the family as a context for ICT. The use of quantitative methods would have been impossible without knowing these characteristics. However, some quantitative methods (Wilcoxon Signed Ranks Test and Spearman's Rank Correlation

Coefficients) for small amounts of data were applied in the analyses when needed.

The study process as a whole followed the main idea of the Grounded Theory by approaching the issue without predefined hypotheses. During the different stages the focus of research was then specified by more exact research questions and methodological choices. This approach seems to be useful when the study focuses on a little studied research issue.

Three different methods in data gathering were applied during the research project: 1) A diary study, 2) A thematic interview, and 3) A field trial. In addition to these methods, different kinds of analyzing techniques were also utilized. Even though the use of a researcher's own experiences is not accepted in some research cultures, it was utilized during the first stage of the project (Study I) and it has its own role and strengths in this study. The diary study was used to find out different kinds of characteristics of the phenomenon and was found to be a suitable tool for the purpose in this challenging context. It provided a good base for the interviews.

Thematic interview was used to gather data from more participants. The data obtained this way was extensive and provided material for several possible research questions. A disadvantage was that the data was laborious to analyze even with modern computerized tools for qualitative data analyses.

It has been suggested by some that the same data cannot be used for several articles. But once in-depth interviews with a broad focus have been obtained as is the case here, it would be a waste to write only one or two articles based on that material. It became obvious during the course of the research that the data gathered by thematic interviews could provide materials for more than two articles. For example, the concept of attitudes could be studied with this material.

The field trial consisted of a procedure to collect more experiences. Its role was convergent with the diary study – to gain more experiences about the issue. Field trial is a widely used method in the IS field. However, in the early stage of this research project it was not found to be very useful even though some interesting results (e.g. mothers' positive attitude to technologies) surfaced during the analysis. Nevertheless, it has its own important role to play in the study. Had there been more resources available for system development and ethnographic field studies, field trials would have been more useful.

By means of these qualitative methods knowledge about families as a context for ICT has increased. This knowledge provides a good base for quantitative studies and for more focused qualitative studies in future. With these more concrete concepts it is possible to create questionnaires and work with bigger samples.

The thematic interviews and analyses were used to approach research questions in a technology-independent way. Of course, during the interviews the participants talked about different technologies and other related things. However, instead of the technologies mentioned the analysis focused on actions discussed. Of course, comments about present technologies were considered, especially when dealing with demands. During the analysis the technology-

dependent expressions were used to generate concepts in a more general level so that they could be used with other technologies too.

Finally it is good to consider the relationships between the researchers and research objects. It has been stated that too close a relationship is an obstacle to objective research. However, practically all researchers do have experiences about family and thus some pre-conceptions of it. The use of own experiences and the existing family system can help in creating initial models and hypothesis and reflecting on ideas found in other studies. Of course, it may also make it more difficult.

If the researcher can approach a phenomenon without believing in the existence of only one truth, doing research which includes one's own experiences in addition to other people's experiences is possible and interesting. It is easier to ask "Why?" again and again during the interviews if the researcher understands that there are no two identical persons and that everybody has her/his own experiences and world view.

The existence of these differences must be admitted also when the data is analyzed and the results are considered. In qualitative research the participants present their interpretations about the issues under research. The researcher makes her/his own interpretations about the participant's expressions later on when reading the transcribed interviews. However, this is not related to qualitative research only. In quantitative research participants also have to make their own interpretations about the questions or statements of the inquiry. Later, when constructing the results the researcher interprets these answers.

5.3 Future directions

The research project gave answers to many questions but it also brought up at least as many new questions. Using the same data it is possible to focus even better on mothers' attitudes and on changes in them. In addition to this and to several smaller questions introduced earlier, three other main lines for future research are suggested. Firstly, the classification of family actions has to be validated with other members of the family (fathers, children, and grandparents). The existence and importance of different action types can then be studied by quantitative means as well.

Secondly, the hypothesis of the use of these action types in design and of their support for transfer and implementation should be validated more accurately. Research of this kind can also indicate whether user psychological approach is worthwhile for design.

Thirdly, the 37 demands generated during Study V have still to be considered in relation to action types, services, and different user groups. This means that the existence of these demands and possibly others should be further studied and their importance defined. As a result the DTM can be developed and the possibilities to combine it with TAM model can be evaluated. TAM would provide user's properties and external factors that

influence the acceptance, and DTM would complement these. In this case the new model would consider both viewpoints of technology acceptance.

YHTEENVETO (FINNISH SUMMARY)

Tieto- ja viestintätekniikoiden suunnittelu äideille. Käyttäjäpsykologinen näkökulma.

Perheet elävät ristiriitaisten vaatimusten keskellä usein tämän päivän yhteiskunnassa (Higgins et al. 1994, Kinnunen et al. 2000, Reuna 1999). Työn ja perheen tarpeita voi olla vaikea sovittaa yhteen varsinkin perheissä, joissa molemmat vanhemmat käyvät töissä kodin ulkopuolella (Higgins, Duxbury & Lee 1994, Reuna 1999). Useiden tutkimusten (Anderson et al. 1999, Haddon 1997, Perry-Jenkins, Pierce & Goldberg 2004, Pääkkönen et al. 2005, Tollmar & Persson 2002) mukaan äiti on perheenjäsen, joka kantaa päävastuun kotitaloustöistä ja perheen viestinnästä kodin ulkopuolella tehtävän työn lisäksi. Viestinnän tueksi on nykyään käytettävissä runsaasti erilaisia tekniikoita. Kuitenkin näyttää sille, että varsin usein näiden tekniikoiden kehitys on perustunut työelämän tarpeisiin ja maskuliiniseen näkökulmaan (McDonough 1999, Pulkkinen 2000, Rommes 2000, Tiainen 2002). Tutkimuksessa erityisesti perhe ja perheen sisäisen viestinnän tarpeet ovat jääneet tieto- ja viestintätekniikoiden käyttöympäristönä varsin vähälle huomiolle (Brown & Venkatesh 2005, Hughes & Hans 2001, Jennings & Wartella 2004).

Tämän tutkimuksen tavoitteena on ollut selvittää, millainen ympäristö perhe on viestintätekniikoiden käytölle ja kuinka tätä tietoa voidaan käyttää tekniikoiden ja palveluiden kehitystyössä. Aihepiiriä on lähestytty käyttäjäpsykologian ja käyttäjän suorittamien toimintojen näkökulmasta. Käyttäjäpsykologiassa käyttäjä pyritään huomioimaan kokonaisvaltaisesti. Tavoitteena on ymmärtää, kuinka käyttäjä toimii tietyssä ympäristössä (Saariluoma 2004, 2005b). Tutkimusta tehtäessä hyödynnetään psykologiassa käytettyjä metodeja ja konsepteja, joita myös kehitetään tutkimuksen myötä edelleen. Lopulta saatu tietämys tuodaan tuotekehityksen tueksi jo prosessin alkuvaiheista asti. (Saariluoma 2005b) Myös Norman (1998) on vaatinut käyttäjän toiminnoista lähtevää tuotekehitystä käytettäväksi, jotta voitaisiin ennaltaehkäistä monenlaisia käytettävyysongelmia.

Keskityttäessä perheeseen tieto- ja viestintätekniikoiden käyttöympräistönä käyttäjäpsykologinen ja toiminta-orientoitunut lähestymistapa merkitsee sitä, että mahdolliset käyttäjät (perheenjäsenet) huomioidaan kokonaisvaltaisesti. Tämä tarkoittaa mm. heidän tavoitteisiin, asenteisiin, ajatteluun, tunteisiin ja toimintaympäristöön perehtymistä. Tämä tutkimus rajattiin käsittelemään äitien näkökulmaa perustuen heidän vahvaan rooliinsa perheiden viestintä toiminnoissa. Tutkimuksen fokusta ohjattiin kahdella alakysymyksellä: 1) Mitä tieto- ja viestintätoimintoja perheissä esiintyy?; 2) Mitä vaatimuksia tieto- ja viestintätekniikoille asetetaan käyttäjien näkökulmasta? Näiden kahden tutkimuskysymyksen lisäksi metodologisia kysymyksiä on pohdittu tutkimuksen eri vaiheissa.

Aineistoa kerättiin kolmella eri menetelmällä: päiväkirjatutkimus, teemahaastattelu ja kenttäkoe. Saatuun aineistoon pohjautuen kirjoitettiin kuusi artikkelia. Aineistojen analyysi lisäsi tietoa perheistä tieto- ja viestintätekniikoiden

käyttöympäristönä, vaikka aihetta käsiteltiinkin vain äitien näkökulmasta. Tulokset osoittavat esimerkiksi, että perheiden arjesta löytyy edelleen ongelmakohtia, joita voitaisiin ehkä ratkoa tekniikan tarjoamin mahdollisuuksin.

Ensimmäinen kahdesta päätuloksesta oli perheiden tieto- ja viestintätoimintoja käsittelevä luokittelu (Study III). Se vastaa kysymykseen, mitä tieto- ja viestintätoimintoja perheissä esiintyy äitien näkökulmasta. Malli tarjoaa meta-tason luokittelun toiminnan tavoitteista. Esimerkiksi henkilöltä-henkilölle viestintä käsittää viestinnän eri aihealueita kuten hoitaminen, tukeminen, tunteet ja kontrollointi, jotka aiemmissa tutkimuksissa on määritelty perheviestinnän sisällöiksi (Crnic & Greenberg 1990, Greenberger & O'Neil 1993, Kasesniemi & Rautiainen 2001, Reuna 1999, Rönkä et al. 2002, Vestby 1996). Tämä malli on vastaus Whittakerin ym. (2000) toiveeseen kehittää yleisempiä malleja käyttäjien toiminnoista.

Kun perheiden toiminnan tavoitteet tunnetaan paremmin, voidaan määrittää minkälaisia tekniikoita tarvitaan. Perheiden viestintätoimintojen mallia (action schemata) voidaan käyttää uusien palveluiden suunnittelussa. Tätä mahdollisuutta on käsitelty tarkemmin tutkimuksessa IV (Study IV), jossa myös esitellään käyttäjäpsykologinen ja toimintaorientoitunut lähestymistapa. Artikkelissa esitetään, että palveluiden suunnittelussa voidaan hyödyntää viestintätoimintojen mallia määrittelemällä niiden pohjalta palveluiden yhteiset ja palvelukohtaiset ominaisuudet. Palveluiden yhteiset ominaisuudet mahdollistavat transferin, kun käyttäjä opettelee uusien palveluiden käyttöä. Kehittäjän näkökulmasta helpottaa käyttöliittymien suunnittelua, kun eri palveluille yhteiset ominaisuudet tunnistetaan.

Toinen päätulos oli 37 kohtainen luettelo vaatimuksista tieto- ja viestintätekniikoille (Study V). Vaatimukset kertovat ominaisuuksista, joita tekniikalla pitää olla, jotta käyttäjä ottaisi sen käyttöönsä. Aiemmat tutkimukset ovat käsitelleet vaatimuksia ja tekniikoiden ominaisuuksia lähes aina vain yhden tietyn tekniikan näkökulmasta. Näin ollen vaatimuksiin liittyvä tieto on ollut hyvin fragmentoitunutta. Tässä tutkimuksessa käyttäjien vaatumukset listattiin kokonaisvaltaisesti. Joitakin näistä vaatimuksista on listattu aiemmissa tutkimuksissa kuten sopiva koko (Sarker & Wells 2003), vuorovaikutteisuus (Mäkelä et al. 2000, Sarker & Wells 2003), luotettavuus (Sarker & Wells 2003) ja mahdollisuus tallentaa (Mäkelä et al. 2000).

Tämä kokonaisvaltainen lista on alku meta-tason mallille vaatimuksista tieto- ja viestintätekniikoille perheympäristössä. Määrittelemällä nuo meta-tason vaatimukset mahdollistetaan ohjeistuksen luominen tekniikoiden kehitystyön tueksi. Löydetyt 37 vaatimusta ovat myös alku tekniikoiden vaatimukset mallin (Demands for Technology Model, DTM) luomiselle. DTM tulee tarjoamaan vastakkaisen lähestymisnäkökulman TAM-mallille (kts. Davis et al. 1989, Jantunen 2006, Lee et al. 2003) ja yhdessä ne voivat tarjota kokonaisvaltaisen kuvan tekniikoiden/palveluiden käyttöönottoon liittyvistä tekijöistä.

Edellä esitetyn kahden päätuloksen lisäksi tämä tutkimus nosti esiin myös muita mielenkiintoisia näkökulmia liittyen asenteisiin ja viestintävälineen valintaan. Esimerkiksi tutkimus II (Study II) osoittaa äitien olevan halukkaita ottamaan käyttöön uusia viestintätekniikoita, jos niillä saavutetaan riittävä hyöty.

Tämä tulos positiivisesta suhtautumisesta uusien tekniikoiden käyttöönottoon oli hiukan yllättävä, koska aiemmat tutkimukset ovat osoittaneet naisten suhtautuvan negatiivisemmin (Gilroy & Desai 1986, Oksman 2003, Tiainen 2002). Perheen ja viestintätekniikoiden suhteeseen keskittyneiden kysymysten lisäksi tutkimuksessa VI (Study VI) käsiteltiin metodologista kysymystä pohdittaessa, onko 10 osallistujaa riittävä määrä tällaiseen tutkimukseen. Artikkelissa esiteltiin yksi mahdollinen tapa analysoida ja lähestyä kysymystä riittävästä osallistujamäärästä. Artikkelin pohjalta todettiin, että 10 haastattelua tarjosi riittävästi materiaalia perheiden keskeisten tieto- ja viestintätoimintojen tunnistamiseksi. Esiteltyä lähestymistapaa ja tulosta voidaan hyödyntää muissa vastaavanlaisissa tutkimuksissa.

Kaiken kaikkiaan tämä tutkimus on koonnut yhteen aiempia tutkimustuloksia tieto- ja viestintätekniikoiden käytöstä perheiden sisäisessä viestinnässä ja aineiston hankinnan sekä analyysin seurauksena tätä tietämystä on myös kartutettu. Tehty tutkimus osoittaa käsillä olevan aihealueen muodostavan hyvin moniulotteisen ilmiön. Siihen liittyy lukuisia alailmiöitä, jotka ovat yhteydessä toisiinsa. Asenteet riippuvat tekniikoiden ominaisuuksista, henkilökohtaisista tekijöistä, tilannekohtaisista tekijöistä, henkilökuhtaisista uskomuksista jne. Asenteet ovat myös yhteydessä käyttömotiiveihin, jotka puolestaan ovat yhteydessä valintatilanteeseen, jossa käyttäjä valitsee tekniikkaa tiettyyn viestintätilanteeseen.

Edes tämä tutkimus ei ole voinut käsitellä kaikkia ilmiöön liittyviä näkökulmia kattavasti. Tutkimuksen kontribuutio muodostuukin siitä, että se on koonnut sirpaleista tietoa yhteen, vastannut aiemmin tutkimattomiin kysymyksiin ja nostanut esiin uusia näkökulmia ja tutkimuskysymyksiä. Tutkimus toivottavasti pitkällä aikavälillä hyödyttää myös perheiden käytännön elämää, jos uuden tiedon ja kehityksen työkalujen myötä heidän käyttöönsä saadaan entistä paremmin heidän tarpeistaan vastaavia tekniikoita ja palveluita.

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APPENDIX 1: OUTLINE OF THEMATIC INTERVIEWS

Theme	Issues (The questions were not used in interviews in this way)
Family	Who are the members of the family?
	How old are the members of the family?
	How long the parents have been together?
	Are there other close people?
	Describe the role and meaning of those close people.
	Describe a typical day and week in the family.
	What communities are parts of family's daily life (schools, day-care centers, clubs…)?
Family Interaction	How does information change?
	What is it that is talked about in the family?
	When do people chat and discuss?
	With whom do people chat/discuss?
	Are there other means for information transferring?
	Describe the roles of the people in the family.
	Describe the mother's role.
	Describe the family rules.
	What kind of trust is found in the family?
	What are the best features of family communication in the family?
	What are the problems of family communication in the family?
Communication Technology	How are different kinds of communication technologies employed in family communication?
	What technologies are used?
	For what are the technologies used?
	Why are these technologies used?
	What is it that the mother would like to use the technology for but does not ? Why not?
	What is it that the mother would not like to use this technology for? Why not?
	What kind of experiences, opinions and ideas the mother has about the use technology?
	What are the preconditions of implementation for some new technology?
	Describe the influences of the use of communication technologies in families.
	What are the usable technologies for mothers? Why?
	What kind of communication practices would be a mother's dream?
	What would the life be like without communication technologies?