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Abstract. This paper discusses early digital interventions and evolvement of persuasive technologies sometimes termed as behavior change technologies. In addition, it builds upon the conceptual behavior change support system (BCSSs) as an idyllic platform for developing effective persuasive technologies aimed to promote behavior change in a wide array of issues from everyday life.

Background. The research field of persuasive technologies has gained significant momentum over recent years with encouraging results. Yet, a key weakness with prevalent persuasive technologies is their focus on singular problem domains and lack of enduring support for users resulting in high drop out rates.

Objectives. This paper discourses the development of persuasive systems (PS); emergence of BCSSs and the scope of Persuasive Systems Design (PSD) model in developing successful behavior change support systems (BCSSs).

Methods. To conduct literature review, key words such as Digital Interventions and Persuasive Systems were used via Google Scholar. In addition, a thorough review was performed from the proceedings of Persuasive 2007 to 2012. Finally; some open research questions are poised to instigate discussion with an aim to have a mutual understanding of BCSSs followed by concluding remarks.

Conclusion. The paper has design implications for a broader research in persuasive systems design, digital health interventions and general IS.

Keywords: Digital interventions, persuasive technologies, behavior change support systems, PSD model.

1 Introduction

It would be a realistic to insinuate that the field of persuasive technology is no more in its infancy. The discipline is promoting new research challenges and dimensions in developing systems that support people to perform desirable behaviors. We as human beings are fundamentally driven by inspirations. Our motivations could be a blend of diverse dynamics ranging from living a healthy life, saving money, protecting the eco-system and so on. Further, we have peculiar philosophies and viewpoints that become a part of their personae over time.

The central question remains that how many of us act in concurrence with our beliefs. For illustration, exercise is favored by almost everyone yet not many people adhere to regular exercise regime. The same goes for smoking, despite its’ detrimental effects on health, smoking population is enormous. It is not surprising to find people with contradictions between their viewpoints and actual actions. In simple words, there is a gap between what people believe and actually do. Such variance in values, beliefs and
actual actions give rise to a unique state of cognitive discomfort as proposed by the Cognitive Dissonance theory (Festinger, 1957). It was this particular gap that stipulated a manifesto for persuasive technologies to play a role in helping people to overcome disparities between attitudes and behaviors.

Inconsistencies between peoples’ beliefs and actions could be an outcome of multiple reasons. For instance, Fogg (2009) pointed out that lack of appropriate prompts could be one of the reasons. Additionally, busy lifestyle, lack of information or mere forgetfulness could hinder people from performing desired behaviors. Developing technologies that aim to change peoples’ behaviors is a challenging and arduous task. However it is a research area, which regardless of its appreciation exposes plentiful gaps in terms of the descriptions, development and implementation and more critically evaluation methodologies.

This paper aims to delineate and distinguish behavior change technologies, present the pattern of current research, elucidate how such technologies are being developed and appraised. Finally, a few open questions are presented that would lead to a better conception and augmentation of behavior change technologies in future research.

2 Behavior Change Technologies

It is vital to ascertain and distinguish behavior change technologies. Generally speaking, there are three separate classes of such technologies with subtle yet substantial differentiations. Simplistically, these technologies could be classified as Digital Interventions (DI), Persuasive Systems (PS) and Behavior Change Support Systems (BCSSs). Digital interventions have been more or less focused on intervening behaviors in the preventive health area primarily through reminders, persuasive technologies emerged as a sophisticated field where artifacts have been developed to address behavior change in a much wider scope and software functionalities such as reminders, rewards, social learning have been employed. Despite its refinement, persuasive technology researchers have somewhat failed to demonstrate actual behavior change as pointed out by Oinas-Kukkonen (2010). For successful behavior change technologies, Oinas-Kukkonen (2010) promotes a deeper understanding of social as well as technological features. Building upon the existing research, he conceptualized behavior change support systems that would be built by incorporating persuasive software features. Hence, there is a clear hierarchical development depicting the development of behavior change technologies to date. This pattern is represented in figure 1.
Information systems that aim to change behaviors are often considered as digital (behavior) interventions, for instance see Reeve and Dunbar (2001). It could be argued that labeling behavior change technologies as digital interventions is way too simplistic and holistic. The research field of digital interventions dates back to early 90s where interventions were primarily employed and evaluated in the field of preventive health and medicine mainly through intermediations (paper-based and/or telephonic reminders). A considerable number of studies have been conducted that aimed to intervene health-related behaviors. For instance, Reiter et al.’s (2003) STOP system studied smoking behaviors using digitally generated and letter-based interventions, Revere and Dunbar (2001) argue that tailored digital interventions are moderately effectual. Likewise, Brendryen and Kraft (2008) studied web-based digital intervention on smoke cessation. The intervention was done using the Internet and by telephone. Brendryen and Kraft (2008) argue that digital interventions showed promise in supporting peoples’ behaviors. Noar et al. (2009) report that a substantial amount of work has been done in personalizing interventions in the health domain. They base their illustration on their review of 37 health behavior intervention studies. Noar et al. (2009) also performed a meta-analytic review of 57 studies evaluating health behavior interventions and report that tailoring can bring effectiveness to the technique of intervention in the health domain.
3 Persuasive Systems

Persuasive systems are inherently interactive and are particularly designed to influence users’ behaviors. The web and ambient technologies have created opportunities for persuasive technologies. Persuasive technologies have particularly shown promise in the area of health, well-being and economic contexts (Oinas-Kukkonen and Harjumaa, 2008). Recent studies have shown that information technologies can influence peoples’ behaviors and attitudes by motivating them to perform desired behaviors (Oinas-Kukkonen and Harjumaa, 2008). They further add that Information Systems research has a rich history in examining users’ attitudes and behaviors. Persuasive technology systems or persuasive systems (Oinas-Kukkonen and Harjumaa, 2008) have an elusive distinction when compared with digital interventions. Oinas-Kukkonen and Harjumaa (2008) define persuasive systems as “computerized software or information systems designed to reinforce, change or shape attitudes or behaviors or both without using coercion or deception”. A wide variety of descriptions aiming to explicate the crux of persuasive systems can be found in the existing literature. Fogg (2003) defines persuasive systems as technologies that are designed to bring a desirable change in peoples’ behaviors and/or attitudes. Fogg’s definition adds a new dimension to the research of behavior change technologies by addressing attitudes along with behaviors. At present, persuasive system are being applied to a varied range of domains such as promoting physical activity (see Toscos et al. 2006), encouraging smoking cessation (see Reiter et al. 2003), promoting happier life styles (see Chatterjee and Price, 2009), encouraging people to save energy (see Midden and Ham, 2009) and promoting healthy aging (see Intille, 200). Table 1 represents few examples of persuasive systems from the available literature.

<table>
<thead>
<tr>
<th>Research Paper Title</th>
<th>Persuasive System</th>
<th>Problem Domain</th>
</tr>
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<tbody>
<tr>
<td>Designing for persuasion: Toward ambient eco-visualization for awareness (Kim et al. 2010)</td>
<td>Providing feedback to users without interfering in their primary tasks.</td>
<td>Creating awareness towards lifestyle and its impact on ecosystems.</td>
</tr>
<tr>
<td>Personality and persuasive technology: An exploratory study on Health-promoting mobile applications (Halko &amp; Kientz, 2010)</td>
<td>To explore the relation between persuasive technology and health-promoting mobile applications.</td>
<td>Personal health through mobile applications.</td>
</tr>
<tr>
<td>Persuasive features in six weight loss websites: A qualitative evaluation (Lehto &amp; Oinas-Kukkonen, 2010)</td>
<td>To explore persuasive features in pre-selected web sites for weight loss.</td>
<td>Creating awareness of incorporated persuasive software features in the evaluated web sites.</td>
</tr>
<tr>
<td>Turning the classic snake mobile game into a location-based exergame that encourages walking (Chittaro &amp; Sion, 2012)</td>
<td>Using exergames to encourage physical activity.</td>
<td>Using exergames to encourage walking.</td>
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<tr>
<td>Comparative analysis of recognition and competition as features of social influence using Twitter (Stibe and Oinas-Kukkonen, 2012)</td>
<td>Using social influence software features from the PSD model.</td>
<td>Persuading people to actively partake sharing feedback at airport setting.</td>
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4 Behavior Change Support Systems

“A behavior change support system (BCSS) is an information system designed to form, alter or reinforce attitudes, behaviors or an act of complying without using deception, coercion or inducements”. (Oinas-Kukkonen, 2010)

Oinas-Kukkonen (2010) has enriched the research discipline of persuasive systems by arguing that next generation of web has substantial prospective in healthcare and general well-being of people. His work takes the contemporary persuasive systems research a step further since there is a clear emphasis on systems that continually support users during the behavior change process. He rightly adds that persuasive technology is a field of scientific research while BCSS is an object of study within the field of persuasive technology. Oinas-Kukkonen (2010) has devised the term Behavior Change Support Systems or BCSSs. He argues that emerging technologies especially the Web 2.0 have a potential for designers to develop information systems that could inspire and support people in an effective way for an extended period of time. He fittingly adds that healthier lifestyles and wellness of people are going to be prominent areas of future research in behavior change purview. What is critical for researchers is to understand that a behavior change support system (BCSS), despite being a successor of persuasive systems, has something “more”. Interestingly, the concept of BCSSs evolves from the persuasive systems yet it shows promise to overcome such systems i.e. not all persuasive systems could be categorized as BCSSs yet all the BCSSs would essentially have persuasive systems features in one form or the other.

The concept of BCSS brings new elements into play for researchers, such as exhaustive study and employment of persuasive software features (tunneling, reduction, personalization, reminders, praise, rewards, social influence etc.), what persuasive strategies ought to be implemented (direct or indirect routes) and lastly there is a particular stress on the user context i.e. the problem domain and persuasion through profiling (Oinas-Kukkonen and Harjumaa, 2009). A typical BCSS is not aimed to detect a change in a given behavior however it is a platform that has the prospective and indispensable features to involve the user in an enduring interaction with the system. In addition, it would fit effortlessly into users’ daily routines and have components that provide on-going support during and after the behavior change process.

As stated above, BCSSs are relatively new in the arena of IS research. Nevertheless, they concept is gaining ever-growing popularity and fully functional BCSSs would benefit researchers and practitioners in medicine and preventive health domains. In addition, it will positively impact the society as a whole. It is critical to understand that BCSSs are not mere simplistic web interfaces. The fact of the matter is that it needs a well-designed amalgamation of various facets of technology including specific persuasive software features, high quality information content, robust functionality of the system and scalability.
4 Designing Behavior Change Technologies

The designers of behavior change technologies have so far failed to produce an idyllic platform that could bring a permanent change in a users’ behavior. The area of designing web-based technologies that support users to improve overall well-being is gaining momentum (Oinas-Kukkonen, 2010). Such technologies predominantly aim to assist users in better managing their lifestyles. Currently different platforms are available for developing behavior change technologies i.e. web-based systems, portable devices and smart phones (Langrial et al. 2012). Nevertheless, the challenge of designing behavior change technologies evidently maintains its coherent challenges, for example, how would the users interact with the technology and further how would they process and understand the information (Eysenbach, 2000). Moreover, it is desirable that designers systematically understand how the users perceive to benefit from such technologies. The list of challenges in designing interactive technologies aimed at supporting behavior change goes on like an endless loop.

To be able to design technologies that are by essence interactive is problematic for several reasons therefore designers need to be mindful of the actual needs and expectations of the users. Generally, there is a lack of understanding of theoretical paradigms that are aimed at changing or influencing human behavior (Or et al. 2011) and lack of emphasis on human computer interaction methodologies being implanted in the design process. According to Benbasat (2010), systems developed in the HCI discipline are neutral in nature however this argument is subjective. On the contrary, bringing in HCI into designing persuasive or behavior change systems can enrich the aesthetics of the systems. Aesthetics can play a critical part in designing and developing behavior change technologies and is promoted by Oinas-Kukkonen and Harjumaa (2009) as a persuasive software feature, liking. One reason is that largely, users’ initial impression and evaluation of a given system is greatly dependent on its visual layout. Maitland and Siek (2009) argue that design of an interface plays a central role in engaging users and making the user experience (UX) enjoyable. A good example is that of UbiFit Garden (Consolvo et al. 2008). It is an interactive application that aims to promote physical activity through different tools and techniques. One of the key features of the UbiFit Garden application is the visual display that presents aesthetic images representing user information about their physical activity. While reporting the results from their study, Consolvo et al. (2008) add that the users were generally very much amazed with the interface design and visual layout leading them to a higher motivation to perform physical activity.

Another area that needs further research and deliberation is that of the commonly incorporated persuasive methods. It is evident from existing literature that most frequently incorporated techniques to improve the interaction between the users and the systems are prompts or reminders (see Walji and Zhang, 2008), praise or feedback (see Arroyo et al. 2005), rewards (see Harjumaa et al. 2009) and social facilitation (see Gasser et al. 2006). All the aforementioned methods and features play an essential role in behavior change technologies yet there is a need to craft or enhance persuasive features that improve the human-computer interaction or dialogue support as outlined by the PSD model (Oinas-Kukkonen and Harjumaa, 2009). For example, the reward feature could prove to be meaningless for some users, for some it might be motivating still there could be users who would have an altogether different opinion
about rewards. Correspondingly, social facilitation is a sensitive and delicate issue. On a general level, users could be categorized as introverts and extraverts. Additionally, not many users would like to share personal information with others especially when it comes to habits relating to alcohol consumption, sleep disorders or even more importantly about their illnesses. Therefore, if social sharing is incorporated in a behavior change system there should always be an option for people to “opt-out” from social sharing or comparison. These are relatively simplistic issues but could have a significant effect on the overall persuasiveness of a behavior change system.

It has become a custom in the filed of persuasive systems that designers and researchers aim at changing behaviors that are relatively inflexible and require a great deal of motivation and long-drawn-out support. For instance, targeting smoking (Reiter et al. 2003; Brendryen and Kraft, 2008) has been studied at several levels. To an extent, it would be fair to state that such target behaviors are inspired by over ambitions. As outlined by Fogg (2009), “stopping smoking—especially for those who have a long-time habit – is the mount Everest of human behavior change”. However, he supports the development of technologies that could bring incremental and step-by-step change in peoples’ behaviors. Such arguments strengthen the idea that researchers and designers should aim at behavior change that could be realistic for the target audience.

Additionally, an incremental strategy to amend an existing behavior is highly desirable. Evidence from available literature especially from the proceedings of Persuasive conferences indicates that an overwhelming majority of publications project success, for example, Kim et al. (2010) worked on ambient displays for encouraging users improve their behaviors towards ecological environment, Salam et al. (2010) worked on dental anxiety in children and reported promising results from their study, Mazzotta et al. (2007) worked on promoting healthy eating and Intille (2004) worked on the use of persuasive technology to promote healthy aging. To the author’s knowledge none of the publications from persuasive technology platforms have reported failures. They either reflect a huge success or strong evidence towards a potential successful technological development. As hinted by Fogg (2009), failures are not bad at all. The fact of the matter is that we can learn more from failures than success. Retier et al. (2003) have promoted work that elaborates failures in Natural Language Generation (NLG) research community. Reporting of failures is equally applicable to the publications in persuasive/behavior change technologies.

5 Use of Socio-psychological Theories

The decisive objective of designing a behavior change technology is to inspire and motivate users to bring a desired and enduring change in their behaviors. Therefore, it would be sensible to argue that helping people to uphold motivation is one of the key elements of a given persuasive or behavior change support system. An individual might feel motivated to perform a certain action but their ability to perform certain action is a different matter. Even when someone is motivated and willing to perform an action, time constraints and/or lack of resources could cause significant hindrances. The later is about an individual’s ability to perform an action (Fogg, 2003). An example could be of a person who is highly motivated to perform physical exercise but lack of time restricts her from doing so.
Early theories of motivation have presented general explanations of human behavior. For example, Hull’s Drive theory (Graham and Weiner, 1996), the Incentive theory (Hogg et al. 1995), and the Goal-setting theory (Locke and Lathman, 2002) provide an understanding of factors behind human motivation. By and large, motivation can be categorized into three main types: Intrinsic, Extrinsic and Image motivation (see Ariely et al. 2008, Goffman, 1959). A considerable amount of work has been done in the area of persuasive systems and behavior change technologies using motivational techniques such as goal-setting (Locke and Lathman, 2002), conditioning though positive and negative reinforcement (Dey and Abowd, 2000), Social Identity theory (Turner and Reynolds, 2010) and Cognitive Dissonance theory (Festinger, 1957). It is a promising sign to observe that designers of behavior change technologies have realized the impact of theoretical constructs on the design process and it is therefore that we witness studies that are more often theory driven more recently. For instance, Consolvo et al. (2009) have proposed theory-driven strategies for designing behavior change support systems and have incorporated the Transtheoretical Model and Presentation of Self in Everyday Life. Likewise, the behavior change support system (BCSS) proposed by Oinas-Kukkonen promotes the use of theory of Self-efficacy (see Bandura, 1977) by incorporating primary task and dialogue support components with an aim to support users in bringing an enduring change in their behaviors.

A detailed conception of socio-psychological theories is critical in the design process yet there is the technical side of developing and implementing the systems. As argued by Consolvo et al. (2009), technical support ought to be incorporated in such a manner that the system integrates impeccably in the everyday life of the user. This argument is also backed by Oinas-Kukkonen (2010). To sum it up, theories of motivation and behavior change that have been studied provide a rich base for understanding and predicting human behavior. There is a need for incorporating socio-psychological theories in the design process while keeping in mind the problem domain [Use Context] and the target audience (Oinas-Kukkonen and Harjumaa, 2009). This argument originates from Fogg’s (2009) work and clearly the prominence is upon targeting an audience in a systematic way using mixed methodologies by incorporating appropriate socio-psychological theories. For example, if the target behavior were to make people walk more, a pre-study survey would be a good starting point to pinpoint the right kind of audience that is enthusiastic and determined to walk more. Further, involving the users to gather deeper information is a suitable step since it could provide information about users’ expectations, what stops them from the desired action and what could inspire them at best. Involving users in the design process and evaluation of the system is also desirable. Users have been involved in various studies that are aimed to promote every day life, for instance, assistive living and persuasive reminders.

6 Evaluating Behavior Change Systems

Technologies and innovations that aim at supporting behavior change are evolving at a swift pace however weaknesses in prevalent research techniques are noticeable (Oinas-Kukkonen, 2010). Rigorous evaluation methodologies would enhance the discipline of behavior change technologies. According to Consolvo and Walker
(2003), for successful implementation of such technologies, a rigorous evaluation process is critical. They argue that if evaluations are carried out on incessant basis, there is a greater chance of refining technologies by identifying and isolating users’ needs and expectations. Technologies that promote a healthier lifestyle are also gaining popularity in the HCI discipline according to Klasnja et al. (2011). Paradoxically, the evaluation of such technologies remains rather unclear.

Noticeably, there is a need for a framework that could be employed in the process of evaluating behavior change systems. It would be fairly difficult to have a comprehensive framework that could tackle all the relevant persuasive features incorporated in it. Nevertheless, there are already a number of schemas available, probably a good strategy would be to amalgamate key techniques from each and make an effort to come up with a more effective valuation apparatus. Researchers from HCI and IS fields have contributed towards developing frameworks, for example, Consolvo et al. (2009) signify the importance of behavior change theories as well as design components and have outlined eight strategies for design i.e. Abstract and Reflective; Unobtrusive; Public; Aesthetic; Positive; Controllable; Trending and Comprehensive. A key element of Consolvo et al.’s (2009) work is that it involves users in the evaluation process while designing and studying the system. Likewise, Consolvo and Walker (2003) have advocated Experience Sampling Method (ESM). Again, this method is user-centered and researchers have previously employed the technique to study areas such as social interactions. Scholtz and Consolvo (2004) argue that there is a lack of a widely accepted framework for users to evaluate the efficacy of ubiquitous computing applications. They have conceptualized a framework that is explicitly aimed at evaluating ubiquitous computing technologies. They call their framework as UEAs or Framework for Ubiquitous Computing Evaluation Areas. The key constructs of the UEAs1 are 1) Attention; 2) Adoption; 3) Trust; 4) Conceptual Models; 5) Interactions; 6) Invisibility; Impact and Side Effects; 7) Appeal and Application Robustness (Scholtz and Consolvo, 2004).

More lately, Fogg (2009) proposed a framework called as the Fogg Behavior Model (FBM). The model states that for a desired action to be performed, it is a requisite that the individual has the motivation, the ability and a well-timed trigger (reminder). The FBM clarifies the connection between motivations, abilities and reminders but it fails to provide an evaluative methodology for measuring the persuasiveness of behavior change systems. Wiafé et al. (2011) have come up with their own framework; they call it the 3D-RAB model. It is aimed at evaluating persuasive technologies and takes into account connection between 1) attitudes and behaviors, 2) attitudes and behavior change and 3) attitudes and sustaining behavior change. It would be hard to vindicate whether the 3D-RAB model could be used to evaluate the success of a persuasive system. However, it can help identify varying levels of users’ cognitions.

Oinas-Kukkonen and Harjumaa (2009) put forward a framework for designing and evaluating persuasive systems. They have labeled their framework as the Persuasive Systems Design model or the PSD model. Although the PSD model is conceptual yet it facilitates thorough evaluation of the persuasion context (the intent, the event and the strategy). The model comprises of four distinct categories or principles aimed at enhancing persuasiveness and evaluation of persuasive systems. These categories

include: (i) primary task support; (ii) dialogue support; (iii) credibility support and (iv) social support. Primary task support aims to facilitate users’ interaction with the system through features such as reduction, tunneling, tailoring and personalization with the goal to reduce the cognitive encumbrance on the user and make the interaction simpler. Further features such as personalization help users identify and set their goals and monitor their progress through self-monitoring. The Dialogue support features aim at reassuring, motivating and supporting users to have a continuous interaction with the system through employing features such as praise, rewards, reminders and suggestions. Credibility support features bring in the element of credibility and trustworthiness by incorporating features such as expertise, 3rd party endorsements and authority. Finally, the Social support features aim to foster users’ motivation through features such as social learning, social comparison, cooperation, recognition and competition. The PSD model contributes to persuasive systems’ research by providing a systematic approach to analyze and evaluate the context of persuasion and apt techniques. While carrying out an analysis of the persuasion context, it is essential to identify the intent (of the persuader and the change type), the event (use context, user context and the technology context) of persuasion and the strategy (message and the route) employed. Such an approach will provide designers and researchers with a better understanding of the target behavior, audience and appropriate persuasive strategies. The PSD model has been recognized as a state-of-the-art framework for designing and evaluating persuasive technology system in recent times. More recently, it has been applied to evaluate persuasive software features in score of studies, for instance, Drozd et al. (2012), Wiafe et al. (2012), Langrial et al. (2012), Langrial and Oinas-Kukkonen (2012) and Stibe and Oinas-Kukkonen, 2012.

7 Evaluating Systems’ Persuasiveness

The process of evaluating perceived persuasiveness of behavior change systems poses an ongoing challenge. Designing systems that aim to modify users’ behaviors is a multifaceted task that requires an across-the-board understanding of multiple disciplines. Researchers and designers need to be realistic while targeting behavior change. Technologies cannot perform wonders hence it is judicious that the target behavior is simple as recommended by Fogg (2009). Further, user involvement offers an opening for designers to segregate target audience that is responsive to persuasion.

User involvement in the process of designing behavior change technologies can give valuable understandings and intelligence that otherwise may be hard to obtain. For example, users can provide information of what stops them from performing a desired behavior (factors acting as barriers), what is their expectation of the system (perceived benefit etc.), how do they anticipate to use the system (intention to use the system), what is the best channel to reach them (persuasion route), whether they are goal-oriented or competitors (individualized information). Such insights can provide knowledge for using apt theoretical constructs in the design process. Naturally for goal-oriented people, goal-setting theory would be ideal, for those who do not have enough self-assurance in their ability to perform desired actions, the theory of Self-efficacy would make perfect sense and for users who are at different cognitive levels of changing their behaviors, Transtheoretical Model can provide a suitable platform.
In addition, there is a need for involving professionals (health, social psychologists and end-users) in the design and evaluation process. Health professionals and social scientists could augment effectiveness of the content of the persuasive messages for instance and real users could provide valuable feedback for constant improvements in the systems. It is also time that the IS research community makes an effort to recruit and study a larger sample sizes. Conventionally in the persuasive systems discipline, relatively small population samples are studied yet major claims are made. Smaller sample sizes might offer an indication of success or failure but having a larger population sample would bring in added assuring estimations.

Similarly Human Computer Interaction researchers and experts could play a vital role in better designing and evaluating persuasive systems. For example, Klasnja et al. (2011) have raised two critical issues regarding evaluation of behavior change systems in the general HCI context: identifying and employing adequate evaluative methods and the reporting the results of the evaluations. They argue that initial findings that might indicate a potential of behavior change are have a limited scope. Hence, multi-method approaches should be adopted including both quantitative and qualitative methodologies. Such strategies could provide deeper insights into users’ experiences with technologies leading to a better evaluation of success or failure of behavior change systems.

According to Vredenburg et al. (2002), User Centered Design (UCD) has the tendency to improve product (technology) usefulness and usability. They further add that for an optimal use of UCD process, key areas such as user experience, end user involvement and overall customer/user satisfaction need to be given prime attention. Brandt (2006) discusses the process of participatory design involving users to develop technological artifacts. She advocates involving users in the design and development of technologies thereby creating an environment of collaboration between designers and end-users. Among other benefits of participatory design, several authors have reported enhanced communication, negotiation and compromises. Brandt (2006) argues that participatory design offers an ideal framework for designing and developing useful technologies. Langrial and Oinas-Kukkonen (2012) carried out a multi-method study on persuasive reminders and concluded that user involvement in the design, implementation and evaluation of persuasive systems could highlight insights that are rather hard to obtain from statistical data alone.

8 Conclusions

This paper presented an overview of behavior change technologies from their surfacing as relatively simple digital interventions to state-of-the-art behavior change support systems. Developing systems that attempt to influence peoples’ behaviors is an arduous task. However, research in the area of Persuasive Technology and HCI has shown promise in changing peoples’ behaviors. It is vital for the researcher community to identify emerging patterns and build upon future research endeavors. It would be beneficial for the research community if failures are reported and discussed. Understanding use context, user context, user expectations and socio-psychological theories will play a central role for developing successful behavior change systems. We as IS researchers need to mutually understand the dynamics of the conceptual BCSSs and appreciate its potential for providing an idyllic platform with optimal
persuasive techniques and functionalities. Likewise, the PSD model needs well-deserved attention from both researchers and designers for it provides an in-depth content for both developing and evaluating BCSSs. BCSSs have the potential of enhancing users’ self-efficacy through enhanced dialogue and social support features leading to enduring change in users’ behaviors. Well designed BCSSs would incorporate direct, indirect or both routes for persuasion and key persuasive software features (reduction, tailoring, personalization, self-monitoring, rehearsal, feedback, reminders and social role) would add to the success of such systems.

To construct a comprehensively applicable evaluation system for behavior change technologies is similar to finding the “holy grail”. Nonetheless, appropriate and well-planned evaluative measures can determine some key issues that can identify persuasiveness of behavior change systems. Below are presented some open questions to prompt a discussion that would (ideally) lead to a better and mutual understanding behavior change support systems:

1. How do we make sure that the intended design leads to a corresponding system?
2. How do we determine whether a system performs what it was originally designed to do?
3. What is the difference between an “indication” of behavior change and an enduring change in behavior?
4. What is the most accurate measure of a real behavior change?
5. What is the optimal methodology for evaluating persuasiveness of a system?
6. What are the strengths and/or weakness of the proposed BCSSs?
7. What are the implications of obtrusive BCSSs?

The paper has its limitations and strengths. The key limitation of this paper is that it is entirely theoretical nevertheless an effort has been made to instigate a discussion that would ideally lead to a deeper and mutual understanding of behavior change support systems in terms of design, implementation and evaluation.

Digital interventions have transformed into stand-alone persuasive systems that aim to promote desirable behavior. Behavior change support systems (BCSSs) are a step further from persuasive systems. There are two distinct elements that could be identified from the term i.e. behavior change and support systems. The future of persuasive technology systems will build upon successful design and implementation of state-of-the-art behavior change support systems. Since the conceptualized BCSSs are new to the arena of information systems, it is relatively hard to provide an explicit example, however, there is an emergent trend in the research community focusing in the area (see Drozd et al. 2012; Langrial et al. 2012)

The paper contributes to the discipline of digital interventions (DI), persuasive technology systems (PS) and conceptual behavior change support systems (BCSSs). An effort has been made to illustrate how simple digital interventions grew into stand-alone persuasive systems over the years finally leading to the idyllic behavior change support systems. The paper presents recent examples of persuasive systems; it highlights the implications of such technologies for medical practitioners, health authorities and the society. Although there is no concrete example of a fully operational behavior change support system, yet several projects could be found that
aim to tackle rather critical issues. (see Langrial et al. 2012). In addition, the paper highlights the importance of the PSD model, which is a state-of-the-art framework. The PSD model has been recognized as a methodical framework for developing and analyzing persuasive systems. With its four distinct categories (primary task, dialogue support, credibility support and social support) and 28 distinct persuasive software features, the PSD model can help design and evaluate effective behavior change technologies.

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