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DESIGNING FOR BEHAVIOUR CHANGE: SMART PHONE APPLICATIONS AS PERSUADERS OF PRO-ENVIRONMENTAL BEHAVIOURS

Aykut COŞKUN*, Çiğdem ERBUĞ*

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1. For a list of design-for-sustainability approaches, please see (Bhamra and Lofthouse, 2007; Sherwin, 2004; Crul and Diehl, 2005; Birkeland, 2002).

* Department of Industrial Design, Faculty of Architecture, METU, Ankara, TURKEY.

INTRODUCTION

The purpose of design for sustainability, in a broad sense, is to reduce our negative impact on the environment, society, and the economy. To date, various approaches have been proposed to serve this purpose (**1**). These approaches commonly focus on the physical and technological qualities of sustainable products or services; for instance, reducing the amount of material used during manufacture, using recycled or recyclable materials, improving products' resource efficiency, and so on. However, a product's environmental impact also depends on user behaviour; researchers have found that the majority of the impact of an electronic product occurs during the use phase, and that this impact is largely determined by user behaviour (McCalley and Midden, 2002; Wood and Newborough, 2003). This finding illustrates that promoting sustainable consumption practices is critical for moving towards sustainability as well as for designing sustainable products (Stegall, 2006).

Many studies illustrate design's potential in influencing user behaviour for the purpose of sustainability (Bhamra et al., 2011; Broms et al., 2009; Gustafsson and Gyllenswärd, 2005; Lilley et al., 2005; Lockton et al., 2010; Mazé and Redström, 2008; Tang and Bhamra, 2008; Wever et al., 2008). This potential relies on the belief that design can be used to communicate persuasive arguments to users. Buchanan (1985, 8-9) states that 'the designer, instead of simply making an object or thing, is actually creating a persuasive argument that comes to life whenever a user considers or uses a product as a means to some end'. In this view, designers talk to users through products: when imagining a new product, designers make decisions about dimensions such as form, function, interaction, technology, material, colour, and so on. By manipulating these dimensions, they convey messages to users about how the product is (or should be) used, how it functions, and how users interact with it. In short, designers have the opportunity to inscribe their 'persuasive intentions' into the products

(Crilly, 2011); this intentional nature of design activity makes it a valuable tool for developing persuasive products.

DESIGNING FOR PRO-ENVIRONMENTAL BEHAVIOUR CHANGE

Redesigning an existing product to modify user behaviour can reduce its environmental impact during the use phase. However, designers can go beyond this idea by designing a new product, whose main purpose is to encourage a set of environmentally responsible behaviours, for instance, an assistant that help users in adopting a sustainable lifestyle by providing suggestions on daily activities such as driving, eating, shopping etc. In other words, besides modifying an existing behaviour, design can be used to motivate new pro-environmental behaviours (PEBs), defined as behaviours that a person performs consciously in order to minimize his or her negative impact on the environment (Kollmuss and Agyeman, 2002). Such activities involve minimizing resource and energy consumption, using non-toxic substances, choosing public transportation, recycling, or being a member of an environmental organization.

Designing products for PEBs requires designers to have a thorough understanding of the persuasion context, i.e. the aspects that comprise the context and influence the success of a persuasive attempt. In their persuasive system design model, Oinas-Kukkonen and Harjumaa (2009) describe the three key aspects of the *persuasion context* as 1) the intent, 2) the event, and 3) the strategy. The intent includes the persuader, in this case the product, and the type of change the persuader is trying to achieve, i.e. to increase, decrease, stop, or maintain behaviour. The event consists of the situation where the persuasion occurs (use context), the technology used to persuade (technology context) and the characteristics of the user (user context). User context includes psychological factors such as attitudes, intentions, and beliefs that influence users' likelihood of performing behaviour or their compliance with a persuasion strategy. Finally, the strategy includes the persuasive message and the way this message is delivered to the users (route).

Concerning the persuasion context, this paper focuses on the persuader. Unlike human persuaders, the persuaders in *design for behaviour change* are usually products such as electrical appliances, computers, electronic devices, smart phone applications, etc. These products have no intentions on their own, of course, but convey designers' persuasive intentions. One of the key issues for product persuaders is that they should encourage sustained interaction over time to have a meaningful impact on behaviour change (Nawyn et al., 2006). This result can be achieved by providing a satisfactory and pleasurable user experience; however, it is critical to know which product qualities (of the persuader) contribute to sustained interaction. According to Hassenzahl (2003), there are two types of product qualities that influence user experience and satisfaction: *pragmatic* qualities and *hedonic* qualities. The former refers to those that allow users to achieve their behavioural goals, such as usability, whereas the latter refers to those that address users' stimulation and identification needs, such as novelty and challenge. This paper focuses on smart phone applications as persuaders of pro-environmental behaviours, and the desired qualities that contribute to their sustained usage.

SMART PHONE APPLICATIONS FOR ENCOURAGING PEBs

Because of their mobility, connectivity and smartness, smart phone applications have great potential to initiate PEBs (Fogg and Eckles, 2007). Mobility can facilitate behaviour change by delivering the required information to users at the right time and right place; offering suggestions at the right time may enhance the chance to persuade users (Fogg, 2003). Connectivity allows users to have immediate access to and share of information at any time from any place or any device. Thus, connectivity can facilitate behaviour change through delivering up-to-date and contextual information as well as by utilizing social influence strategies such as social learning. Smartness can facilitate behaviour change by providing a better understanding of users and of the context where the persuasion event occurs.

Many studies illustrate the potential of smart phone applications for facilitating pro-environmental behaviour change. For example, Weiss et al. (2012) find that users have a positive attitude towards using such applications for encouraging energy conservation. In their study of a mobile application giving feedback about residential energy consumption, Kjeldskov et al. (2012) find that the application allows people to obtain a deeper understanding of energy use, which reminds them of the environmental importance of conserving energy. Marcus and Jean (2009) develop a mobile phone application which combines smart grid technology with persuasive means of communication to decrease household energy consumption. They find that the application encourages users to be *greener*. Similarly, Weiss et al. (2009) designed a mobile application that works with a smart energy meter which allows users to monitor, control and measure their energy consumption at home. They state that the application allowed users to decrease their energy consumption through identifying the biggest energy consuming domestic appliances.

In another study, apart from energy consumption, Froehlich et al. (2009) report that a smart phone application, which senses and gives information to users on their transportation behaviour, encouraged eco-friendly travel choices. In addition to that, Ganti et al. (2010) design a mobile GPS application that senses and suggests the most fuel efficient route to the drivers. They report that the application can influence drivers' choices and increase fuel savings, which in turn reduce CO_2 emissions. Lastly, Rahman et al. (2012) develop a mobile phone application providing feedback about users' carbon footprint according to their transportation choices, and suggesting alternative (more environmentally friendly) transportation options to the same destination.

It seems that, these studies focus on specific domains and behaviours, i.e. energy consumption and transportation. Thus, the exploration of smart phone applications that aim to motivate sustainable lifestyles related to diverse activities such as eating, commuting, driving, heating, recycling etc. is also required. Furthermore, the common methodology that these studies use is designing and testing of an initial prototype. Therefore, further research that examines how users experience with commercial applications and how their preferences influence their experience would contribute to the field.

STUDY DESIGN

Smart phone applications with ecological themes

This study explores smart phone applications with ecological themes, which refers to applications that aim to encourage environmentally responsible behaviours. It aims to determine the desired product qualities that influence users' preferences of and experiences with these applications, as well as their potential contribution to behaviour change. To find the appropriate smart phone applications for the study, we searched the internet using keywords such as smart phone applications, mobile persuasion, persuasion, behaviour change, sustainability, and pro-environmental behaviours. We found 16 applications, developed for IPhone, and downloaded the latest versions of the applications (as of December 2011, when this research was conducted) from iTunes application store. The main motivation behind selecting a specific smart phone brand and specific applications is not to evaluate their performance, but to stimulate users to reveal their preferences and experiences. Later, we chose four applications based on the persuasion technique used to motivate behaviour change. We used the persuasion techniques and principles from the ones proposed by Oinas-Kukkonen and Harjumaa (2009) and Fogg (2003) when choosing the applications (**Table 1**).

Because the purpose was to study diverse persuasion techniques and choose applications easily accessible to participants, selected applications were required to have at least two different persuasion techniques and cost less than one dollar (US). **Figure 1** illustrates the selected applications' interfaces and provides a summary about the techniques.

Participants

Participants were selected for this study based on demographic characteristics such as gender, age, and education level. The sample consisted of 10 males and 10 females between the age of 23 and 34 (average age of 27). Participants were required to have at least an undergraduate degree, since higher-educated people are tend to be more concerned about environment and more motivated to perform pro-environmental behaviours (Diamantopoulos et al., 2003). In addition to that, participants were required to own an iPhone and to have been using smart phone

Eco-feedback Product's ability to provide feedback about user behaviour (either current or future behaviour) via real-time feedback or simulation.
Reminder Product's ability to remind users to perform an environmentally friendly behaviour.
Reward Product's ability to provide rewards to the users for achieving a goal, e.g. giving a virtual trophy when energy conservation reaches a desired level.
Self-monitoring tool Product's ability to allow users to monitor themselves; that is, observe their behaviour to determine whether they succeeded or not.
Social learning and facilitation (through social media) Product's ability to allow user to observe others who perform the same behaviour and compare user's own actions, e.g. observing friends' actions regarding energy consumption.
Suggestion Product's ability to deliver suggestions or recommendations to users on issues related to environmental problems to increase their awareness about PEBs, e.g. 'Using energy-efficient light bulbs would help your economy and the environment'.
Trigger Product's ability to stimulate (or push) users to perform a desired behaviour.

Table 1. Persuasion techniques explored during the study.

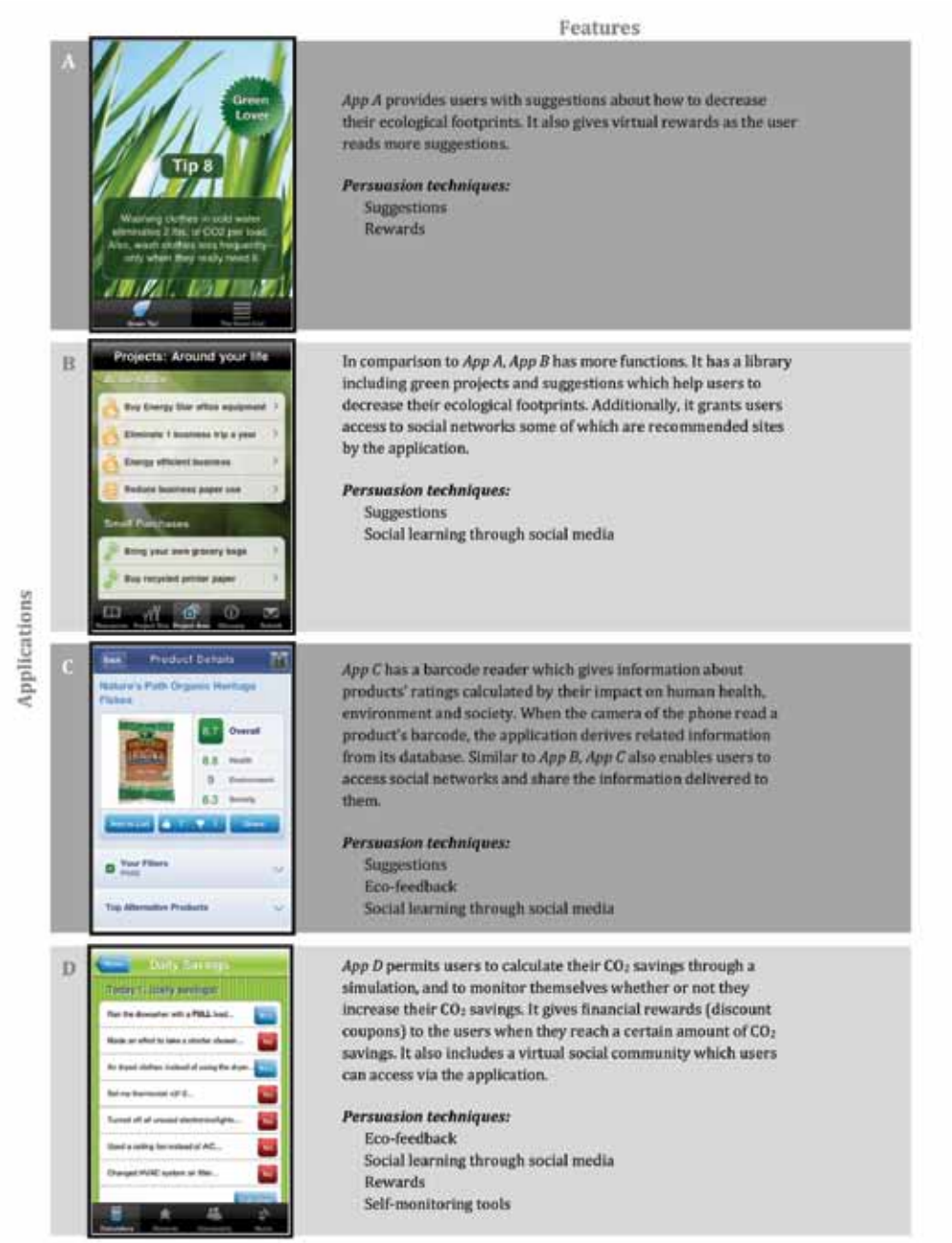

Figure 1. Selected applications and their features.

applications for at least six months. None of the participants had previous experience with an application with ecological themes. Three participants attended only the first phase of the study, citing their busy schedules that caused them to forget to use the application. Thus, the results presented here are based on data from 17 participants (eight males and nine females).

Stages of the study

The study consists of two main foci: 1) product qualities that influence users' preferences at first glance, and 2) product qualities that influence users' early experiences with applications and contribute to sustained usage. To gain insights on these two aspects, participants were first

Figure 2. An application card presented to participants during the interviews.

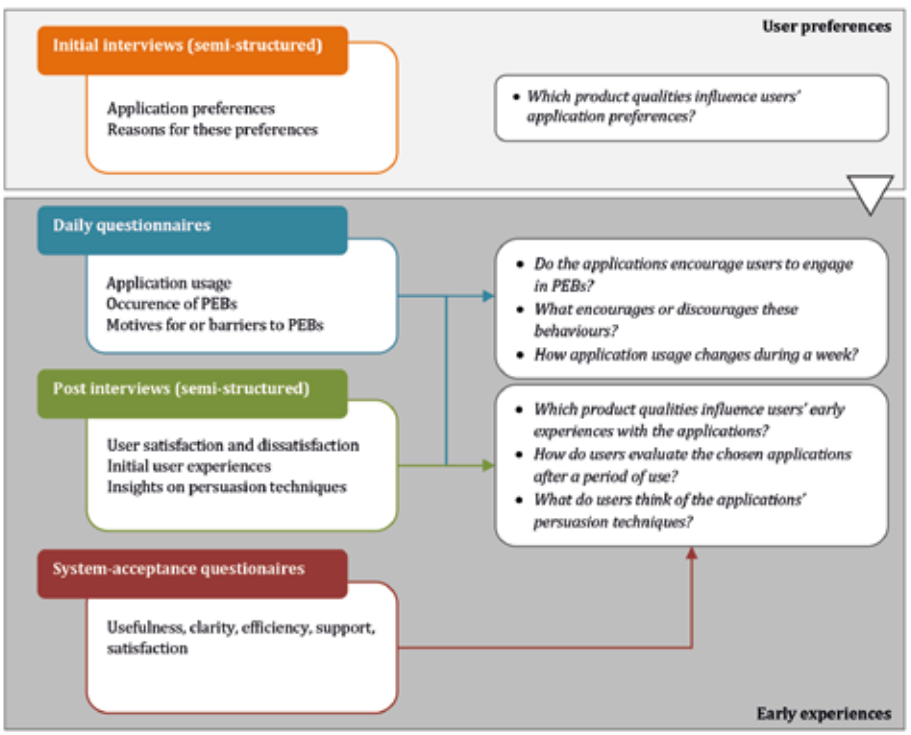

Figure 3. Study design.

presented with four application cards that were composed of the summary of main features of each application and three screenshots from the usage scenario (**Figure 2**).

The cards were colour printed on A5 size paper. All cards were presented to participants at the same time. Next, participants were asked to choose the one that best suited their needs, and to use the preferred application for one week. A series of interviews and questionnaires were used for data collection during this process, explained in the next section. The study design is illustrated in **Figure 3**.

Stage 1: initial interviews

Two semi-structured interviews were conducted in the study: one during the participants' first encounter with the applications, and one after they had used one of the applications. Interviews were held in a laboratory environment (the METU-UTEST Product Usability Unit) and all were voice recorded. The purpose of the initial interviews was to explore participants' application preferences and the reasons for those preferences. The interviews consisted of open- and closed- ended questions. Each interview began with the latter, such as demographics, e.g. age, gender, occupation. At the beginning of the first interview sessions, each participant was asked about their intention of performing PEBs. The purpose of this question was to provide additional user information, which can be valuable for discussing applications' contribution to behaviour change. Next, participants were asked to study four application cards and select two in order of preference. The reasons for their choices and the product qualities affecting these choices were probed in detail with open-ended questions.

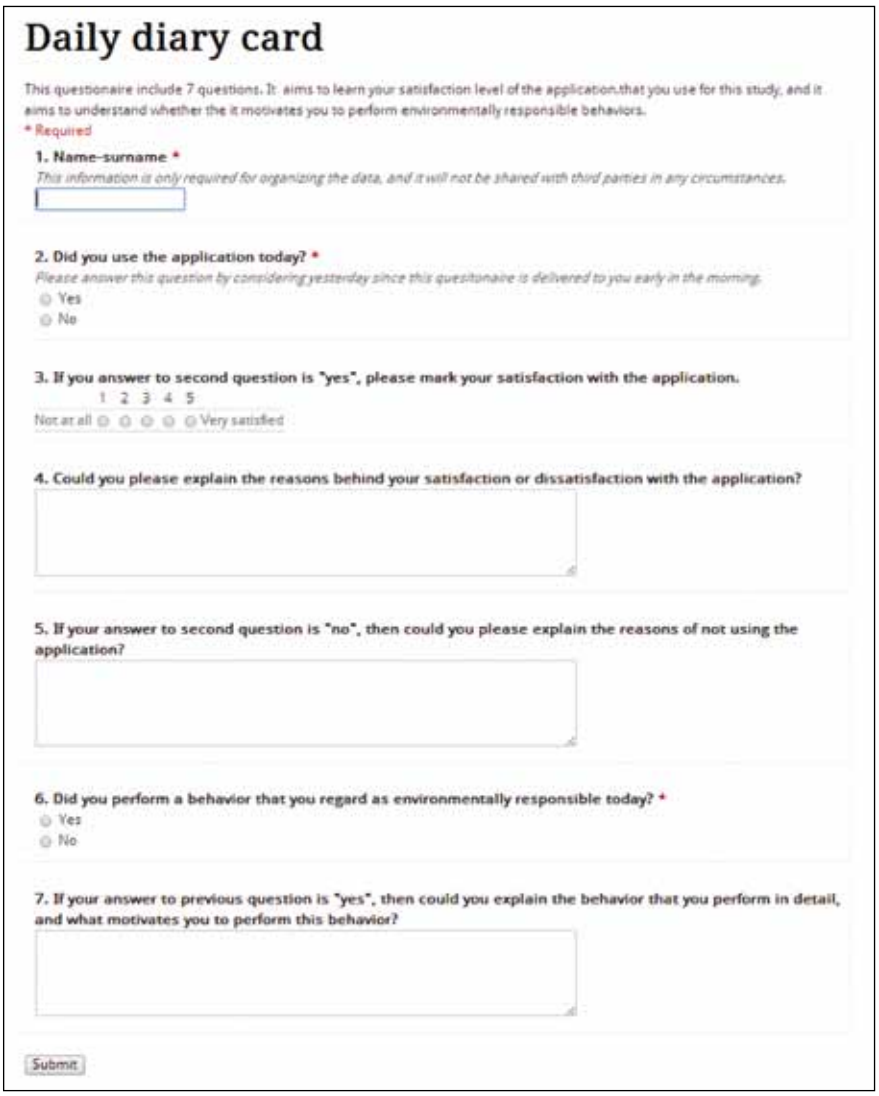

Figure 4. A screenshot of a daily diary card.

Stage 2: daily questionnaires

To observe participants' daily use of the applications and their experiences, questionnaires were devised as diary cards, and delivered daily to participants via e-mail. These questionnaires included items related to application use, frequency of PEBs, and motives for and barriers to engaging in PEBs (**Figure 4**). We used Google Drive, free online software for creating and disseminating questionnaires, to create the forms and collect the responses. We preferred this method for several reasons: 1) researchers and participants did not have to meet in person to disseminate and receive the diary cards or arrange pick up of them; 2) because people usually check their email inbox throughout the day, emailed questionnaires can remind participants to answer the questions after using the applications; 3) it is much easier to manage data collected online because this method does not require transcribing user responses for data analysis.

Stage 3: post-interviews

Post interviews mainly inquired about participants' early experiences with the applications, i.e. levels of satisfaction and dissatisfaction, qualities influencing their experiences, and insights on how different persuasion techniques motivated PEBs.

Stage 4: system-acceptance questionnaire

After the post interviews, participants were asked to fill in system acceptance questionnaire (SAQ) developed by Maguire (2001). The questionnaire consisted of 27 items and corresponding scales from 1 to 7 (1=strongly agree, 7=strongly disagree). The items are situated in association with five different dimensions: usefulness, clarity, efficiency, support, and satisfaction. It should be noted that, the purpose of using SAQ was not to evaluate the performance of the applications, i.e. which one of them was the most usable or which one was the most satisfying, but to motivate participants to discuss the reasons behind their evaluations.

Data analysis procedure

Because the collected data was mostly qualitative, we used a content analysis method (Krippendorff, 2004) divided into two phases of deductive and inductive coding procedures (Strauss, 1987). First, the data was

Main product quality	Sub product quality	Participant's comment	Hedonic/pragmatic quality
User engagement	Ease of use (Simplicity)	*I think that such ecological applications should not overwhelm the user as environmentally responsible behaviors need to be done repeatedly to have an effect. Thus, if the application is not easy to use and provide an engaging use such as reading a product barcode and having immediate feedback with one simple action, you may get bored and lose your motivation to use it.*	Excitement

Table 2. Coding example.

coded deductively using hedonic and pragmatic product qualities, as in Hassenzahl (2004). In our case, the purpose was to observe whether the significance of two different type of product qualities varied according to the state of interaction, i.e. during the application selection and during the initial experience. Second, we labelled data segments according to their content (open coding) and grouped the segments into broader categories (axial coding) using the codes that emerged from the data which involved more-detailed and mainly inductive coding (Corbin and Strauss, 2008) (**Table 2**). Last, we analysed the relationships between these categories in order to create a model that illustrates the desired product qualities. We complemented this analysis with a quantitative analysis of the number of the comments made about each quality and the number of participants who mentioned each quality by using NodeXl (Hansen et al., 2011).This helped to visualize and understand the prominent qualities and their relations to each other, which contributes to the model that summarizes the qualities and relations influencing sustained interaction.

Results

We present the results in three sections, supported by user quotations from the qualitative data. First, we discuss the users' one-week experience and application selection based on hedonic and pragmatic product qualities. Second, we elaborate on each product quality that influenced the selection of and early experiences with the applications. Finally, we discuss the applications' contributions to behaviour change based on behaviours adopted by participants and their insights on different persuasion techniques.

Application selection and initial user experience

Our results show that during the application selection users were more likely to consider hedonic qualities, such as novelty, excitement, challenge, and originality, over pragmatic qualities. However, during the initial experiences, pragmatic qualities, such as practicality, functionality, directness, complexity, and clarity, became prominent as participants encountered problems related to the applications' utility and usability (**Figure 5**). We suggest that users made choices in this way because they are first in search of the appropriate knowledge, skills, and intentions to perform PEBs, and hedonic qualities contribute to these requirements by stimulating increased environmental awareness and establishing

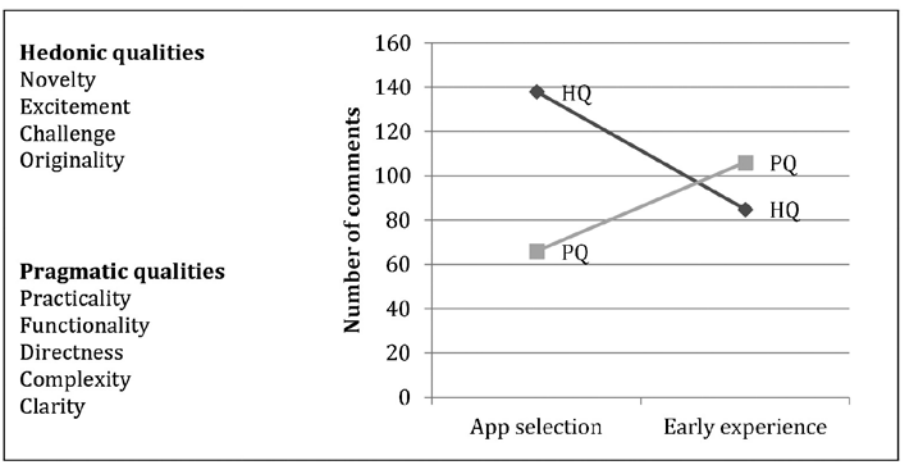

Figure 5. Number of comments on hedonic and pragmatic qualities according to application selection and early experiences.

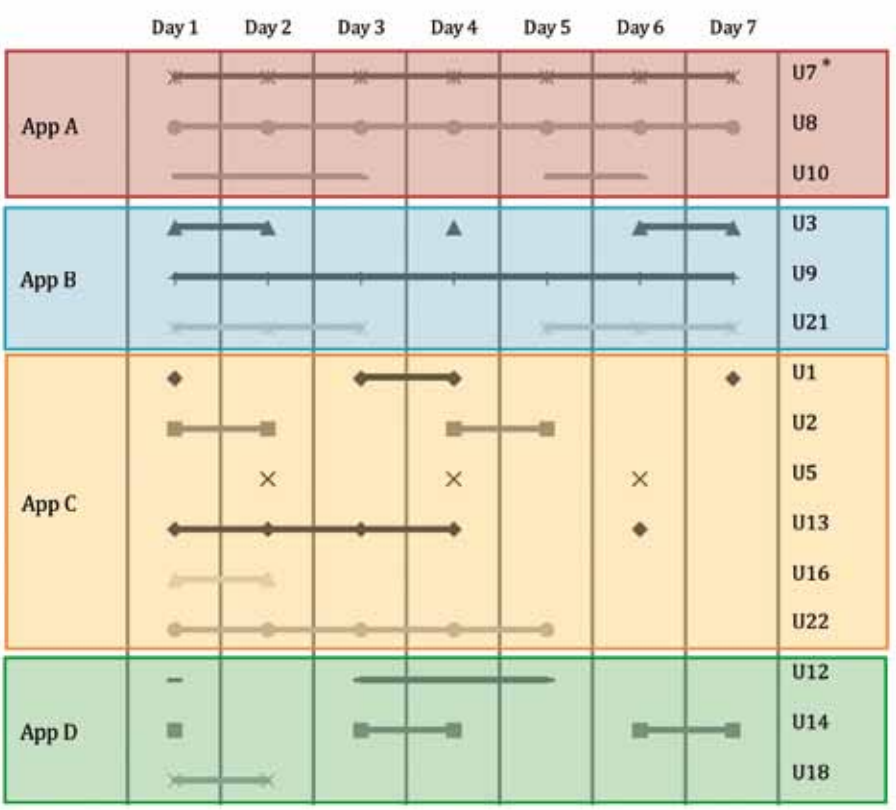

Figure 6. Participants' use of the applications over one week (**3**).

behavioural intention. Once the intention has been established, users are more likely to evaluate an application according to its pragmatic qualities.

Although the aim is not to evaluate applications' performance by SAQs, the results are beneficial to understand the reasons behind the evaluations. The results reveal that overall satisfaction with each application was not very high: App A=4.00, App B=5.22, App C= 3.52, App D=2.94 (**2**). Other values associated with each dimension in the questionnaires were above the mean value only for Application B (Usefulness=5.17, Clarity=6.15, Efficiency=6.00, Support=6.07). Moreover, the results derived from the daily questionnaires indicated that the majority of participants (n=12) did not use the applications continuously (**Figure 6**). For instance, seven participants stated that they sometimes avoided using the applications because of the time and effort required to perform the tasks. Consequently, providing easy to use and engaging interactions is crucial in order to increase user satisfaction as well as sustained usage.

Product qualities

Discussing product qualities based on their hedonic and pragmatic aspects provided a broad understanding of user preferences and satisfaction with the applications. Then, the inductive and quantitative data analyses allowed us to delve into these qualities, focusing on smart phone applications with ecological themes, and revealing the relations between them (**Figure 7**). Three qualities emerged that appear to encourage sustained usage: applicability to personal needs, acquisition of environmental knowledge, and user engagement. Satisfaction with these

2. The values are out of seven.

3. Two of the participants did not fill in the daily questionnaires even though they attended other research sessions. Thus, the figure is based on data from 15 participants.

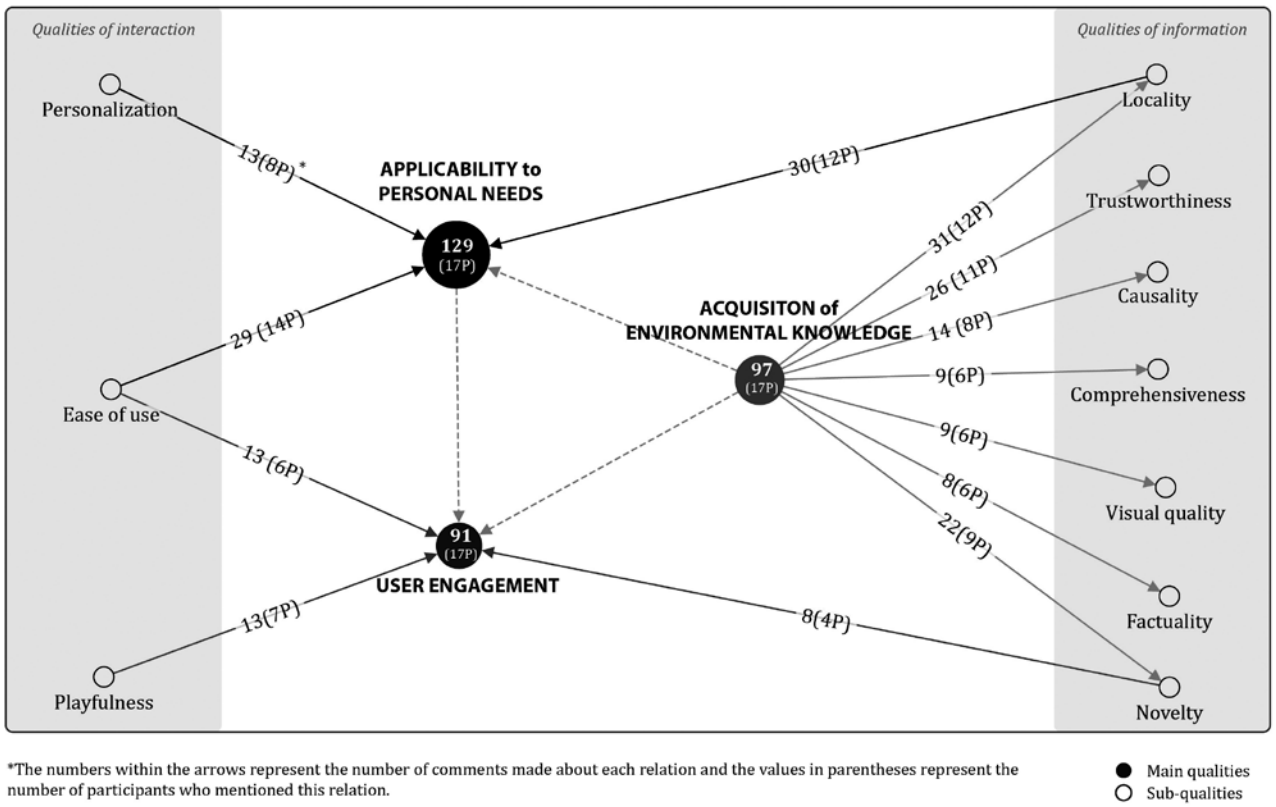

Figure 7. Relations between application product qualities.

qualities is influenced by how interactive the application is, as well as what information the application provides and how it does this. The following sections explain these qualities in more detail, based on the required sub-qualities.

Acquisition of environmental knowledge

The first prominent product quality is an application's ability to increase users' environmental awareness (97 comments from 17 participants). In accordance with their personal needs, users expect to acquire information on environmental issues, (e.g. 'if current consumption patterns remain the same, an additional Earth is required for humankind's survival by 2050.'), and action strategies to overcome these problems, (e.g. 'choosing public transport over a private vehicle can reduce one's "ecological footprint" up to 18 %.') (Wackernagel and Rees, 1998, 9). Furthermore, the means of delivering this information seems as important as the information itself. For instance, seven participants preferred receiving eco-feedback (e.g. showing weekly CO_2 savings with figures and graphs when participants' actions are entered into the application) rather than reading a suggestion from the application (e.g. 'you can decrease your ecological footprint by travelling less often'.). However, users seem to be most concerned about the content and qualities of the information, starting with locality. Since the majority of the participants (n: 12) preferred locality, smart phone applications should provide locally applicable information to increase the user's likelihood of performing PEBs:

> "The app couldn't lead me to a store nearer my home. I was to drive half an hour to the suggested store to purchase organic food, which costs me time and money." (P12)

The second-most important sub-quality is trustworthiness. Nine participants stated that they consider changing their behaviours only if they believe that the information delivered to them is trustworthy. This quality is mostly associated with the information's consistency with the user's existing knowledge, factuality and its source (trusted person such as a friend, trusted organization such as government or university, and a trusted brand). One participant illustrated the importance of this quality as follows:

> "If the information provided to me is not trustworthy, I would not even use the application. I will probably check the information with other sources to determine whether it is true before attempting to change my behaviour…. I would consider information trustworthy if I know that the source is credible, for example, a government institution." (P10)

The third-most important information sub-quality is novelty. Users want to see recent and new information (n:9), and they prefer to have an application that can update its content easily via virtual communities and social networks. Qualities such as novelty, trustworthiness, and locality are also required for sustained usage; in addition to motivating PEBs, they enhance user engagement.

The next-most important information quality is factuality, which is giving specific factual information to the users. Users stated that when they see factual information presenting concrete examples supported by statistical explanations, they believe that the associated behavioural outcomes are realistic, which motivates them to reduce their impact to perform PEBs. Users want to see (n:6) causal information, such as why a particular product is more environmentally friendly than others, or what the outcomes would be of choosing one behaviour over another. Users also demand high visual quality because this aspect affects information comprehension and enhances usefulness. Finally, it is also important to provide comprehensive, essential and saturated information about the behaviour to be adopted:

> "Well, I like the idea that the application gives you projects, which include different environmentally friendly behaviours to reduce your ecological footprint. It offers a choice of many projects, varying in terms of size (small, medium, and large) and environment (work and home). This aspect really helped me choose the projects that were suitable to my daily life." (P12)

Applicability to personal needs

The second-most prominent product quality regarding application selection was applicability to users' needs, capabilities, and environment in terms of content and the interaction (129 comments from 17 participants). For example, information should be delivered to users in accordance with their level of environmental awareness. Users with low environmental awareness wanted to know more about problems such as global warming, whereas those with greater awareness wanted to learn more about their impact on the environment and ways to reduce it. Furthermore, it is advised to give behavioural suggestions based on their past behaviours and habits:

> "The app says 'Instead of using a dryer you can line dry your clothes to save energy'. In fact, I do not have a dryer, and I have been line drying my laundry for a long time, so this suggestion does not mean anything to me in terms of adopting environmentally friendly behaviours. If it came up with a suggestion that I hadn't done and could easily integrate into my daily life, I would definitely try to do it." (P7)

This factor is also related to users' actual and perceived behavioural control over their behaviours. For instance, seven participants stated that they comply with suggestions only if they believe that they are capable of doing them. For instance, due to time and money limitations, respondents may ignore suggestions such as 'You could achieve up to 15% in energy savings if you replace your heating system with solar energy panels' or 'You can decrease your ecological footprint by cycling to go shopping'. As for the applicability of the interaction, results show that users do not favour applications that require a lot of effort to access information, and they avoid using the applications unless they are personalized and easy to use:

> "I wish the app would allow me to scan many products at the same time. When I was shopping, I wanted to know the environmental quality of different products and brands. I tried to scan them but each time I had to close the information page and launch the scan function again, which took a lot of time." (P2)

Furthermore, five participants stated that the applications should easily fit into their lifestyles; that is, that the products understand users' skills and abilities, provide ease of interaction, and suggest suitable behaviours that can be implemented easily. These qualities may require a certain level of personalization and smartness; that is, based on our results, applications that can determine users' personal needs, tailor the information to those needs, and propose a personalized experience have great potential to elicit positive behaviour change.

User engagement

The third most-prominent quality is the application's ability to engage the user (91 comments from 17 participants). This factor contributes to sustained usage, which is essential to motivate and maintain behaviour change. This aspect can be enhanced by two product qualities: ease of use and playfulness. The results showed that although ease of use was mostly associated with pragmatic qualities such as practicality and complexity, it is also related to smartness: personalization and the ability to remember and learn. This understanding of ease of use can enhance willingness to use (user engagement) and the application's applicability to personal needs. Playfulness is usually about creating fun and enjoyment during use. Users would like to set behavioural goals challenging enough to compete against themselves or others, track their progress, and be rewarded when they achieve their goal:

> "In one or two weeks, I will be bored of this application; it should offer me an enjoyable experience such as playing a game so that I will keep using it. For instance, I might earn environmentally friendly points when I unplug my TV before going to bed or when I share a story on how excessive consumption threatens polar bears." (P19)

Applications' contribution to behaviour change

Seven participants reported that the applications motivated them to perform PEBs despite the limited time they spent with using them. Although this finding does not allow us to make generalizations about the applications' effects on behaviour change, it clearly shows their potential in encouraging PEBs; participants reported the following behaviours:

- Shutting down an electrical device at home (TV, computer monitor, etc.) after learning that even in stand-by position electrical appliances consume energy. (P8, P10, P21)

- Using public transportation instead of using his/her own car to go to work. (P1,P2,P14)
- Not purchasing a product after learning about its negative impact on the environment, health, and society. (P1, P2)
- Using a fabric shopping bag. (P9, P21)
- Sharing information through social media via the application, i.e. the learned negative impact of a favoured product. (P1)
- Forgoing additional electrical heater at the office. (P14)

The results show that perceived behavioural control (Ajzen, 1991) and situational factors (Stern, 2000) influenced users' performance of these behaviours. For instance, due to stated time, money, and availability restrictions, three participants did not perform any PEBs despite declaring their intentions to do so. On the other hand, two participants who declared that they would likely perform no PEBs stated that they did; because the behaviours required little effort.

Participants stated that applications' persuasion techniques were generally useful. Users thought that suggestions, eco-feedback, social media, and self-monitoring tools increased their awareness of environmental problems and ways to overcome them. However, they commented that merely reading environmental suggestions may not be sufficient to motivate behaviour change, and that perhaps the applications should play a more active role in persuading users to perform PEBs, such as providing notifications and triggers. Participants agreed that social media has great potential for persuasion because it enables sharing and accessing information shared by others. Users also thought that different members of social communities could provide different types of information:

> "In such a social community, each member can share his or her experience with environmental behaviours with others. This provides up-to-date and rich information that is created collaboratively." (P15)

Despite these advantages, users had concerns about sharing information such as the products they purchase, the amount of energy they conserve, etc. Some participants opposed the idea of using social media for increasing environmental awareness; they felt that social learning is more beneficial in a face-to-face context. Therefore, although social media tools are promising for smart phone applications with ecological themes, their pros and cons should be considered carefully when designing such applications.

The rewards given when a behavioural goal is achieved (such as reducing at-home monthly energy consumption by 10%) include financial rewards (e.g. discount coupons) and virtual rewards (e.g. achievement trophies). Participants found virtual rewards motivating for adopting and maintaining behaviour because they represented accomplishment. However, some stated that these rewards were not always persuasive, and can be perceived as childish. Many users found financial rewards motivating due to their contribution to their economy and the environment but others opposed the idea of rewards in general. The latter group felt that rewarding someone for performing PEBs conflicts with the idea of responsibility to the environment and society:

> "It seems contradictory for an application that encourages environmentally friendly behaviours to give discount coupons that promote further consumption. In fact, I prefer to behave more environmentally friendly without thinking of a reward at the end." (P18)

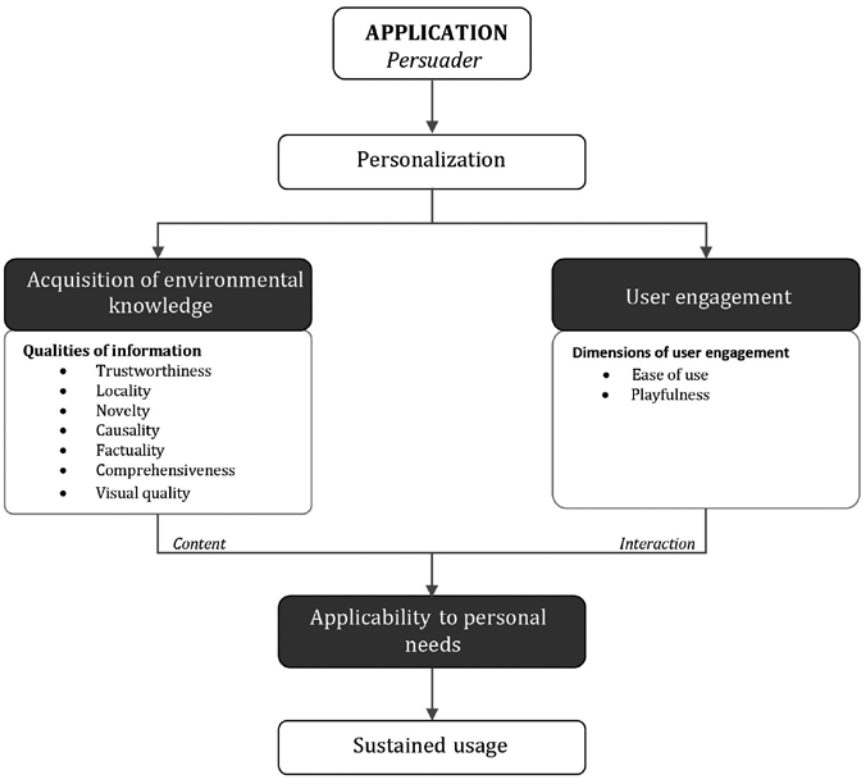

Figure 8. Model for sustained usage of smartphone applications as persuaders.

DISCUSSION AND CONCLUSIONS

It is true that that smart phone applications carry great potential for encouraging PEB change. However, we need to understand that behaviour change is a long term process and maintaining PEBs is as critical as encouraging people to start performing them. Thus, smart phone applications need to support people along the way and encourage sustained usage in order to ensure positive change for the sake of sustainability. In this respect, for smartphone applications as persuaders, this paper proposes an initial model that elaborates on the product qualities contributing to their sustained usage and influencing users' preferences and early experiences. (**Figure 8**).

According to this model, an application designed to persuade users to engage in pro-environmental behaviour change should allow personalization in content and interaction. As explained above, an application's content should be trustworthy, local, novel, causal, factual, comprehensive, and visual. These desired factors imply that the content should provide intellectual satisfaction to the user through appropriate acquisition of environmental knowledge as well as create excitement about using and motivation to use the application through new information and functions.

In parallel, the application's interactive qualities should provide engaging experiences through easy-to-use and playful features. In the context of this study, ease of use has nothing to do with menu structures or icons but is related to smartness, a quality that makes an application more usable through functions that allow recording habits, personalizing the interface, or sensing characteristics and adapting to different users and

situations. In the same way, playfulness means more than playing games with the application; it refers to some essential components of a game, such as challenge, competition, and achievement. In this sense, setting a challenging goal and being rewarded when this goal is attained can also create engaging experiences and motivate sustained usage.

Personalizable content and interaction is required to bind technology to our daily activities. In this respect, applicability to personal needs appears to be the most critical component in designing applications persuasive enough to encourage different types of users to perform PEBs. This quality will require designers to have a coherent understanding of users and to clarify meanings attached to user needs. Thus, to comprehend the nuances of human values, diverse methodologies will be required to derive similarities and differences between users to achieve an optimized level of personalization.

To conclude, the model presented here suggests that designers need to consider user diversity when designing for pro-environmental behaviour change. The reason for that is the differences in users' attitudes, interests, beliefs, needs etc. can influence how they experience a persuasive product and how they respond its persuasive attempts. Thus, the more the applications can be easily adapted to users' lifestyles the more they have the potential to encourage and maintain pro-environmental behaviours, which in turn contributes to sustainability.

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Anahtar Sözcükler: Davranış değişikliği için tasarım; ürün özellikleri; çevre dostu davranış.

DAVRANIŞ DEĞİŞİKLİĞİ İÇİN TASARLAMAK: ÇEVRECİ DAVRANIŞLARI ÖZENDİREN AKILLI TELEFON UYGULAMALARI

Davranış değişikliği için tasarım, son yıllarda tasarım yazınında önem kazanan ve çevreye dair sorunlara yeni bir anlayışla çözüm getirmeye amaçlayan bir yaklaşımdır. Bu yaklaşımın temelinde, ürünler ile kullanıcıların yönlendirilmesi ve bu yolla arzu edilen davranışın teşvik edilmesi yatmaktadır. Günümüzde, bu yaklaşım ile geliştirilen ve çevreci davranışları özendiren ürünler yaygınlaşmaya başlamıştır. Bu ürünlerin etkili bir davranış değişikliği yaratabilmesi, kullanıcılar tarafından olumlu karşılanmasına ve uzun süreli kullanılmasına bağladır. Bu bağlamda, ürün tasarımı, özellikle bu ürünlerin uzun süreli kullanılmasında önemli bir rol oynamaktadır.

Bu çalışma, kullanıcıların çevreci davranışları özendiren akıllı telefon uygulamalarına yönelik deneyimlerini; onların uygulamalar ile ilk karşılaştıklarında algıladıkları ürün özelliklerini ve uzun süreli kullanımı teşvik eden ürün özelliklerini incelemektedir. Çalışma sırasında, dört farklı akıllı telefon uygulaması kullanıcılara sunulmuş ve bu uygulamalardan kendilerine en uygun olanı seçmeleri istenmiştir. Daha sonra kullanıcılar, seçtikleri uygulamaları bir hafta süreyle kullanmışlardır. Veri toplama araçları olarak yarı yapılandırılmış mülakatlar, günlük anketler ve memnuniyet anketleri kullanılmıştır. Çalışmanın sonunda, kullanıcı tercihlerinde ve ilk deneyimlerinde etkili olan ürün özelliklerini örneklemek için bir model geliştirilmiştir. Bu modele göre kullanıcı tercihlerinde ve ilk deneyimlerde etkili olan temel ürün özellikleri; kişisel ihtiyaçlara uygunluk, çevresel sorunlara dair bilgi kazanımı ve kullanıcının ürüne olan ilgisi (bağlılığı) olarak üç ana başlık altında toplanmıştır. Bu ana başlıkları etkileyen diğer ürün özellikleri ve bu özellikler arasındaki ilişkiler yapılan mülakatlardan alınan alıntılar ile desteklenerek ayrıntılı bir şekilde anlatılmıştır. Son olarak, uygulamaların çevreci davranış değişikliğine katkısı da tartışılmıştır.

AYKUT COŞKUN; BID., MSc.
Received his BSc. and MSc. in Department of Industrial Design from Middle East Technical University Faculty of Architecture (2008-2010). He currently works as a research assistant and he is a PhD. candidate in the Department of Industrial Design at Middle East Technical University (METU). He also works as a researcher in the UTEST Product Usability Unit at METU. His major research interests include product design for sustainability, design for behavior change, persuasive technology, and user-experience design. aycoskun@metu.edu.tr

ÇİĞDEM ERBUĞ; BID., MSc., PhD.
Currently an Associate Professor of Department of Industrial Design at Middle East Technical University (METU), Ankara-Turkey. She teaches ergonomics for designers and User Experience Research. She is also the founder and director of UTEST, Product Usability Unit and Automotive design testing laboratory. She works together with design and manufacturing firms on the assessment of product expression and user experience. She has an experience on design information systems. She conducts research on interaction design, user experience and smart products. erbug@metu.edu.tr