

Persuasion for a Healthier Life

Persuasive Technology Design Guidelines from the *Precious* Project for Indian diabetics

Deniz Arik¹, Annemiek van Boeijen², Prabhu Kandachar³

Faculty of Industrial Design Engineering, Delft University of Technology, Netherlands
¹denizarik@gmail.com, ²A.G.C.vanBoeijen@tudelft.nl*, ³P.V.Kandachar@tudelft.nl

Abstract: Health behaviour change is a key issue in India and especially for reducing diabetes related risks. But the issue is confined neither to diabetes nor to India. After the proliferation of personal digital devices and widespread internet access, persuasion for behaviour change has taken new forms. In this paper we propose 8 design guidelines for future persuasive technology designers who will work in similar domains. These guidelines are formulated based on experience acquired during a design research project leading to the degree of M.Sc. They are presented with references to their theoretical foundations, with findings from the field research conducted in India or personal experience acquired during the design process. The guidelines are further explained with the result of our project, *Precious*, as an example. We believe most of the guidelines can also be applied to health related persuasive technology design projects that fall outside diabetes domain as well as outside India.

Keywords: *design guidelines, health behaviour change, persuasive technology, diabetes, India*

1. Introduction

The guidelines presented in this paper are formulated for the purpose of transferring the knowledge acquired during a design research project from the faculty of Industrial Design Engineering at the Delft University of Technology. The project involved designing a persuasive application for Indians with diabetes related risks. This application, *Precious*, is discussed in this paper as a case for illustrating the proposed guidelines.

India is becoming the diabetes capital of the world. [1] Genetic susceptibility in Indian subcontinent and unhealthy lifestyles are the two major factors leading to this phenomenon observed.

In order to avoid the onset of diabetes or further complications of it, lifestyle modification is essential in India as it is elsewhere. This, for many, means eating less yet healthier and being more physically active.

Unfortunately Indians under this high diabetes related risk are either not aware or not very committed to change their lives towards a healthier one with lower risk of having diabetes or suffering from its common complications [2], like renal failure, retinopathy, amputations and other cardiovascular diseases.

Although digital devices, such as mobile phones and computers are fast becoming ubiquitous, even in emerging markets, there are not many successful attempts to tackle the above-mentioned problem and similar ones by the use of the technology.

We believe more human-centered design activity is needed in the persuasive technologies domain to address such and similar issues, and in order to ease the work of future designers working on similar projects, we have come up with some design guidelines with the aim of transferring the experience acquired during *Precious* project.

We will be discussing the guidelines, along with references to the theory supporting it and relevant field research findings, with examples of how it reflected in our case, *Precious*.

We believe most of the guidelines would also be helpful in other projects, perhaps not necessarily in diabetes domain, as well as outside India.

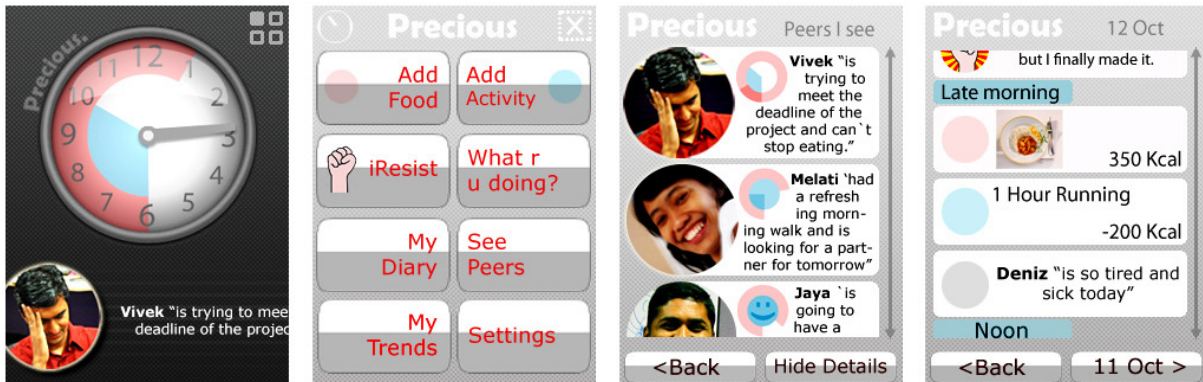


Figure.1 *Precious* interface. From left to right: *Main Screen* with real-time personal and peer information, *Menu Screen* giving access to different features, *Peers View* with medium level of detail, A day from *Diary* showing diverse entries.

2. An example: *Precious* [2]

For illustrating the guidelines we'll make use of the *Precious* project.

Precious is a proposed PDA application that aims to motivate urban Indians to adopt and maintain a healthier lifestyle. The interface lets the user keep a journal of exercise and diet in an easy way and shows progress towards daily and long-term targets. Most important of all, it is a peer based application where the user can see how their loved ones are doing and can communicate with them.

The main screen, that also becomes the screen saver of the phone when the application is on, shows information about current status of the user (clock with red and blue progress indicators for food and exercise respectively) as well as diverse information coming from friends, sliding under the screen continuously. (Fig.1)

Peers are represented with reactive profile pictures, changing from worried to neutral and to happy, based on their current performance. (Fig.1)

Achievements are rewarded with new levels in *Precious*. (Fig.3) When the user passes to the next level, she is allowed to watch the real-time details of one more peer.

3. Method

During the course of the project, we have made use of conventional and online questionnaires, user and expert interviews and email reviews of the progress with potential stakeholders. Face to face user and expert interviews with the help of a local polyglot interpreter proved to be the most gainful when compared to other field research techniques mentioned above.

The other major component of our analysis has been literature research about previous such projects, theories of behaviour change, more specifically Health Belief Model (HBM) [3], Social Learning Theory (SLT) [4], and Transtheoretical Model (TTM) [5]. All these theories are comprehensively summarized in [6]. Last but definitely not least, Captology [7,8], the field of persuasive computers provided us with valuable insights.

Knowledge that we have acquired with the methods mentioned above always formed the base of our decisions in the project. This same knowledge also helped us come up with the guidelines presented in this paper.

4. Guidelines

In this section the guidelines we have formulated based on our project will be presented. The first 5 guidelines are product related guidelines and the last 3 are process related guidelines.

Our purpose was to keep them as universal as possible, widening their domain of application. The readers are invited to judge the usefulness of each of them for their own special case.

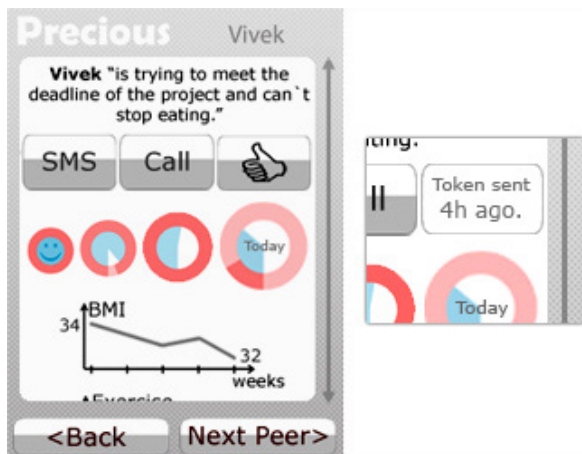


Figure.2 Detailed view of a peer, and among other things, the *Token of Encouragement* before and after sending.



Figure.3 Some of the rewarding schemes in *Precious*.

4.1 “The product should encourage frequent user interaction.”

In persuasive technology applications, more frequent interaction is correlated with better behaviour change results. [9] Frequent interaction with the product should be encouraged in order to keep the personal goals in user’s mind, facilitate more frequent self reflection and if the product requires timely user input, to make the user input to the device more punctual.

Frequent interaction with a product may have the drawback of making the product more obtrusive, which may, in turn, deteriorate user experience. However more frequent glances at the status of the product can also be achieved without using alarms and reminders. Research shows that peer supported technologies enjoy a higher frequency of user interaction. [9]

In *Precious*, the *Main Screen* is intended to evoke a feeling of curiosity in user’s mind. It shows real-time information coming from peers. (Fig.1)

This screen appears as an attractive screensaver of the phone which ensures that at least every time the phone is interacted with, the user will also have a quick glance at the status of the application and will perhaps notice something going wrong and take action.

One final feature of *Precious* encouraging frequent interaction is the *Token of Encouragement*. (Fig.2) It is a digital token that you can send to your peers, only from the screen showing their details. Once you send the token, in order to receive it back, your peer has to acknowledge it. Your peer will only see and acknowledge it next time she goes to the main menu of *Precious*.

The token’s meaning is twofold: after receiving the token notification with words of encouragement and support, your peer will know that you have been browsing through her details, she’ll know that she is not forgotten and that she is supported. But, at the same time, you’ll know when your peer goes to the main menu for the next time, giving you a hint about how frequent she interacts with the application. This will help build additional social pressure on your peer to frequently interact with the application.

4.2 “The product should communicate in the appropriate style.”

The communication style should be carefully thought of for effective persuasion to take place.

Rothman & Salovey [10] have found that loss and gain-framed messages used for persuasion work in different ways. In their work, titled “Shaping perceptions to motivate healthy behaviour: The role of message framing.”,

they argue that loss-framed messages (emphasizing the risk of not involving in behaviour change) work better for promoting better disease detection behaviour, (such as periodic breast examinations for early detection of breast cancer) and gain-framed messages (emphasizing the beneficial consequences of behaviour change) work better for promoting preventative behaviour (such as eating less fat and exercising more for preventing cardiovascular diseases).

Somehow related to message framing, another issue is whether the designer should punish undesirable behaviour or reward desirable ones. Literature shows that rewarding desirable behaviour works better than punishing undesirable ones, as is in the example of UbiFit application. [11]

We should also mention that SLT includes “*Reinforcements*” as one of the factors affecting behaviour change.

We must add that a modest recognition from the product, such as a plain “ * ” appearing on the screen when the user reaches a target can be enough motivation. [12]

In our case, *Precious* is almost void of any punishment. In many instances, there are rewards, such as the smiley appearing when the daily exercise target has been exceeded, or the level based principle of *Precious* that lets you add more and more peers to your watch list as you reach small milestones on your way to a healthier lifestyle. (Fig.3) The user can also receive rewarding messages from peers worded in very different and personal ways.

4.3 “The product should give the user the chance to reflect on her own behaviour.”

Moments of self-reflection are very important, because they often lead to an attitude change which might be a good step preceding behaviour change.

During self-reflection one can judge her past behaviour and notice some patterns of success and failure [12], such as over eating in most days on lunch time, or skipping late evening walks on particular weekdays. Once such patterns are recognized, the user can come up with strategies to alter these patterns.

According to Captology theory, there are opportune moments for persuasion to take place easily. A mobile application can get the much needed uninterrupted attention when the user is idle and has nothing better to do, such as while commuting in the public transport, or while waiting in lines. These moments are also best times for effective self-reflection.

In *Precious* self reflection is supported in some ways. The user can browse through past days’ events, see graphs showing her important trends in a simple way and compare her behaviour and performance to others. (Fig.4)

The application also has another feature called “*What r u doing now?*”. It is a way to feed relevant contextual information into the event log such as “I am trying to meet the deadline of the project.” This information is immediately displayed in the main screens of peers watching you, but more important is the fact that these tags help you make better meaning of the past days while you browse your history. This kind of contextual information feeding mechanisms proved to improve user experience [12], and can improve self-reflection.

4.4 “The product should enhance the presence of the significant people in user’s life, involve them in the use.”

The influence of other people and the environment on the behaviour change is expressed under the term “*Reciprocal determinism*” in SLT.

Especially in collectivist cultures the situation is more complex. Kreuter and Houghton [13] suggest that in collectivist cultures, the emphasis is less on the individual, more on the group and people prioritize the needs of others before their own. Our interviews with many diabetics have also shown that one of the primary motivating factors of taking care of one’s self was the idea that others needed their help or else they would be a burden to the others if their health deteriorated.[2]

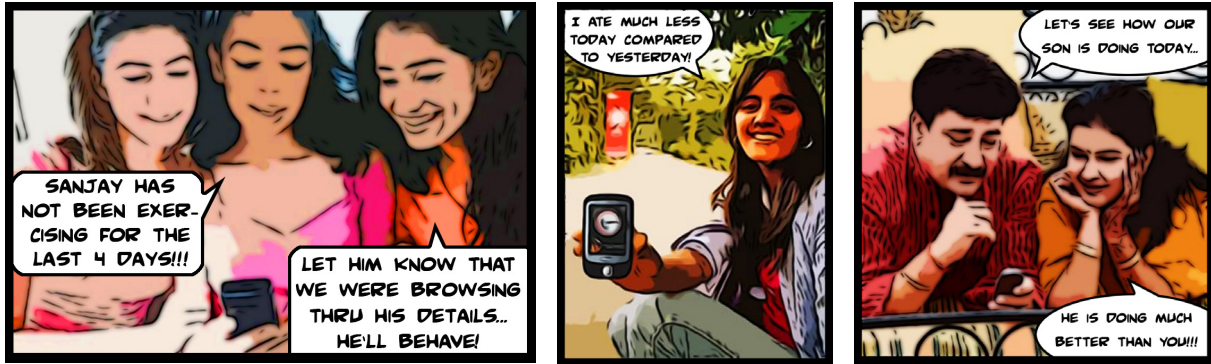


Fig 4. Usage scenarios of *Precious*

This brings the idea of involving these very important others into the design, perhaps (but not necessarily) by means of simple networking applications, since we are designing in technology domain.

When the others, that you feel responsible to, are following your behaviour, a kind of *social pressure* is established [12], and the chances are you show greater effort to behave the ideal, desirable way. Taken the other way, when a loved one needs to change his or her health behaviour, you can better motivate, advise and persuade him if you have the means to see what goes bad in more detail. This is *social support*. [12]

In *Precious* this is the idea on which the entire application is based. (Fig.4) By social networking with a few important people you know, your behaviour is socially transparent, which puts a pressure on you to come closer to ideal behaviour. You can also know what goes wrong with your peers and you can help them, with practical advices, words of inspiration or simply listening to them.

Observational Learning is another concept discussed in SLT. According to this concept, people form certain beliefs by observing others being punished and rewarded for their actions. These beliefs are influential in behaviour change. In *Precious*, one can see the direct causality between exercise and diet patterns of a peer and her weight.

4.5 “The product should make use of easy qualitative inputs and representations and avoid difficult quantitative ones.”

This is a very important factor to consider, at least in India, where people do not have much quantitative knowledge about diabetes management. [2]

In the expert interviews, we have come to know that, as opposed to what one would expect in Western countries, doctors and dieticians did not mention many numbers when they were advising about diet to diabetes patients. Advices were in the lines of “Eat less each time, but eat more frequently” “Make vegetables at least half of your meal”. [2]

In consequence, in *Precious*, we tried to come up with other less accurate but more usable methods of food entry along with conventional method of quantification of food consumed and determining the food components it contains. (Usual diet chart approach)

The timing component of *Precious* is also only as accurate as needed. Instead of a “hh:mm” format, we decided to use tags mapping to different times of the day such as “early morning”, “noon”, “late evening” etc. which takes away the cognitive discomfort of trying to remember the exact time of an event, and speeds up event logging.

When it comes to displaying information, there are examples from literature making use of qualitative representations (such as blossoming flowers as the user exercises) and avoiding quantitative ones (such as displaying numerical values of burned calories). They also suggest this approach to other designers. [11,14]

4.6 “The designer should determine where the target population is most likely to be, according to TTM.”

In TTM mentioned earlier in the third section, behaviour change is explained with a stronger focus on stages rather than factors influencing change. This uniqueness of TTM helps the designer to roughly estimate at which stage the target group is expected to be.

The stages proposed in TTM are: *Pre-contemplation* (no consideration of change) *Contemplation* (consideration of change, weighing of benefits versus losses) *Preparation* (change planned in short-term, small attempts to change) *Action* (change has been taken recently) *Maintenance* (change has been successfully implemented and relapse is unlikely)

Once the stage is determined, the theory also proposes strategies helping the passage to the next stage. For a persuasive technology designer, this means that she can shape the product requirements accordingly.

TTM can also be used to screen participants for user evaluations. For instance, if the product is targeting action and maintenance stage users, it might be worth to eliminate participants who are in earlier stages.

One can also use this model to reflect on the final design, determine how effective the final product is for each stage and fine-tune the product features if required.

For example, for people in the *Pre-contemplation* stage who are not aware of any problem or denying, it is typically more difficult to take action. In *Precious* this group is not left behind. Because of extremely high familial aggregation of diabetes, many *Pre-contemplation* stage users in India (people having risk of developing diabetes but not aware or not committed) have relatives that are diabetics. In fact, while using the product for convincing and motivating their loved ones, (also taking into account the principle of *attitudinal advocacy* discussed in SLT and HBM) they are more likely to realize that not everything is so optimistic for them as well.

4.7 “The designer should identify barriers to health behaviour change; decide which ones are to be tackled by the project.”

HBM describes the factors affecting behaviour change. These factors can be listed as: *Perceived Severity* (of the consequences of keeping undesirable behaviour), *Perceived Susceptibility* (of the individual to these consequences), *Perceived Benefits* (of changing behaviour), *Perceived Barriers* (to behaviour change), *Cues to Action* (other factors in one’s environment facilitating change), and *Self-Efficacy* (confidence in one’s self that she can successfully take the change).

According to Janz and Becker [3], among these factors, *Perceived Barriers* is the most influential factor for behaviour change.

Typically before generating concept ideas, towards the end of analysis phase, it might be wise to make a list of barriers to behaviour change as it is described in HBM. One can make use of literature research as well as field research to make a complete list of barriers to behaviour change in the particular domain studied.

After coming up with a list, it might be obvious that some barriers are not going to be tackled within the scope of the current project. For instance in our case, during the analysis phase, we have seen that the cost of insulin was a barrier in India in front of good diabetes therapy compliance. This problem was not possible to deal with, within the scope of our project.

It might also happen that some of barriers are very promising paths to follow for a designer. We have seen that there were barriers such as difficulty finding walking partners or good walking paths, or typical Indian feeling of responsibility to others before your own needs, in other words, selflessness. These were some other barriers to better self-care, that we tried to tackle in the concept generation phase. In fact, one of our concepts was only focusing on path and partner suggestion for morning and evening walks, which are the most widespread type of physical

activity in India. The selflessness of Indians are tackled by including other important people in the use of *Precious*, who, we believe, could establish one strong channel of persuasion in the use of *Precious* and can effectively counter the effects of selflessness.

4.8 “The designer should be familiar with diverse strategies of persuasion discussed in Captology theory.”

Captology, as mentioned earlier, is the domain of persuasive computers. The domain is still recent and progressive. The persuasive technology designer benefits from the structure Captology theory can provide, instead of relying solely on intuition. This will help take more informed decisions.

At this point, the dynamism of the field should be well understood and one should be familiar with the most recent theoretical developments and the new cases, to the extent possible.

During our project, we have used captology in two particular moments:

During concept generation phase Captology helped us to add more diversity to our set of concepts. Starting from main keywords it provides, such as “just-in-time persuasion”, “personalized persuasion” or “tunnelling”, we tried to come up with product ideas. The designer can also use these main concepts to “structure” brainstorm sessions.

Towards the end of concept detailing phase, after the most promising concept is selected and is further developed, we went back to Captology and used it as a checklist to see what other potential points for stronger persuasion were left unused. For example, after all the details of *Precious* were decided, we have realized that the concept of “tunnelling” could still be implemented in it, in order to make it more persuasive. This is how we came up with the level principle of *Precious*, where, by meeting certain incremental behaviour improvement requirements, such as slightly more exercise and less calories consumed, the user is guided towards the final goal.

5. Discussion and Conclusion

In this paper, our aim was to introduce a set of guidelines for persuasive technology designers in health domain. We have made use of the experience acquired during an Industrial Design Engineering M.Sc. graduation project. The result of this project, *Precious*, has also been discussed in this paper and used for illustrating the guidelines.

The aim in the project was to come up with a persuasive technology design to facilitate the behaviour change in Indian population to reduce their diabetes related risks. Although the guidelines are the results of this project, we believe most of them are relevant in even wider domains.

Considering the diversity of possible topics and target groups, we think it is more appropriate to let the readers decide which guidelines are more relevant for their own case.

This is also why we have avoided giving guidelines related to design manifestation, in other words, guidelines at symbolic or morphological levels such as the ones related to selection of pictograms, colours and form.

Although most of the guidelines proposed in this paper are logically derived from our literature research and otherwise from the results of our own extensive field research, the example we used to illustrate them, *Precious*, has not been re-evaluated in depth. We think it would be beneficial to conduct an extensive user evaluation for a product designed based on these guidelines to further validate them.

We hope our guidelines, together with the literature references we have provided in this paper will help future designers.

6. References:

[1] Joshi, S.R. and Parikh, R.M. 2007, *India - Diabetes Capital of the World: Now Heading Towards Hypertension*, Journal of The Association of Physicians of India, Vol. 55, 323-324

- [2] Arik, D., M.S. Thesis, 2008, *Mobile Social Networking in India for Promoting Healthy Urban Lifestyle*, Delft University of Technology, Delft, The Netherlands.
- [3] Janz, N.K., Becker, M.H., 1984, *The Health Belief Model: A Decade Later*, Health Education & Behavior, Vol. 11, No. 1, 1-47
- [4] Bandura, A. (1977) *Social Learning Theory*, Prentice Hall, Englewood Cliffs (NJ)
- [5] Prochaska, J.O., DiClemente, C.C., Norcross, J.C., 1992, *In Search of How People Change: Applications to Addictive Behaviors*, The American psychologist, Vol. 47, No. 9., pp. 1102-1114.
- [6] Glanz, K., Rimer, B.K., 2005, *Theory at a Glance, A Guide For Health Promotion Practice* (Second Edition) National Cancer Institute, U.S. Department of Health and Human Services.
- [7] Cheng, R., 2003, *Persuasion strategies for computers as persuasive technologies*. Department of Computer Science, University of Saskatchewan.
- [8] Fogg, B.J., 1998, *Persuasive Computers: Perspectives and Research Directions*, Proceedings of the SIGCHI conference on Human factors in computing systems, Pages: 225 - 232, Los Angeles, California, United States
- [9] Norman, G.J., Zabinski, M.F., Adams, M.A., Rosenberg, D.E., Yaroch, A.L., Atienza, A.A., 2007, *A Review of eHealth Interventions for Physical Activity and Dietary Behavior Change*, American journal of preventive medicine, Vol. 33, No. 4., pp. 336-345.
- [10] Rothman, A.J., Salovey, P., 1997, *Shaping perceptions to motivate healthy behavior: the role of message framing*, Psychological bulletin, Vol. 121, No. 1. pp. 3-19.
- [11] Consolvo, S., McDonald, D.W., Toscos, T., Chen, M.Y., Froehlich, J., Harrison, B., Klasnja, P., LaMarca, A., LeGrand, L., Libby, R., Smith, I., Landay, J.A., 2008, *Activity sensing in the wild: a field trial of ubifit garden*, Proceeding of the SIGCHI conference on Human factors in computing systems, Florence, Italy
- [12] Consolvo, S., Everitt, K., Smith, I., Landay, J.A., 2006, *Design requirements for technologies that encourage physical activity*, Proceedings of the SIGCHI conference on Human Factors in computing systems, Montréal, Québec, Canada
- [13]: Kreuter, M.W., Houghton, L.T., 2006, *Integrating Culture Into Health Information for African American Women*. American Behavioral Scientist, Vol. 49, No. 6, 794-811
- [14] Lin, J.J., Mamykina L., Lindtner S., Delajoux G., Strub H.B., 2006, *Fish 'n' Steps: Encouraging Physical Activity with an Interactive Computer Game*, UbiComp 2006: Ubiquitous Computing, pp. 261-278.