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Towards Sustainability with Behavior Change and Persuasion: Bringing Developed Concepts to an Emerging Context

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Abstract

An increasing emphasis is being placed on maintaining sustainability, a crucial notion in modern life. Regardless of multiple attempts to decrease adverse impact on the surroundings, numerous human behaviors are still impeding sustainable development. Changing well-rooted unsustainable practices is challenging and, therefore, requires application of a combination of established theoretical frameworks and practical tools. In order to create a lasting pro-environmental mindset, behavior modification is necessary. Considering that foundation of behavior change science is universal in any setting, applying behavior-altering methods that have been proven in other domains, such as health and well-being, to sustainability context should be considered as a potential solution. Thus, theoretical foundations of Behavior Change Support Systems (BCSSs) and Persuasive Systems Design (PSD) research need to be investigated in the realm of sustainability domain. Based on existing conceptual background, Behavior Changing Green IS/IT could be created as tools for fostering sustainable behavior change.

Keywords: behavioral change, persuasive technology, environmental behavior, sustainability, Green IS/IT

Introduction

Sustainability is the capacity to endure and can be defined as “the long-term maintenance of wellbeing, which has environmental, economic, and social dimensions, and encompasses the concept of stewardship and responsible resource management” (Breen 2013, p. 53). Enforcing sustainable development presumes “meeting the needs of the present without compromising the ability of future generations to meet their own needs” (WCED 1987). Resource overconsumption, global climatic disruption, waste production, species extinction, population growth (Tomlinson 2010, p. 29) are examples of serious modern concerns that endanger sustainable future. As the environmental issues remain critical (Dedrick 2010), the society desperately needs to increase incorporating sustainable practices in daily routines. Fundamental, long-lasting changes in consumption patterns and practices lie at the heart of sustainability.

Emerging Green Information Systems and Technologies (Green IS/IT) present a myriad of internal and external opportunities in fostering environmentally friendly lifestyles. For instance, Green IS/IT can have multiple effects on economics, ecological monitoring, as well as cultivating people’s everyday sustainable

consumption choices including reducing the impact of e-waste, reinforcing sustainable interaction design, and decreasing energy usage by computational systems (Tomlinson 2010). Thus, potential of the Green IS/IT solution and applications in contributing to sustainability should not be neglected.

Modern advanced technologies, analytics, and informatics are omnipresent and powerful enough to alter behaviors and break habits. Continually-improving pervasive mobile technologies, such as smartphones, tablets, and wearables offer plenty opportunities to persuade and influence individuals' behaviors (Woodruff and Mankoff 2009). Particularly, persuasive technologies in web and mobile applications promoting physical activity have become increasingly prevalent with the increased access and usage of smartphones. These applications incorporate numerous persuasive design features to modify behavior of users. Context plays an important role in influencing behavior by persuasion. For example, individuals are being motivated and inspired to achieve their fitness goals and improve their wellbeing (Matthews et al. 2016).

Environmental quality strongly depends on human behavior patterns (Koger and Winter 2011; Gardner and Stern 2002; Vlek and Steg 2007), and thus can be managed by changing relevant behavior to reduce negative environmental impact. Designing practices and policies for maintaining sustainable future requires understanding pro-environmental behavior psychology as well as ability to use behavior-altering techniques to ensure enduring behavioral modifications.

Therefore, knowledge and practices previously gained in Persuasive Systems Design (PSD) and Behavior Change Support Systems (BCSSs) research (Oinas-Kukkonen 2013; Oinas-Kukkonen and Harjumaa 2009) can build a foundation for a systematic approach to creating innovative solutions that promote sustainable lifestyles. An overview of sustainable behavior psychology and encouraging pro-environmental behavior emphasizes the need of persuasion as a tool for inducing behavior change. Understanding background of Persuasive Systems Design and Behavior Change Support Systems as well as domains in which these concepts have been investigated highlights potential of these theoretical approaches to be applied in emerging contexts.

Considering that the same underlying factors are required to trigger behavior changes in any context (e.g. health, wellbeing, sustainability etc.), established frameworks previously applied in health and wellbeing-related domains could also be used as a roadmap for paving a path towards sustainable future. Correspondingly, sustainability would establish a novel context for employing behavior changing and persuasive systems. The paper outlines perspectives of merging theoretical understanding of foundations of the PSD model, BCSS framework and pro-environmental behavior facilitation. These theories will provide valuable essence for the IS researchers and practitioners with directing their efforts moving towards more sustainable future.

Understanding Persuasive Systems Design

Behavior Change Support Systems are defined as sociotechnical information systems with psychological and behavioral outcomes designed to form, alter or reinforce attitudes, behaviors or an act of complying without using coercion or deception. BCSSs are, in essence, persuasive systems, since the key element in voluntary use of a BCSS is persuasion (Oinas-Kukkonen 2013). Persuasive Systems Design model developed by Oinas-Kukkonen and Harjumaa (2009) is a state-of-the-art conceptual framework for designing and evaluating persuasive systems which consists of several steps.

According to Oinas-Kukkonen and Harjumaa (2009), prior to implementing a system it is required to understand the fundamental *persuasive postulates*. The seven postulates drawn from both software and information systems design and psychology emphasize key concerns to be taken into account before creating a new system. Next, the *persuasive context* for systems needs to be analyzed, recognizing the *intent*, *event*, and *strategies* for the use of the system. This analysis helps determine the persuader is, what type of behavior change is required to achieve, which message and route to use for persuasion and, what strategy to choose depending on the user and use situation and technological concerns. The final step is choosing *persuasive features* of a new system or evaluating features of the existing one. See Figure 1.

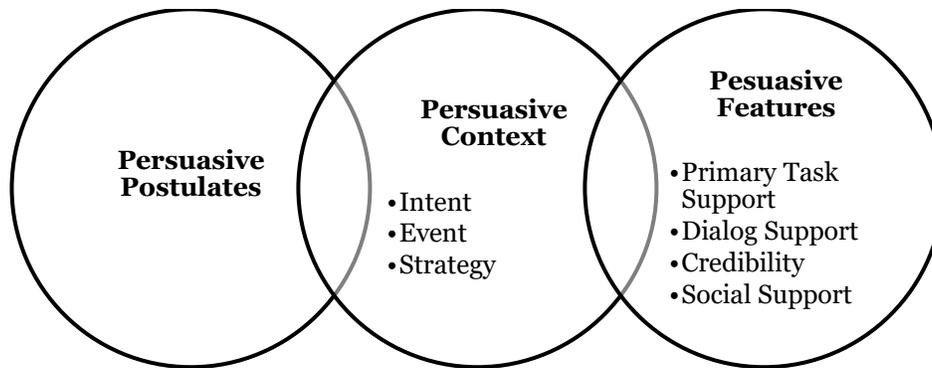


Figure 1. Persuasive Systems Design (Oinas-Kukkonen and Harjumaa 2009)

Several parts of the model have been validated in previous studies (Corbett 2013; Davis 2010; Harjumaa, Segerstahl, and Oinas-Kukkonen 2009; Kelders et al. 2012; Lehto and Oinas-Kukkonen 2015; Lehto, Oinas-Kukkonen and Drozd 2015; Lehto et al. 2012; Lehto and Oinas-Kukkonen 2011; Räsänen, Lehto and Oinas-Kukkonen 2010; Segerstahl, Kotro and Väänänen-Vainio-Mattila 2010; Wiafe et al. 2011; Yetim 2011). Flexible use and combinations of design principles make PSD model an effective tool for designing and tailoring solutions for different purposes (Oinas-Kukkonen 2013) and thus can be transferred to emerging contexts such as crafting Green IS/IT which can support sustainable behavior change.

Understanding Encouraging Sustainable Behavior

Based on the definition of pro-environmental behavior (Steg and Vlek 2009), sustainable behavior can be defined as the series of actions that harm the ecosystem as little as possible, or even benefit it. There are several steps to be taken in order to encourage sustainable behavior. Firstly, it is required to examine factors that promote environmental quality, then applying necessary interventions and finally systematically evaluate the effects of the interventions (Geller 2002). Steg and Vlek outline the steps (see Figure 2) required for transforming behavior from unsustainable to pro-environmental. Below is a more detailed explanation of these steps, since understanding psychology of encouraging sustainable behavior cannot be neglected when designing and implementing Green IS/IT.

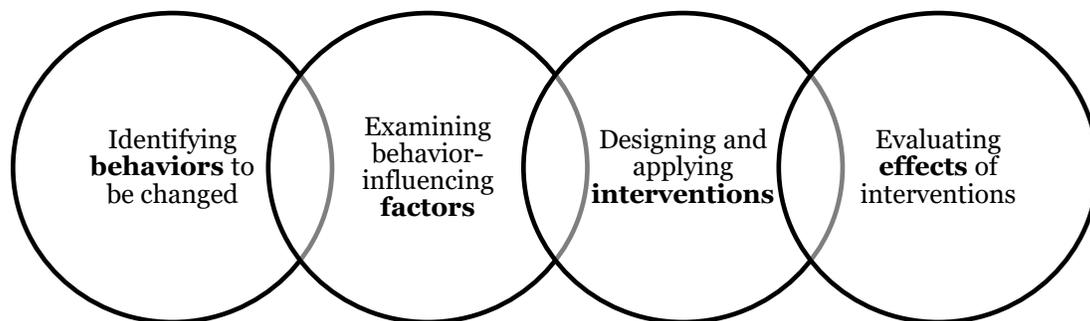


Figure 2. Supporting Sustainable Behavior Change Framework (Steg and Vlek 2009)

Identifying Behaviors to be Changed

Driving the overall increase in pro-environmental mindset and supporting behavior change begins with selection and assessment of specific behaviors. After establishing which behaviors require immediate modifications because of their harmful impact on sustainability of environment, it is necessary to determine whether such changes are feasible and if these alterations will be acceptable. Feasibility and acceptability highly depends on behavioral factors and intervention strategies which are taken into account in the further stages of the framework. Furthermore, valid measures have to be established to ensure proper assessment of desired behavior change. Because of the variety of underlying behavioral factors and feasible strategies, selecting target group(s) of individuals is necessary as well as deciding

whether the groups can be treated homogeneously or whether specific interventions for each group will be required.

Examining Behavior-Influencing Factors

Once behaviors which need to be modified are discovered, the causes of these behaviors should be examined. While determining factors which shape a behavior may be more complicated than expected since these factors stem from motivations which are rarely homogeneous. For example, the Goal-Framing Theory (Lindenberg 2001a; 2001b; 2006) suggests that behaviors are triggered by multiple motivations resulting in one focal goal which has the strongest influence on the individual's information processing while the other existing goals increase or decrease the strength of the focal goal.

The individuals' approach to *weighing costs and benefits* constitutes one behavior-forming factor (Steg and Vlek 2009). This notion stems from the Theory of Planned Behavior (Ajzen 1991) which suggests that people make reasoned choices and choose alternatives with highest benefits against lowest costs (e.g., in terms of money, effort and/or social approval). Additionally, Steg (2005) examined the role of *affect* in explaining environmental behavior because the theory on the meaning of material possessions (Dittmar 1992) suggesting that the use of material goods fulfils three functions (instrumental, symbolic, and affective) provided insights in individuals' choices to use a car.

Furthermore, previous research determined that various *moral and normative concerns* heavily impact the individuals' behaviors. Studying *value-basis of environmental beliefs and behavior* revealed that the more strongly individuals relate to values beyond their immediate own interests (self-transcendent, prosocial, altruistic or biospheric values), the more likely they are to acquire pro-environmental behavior. Research focused on *environmental concerns* showed that higher environmental concern is associated with acting more pro-environmentally (Steg and Vlek 2009). One of the frequently used tools to measure environmental concern is the New Environmental Paradigm scale (Dunlap and Van Liere 1978; Dunlap, Van Liere; Mertig and Jones 2000). *Moral obligations* to act pro-environmentally have also been researched and related to sustainable behavior based on the norm-activation model (NAM) (Schwartz 1977; Schwartz and Howard 1981) and on the value-belief-norm theory of environmentalism (VBN theory) (Stern 2000; Stern et al. 1999). The influence of *social norms* on any behavior (including sustainable) is supported by the theory of normative conduct (Cialdini, Kallgren and Reno 1991; Cialdini, Reno and Kallgren 1990) and distinguishes two types of influential social norms. *Injunctive norms* describe the extent to which behavior is supposed to be commonly approved or disapproved, while the *descriptive norms* reflect the extent to which behavior is perceived as common.

Apart from the factors that drive reasoned behavioral choices, *habits*, guided by automated cognitive processes, rather than by elaborate reasoning, also highly impact sustainable behavior. Computer simulation is one way to study the formation and reinforcement of habits (Jager and Mosler 2007) to design effective interventions. Finally, in addition to the individual motivations, *contextual factors* impact sustainable behavior by facilitating or constraining it. Context affects behavior in several ways, such as directly or via relationships with the by motivational factors (such as attitudes, affect, or personal norms).

Designing and Applying Interventions

The next step in promoting sustainable behavior is choosing appropriate interventions for changing existing behaviors. Among various classifications of possible strategies, the most frequently referred to are *antecedent* and *consequence* as well as *informational* and *structural* (Steg and Vlek 2009). Determining the most effective choice of strategy depends on the specific barriers that inhibit individuals to act pro-environmentally.

Antecedent strategies (information and education, prompting, modelling, behavioral commitments, and environmental design) are meant to change factors that precede behavior raising problem awareness, informing about choice options, and announcing the likelihood of positive or negative consequences. On Consequence strategies (feedback, rewards, and penalties) are aimed at altering consequences following behavior.

Informational strategies aim to change prevalent motivations, perceptions, cognitions and norms. Education and information dissemination increase individuals' awareness of environmental problems, environmental impacts of behavior, and introduces behavioral alternatives. Persuasion can be aimed at

influencing attitudes, strengthening altruistic and ecological values, and increasing commitment to act pro-environmentally. Additionally, social support and role models can be used to intensify social norms, and to inform individuals about the perceptions, efficacy and behavior of others, which has been successful in supporting sustainable behavior (Abrahamse et al. 2005; Lehman and Geller 2004; Schultz et al. 2007).

Structural strategies increase individuals' opportunities to act sustainably and pro-environmental behavior choices more attractive, and thus aim to change the circumstances not controlled by the individuals themselves, for instance, contextual factors such as availability and the actual costs and benefits of behavioral alternatives. For instance, the availability and quality of products and services may be altered, environmentally harmful behavioral options can be limited, and new improved sustainable behavior options may be provided. Often, implementation of structural strategies takes form of either rewarding proper behavior or punish unwanted behavior (Geller 2002). For instance, regulations can be implemented enforcing legal measures and provisioning punishment of violations. Similarly, pricing policies can decrease prices of pro-environmental choices or increasing prices of unsustainable alternatives.

Evaluating Effects of Interventions

The final step in the process of supporting sustainable behavior is evaluation of effects of interventions. It should focus not only merely on changes in environmental behaviors, but also on other aspects. For instance, it is important to record changes in behavioral determinants, which provides an insight into why intervention programs were successful or not. Additionally, monitoring changes in environmental impact reveals whether the ultimate goal of behavioral interventions in the was reached. Moreover, observing changes in the overall quality of life is a crucial part of the evaluation process since it directly relates to the more general notion of sustainable development. With continuous monitoring of behavior, one can assess if the success of interventions is able to withstand the test of time.

Behavior Changing Green IS/IT

Based on the discussion of the previous research from the fields of information systems, psychology, and sustainability, creating behavior changing Green IS/IT required insights from multiple disciplines. In order to initiate bridging knowledge acquired from persuasive systems and sustainable behavior change research, the steps of encouraging sustainable behavior need to be combined with the persuasive systems design into one comprehensive theoretical model (see Figure 3). Further studies required to scrutinize persuasive context in sustainable domain and to choose specific most applicable persuasive features.



Figure 3. Creating Behavior Changing Green IS/IT

Conclusion

Since theoretical background of health, well-being and sustainable behavior stems from related theories, achieving any behavior modification should be possible with the application of the similar methodologies. For instance, providing feedback to the users and increasing awareness of their own behavior have been most prominent strategies in both healthcare improvements and fostering environmentally-friendly lifestyles (Coskun, Zimmerman and Erbug 2015; Middelweerd et al. 2014). Therefore, Behavior Change Support Systems framework and Persuasive Systems Design model, which so far have been discussed and applied mainly in health and wellbeing contexts, are worth considering when enforcing sustainable

behaviors and building corresponding “green” applications aimed at encouraging pro-environmental behavior.

Additionally, to facilitate development of Green Information Systems and Technologies as well as preventing their fading like a short-living fad (Dedrick 2010), continuous revision of the theoretical frameworks and practical solutions for “greening” individual behaviors is required. Understanding cognitive, motivational and structural factors and processes that threaten environmental sustainability enables producing frameworks and solutions for facilitating pro-environmental behaviors and attitudes. Having identified that sustainability context lacks coherent conceptual frameworks and systematic analysis of effective solutions (Coskun, Zimmerman and Erbug 2015), this paper proposed utilizing insights from existing Behavior Change Support Systems, Persuasive Systems Design, and behavioral studies from pro-environmental domain. Based on assessment of BCSS and PSD research, it was hypothesized that the same underlying principles of constructing effective behavior-altering applications can be utilized in sustainable solutions. It is proposed that merging insights from the previous studies applicable to the Green IS/IT (Oinas-Kukkonen 2013; Oinas-Kukkonen and Harjumaa 2009; Steg and Vlek 2009) can initiated bridging an emerging context of sustainable behavior with the Persuasive Systems Design resulting into Behavior Changing Green IS/IT.

Overall, thorough theoretical understanding of human behavior and its change with IS will help outlining steps to assist incorporating sustainability context in creating applicable Green IS/IT solutions for inducing pro-environmental behaviors. To move on, the forthcoming research goal should be driving further theoretical research of utilizing Persuasive Design and Behavior Change Support Systems concepts in Green IS/IT as well as practical implementations in order to validate theoretical findings and continue walking towards sustainable future.

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