3-2009

Persuasive Technology to Shape Social Beliefs: A Case of Persuasive Health Information Systems for Rural Women in India

Vikram Parmar

Delft University of Technology, v.s.parmar@tudelft.nl

David Keyson

Delft University of Technology

Cees de Bont

Delft University of Technology

Follow this and additional works at: <https://aisel.aisnet.org/cais>

Recommended Citation

Parmar, Vikram; Keyson, David; and de Bont, Cees (2009) "Persuasive Technology to Shape Social Beliefs: A Case of Persuasive Health Information Systems for Rural Women in India," *Communications of the Association for Information Systems*: Vol. 24 , Article 25. DOI: 10.17705/1CAIS.02425

Available at: <https://aisel.aisnet.org/cais/vol24/iss1/25>

This material is brought to you by the AIS Journals at AIS Electronic Library (AISeL). It has been accepted for inclusion in Communications of the Association for Information Systems by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

Communications of the Association for Information Systems

CAIS

Persuasive Technology to Shape Social Beliefs: A Case of Persuasive Health Information Systems for Rural Women in India

Vikram Parmar

Department of Industrial Design, Delft University of Technology

Landbergstraat 15, 2628 CE Delft, The Netherlands

v.s.parmar@tudelft.nl

David Keyson

Department of Industrial Design, Delft University of Technology

Landbergstraat 15, 2628 CE Delft, The Netherlands

Cees de Bont

Product Innovation Management, Delft University of Technology

Landbergstraat 15, 2628 CE Delft, The Netherlands

Abstract:

This paper presents Persuasive Health Information systems (PHIs), which has been deployed over a period of eight months at a pilot site to improve health information dissemination among rural women in India. The design process of the PHI integrates social cues from the persuasive technology and the theory of planned behaviour for shaping social beliefs and health practices of rural women. Two field studies were conducted to design and evaluate the PHIs. The results from study one revealed social beliefs and practices related to primary health that formulated the design requirements for the PHIs. On the basis of these requirements, the social beliefs were addressed by applying persuasive social cues to the design of the form, content, and interaction of the PHIs. The results from study two involved comparative engagement between PHIs and an existing health information system supported by a local nongovernmental organization. The results indicate that application of persuasive technology can persuade the rural women to change their existing social beliefs and health practices in a positive manner. This paper contributes by providing theoretical understanding of what restricts the information transfer among rural women in terms of health care practices and how it can be addressed by applying persuasive technology for the design of health information systems. We hope that health practitioners, ICT developers and the design community would benefit from this approach in developing information systems for health care, e-government, and education in a rural context.

Keywords: societal change, collective use, community wide approach, interdisciplinary, sociological theory, empirical, behaviour, need identification, persuasive technology

Volume 24 Article 25. pp. 427-454. March 2009

This manuscript was submitted on 9/15/2008 and has been with the authors for 3 months for 2 revisions.

I. INTRODUCTION

Persuasive technology plays a significant role in designing information system for instigating change in health related attitude and behaviour among users' [Fogg 2003]. Persuasive technology has been applied in computer-human persuasion and computer-mediated persuasion to bring social changes in areas such as, health [Oinas-Kukkonen and Harjumaa 2008], education [Fogg 2003], and energy consumption [Bang et al. 2006] in western countries. In our opinion, persuasive technology can also be an important element in addressing problems related to health behaviour change in rural context of developing countries such as India, Tanzania, Uganda, and China. This paper will demonstrate the role of persuasive technology in shaping social beliefs and health attitude of rural women in India.

Literature on Indian maternal healthcare system shows that, due to orthodox socio-cultural norms related to personal health among rural women, acceptance of current health interventions has only achieved partial success [Deodhar 2000; Bharat 2001]. Past research have shown that ignorance of culturally divergent beliefs and traditional health care practices may lead to the failure of health interventions [Spector 1991,1995]. Despite huge investments in maternal care, India still has 60 million undernourished children [Gragnotati et al. 2005] and more than 300 women die during childbirth in every 1,000,000 live births. Globally, every fifth woman who dies in childbirth because of poor medical care is from India [Chronicle 2007]. As a consequence, the dissemination of relevant primary health information in relation to maternal health of rural women remains a serious challenge for the government and private sectors in India [Sen 1999; Prahalad 2006; Pandey et al. 2007].

Reviewing literature on Health Information Systems (HISs) targeted at rural India indicates that the existing health systems such as Tele-doc [Jiva 2005] and N-logue [Kumar and Jhunjhunwala 2002] have focused mainly on providing distance diagnosis and have limited ability to offer primary health information directly to rural users. These HISs have not fully exploited ICT as a medium to disseminate primary health information [Lucas 2008]. Although local nongovernmental organisations (NGOs) have developed health information systems to disseminate the information, they fall short in terms of the following information dissemination issues:

First, the content and the design of HISs do not motivate regular use. One of the reasons for this is the non-persuasive setting of health interventions, which, results in an information gap between rural women and critical primary health information [Lucas 2008; Parmar et al. 2007; Saith and Vijayabaskar 2008; Jain et al. 2008]. Non-persuasiveness means an intervention that is not motivating for rural users to change their existing health behaviour and practices; nor does it actively involve users in a health information exchange process.

Second, owing to the lack of knowledge about existing social beliefs related to health practices, the impact of HISs in educating the rural users have been limited. Furthermore, application of both traditional and ICT-based health interventions such as showing films to villagers or radio programmes, and traditional media like paper pamphlets, posters or door-to-door visits, have been less effective in improving health practices of rural [Spector1991; Brewer et al. 2005].

Third, the content offered through HISs deployed for rural users is based mainly on content targeted at urban users. This causes a mismatch between information offered to and required by rural users. Besides, the systems do not offer domain-specific information likely to increase users' understanding about medical phenomena and the precautions required to avoid related diseases. In particular, women-related personal health issues such as maternal health and menses have not been addressed [Parmar et al. 2007]. As a result, rural women do not see any value in the health information offered and are not persuaded to access and use the HISs.

Fourth, in order to access health information via HISs, rural users are expected to have a certain level of computer literacy. As most rural users are semi-literate and have limited technology exposure; this makes them dependent on the community health workers for access to personal health information. This de-motivates the rural users, because it confronts them with their poor exposure to technology [Parmar et al. 2008, 2009].

HISs, therefore, need replacement with persuasive health information systems (PHIs), systems which persuades users to access information to increase their primary health knowledge, thus motivating them to improve their health practices. On the basis of the limitations of HISs outlined previously, two questions have been found to be critical to the development of PHIs :

1. How can we identify the social beliefs and information requirements related to primary health in rural areas in order to specify the design requirements of PHIs in terms of content, user interaction and physical design of the system?
2. How can we apply persuasive technology to shape existing social beliefs, thus persuading rural users to positively change their health behaviour and practices?

Answering these two questions requires an amalgamation of theories from disciplines such as social sciences and computer sciences. In this context, the contribution of the paper is to illustrate a multidisciplinary design approach that integrates the following two complementary theories of behavioural change as fundamentals in the design and development of PHIs. First, persuasive technology, which has emerged as a strategy for changing people's social and health-related attitudes [Fogg 2003]. Recent literature on it illustrates the use of personal digital assistants (PDAs), desktop-based applications and object or environment simulations to positively persuade target users to perform certain tasks or behaviour, for example: (a) "Power house," a computer game designed to persuade users to reduce energy consumption to induce energy-aware lifestyles among teenagers [Bang 2006]; (b) Using PDAs as a persuasive tool to change attitudes toward medication taking, in this case, helping elderly patients to remember pill intake [Ajzen and Manstead 2007]; (c) "Baby think it over," an infant simulator to persuade teenagers to understand how much attention a baby requires, thus persuading them to avoid early pregnancy [Fogg 2003].

Second, the Theory of Planned Behaviour (TPB) [Ajzen 1991] which focuses on why people perform, or fail to perform, recommended health practices. Current literature on understanding social norms points to the TPB as a widely applied conceptual framework to understand diverse health-related behaviours such as physical fitness, adhering to low-fat diets, using condoms for AIDS prevention, and wearing a safety helmet [Ajzen and Manstead 2007].

So far, the application of persuasive technology and theory of planned behaviour has been limited largely to the development of persuasive information systems for urban users in western countries, where the major part of the testing and designing has been restricted to student or lab settings. To our knowledge, until today, both of the theories have not been applied for designing PHIs, deployed and evaluated with rural users. This paper contributes to the persuasive technology literature by demonstrating the application of persuasive technology in combination with the theory of planned behaviour for developing PHIs for rural users in developing countries. The PHIs has been developed by integrating two theories in the design process. The theory of planned behaviour has been applied to investigate existing behavioural, normative, and control beliefs of the rural women. Persuasive technology has been applied to design content, physical design, and user interaction of the PHIs. We have selected a case of disseminating primary health information on menses and maternal health among rural women. This issue has been considered as a predominant problem by private and governmental organizations [Parmar et al. 2007, 2008]. The PHIs has been deployed at the pilot site for two years in western India. We hope that the health practitioners, ICT developers and design community involved in developing PHIs, will benefit from application of the selected theories in the rural context.

The paper is structured as follows: Section II explains the theoretical framework. Section III explains the design framework, including the design process which has been used to support the development of the PHIs. Section IV describes Study 1, which focuses on identifying user beliefs and information requirements of the PHIs. Section V explains the design and components of the proposed PHIs. Section VI describes study two, which involves a field evaluation study of the PHIs. The study has been conducted to compare the proposed PHIs with the existing local NGO-governed health information system to measure the level of engagement of the rural women. The paper concludes with guidelines for applying persuasive technology in future development of PHIs.

II. THEORETICAL FRAMEWORK

In order to develop PHIs, it is important to apply a user-centred approach to design and development. At the same time, it is equally important to develop a system based on empirically tested theories in order to gain critical insights about user social norms and technology and long-term behavioural change. This will lead to development of PHIs that are socially and technically acceptable in the developing countries, particularly in rural contexts. The advantage of theoretical based development is that it offers a scientific platform for aggregating knowledge, and allows empirical validation of the design and development approach. The two selected theories, persuasive computing [Fogg 2003], which can be understood as *any interactive computing system designed to change people's attitudes or behaviour*, and theory of planned behaviour [Ajzen 1991], which helps to understand *how we can change the behaviour of people and predicts deliberate behaviour, because behaviour can be planned*, complement each other and offer a framework to address the research requirements (See Figure 1). They have been selected on the basis of the following criteria: (a) determining social beliefs and subjective norms of user; and (b) identifying persuasive strategies for designing PHIs.

Despite successful application of the theory of planned behaviour in multiple disciplines, it has a limitation in the area of volitional control [Ajzen and Manstead 2007]. This is also known as perceived behavioural control, and means the ability to make conscious choices or decisions to change behaviour. Several studies have indicated that the greater the perceived behavioural control, the stronger the person's intention to perform the behaviour in question should be [Ajzen 1991; Ajzen and Fishbein 2005; Ajzen and Manstead 2007]. To overcome this limitation and increase perceived behaviour control of users, social cues from the functional triad framework of persuasive technology has been applied to increase intention to perform the behaviour (See Figure 1). The functional triad is a framework for thinking about the roles that computing products play from the perspective of the user. The framework shows that interactive technologies can operate in three basic ways: as tools, media, and as social actors [Fogg 2003]. Another framework for designing and evaluating persuasive systems is proposed in this issue by [Oinas-Kukkonen and Harjumaa 2009].

Figure 1 illustrates the amalgamation of the two theories, where the limitation of TPB, perceived behavioural control, has been addressed with the social cues from the functional triad framework of persuasive technology. In addressing the TPB limitation, the role of the social cues is to persuade users to have high perceived behaviour control so that they have a strong intention to change the behaviour in question. The computing system also functions as a tool, medium or social actor to reinforce rational behaviour to ensure lasting behavioural change. The three factors of TPB can be understood as: (1) *Attitude toward the behaviour*: a favorable or unfavorable evaluation of the behaviour; (2) *Subjective norm*: perceived social pressure to perform the behaviour; and (3) *Perceived behavioural control*: perceived capability to perform the behaviour. In addition, background variables such as personal, demographic, and environment are included in this theory because they all influence user behaviour indirectly [Ajzen 1991].

Figure 1. Depicts the Theoretical Framework

The following section will explain how the above theoretical framework has been included in the design and development process of the PHIs for rural women.

III. DESIGN PROCESS

The following design process has been applied in developing PHIs for rural women to disseminate primary health information. The design process is based on the principles of user-centred design [Norman 1998]. See Figure 2 for an illustration of the design process. The process is divided into three phases: exploratory research, creative design research, and evaluative research. The third phase (evaluative research) is beyond the scope of this paper. The design process integrates the theory of planned behaviour in phase 1 to identify social norms related to menses and maternal health and persuasive technology in phase 2 to design content, physical design, and user interaction of the PHIs.

Phase 1: Explorative research involves identifying the target user group, user needs, user characteristic, social values, and rural contextual factors by conducting contextual inquiry [Beyer and Holtzblatt 1998] and focus groups [Stewart and Shamdasani 1990]. These studies are conducted in the field along with rural users, interested stakeholders such as community hospital health workers, local nongovernment organizations and village political units. This phase results in three main findings. First, formulation of the design brief for the PHIs, specifically the information content, form and requirements for user interaction. Second, the results reveal four contextual design factors: socio-cultural, technological, economic and user past ICT experiences. These factors, which are constantly

considered in phases two and three to support the design of the PHIs, are: socio-cultural: understanding social norms and community culture; technological: understanding available technology infrastructure and limitation; economic: understanding local market and economic trends and user past ICT experiences, incorporating users existing technological exposure and skill sets. Third, the results allow definition of the responsibility of various stakeholders in the design and development of the PHIs.

Figure 2. The Design Process Applied to Design the PHIs

The questionnaires in the exploratory research were based on the three factors of the theory of planned behaviour explained in the theoretical framework section. In summary, the theory provided a platform to investigate the behavioural, normative, and control beliefs and health practices of women at individual and community level and how these beliefs have been influencing the decision-making to access given health information. Details about the exploratory research phase are described in Section IV. The questionnaire based on these factors investigated the social norms related to menses and maternal health and later contributed to the development of information content for the PHIs, See Appendix 1: (a) *Attitude toward the behaviour* provided insight into the attitude of rural women toward personal health practices, toward sharing personal health information, and toward perceiving new ICT-based health systems; (b) *Subjective norm* allowed investigation of social beliefs influencing the decision making of rural women at family and community level to access personal health information; (c) *Perceived behavioural control* provided insight into the users' capacity to question existing subjective norms and ability to change their existing attitudes toward personal health.

Phase 2: Based on the design brief from Phase 1, creative design research involves design of PHIs, also termed as *flexible knowledge aggregation platform*. The social cues of persuasive technology has been applied to design content, physical design, and user interaction of the PHIs. Using PHIs as a tool, medium, and social actor, the system should persuade rural women to have high behaviour intention and thus increase their perceived behavioural control to change their health practices. The design process involves constant iteration with the users and evaluation of PHIs with respect to innovation attributes of the theory of diffusion [Rogers1995]. Findings from the constant user evaluation are expected to result in a high rate of adoption. The results from evaluative studies are beyond the scope of this paper. Phase two addresses the limitation of the theory of planned behaviour as mentioned in the previous section. Details about the creative design research phase are described in Section V.

As part of exploratory research, the following section explains Study 1, conducted to investigate social beliefs and health practices related to menses and maternal health among rural women.

IV. STUDY 1: IDENTIFICATION OF DESIGN REQUIREMENT FOR PHIS

As part of the exploratory research phase of an integrated design process and in order to identify the design requirements to develop the PHIs, study 1 addresses the first research challenge of identifying the social beliefs related to personal health and problems related to existing HIS systems. A combination of two well-established user observation methods contextual inquiry and focus group have been applied to extract qualitative and quantitative data. The study consisted of three phases: (1) contextual inquiry and focus groups used for data collection; (2)

analysis, interpretation, and modelling of findings resulting in the generation of a consolidated cultural model; (3) consolidation and extraction of design requirements.

Contextual Inquiry

Contextual inquiry method was selected because it makes data gathering from users the base criteria for deciding what the system should do and how it should be structured. It allows designer in finding out about context and translating these factors into the design of products which meet users' needs [Beyer and Holtzblatt 1998]. This method has also been found effective in designing ICT based products for developing countries [De Angeli et al. 2004]. The inquiry was conducted with participants including (n=120) rural women and adolescent girls, to identify existing social beliefs and practices related to menses and maternal health. The participants age ranged from 12 to 60 years; they belonged to similar economic strata and had varied literacy levels. The inquiry included structured interviews and observations, which were conducted to obtain information related to existing and perceived value of health care among women, social environment and social beliefs and practices followed during menstruation and maternity. The questionnaire was based on the theory of planned behaviour [Ajzen 1991] including issues related to attitudes of women toward personal health practices, how women perceived new ICT-based health system, attitude toward sharing personal health information, and the intention of women to improve their personal health (See Appendix 1). The content of the questionnaires was verified by the local health workers and community doctor. All the observations and interviews were conducted by visiting the residence of the rural women in the village. Local community health workers were hired to gain access to rural women, and build up a positive reputation with the rest of the villagers. The inquiry team which included one industrial designer and two local community health workers. One industrial designer asked questions in the local language; the other workers observed the environment. All the interviews were audio-video recorded where possible and photographs were taken.

Focus Groups

Focus group method was selected as it allows the opportunity for sharing and comparing knowledge on a focused topic between participants [Stewart and Shamdasani 1990]. Six focus groups were conducted with (n=7) participants in each group (See Figure 3). In particular, two focus groups were conducted with married women, and one each with adolescent schoolgirls, community health workers, village governing council, and elderly women. The purpose of the focus groups was to obtain feedback related to the participants experience with content and usage of existing HISs, contextual factor influencing usage of HISs, and user technology exposure related to ICT products. The sessions with married women, adolescent schoolgirls, and elderly women was focused upon investigating issues related to social stigma, women's personal world, current health information sources, privacy and trust. Considering the shy nature of rural women and the sensitivity of the topic, a card-sorting technique was used to initiate discussion in focus groups. Cards containing images of existing social beliefs and local artefacts were shown to the participants. Participants were given five cards related to each topic and asked to arrange them in hierarchal sequence in which they perceived the problem and then discuss their reasons. Images selected for the card were hand drawn to create a local impression during the focus group. The team conducting focus groups involved one industrial designer and two community health workers.

Figure 3. Focus Group Sessions Using Card-Sorting Technique with Adolescent Girls and Women

Analysis and Results

The results from contextual inquiry and focus groups were separately analyzed. Contextual inquiry interviews and observations were transcribed from local regional language to English and key statements were extracted. The key statements were coded against three coding schemes: (1) Demographic data including past experience of using earlier technological products; (2) Social beliefs and practices related to menses and maternal health; and (3) Socio-cultural environment of participants. An affinity diagram of all the key statements was build by following the methodology suggested by [Beyer and Holtzblatt 1998]. An affinity diagram organizes key statements into a smaller set of common issues and themes. The affinity analysis also revealed some interesting contradictions; for example, a young adolescent girl and a married woman were not aware about the rational reason behind menstruation, but their beliefs were contradicting. Adolescent girls thought that menstruation “is an inside dirtiness from women which comes out every two months”. The married women thought that menstruation “is a punishment from god for past sins”.

The findings from the three coding schemes are described following:

1. The demographic findings revealed that age, economic strata, and literacy level had negligible influence on the social beliefs and health practices related to menses and maternal health. Furthermore, the socio-cultural environment of the participants was found homogenous due to the similar economic strata. The participants' main source of health information was television, radio, and word of mouth. Participants reported that any information offered through television health programs and commercials was not useful because information was not communicated in the regional language. Although radio health programs were broadcasted in regional language, due to fixed timing, participants often missed these health programs. Word of mouth was considered a common practice for obtaining health information; however, participants considered it to be unreliable. Participants' past experience of using technological products revealed that their experience was limited to operating on/off and channel functions on TV remote and DVD players. With reference to usage of mobile phone, participants reported only using call receiving and dialling functions; very few participants had the basic knowledge of typing messages or changing phone settings.

Usage:

1. Sanitary pad is not used because it is difficult to dispose.
2. Cotton clothes are easier to burn and sanitary pads cannot be disposed.
3. Only cotton clothes should be used during menses as they are sterile.

Social stigma:

4. Women who use sanitary pads are often treated as outsiders in the society as everyone uses cotton pads.
5. Issues related to menses are not openly discussed due to fear of being out-casts in the society.

Ignorance:

6. The relation between menses and motherhood
7. In rural areas, sanitary pads is not easily available.

Figure 4. Social Beliefs and Practices of Rural Women Related to Menses

2. The social beliefs and practices related to menses and maternal health revealed from the affinity diagram were calculated as frequency and have been represented as graphs (See Figures 4 and 5). Figure 4 illustrates the percentage of women (n=120), who agreed on the identified beliefs and practices concerning menses. All the identified beliefs have been grouped into three categories: (1) *Usage* involves practices and beliefs related to usage of sanitary pads during menses, and problem of disposability in rural areas; (b) *Social stigma* involves beliefs related to peer pressure to adhere with social norms and fear of being outcasts from the community; and (c) *Ignorance* involves beliefs indicating existing knowledge of women about menses and maternal health. Figure 5 illustrates the percentage of women, who agreed on the identified beliefs and practices concerning maternal health. All the identified beliefs have been grouped into three categories: (1) *Ignorance and nutrition* involves beliefs and practices about nutrition intake during the maternal period, and women's existing knowledge about maternal health; (b) *Perinatal* include beliefs and practices that are followed before, during, and after the maternal period; and (c) *(Non)-institutional delivery* include beliefs related to institutionalization of child delivery.

Ignorance and nutrition:

1. Pregnant ladies should not have milk and curd, otherwise child will be born white.
2. Pregnant ladies should not have coconut, as coconut makes head of the child very soft and porous.
3. If women have irregular periods, it means they are pregnant.

Perinatal:

4. Bathing a new born baby, will change the color of the baby.
5. If there is a delay in feeding breast milk, one should give sugar water to newborns.
6. When you start to hate the food smell, it means you are pregnant.

(non)-Institutional Delivery:

7. Delivery of children should be done at home.
8. Women prefer to go to the hospital for delivery, as there has been several cases of child death during delivery at home.
9. Out of two children, one child was born in hospital and one at home.

Figure 5. Social Beliefs and Practices of Rural Women Related to Maternal Health

3. The findings from the socio-cultural environment of participants were analyzed to understand the role of cultural characteristics on participants' perception and attitudes toward and action on menses and maternal health problems. This understanding is instrumental in facilitating technology uptake and improving design localization or the process of infusing a specific cultural context into products designed for different cultures [Carey 1998]. The findings were graphically represented as cultural model, which is a part of contextual inquiry. It reports influencers/entities which affect participants' decisions about accessing health information, their strengths, and mutual relationships. The sample cultural model depicts the socio-cultural setting of one of the participants (See Figure 6). Apart from the social beliefs reported, we also identified social challenges and community sensitive needs [Parmar et al. 2007].

Figure 6. Sample Cultural Model of the Rural Woman

The following design requirements were extracted from this study. Some requirements are exemplified in the following conversation with the participants:

1. The content presented via PHIs should offer rationally clear explanations related to the medical phenomena such as what causes menses and maternal health. *60 percent of the women did not know the relationship between menses and motherhood.* (See Figure 4.)

Interviewer: Why do you think menses occur to women?

Rural participant (US18): Menses come...*because you eat warm food.*

Interviewer: Do you know the relation between menses and maternity?

Rural participant (US18): *About relation between menses and getting pregnant, I have no idea.* I think two activities are separate, and think if you are pregnant then menses never comes (...)

Though community worker come to show health messages, but the way they show it, they don't show it properly. So it is difficult to catch up with their speed.

2. The content presented via PHIs should focus on reducing stigma related to menses and maternal health problems. *63 percent of the women do not talk about the difficulties arising from menses because of the fear of being outcasts from society.* (See Figure 4.)

Interviewer: What are the issues you are concerned about while sharing menses and maternal health problems?

Rural participant (US 67): I am concerned about my privacy and my dignity. I would never want to bring bad name to my household (...) because of publishing my health issues. *I can't afford to lose face in own family and society.*

3. The content offered via PHIs should focus on explaining good health practices related to nutritional diet and hygiene required during menses and maternity. *68 percent of the women believed pregnant women should not have curds or milk, otherwise their children would be born white.* (See Figure 5.)
4. The content offered via PHIs should persuade women to scientifically debate the existing social beliefs and practices which are traditionally being followed in order to be able to make rational decisions. *24 percent of the adolescent girls and women believed that if they use pads, other village ladies might treat them as outsiders and not as one of them, because everyone else uses cotton pads; 93 percent of the women believed that if you give a bath to a newborn baby, the color of the baby will change.* (See Figures 4 and 5.)

Focus group discussions were transcribed from local regional language to English, and key statements were extracted. The key statements were coded against three coding schemes: (1) content, (b) form and interaction of existing Health Information System (HIS), and (c) contextual factors. An affinity diagram of all the key statements was built. Findings from focus group indicated that the problem is not only the lack of health interventions by government or NGOs, but also poor information presentation, poor communication strategies, and non-persuasive approaches to disseminate information in rural areas. These findings are similar to those in a study by [Pandey et al. 2007] on information resources for poor populations, which demonstrated that weak mechanisms of accountability and poor information dissemination intervention are predominant problems in rural India. All the findings and design requirements based on the three coding schemes have been explained following.

Figure 7. Focus Group Findings Related to Content

Content

1. *Domain-specific application.* Existing HISs are focussed mainly on providing tele-care or Internet access to general health information, rather than offering any domain-specific application. As a result, rural users seldom report any substantial benefits from health information offered by HISs. This has led to an information divide between the specific information needs of the rural populace such as primary health information and what is offered in the general HIS. (n=27) participants reported absence of domain-specific content as a reason for not accessing HIS (See Figure 7).

Design requirement. There is a need for the development of simplified information content related to topics of relevance to the rural users, thus helping them in making better decisions to enhance their well being.

2. *Belief-based content.* Strong social beliefs and practices related to menses and maternal health exist among rural women (See Figures 4 and 5). These social beliefs and practices inhibit information transfer in rural areas. In the HISs currently deployed in rural areas, information offered is often adapted from the content primarily designed for urban users. Consequently, information offered in HIS does not appropriately address the existing social beliefs and health practices of rural users. (n=35) participants said they do not use HIS, because they can not understand the health information provided (See Figure 7).

Design requirement. In order to increase the usage of PHIs and thus user knowledge about health phenomena, developing content based on existing beliefs and practices of the rural populace is necessary. Traditional metaphors such as puppet shows, storytelling, or folk songs in content design, can be used to discuss the cause and effect of social beliefs and health practices on women's personal health.

3. *Content update mechanism.* Due to poor content update mechanisms, HISs deployed in rural areas have not been able to be sustained in the long term. Typically, HISs start by offering digital content related to general health issues in rural areas, such as information related to polio drops, malaria, and tuberculosis. The initial hype of HISs does persuade a large number of users to use and collect relevant information. Owing to poor content update mechanisms, however, villagers start to lose interest in HIS content because on every visit they expect to learn and gather new information. Poor content update is a consequence of dependence on content developers located in nearby urban areas. All the participants reported poor content update mechanism as a critical problem in current HISs (See Figure 7).

Design requirement. In the light of the current dependence on content developers, it is clearly necessary to train local villagers and NGOs to make them self-reliant in the updating of PHI content.

4. *Trust.* Currently, health information offered in rural areas focuses on increasing the awareness of health issues such as HIV-AIDs, malaria, and cancer. The information which can be used to improve their health condition is often well received. However, when the information offered requires rural users to make a change in their thought process or daily practices, it is neither well received nor trusted. (n=30) participants indicated lack of trust as one of the reason for not accessing HISs for personal health issues (See Figure 7).

Design requirement. The information offered should include some local success stories about how a particular piece of information can positively make a change to their daily lives, or improve their health, in order to increase user trust.

Form and Interaction

1. *Multiple user interaction.* Since rural villages in India are a complex arrangement of community-based societies [Raj 2005], actions and decisions related to social change are taken mostly at community or group level. It is therefore necessary to educate communities as a whole toward a better understanding of primary health-related issues and related basic preventative measures. Our findings reveal that due to close physical environment and limited screen size, the current health intervention offers limited opportunities for the dissemination of information to multiple users. There is little evidence of HISs which address women's health related issues or stimulates group participation among village women during interaction. (n=38) participant indicated the need for multi-user interaction in accessing health information (See Figure 8).

Design requirement. Introducing strategies which involve group participation by women could amplify their exposure to new healthcare developments. Group participation may offer the opportunity to display individual skill sets in front of other village women, which could strengthen their intra-personal trust. In this context, there is a need for the design of PHIs flexible enough to support multiple user interaction.

Figure 8. Focus Group Findings Related to Form and Interaction

2. *Privacy.* Due to existing social norms, there is low privacy related to accessing and sharing personal health issues. In rural India, privacy is curtailed by the fact that interaction in public or even private places is often subject to external observation and intervention. This makes women hesitant to discuss personal health issues with each other and even health workers. Our findings indicate that the interaction between user and health worker seldom offers the necessary privacy for sharing primary and personal health problems. Many adolescent girls reported that sharing menses-related issues would not have been so painful and disturbing if they had prior knowledge or private space to share information. A study in Rajasthan of 800 adolescent girls found that most of the girls were frightened, embarrassed, and disturbed as a consequence of ignorance and stigma about menses

[Khanna et al, 2005]. (n=32) participants pointed out lack of privacy as one of the inhibiting factors for women in accessing and sharing personal health problems (See Figure 8).

Design requirement. In the light of the privacy issue, PHIs should ensure privacy while users receive information related to primary health and, at the same time, should offer the flexibility of sharing information at community level.

3. *Simplified interfaces.* Due to low literacy levels in rural India, the user's ability to access and comprehend the given information is limited. By low literacy level, we mean that the user has the ability to read regional content but not write and has a low level of technology usage exposure. Most current HISs deploy personal computers as a device for accessing information [Bailur 2007; James 2005; Cecchini and Raina 2004]. Interacting with these set-ups requires a reasonably well-developed level of computer literacy, so they are currently operated by dedicated operators who are computer literate and can assist illiterate and semi-literate users to access the information. This dependence on the operators is another inhibiting factor restricting the usage of HISs and thus hindering information transfer. (n=38) participant highlighted the need for simplified interface for accessing health information (See Figure 8).

Design requirement: Customized interaction with simple audio video interfaces which can be used by (semi)-illiterate users, thus making them self-reliant in accessing the information.

Figure 9. Focus Group Findings Related to Contextual Factors

Contextual Factors

1. *Socio-cultural.* The current social setting in rural area involves social norms that have to be followed by every individual of the community [Raj 2005]. For instance, there are certain social beliefs and practices related to personal health which continue to be followed despite the government interventions. Women with personal hygiene issues often do not seek treatment due to existing self- and society-created stigmatization. For fear of embarrassment, women hesitate to discuss their personal health problems [Bang and Bang 1989; Nandini 2000]. Furthermore, due to superstition, women are not allowed to visit holy places during their menstrual periods. As a consequence of lack of exposure, many women think that menstruation is a punishment for sin [Deo and Ghattargi 2005]. Many users followed nutritional-related beliefs and were ignorant about medications required by a pregnant woman. In extreme circumstances, they seek treatment from local quacks who are not scientifically qualified. These socio-cultural factors have been inhibiting information transfer in the rural context. It is necessary to include these factors in the design of PHIs. (n=38) participants pointed out the need to include socio-cultural issues in the design process of PHIs (See Figure 9).

Design requirement. The design of the PHIs at the content, form, and interaction level should consider existing social beliefs and cultural norms. Thus the design of the system should be able to persuade the users to access the information and motivate them to apply it in their daily life.

2. *Technology.* Existing health interventions are often based on technologies not readily available in rural areas. For instance, handheld devices offering distance diagnostics require Wi-Fi connectivity or dedicated telephone lines to transfer patient data. These are still not easily available in rural areas. In terms of electricity, on average there are power cuts of six to eight hours per day [Sood 2003], implying that usage of HIS is restricted to half a day. Despite the above limitations, it is possible to design sustainable PHIs which can use resources available in the rural context. For instance, solar-driven design could address the electricity shortage problem. (n=25)

participants believed inappropriate selection of technology to be one of the reason for non-sustainability of existing HISs.

Design requirement. The software and hardware for PHIs should be simple to maintain, easily available, and economical. Dependence on internet-based applications should be minimal because of low bandwidth and poor connectivity. Offline content dissemination should be encouraged. With only brief training, local operators should be able to operate the system.

3. *User past ICT experiences.* The findings reveal that the rural users have limited exposure in using ICT devices. The only major exposure to such use is a public telephone, also known as PCO, or, to some extent, the mobile phone. In particular, the participants experience was limited to on/off and channel shifting keys of a TV remote. We found that, the participants were quite happy with their skills, and had no intention to learn about other functions provided in the remote. Few participants owned DVD players but were dependent on their children, especially sons, to operate them. This implies that, information system design with minimal steps to access information is needed, so that the learning curve to operate information systems for rural women is minimal. The weak position of rural women in the community and the closed mindset of village men in rural communities results in low technology exposure of the rural women. Thus, when given an opportunity to use HISs, the rural women are wary and unable to see added value to their daily life. Furthermore, the high-end environment of current ICT set-ups and required operating skills also creates a class boundary and inhibits them from using the system. (n=35) reported that, new health information system should be easy to use, without having to learn complex operating skills (See Figure 9).

Design requirement. The design of user interaction at physical and content level should consider user technology exposure and past ICT experience, because they may provide critical design cues for designing the system interaction.

4. *Economic.* As a consequence of poor economic models, existing health interventions are unsustainable [Jain et al. 2008]. Economic models used should involve mechanisms to sustain operators for the long term, and generate enough revenue to maintain and earn profit for all stakeholders. Due to low usage and lack of an optimal revenue generating model current health interventions have not been able to generate profit. PHIs need to be economically sustainable in terms of hiring human resources, creating and monitoring relevant information content, electricity, connectivity, and space. The responsibility for financing and running the set-up needs to be distributed at various levels to the involved stakeholders. For the set-up to be locally sustainable, hiring and training local village women is necessary. Economic sustainability, although an important research area, is beyond the scope of this paper.

V. DESIGN OF PHIS

This section addresses the second challenge, how to apply persuasive technology to shape existing social beliefs, thus positively persuading rural users to change their health behaviour and practices. This section is part of the second phase (creative design research) of the design process cycle. The findings from Study 1 revealed the design requirements for the PHIs. Table 1 depicts how the social cues from the functional triad framework of persuasive technology have been applied to the search for design solutions for each design requirements. The design process of PHIs amalgamates computer roles as a tool, medium, and social actor to create a persuasive interactive experience for the rural users to change their social beliefs. Applying more than a single tool or strategy to achieve effective persuasion has been recommended in persuasive literature [Fogg 2003]

Components of the PHIS

The PHI is designed to offer personal health information related to maternal health and menses to rural women and was developed to help them to positively shape their existing health behaviour and increase their perceived behavioural control in the face of social beliefs (See Figure 10).

Physical and Technical Set-Up

The system set-up includes a 21-inch monitor, a customised icon-based keyboard with hot keys, and a trackball. The information is presented using audio-visual aids in the local language using Microsoft PowerPoint, which can be accessed via the iconic keyboard. PowerPoint software was selected for information presentation due to its flexible and simple interface [Lin and Lee 2007]. PowerPoint was also selected because the content had to be easily updatable by the local PHI operators. Three community health workers with the knowledge of Microsoft Office were trained and appointed as operators. They were responsible for providing assistance to rural women in interactive sessions, and regularly updating the PHI content. The PHIs is physically located in the community hall at a pilot village site in western India.

Table 1. The Relation between Design Requirements, Applied Persuasive Technology and Design Solution of the Persuasive Health Information System

Design requirements	Application of social cues of persuasive technology	Design solutions
Content		
1. Should explain medical phenomena	Psychological cues Language cues	1. The content offers phenomena information related to menses and maternal health.
2. Should reduce stigma related to menses and maternal health problems	Psychological cues	2. The stigma is reduced by provision of a specific space for women to interact and discuss personal issues.
3. Should explain good health practices	Psychological cues Language cues	3. The content shows the benefits of following good health practices by including advice from local health experts and village leaders.
4. Should persuade women to scientifically debate existing social beliefs and practices	Psychological cues Social dynamic cues Social role cues	4. The content integrates arguments challenging the social beliefs.
5. Should present simplified information	Language cues	5. The critical information is divided into six main categories to reduce the information overload and provide choices
6. Should communicate health information through traditional metaphors	Language cues Psychological cues	6. The content is communicated using the following traditional techniques: puppet shows, storytelling, and folk songs.
7. Should train local Villagers and NGOs to update content	Psychological cues	7. Local women and NGOs have been trained to update and maintain the system.
8. Should include local success stories	Social roles	8. The content is constantly updated by inclusion of success stories from neighbouring villages.
Form/Interaction		
9. The system design should support the traditional communication behaviour prevalent in rural communities. It should offer the opportunity of multiple user interaction and participation.	Physical cues Social role Social dynamic Psychological clues	9. The system interacts and supports the traditional squatting position of Indian women. It allows multiple user interaction simultaneously.
10. The system should offer the opportunity of sharing private information.	Psychological cues	10. Physical setting of the system offers the flexibility to share information both in isolation and in community.
11. The system should address the user interaction needs of (semi)-illiterate users to make them self-reliant.	Psychological cues Language cue	11. Audio-visual aids and customized graphical interface (keyboard) are used to support user interaction for (semi)-literate users.
Contextual factors		
12. The system interaction/content should support existing social beliefs and cultural norms.	Psychological cues Social role Social dynamics	12. The system includes social beliefs and cultural norms at content and in the physical design.
13. The software and hardware should be simple to maintain, easily available, and economical.	Language cues	13. PowerPoint software has been used to present information in local regional language as it allows easy content update.
14. The design of user interaction at physical and content level should consider user technology exposure and past ICT experience.	Social dynamic Social role	14. The graphical keyboard of the system, incorporates push button iconic keys, which are easily understood by the users.

Content

The PHIs offered domain-specific content related to personal health problems concerning menses and maternal health for rural women. Belief-based content was developed on the basis of social beliefs and practices identified from the contextual inquiry and focus group sessions. This content was verified by the local doctors and community health workers and was stored in two different folders each consisting of information related to menses and maternal health. The information was represented in audio-visual format in the form of a PowerPoint presentation. The regional language was used to display the content.

Interaction

A customized keyboard with 10 keys, four navigation and six information, was designed (See Figure 10). Next to each input key, icons were designed on a white card sheet to assist rural women to understand the function of the relevant key. Separate card sheets carried icons for two topics: menses and maternal health. The participant had to select the appropriate topic card and place it on the keyboard keys. Card sheets for other topics can also be made, making it a modular approach. A simplified interface at physical and software level enabled users to access information from the PHIs on their own after their first session. In order to take into consideration the existing community mind-set of rural women, the physical form of PHIs was designed to cater for group- and individual-level interaction. Issues related to economy sustainability are relevant but because of the pilot nature of the PHIs, no economic model has been followed in the current research.

Figure 10. Physical Design of PHIs and Description of Each Input Key

Persuasive Strategies Employed in the PHI Design Process

The six information keys of the keyboard are linked to the PowerPoint slideshows which include multiple levels of information related to maternal health and menses. Table 2 depicts six information categories and corresponding social cues [Fogg 2003] employed in the design of information content and physical form of the PHIs. The social cues in the context of PHI design are explained following:

1. *Physical cues**. Computing products can convey social presence through physical cues such as eyes, mouth, movement, and other physical attributes. In the PHIs, this is conveyed with two design strategies: Floor placement of the PHI system and adaptation of village persona in the information presentation. First, the PHIs physical attribute of low physical height allows women to sit cross-legged on the floor to interact with it. This sitting position is culturally acceptable among rural women as a standard posture for social interaction and thus persuades them to sit comfortably for extended period. If the users had to stand for accessing health information, then it may not have persuaded them to use PHIs for extended period. Additionally, when the PHIs is placed on the floor at the same

level as the users, this gives the PHI system the social presence of a socially equal being, rather than a system which is beyond their social reach. This persuades them to interact with the system without any inhibitions. Second, the presentations include three local village personas, which also persuades the women to connect easily with the PHIs and openly talk about their health problems.

Table 2. Persuasive Cues Applied in Each Functional Key

PHI components	Persuasion strategies employed in the PHI
Key 1: Information about menses and maternal health	Psychological clues*, language*, storytelling technique, audio-visual feedback in presentation
Key 2: Information about problems related to menses and maternal health	Graphics depicting worst health condition of a women during maternal health, storytelling technique, audio-visual feedback in presentation, language, psychological clues
Key 3: Good practices related to menses and maternal health	Storytelling technique, audio-visual feedback in presentation, language, psychological clues
Key 4: Information about women in developed countries or urban areas dealing with similar problems	Storytelling technique, audio-visual feedback in presentation, language, psychological clues
Key 5: Health-related videos and relevant cases	Social roles*, using traditional folk songs, puppet shows, story telling technique, audio-visual feedback in presentation, language, psychological clues
Key 6: Video recorded advice of local health expert and leaders to motivate women	Social roles, storytelling technique, audio-visual feedback in presentation
Physical form	
PHIs form design and environment	Social dynamics*, physical*, social role*

2. *Psychological cues**. Computing products can lead people to infer, often subconsciously, that the product has emotions, preferences, motivations, and personality. In the PowerPoint slides, three animated personae representing local identities were used to convey relevant messages. These personae were representative of the main characters found in the village community. These included (a) a persona of teenage girl for discussing menses issues; (b) a persona of a married woman for discussing maternal issues; and (c) a persona of a doctor for answering the queries. Traditional folk music and puppet shows were used to convey the stories woven around the personas. In all six categories, the three personae presented existing beliefs through cases and rationally discussed their effects. As a consequence of similarity to the persona's identity, the rural women could emotionally relate to beliefs and problems being discussed and were persuaded to discuss beliefs in the interactive sessions.

3. *Language cues **. Computing products can also use written or spoken language to convey social presence and to persuade. In the PHIs, during interactive sessions, each section of information concluded with a provocative message which persuaded rural women to press the next input key and access additional information. A critical issue of varied literacy level was addressed by offering health information in the local regional language and using local graphics and personae.

4. *Social dynamic cues **. Most cultures have set patterns for how people interact with each other such as rituals for meeting people, taking turns, or forming lines. These rituals indicate the social dynamics. In the PHIs design process, current patterns of accessing information in public or private places, rituals of meeting people and community sensitive needs of rural users were considered. The PHIs physical design offers flexibility for individual or group- based interaction with rural women. Inviting women in groups includes family members, for example, sisters-in-law, mothers-in-law, and best friends. This led to interesting discussions during interactive sessions.

5. *Social role cues **. Just as humans play authority roles, so can computers. When they do, they gain the automatic influence that comes with being in a position of authority. In rural areas, local doctors and village leaders are seen as influential people. In the PHIs, recorded video speech of these authorities is shown to persuade rural women to follow healthy practices during menses and with regard to maternal health, thus, making PHIs authoritative and trustworthy.

VI. STUDY 2: COMPARATIVE STUDY BETWEEN PHIS AND NGO HEALTH SYSTEM

Study 2 was conducted in two stages: Stage 1(comparative study) - A comparative study was conducted after two months of PHIs deployment to measure the level of user engagement with the PHIs in comparison with the local NGO-governed health information system. Stage 2 (follow-up study) - In order to understand the design effectiveness of the proposed PHIs, a follow-up study was conducted after four months of PHIs deployment to ascertain if the knowledge gained was actually being implemented in daily practice. The follow-up study was conducted only for the PHIs. It is important to mention that the follow-up study could not be conducted with participants from NGO-governed system, because the permission to conduct the study was not granted by the NGO management committee.

Stage 1: Comparative Study

Participants

An equal number of adolescent girls, married women, and older women participated in the study (n=100). The age of the participants ranged between 12 to 60 years, and they belonged to similar economic strata (daily wage farmland workers or local vegetable shop owners). All the adolescent girls and women under age 40 had primary education (could read and write local language), and the rest of the participants were illiterate (could only converse in local language).

Method

Five pilot sessions were conducted before finalizing the comparative study setting. This was done to ensure similar experimental/social setting for conducting the final study with both the systems. The comparative study was conducted in controlled settings in two villages (A & B) located in western India. The study was conducted after two months of deployment of PHIs. In village A, semi-literate and illiterate rural women (n=50) were shown health information related to issues such as menses and maternal health, AIDs, malaria, and cancer on an NGO-based health information system. The system was located in a separate room in NGO office building. See Figure 11. This was a typical PC-based set-up with a 21-inch monitor and a standard keyboard placed on a table for regular usage. In village B, the information related to menses and maternal health were shown to (n=50) semi-literate and illiterate rural women through the proposed PHIs (See Figure 12). The PHIs was placed in a pilot village community hall. The design description of PHIs can be seen in Section V.

The study was conducted in both the villages by a single team consisting of three people which included the designer, a health worker, and a locally trained operator. The health worker was a neutral entity responsible to monitor the experimental setting against personal biases. The health worker was also responsible for inviting participants for an interactive session. Both the systems were placed in rooms of similar sizes in village A and B, and the participants were invited in groups of five to interact with the systems. This means in a each session five women were allowed in the room. At each time, one participant was allowed to access the information and others were asked to observe. This experimental setting allowed a similar social setting to access the health-related information. Each participant was asked to access information related to menses and maternal health and were given 15 minutes to interact with the system. They were also asked to make mental notes of any particular issue they came across and could discuss after the session. Locally trained operators assisted women in operating the systems when needed. When the five participants had completed their tasks, they were given the opportunity to discuss and ask questions. Trained operators collected feedback from the participants at two levels: first, content relevance and ability to recall content shown during the interactive session and second, physical design and ease of use.

Measurement Criteria for the Study

According to the theory of planned behaviour, measuring engagement is one of the critical indicators in predicting whether the applied intervention has succeeded in shaping the behaviour [Ajzen and Manstead 2007]. A study by Ajzen and Manstead [2007] suggests that lasting belief change depends, to an important degree, on the mental engagement of the audience. As suggested in the theory of planned behaviour, two indicators were selected to measure user engagement with the PHIs: (a) number of questions asked by the rural women during and after an interactive session was considered relevant in determining the impact of the new information. Questions asked by the rural women denoted their inquisitiveness to know more about primary health and their ability to challenge the existing beliefs and practices; (b) number of re-visits made by the rural woman were taken as an indicator of interest in learning more about menses and maternal health. The re-visits were documented by the trained PHIs operator. Questions asked by the participants were later categorized using the affinity technique [Beyer and Holtzblatt 1998]. The following six categories were identified: questions related to existing health practices and social beliefs, questions challenging existing beliefs, data addition to PHIs, personal questions requiring privacy, and non-health-related questions.

Figure 11. Woman Using NGO-Based Health Information System in Village A

Figure 12. Depicts Women Using PHIs in Village B

Results

The results from the comparative study of the two systems show that the participants from Village B who interacted with the PHIs were persuaded to confront the social issues twice as much as participants from NGO system in village A. The higher persuasion among participants may be attributed to applied social cues of persuasive technology in the design of form, content and interaction of the PHIs. In particular, the design of PHIs offered flexibility to sit together on floor in a culturally familiar sitting arrangement and discuss health issues. The customized form of PHIs and belief-based content persuaded users to easily access, understand, and actively participate in the interactive sessions. The NGO system in village A did not present content in a way that was easily accessible to the semi-literate and literate users. In addition, the users found it extremely difficult to access the information via the traditional keyboard. Participants' engagement with the system was measured by two indicators; first, the number and type of questions asked in the interaction session (See Figure 13). Second, number of re-visits to the health system by the participants (See Table 3). Both the figure and table are explained following:

1. *Challenging social beliefs:* Twice the number of questions related to practices and challenging existing beliefs came from the participants interacting with PHIs ($n=33/50$) as from NGO system ($n=16/50$). This difference may be attributed to the design of the PHIs, at content, form and interaction level and included social cues from persuasive technology (psychological, physical, language, social dynamics, and social role). In particular the strategy of including belief-based health information content and communicating it through psychological cues motivated participants to openly discuss and argue existing beliefs and practices during the session. As observed in one of the arguments during the sessions "...one pregnant daughter-in-law argued with her mother-in-law about the restriction on drinking milk and eating curd during pregnancy. Further she also asked her mother-in-law as to why for all these years this restriction was followed when it is

actually very healthy.” In the NGO system, the information content was not based on existing social beliefs. Therefore, participants were not persuaded to challenge existing social beliefs.

2. *Questions related to the phenomenon:* The participants interacting with PHIs asked more questions related to medical phenomenon about menses and maternity (n=26/50) in comparison to the NGO system (n=12/50). This difference may be attributed to information categorisation in PHIs which offered focused information on menses and maternal health. This categorization reduced cognitive load on the participants, as they did not have to navigate to general medical information. In NGO system, the participants had to browse through general medical information in order to access the information related to menses and maternal health.
3. *General health-related questions:* The number of questions related to general health issues were higher among participants interacting with PHIs (n=30/50) in comparison to NGO system (n=16/50). The participants interacting with PHIs reported that “...because we have learned about menses and maternal health phenomena, we are curious to learn about other health issues.” This implies that PHIs was able to persuade participants to learn about general health issues.
4. *Questions related to individual health cases:* The number of questions related to individual health cases were higher among participants interacting with PHIs (n=21/50) in comparison to NGO system (n=13/50). This may be attributed to application of social cues at content, form and interaction level, which offered conducive environment to participants to talk about any health problem in addition to menses and maternal health. This implies that, social barrier and inhibiting factors about not sharing health problems was addressed by persuasive interactive experience of PHIs.
5. *Re-visits of participants:* Participants (n=36/ 50) re-visited the PHIs after their first session, whereas, only (n=17/50) participants re-visited the NGO system. The findings show that, participants using NGO system found the information offered partly relevant but, due to the lack of a suitable environment to discuss personal health issues, participants could not understand the information provided. As one of the participants said “....In the NGO system there was too much information and I did not know the way to access it; it confused me, so why should I use it again?” The flexibility to sit together comfortably on floor in a culturally familiar sitting arrangement to discuss health issues and psychological cues for communicating health information persuaded participants to re-visit PHIs to access relevant health information. As one of the participants said “...visiting PHIs is like visiting a friends place and I feel comfortable in discussing my private health issues...”

Categories of questions asked by the participants:

1. Questions challenging social beliefs and practices
2. Questions related to phenomena of menses and maternity
3. Questions related to other health related questions
4. Questions related to personal health cases

Figure 13. Categories of the Questions Asked by the Participants

Table 3. Number of Re-Visits by the Participants to Health Information Systems

Village A (n=50 rural women), N(%)	Village B (n=50 rural women), N(%)
17(34)	36(72)

Stage 2: Follow-Up Study with Users of the PHIS

Participants

After four months of the comparative study, a follow-up study was conducted with the same participants of the PHIs. (n=50) as in stage 1 comparative study.

Method

The purpose of the study was to ascertain if the knowledge gained from the PHIs was actually being implemented in their daily practices of the users. The follow-up study was conducted by the same health worker, who was also present during the comparative study. The health worker was a neutral entity responsible to conduct the interview sessions to avoid personal biases. The industrial designer and trained operator did not participate in the follow-up study to avoid possible influences. The follow-up interview sessions were conducted by the health worker by visiting the residence of each participant. The interviews included questions to judge the participants knowledge about menses and maternal health, and changes in their health practices.

Results

The purpose of qualitative results provided in this section is to share preliminary results after a total of six months of PHIs deployment. The participants found the PHIs persuasive and found interacting with the PHIs to be a positive experience. They found the content relevant and the opportunity to challenge the existing beliefs in a personal space very useful. In particular, the flexibility to come in groups persuaded them to use the PHIs as it made it a group event. This is very similar to the social behaviour of rural women, where they do several tasks together, such as going to markets and fairs, buying vegetables, and fetching drinking water. This group interaction opportunity persuaded them to interact with the system and shed their general inhibitions about discussing personal health issues. An increased awareness and behaviour change among the PHIs participants was observed in their daily practices:

1. Adolescent girls and women experienced stigma about disposing of the menstrual cloth. After the session with the PHIs, they learned about the possibility of burning the used cloth in their backyard. It was observed that (n=12/50) participants have started following this new practice.
2. During menses the women and adolescent girls only bathed once a day, but after the interaction with PHIs, (n=18/50) women have started taking baths twice a day to maintain personal hygiene.
3. In Study 1, 61 percent of the participants did not know the relation between menses and motherhood. After interaction with the PHIs all the (n=50/50) participants knew the relation between menses and motherhood. The criteria for assessment was to judge participants knowledge about the relation between ovulation and conception.
4. The finding from Study 1 indicated 68 percent participants did not believe in drinking milk or curd. After interaction with the PHIs, (n=4/50) pregnant women participants fought with their mothers-in-law to change the existing belief and insisted on drinking milk and curd because they saw on the PHIs that milk and curd are good sources of protein.
5. In study 1, 62 percent of the users firmly believed that child delivery should be done at home. After interaction with the PHIs, almost all the married women agreed that the hospital is the best place for child delivery and (n=26/50) made efforts to get enrolled at the hospital.
6. Earlier cloth was stored in an unhygienic place and was not sun dried in the open because women did not see menstruation as a common biological process, which happens to every woman in the world. After the interaction with the PHIs, (n=23/50) participants reported changing the cotton cloth after every two months and sun-drying it to sterilize it.

VII. DISCUSSION AND CONCLUSION

Lack of appropriate information transfer mechanisms which do not take into consideration the orthodox socio-cultural norms related to personal health of women have resulted in serious implications for rural women's reproductive and sexual health [Sivaramakrishnan and Patel 1993; Spector 1995; Heeks 2002]. To bridge the information gap that exists between the rural women and required critical primary health information, this paper has contributed by developing a PHIs based on social cues of persuasive technology in rural setting. The design process amalgamates

the theory of planned behaviour and persuasive technology, allowing the designer to understand social norms and practices related to personal health of rural women and apply social cues to address those beliefs via the content, form, and interaction of the PHIs. Although the existing government and NGO-governed health information system have been designed to change health practices of users in rural areas, they have a long time span for shaping social beliefs and health practices as reported by four local community doctors. By applying social cues of persuasive technology in designing PHIs in rural India, results of the study demonstrate that persuasive components at content, form, and interaction level could accelerate the process of shaping health behaviour of rural women to improve their health practices in their daily life. The PHIs design demonstrates how using computer systems as a tool, medium and social actor can remove social stigma related to sensitive health issues and improve health information dissemination. The paper demonstrates a case of PHIs system which has been developed and tested in the rural setting.

It is acknowledged that conducting experiments in the field with real users in the real world does have certain limitations and not all variable can be controlled as in a controlled lab experiment. The limitations can be understood in terms of addressing dynamic contextual variables such as, taking into accounts external influences in the physical setting of both the system and conducting follow up observations in participants home setting to check the change in health practices. We hope to overcome these limitations in our follow up longitudinal study.

Based on the field studies, the following design guidelines are proposed for health practitioners, ICT developers and the industrial design community in the development not only of health information system but also for use in other domains such as agriculture, education and e-government.

Multidisciplinary Approach to Support PHIS Design

The design process applied in PHIs integrates theories from relevant scientific disciplines such as social sciences and computer science to support the user-centered development process. Until now, both the theories have been widely implemented in the western world to change an individual health behaviour, but examples using both the theories in the rural context and shaping behaviour at a community level are rare. This study successfully applied the theories to design PHIs in the rural context to improve information transfer and shape social beliefs. Based on our experience, we recommend integration of different theories in the design of healthcare interventions to solve social complex problems in rural contexts. In particular, the theory of planned behaviour assisted our understanding of the overall psychology of current health behaviour and persuasive technology contributed to motivating users by increasing engagement of the users through the PHIs. Amalgamation of multidisciplinary theories will eventually lead to a culturally sensitive ICT development.

The domain of social psychology helps in investigating social norms and behaviour prevalent in society which restrict information transfer within rural communities. Once this is understood, persuasive technology can be used to assist in positively shaping social norms and behaviours. Although the theory of planned behaviour offers insights related to behavioural, normative, and control beliefs of users, it lacks explanation about how to increase user intentions to change their health behaviour [Ajzen and Manstead 2007]. Study 2 confirms our proposition that applying the social cues of persuasive technology in the design of content, form and interaction of the system can increase perceived behaviour control and lead to a strong intention to change irrational health practices.

Pandey et al. [2007] conducted a clustered randomized trial in rural India to inform resource-poor populations about entitlement to health services. Their study included conducting four-to-six public meetings in each intervention village to disseminate information on free health services, free education services, and village governance requirement. Their results indicate that while offering information definitely increases user awareness about health services, it does not persuade users to shape their existing social beliefs and irrational health practices. On the basis of our field findings, we conclude that incorporation of persuasive cues in the design of the PHIs can increase user awareness about the entitled health services and, at the same time, persuade them to shape social beliefs and change unsafe health practices.

Persuasive Cues to Design the Information Content, Form and Interaction of the PHIS

The persuasive cues applied in designing PHIs at content, form and interaction level were based on social norms and culture prevalent in rural communities, which shape social beliefs and practices of rural women. Physiological and language cues [Fogg 2003] such as videos of traditional storytelling techniques, puppet shows, and folk songs were incorporated in the content to communicate sensitive health issues to women in local language. The content presented via PHIs also included personae from daily life and the medical issues found to be predominant in our study. This not only motivated the rural women to identify with the local personae and relate to the problems but also to feel persuaded to change their existing health practices.

Our results indicate that the application of physical cues [Fogg., 2003] to the physical set-up of the PHIs encouraged the rural women to sit and access the content for extended periods. It also offered the required private space to discuss personal health issues, while in the NGO-based system both accessing and understanding content were found to be difficult. During interactive sessions, social dynamics and social role cues [Fogg 2003] such as multiple-user interaction and group participation, persuaded women to discuss and openly argue about existing social beliefs and practices. We recommend that design should take into consideration the local metaphors and traditional techniques which are popular in rural contexts for disseminating information. An example of the application of traditional metaphors to the design of a tangible user interface for PHIs in order to increase social interaction can be seen in our recent study [Parmar et al. 2009].

Disseminating Content Based on Social Norms

Existing social beliefs, practices, and lack of awareness about menses and maternal health issues cause personal health problems such as RTIs among adolescent girls, birth of undernourished children, and high risk of death for pregnant women. These social beliefs are inhibiting the information transfer in rural areas. Recent studies have identified various misconceptions related to menses and maternal health in rural India or urban slums, but, apart from suggesting that these beliefs should be changed in order to improve women's well being, they have not indicated any direction for ICT developers and health practitioners in the design of health interventions. Although a wealth of knowledge related to social norms and health practices is available in the field of social sciences, health psychology, and anthropology, there is little evidence demonstrating its use in designing health intervention. Consequently, ICT developers and health practitioners continue to develop health interventions which are only partially useful to their rural users [Heeks 2005; Byrne and Sahay 2007; Lucas 2008]. In order to improve the information transfer between rural women and critical health information, our study first identified the origins of the beliefs and practices of rural women, then used this knowledge to design information content of the PHIs to shape the health-related social beliefs of the rural women. This implies that future ICT development should, besides understanding the social beliefs and attitudes of the target user group, incorporate them in the design of information content and physical environment.

Rural Users as Content Developers

The comparative engagement study between the PHIs and the NGO system demonstrates the relevance of involving rural users in the initial design phase to develop the content. In the NGO system, the rural users were not involved in developing the design requirements or the content of the system. Our results indicate that, as a consequence, the information offered in the NGO system was not found relevant and the women did not see any value addition to their daily health practices. From the findings, we can also conclude that involving rural users in exchanging requirements while developing the PHIs is critical for the acceptance of the system. In addition to rural users, the involvement of the stakeholder in providing, verifying, and updating the content is recommended.

ACKNOWLEDGEMENT

We are thankful to Mrs. Ashis Jalote-Parmar for her critical feedback on the paper. Inputs from Gram Sewa Trust, Centre of Social Studies, and CHETNA have been helpful in updating the content of the PHIs. This research is partially funded by the Smart Surrounding project from the Industrial Design Department, Delft University of Technology.

REFERENCES

- Ajzen, I. (1991). "The Theory of Planned Behaviour," *Organizational Behaviour and the Human Decision Process* 50, pp.179-211.
- Ajzen, I. and M. Fishbein. (2005). "The Influence of Attitude on Behaviour," in *Handbook of Attitudes and Attitude Change: Basic Principles*, D. Albarracin, D. Johnson, and M. P. Zanna (eds.) Lawrence Erlbaum Associates: Mahwah, pp. 173-221.
- Ajzen, I. and A. S. R. Manstead. (2007). "Health-Related Behaviours: An Approach Based on the Theory of Planned Behaviour," in M. Hewstone et al. (eds.) *The Scope of Social Psychology: Theory and Applications*, Hove:, Psychology Press, pp. 43-63.
- Angeli, A. D., et al. (2003). "Introducing ATMs in India: A Contextual Inquiry," *Interacting with Computers* 16(244), pp. 29-44.
- Bang, M., C. Torstensson and C. Katzeff. (2006). "The PowerHouse: A Persuasive Computer Game Designed to Raise Awareness of Domestic Energy Consumption," in W. Ijsselstein et al. (eds.) *Persuasive 2006*, Springer Verlag Berlin Heidelberg, pp. 123-132.

- Bang, R., and A. Bang. (1989). "A Community Study of Gynecological Diseases in Indian Villages," in Zeidenstein and Moore (eds.) *Learning about Sexuality: A Practical Beginning*, New York, Population Council, pp. 223-237.
- Beyer, H. and K. Holtzblatt. (1998). *Contextual Design: Defining Customer-Centred System*, San Francisco, Morgan Kaufmann.
- Bharat, S. (2001). "India: HIV and AIDS-Related Discrimination, Stigmatization and Denial", *UN AIDS Best Practice* collection.
- Brewer, E., M. Demmer, B. Du, M. Ho, M. Kam and S. Nedeveschi. (2005). "The Case for Technology in Developing Regions," *IEEE Computer Society* 6 (38), pp. 25-38.
- Byrne, E. and S. Sahay. (2007). "Participatory Design for Social Development: A South African Case Study on Community-Based Health Information Systems," *Information Technology for Development* 13(1), pp. 71-94.
- Bailur, S. (2007). "The Complexities of Community Participation in ICT for Development Projects: The Case of Our Voices," in proceedings of Ninth International Conference on Social Implications of Computers in Developing Countries, Sao Paulo, Brazil.
- Cecchini, S. and M. Raina. (2004). "Electronic Government and the Rural Poor: The Case of Gyandoot," *Information Technology and International Development* 2(2), pp. 65-75.
- Carey, J. M. (1998). "Creating Global Software: A Conspectus and Review," *Interacting with Computers* (9), pp. 449-465.
- Deo, D. S. and C. H. Ghattargi. (2005). "Perception and Practices Regarding Menstruation: A Comparative Study in Urban and Rural Adolescent Girls," *Indian Journal of Community Medicines* 30 (Jan- March).
- Deodhar, N. S. (2000). "What Went Wrong with Public Health in India?" *Journal of Health and Population in Developing Countries* (3)1, pp. 91-98.
- Deccan Chronicle. (2007). "A Mother Dies every 7 minutes," <http://www.global-sisterhood-network.org/content/view/1594/59/> (Feb 5th, 2009).
- Fishbein, M. and I. Ajzen. (1975). *Belief, Attitude, Intention and Behaviour: An Introduction to Theory and Research*, Reading, MA: Addison-Wesley.
- Fogg, B. J. (2003). *Persuasive Technology: Using Computers to Change What We Think and Do*, San Francisco, Morgan Kaufmann Publishers.
- Gragnotati, M., M. Shekar, M. D. Gupta, C. Bredenkamp and Y.-K. Lee. (2005). "India's Undernourished Children: A Call for Reform and Action," *Health, Nutrition and Population (HNP)*, World Bank.
- Heeks, R. (2002). "Information Systems and Developing Countries: Failure, Success, and Local Improvisation," *The Information Society* (18)2, pp. 101-112.
- Heeks, R. (2005). "ICTs and the MDGs: On the Wrong Track?" *Information for Development* (3)3, pp. 9-12.
- Jiva. (2005). "TeleDoc: Sustainable Healthcare for Rural India," www.jiva.com/health/teledoc.asp (April 20th, 2005).
- James, J. (2005). "The Global Digital Divide in the Internet: Developed Countries Constructs and Third World Realities," *Journal of Information Science* 31(2), pp. 114-123.
- Jain, R., et al. (2008). "Two Mutually Reinforcing Applications of ICT for Socio-Economic Development of India," in *ICTs and Indian Social Change: Diffusion, Poverty, Governance*, A. Saith, M. Vijayabaskar, and V. Gayathri, (eds.) SAGE: New Delhi. pp. 93-112.
- Khanna, A., R. S. Goyal, and R. Bhavsar. (2005). "Menstrual Practices and Reproductive Problems: A Study of Adolescent Girls in Rajasthan," *Journal of Health Management* (7)1, pp. 91-107.
- Kumar, R. and A. Jhunjunwala. (2002). "Taking Internet to Village: A Case Study of Project at Madurai Region," Submitted to United Nations Centre for Regional Development, Madras, n-Logue Communications Pvt. Ltd.
- Lin, L.-C. and W. O. Lee. (2007). "UI Toolkit for Non-Designers in the Enterprise Applications Industry," in *ACM CHI* 2007, San Jose, California, USA, pp. 1795-1803.
- Lucas, H. (2008). "Information and Communications Technology for Future Health Systems in Developing Countries," *Social Science & Medicine* (66), pp. 2122-2132.

- Nandini, O. (2000). "A Decade of Research on Reproductive Tract Infections and other Gynecological Morbidity in India: What We Know and What We Don't Know," *Women's Reproductive Health in India*, R. A. Jejeebhoy(eds.) New Delhi: Rawat Publication.
- Norman, D. (1998). *The Design of Everyday Things*, 1st edition, Boston: MIT Press.
- Oinas-Kukkonen, H. and M. Harjumaa. (2009). "Persuasive Systems Design: Key Issues, Process Model, and System Features," *Communications of the Association for Information Systems* (in this issue).
- Oinas-Kukkonen, H. and M. Harjumaa. (2008). "Towards Deeper Understanding of Persuasion in Software and Information Systems," in Proceedings of The First International Conference on Advances in Human-Computer Interaction (ACHI 2008), pp. 10-15.
- Pakenham-Walsh, N. (2002). "Strengthening Local Capacities to Create and Adapt Healthcare Information International Institute of Communication and Development", IICD, The Hague.
- Pandey, P., A. Sehgal, M. Riboud, D. Levine and M. Goyal. (2007). "Informing Resource-Poor Populations and the Delivery of Entitled Health and Social Services in Rural India," *American Medical Association* (298)16, pp. 1867-1875.
- Parmar, V., D. Keyson, and C. deBont. (2007). "Shaping Social Beliefs: A Community Sensitive Health Information System for Rural India," in Venkatesh et al. (eds.) *Home Informatics and Telematics: ICT for the Next Billion*, Boston- Springer, pp. 133-143.
- Parmar, V., D. Keyson, and C. deBont. (2008). "Persuasive Technology for Shaping Social Beliefs of Rural Women in India: An Approach Based on the Theory of Planned Behaviour," in *Persuasive 2008*, H. Oinas-Kukkonen et al. (eds), LNCS 5033, Springer: Oulu, Finland. pp. 104-115.
- Parmar, V., G. Groeneveld, A. Jalote- Parmar, and D. Keyson. (2009). "Tangible User Interface for Increasing Social Interaction among Rural Women," *Tangible Embedded Interaction*, 2009, ACM digital library (In press).
- Peizer, J. (2003). "Cross-Sector Information and Communications Technology Funding for Development: What Works , What Does Not, and Why," *Information Technologies and International Development* (1), pp. 81-88.
- Prahalad. (2006). "To Create an Impossibly Low-Cost, High-Quality New Business Model, Start by Cultivating Constraints," *Strategy + Business* (44), pp. 3-10.
- Raj, H. (2005). *Rural Sociology*, New Delhi: Surjeet Publications.
- Rogers, E. M. (1995). *Diffusion of Innovations*, New York, The Free Press.
- Saith, A. and M. Vijayabaskar. (2008). "ICTs and Indian Social Change: An Agenda of Concerns," in *ICTs and Indian Social Change: Diffusion, Poverty, Governance*, A. Saith, M. Vijayabaskar, and V. Gayathri (eds.) Sage: New Delhi, pp 13-17.
- Sen, A. (1999). *Development as Freedom*, Oxford: Oxford University Press.
- Sivaramakrishnan, M. and V. L. Patel. (1993). "Reasoning about Childhood Nutritional Deficiencies by Mothers in Rural India: A Cognitive Analysis," *Social Science & Medicine* 37(7), pp. 937-952.
- Sood, A. D. (2003). "The Kiosk Networks: Information Nodes in the Rural Landscape," www.i4donline (January 7th, 2005).
- Spector, R. E. (1995). "Cultural Aspects of Women's Health and Health-Promoting Behaviours," *Journal of Obstetrics and Gynecologic and Neonatal Nursing* 24(3), pp. 241-245.
- Spector, R. E. (1991). *Cultural Diversity in Health and Illness*, 3rd edition, Norwalk, CT: Appleton and Lange.
- Srivastava, A. (2005) "Accelerating Delivery of Health Services," *Information for Development* (3)5, pp. 12-15.
- Sterns, A. A. and C. B. Mayhorn. (2006). "Persuasive Pillboxes: Improving Medication Adherence with Personal Digital Assistants," in W.Ijsselstein et al. (eds.) *Persuasive 2006*, Springer- Verlag Berlin Heidelberg, pp. 195-198.
- Stewart, D. W. and P. N. Shamdasani. (1990). *Focus Groups: Theory and Practice*: London, Sage Publications.

APPENDIX-1: CONTEXTUAL INQUIRY AND FOCUS GROUP QUESTIONNAIRE:

Issues	Questions
Stigmatization/ fear of phenomena	<ol style="list-style-type: none"> Why do you think menses related problem occurs to women? <ol style="list-style-type: none"> Because of god punishment (where user think they must have done something wrong to other person). Due to dirty environment or uncleanliness at individual level. It is some internal health problem of the body. It is a natural phenomenon. Some other reasons (i.e. we are poor people, so it is destined, or there are no personal health facilities to go and get treatment done) What would you do to cure menstruation-related problems? <ol style="list-style-type: none"> Maintain personal cleanliness during and after cycle. It will become normal on its own, I trust god. Go to Tantrik or local Dai's. To understand PH issue in detail at personal level and take precautionary measures in advance. Consult primary health center. What are the issues you are concerned about, while sharing problems related to menses and maternal health? <ol style="list-style-type: none"> Lose face in the society Lose face in own family Lack of privacy for expressing and sharing our PH problem Lack of trust: whom to trust for sharing our personal health problem Some other reasons Do you know the relationship between menses and motherhood?
Health problems caused due to personal hygiene problems Closed mindset Ignorance Misconceptions	<ol style="list-style-type: none"> What do you normally do when your period starts? How strictly do you gauge health problems related to menses and maternal health? What do you think could be the consequences of these problems? (Give more example of PH related diseases) How do village women handle additional problems caused due to personal hygiene problems? Why in such a way? What are the reasons for not taking proper medication, hiding or not sharing health problems openly? (Options below will not be shown to interviewee) <ol style="list-style-type: none"> Low literacy level Individual attitude to hide to maintain sense of dignity in their community. Influence of figures such as religious priest, traditional doctors General negative thinking about PH issues at community level. Some other reason.
Level of awareness	<ol style="list-style-type: none"> How informed are village women about personal menses and maternal health ? <ol style="list-style-type: none"> Very informed Some what informed Not very informed Not informed at all How informed are their husbands about menses and maternal problem? <ol style="list-style-type: none"> Very informed

	<ul style="list-style-type: none"> b) Some what informed c) Not very informed d) Not informed at all
Social hierarchy and relationship	<p>11. What kind of person has the highest chance for a healthy life?</p> <ul style="list-style-type: none"> a) Educated person b) Rich villagers c) Person believing in god d) Person staying in urban areas e) Person with cleanliness <p>12. When you have a health problem, whom do you approach first?</p> <ul style="list-style-type: none"> a) A friend b) Husband c) God d) Doctor e) Mother-in-law/sister-in-law
Demographic data	<p>13. a) What is your age?</p> <p>b) Place of birth?</p> <p>c) How many members in the family? (joint or nuclear family)</p> <p>14. What television channels do you watch?</p> <ul style="list-style-type: none"> a) News, discovery, national geographic, Gujarati operas b) When did you have your last exam? c) Do you watch English movies or read English news paper? (to understand their preferred language of communication) <p>15. What time do you start your day?</p> <ul style="list-style-type: none"> a) What time do you cook breakfast, lunch, dinner? b) What is your pooja time? c) Do you sleep in the afternoon?
Success stories	<p>16. Explain one success story related to personal health, and ask users about their experiences. And ask how differently would they behave if the situation repeats today.</p>
Exposure: General and technical	<p>17. a) Which other city have you visited in Gujarat/India/abroad?</p> <p>b) Do you like eating out or watching movies?</p> <p>18. List the electronic products you have recently/frequently use?</p> <ul style="list-style-type: none"> a) Cell phone b) Home computer c) TV with remote d) Video/DVD player e) Mobile phone f) Digital camera g) ATM card h) Credit card i) Refrigerator <p>Which one is tough to use?</p> <p>19 From where do you receive information about personal health?</p> <ul style="list-style-type: none"> a) Television/radio b) Primary health center c) Internet d) Newspaper e) Word of mouth

	20- What are your likings about general information? Do you like politics, bollywood gossips, education, or regional cultural programs?
Village economy	21- Which profession is popular in your village?
Housing conditions	22- How many times do they take showers during cycle days? How often do they wash their hands (soap present)? How many times do they clean their house, animals? Toilets in or out? Sewer/plumbing available? 23- Do you have electricity during evening hours?

ABOUT THE AUTHORS

Vikram Parmar is pursuing his Ph.D degree at the Department of Industrial Design at the Delft University of Technology. His research involves developing a community-sensitive Information System, taking a case of personal health for women in rural India. He holds a master's degree in industrial design from the Indian Institute of Technology, Bombay. After graduating as an industrial designer, he joined Media Lab Asia; a research lab working toward bridging the digital divide between urban and rural areas by developing ICT-based products and services. He has worked on projects such as of "Key-Lekh," a bilingual keyboard which can type in Hindi and English, "Hardware Browser," an Internet-browsing device for illiterate and semi-literate users. His expertise lies in designing socially and contextually aware and low-cost ICT devices.

David Keyson leads the social and contextual interaction design group at the Department of Industrial Design and is currently a project leader of Smart Surroundings. Prior to joining TU Delft, he worked for 10 years in industry, including Philips Research as a senior research scientist in Media Interaction and at Xerox in the department of Industrial Design and Human Interface. He holds a Ph.D from the Technical University of Eindhoven in Perception and Technology and Masters of Science in Ergonomics from Loughborough University. Dr. Keyson has authored numerous scientific papers in journals such as *Presence*, *Ergonomics*, *Applied Ergonomics*, *Displays*, *Universal Access Information Society* and *Personal Ubiquitous Computing*. He holds 16 patents relating to input devices and design principles of user-system interaction.

Cees de Bont is the dean of the faculty of industrial Design Engineering of the Delft University of Technology in the Netherlands (since 2005). He obtained an MSc degree in Economic Psychology from Tilburg University in 1987 and his Ph.D degree from the Delft University of Technology in 1992. Cees joined Philips to become responsible for Human Behaviour Research at Philips Design (1995-1997) and for Market intelligence and Strategy for Philips Domestic Appliances and Personal Care (1997-2005). In this period (2002), he was appointed as professor of Marketing at the Vrije Universiteit in Amsterdam.

Copyright © 2009 by the Association for Information Systems. Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and full citation on the first page. Copyright for components of this work owned by others than the Association for Information Systems must be honored. Abstracting with credit is permitted. To copy otherwise, to republish, to post on servers, or to redistribute to lists requires prior specific permission and/or fee. Request permission to publish from: AIS Administrative Office, P.O. Box 2712 Atlanta, GA, 30301-2712 Attn: Reprints or via e-mail from ais@aisnet.org

EDITOR-IN-CHIEF
Joey F. George
Florida State University

AIS SENIOR EDITORIAL BOARD

Guy Fitzgerald Vice President Publications Brunel University	Joey F. George Editor, CAIS Florida State University	Kalle Lyytinen Editor, JAIS Case Western Reserve University
Edward A. Stohr Editor-at-Large Stevens Inst. of Technology	Blake Ives Editor, Electronic Publications University of Houston	Paul Gray Founding Editor, CAIS Claremont Graduate University

CAIS ADVISORY BOARD

Gordon Davis University of Minnesota	Ken Kraemer Univ. of Calif. at Irvine	M. Lynne Markus Bentley College	Richard Mason Southern Methodist Univ.
Jay Nunamaker University of Arizona	Henk Sol University of Groningen	Ralph Sprague University of Hawaii	Hugh J. Watson University of Georgia

CAIS SENIOR EDITORS

Steve Alter U. of San Francisco	Jane Fedorowicz Bentley College	Jerry Luftman Stevens Inst. of Tech.
------------------------------------	------------------------------------	---

CAIS EDITORIAL BOARD

Michel Avital Univ of Amsterdam	Dinesh Batra Florida International U.	Indranil Bose University of Hong Kong	Ashley Bush Florida State Univ.
Erran Carmel American University	Fred Davis U of Arkansas, Fayetteville	Gurpreet Dhillon Virginia Commonwealth U	Evan Duggan Univ of the West Indies
Ali Farhoomand University of Hong Kong	Robert L. Glass Computing Trends	Sy Goodman Ga. Inst. of Technology	Mary Granger George Washington U.
Ake Gronlund University of Umea	Ruth Guthrie California State Univ.	K.D. Joshi Washington St Univ.	Chuck Kacmar University of Alabama
Michel Kalika U. of Paris Dauphine	Claudia Loebbecke University of Cologne	Paul Benjamin Lowry Brigham Young Univ.	Sal March Vanderbilt University
Don McCubbrey University of Denver	Fred Niederman St. Louis University	Shan Ling Pan Natl. U. of Singapore	Kelly Rainer Auburn University
Paul Tallon Loyola College, Maryland	Thompson Teo Natl. U. of Singapore	Craig Tyran W Washington Univ.	Chelley Vician Michigan Tech Univ.
Rolf Wigand U. Arkansas, Little Rock	Vance Wilson University of Toledo	Peter Wolcott U. of Nebraska-Omaha	

DEPARTMENTS

Global Diffusion of the Internet. Editors: Peter Wolcott and Sy Goodman	Information Technology and Systems. Editors: Sal March and Dinesh Batra
Papers in French Editor: Michel Kalika	Information Systems and Healthcare Editor: Vance Wilson

ADMINISTRATIVE PERSONNEL

James P. Tinsley AIS Executive Director	Robert Hooker CAIS Managing Editor Florida State Univ.	Copyediting by Carlisle Publishing Services
--	--	--