

# Multifaceted Design for Persuasion: a Case Study about the Design of a Mobile Safety Watch

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## ABSTRACT

In order to design effective Persuasive Technology (PT) interventions, it is essential that designers understand the multitude of factors that lead to behavioral change, rather than guessing at a solution or imitating successful techniques without understanding why. The few available PT design frameworks solely distinguish behavioral determinants on an individual (micro) level (e.g., motivation), whereas successfully persuading a user is a multifaceted and complex task depending also on factors on a meso (e.g., available resources) and macro (e.g., social support and praise) level. We developed an analysis grid that enables PT designers to acknowledge the multifaceted character of determinants leading to behavioral change and select appropriate PT channels and strategies, preventing the failure of PT design. This analysis grid was validated in a case study in which we designed a PT intervention aimed at reporting minor crime incidents among citizens.

## Keywords

Persuasive technology, co-design, behavioral models, design framework

## INTRODUCTION

Interactive information technology designed for changing users' behavior is known as persuasive technology (PT) [1]. The tools for creating PT are getting easier to apply with innovations in online video, social networks, and mobile phones, among others. However, many attempts at persuasive design fail because designers don't understand what factors lead to behavior change [2]. Without this understanding, PT designers are mostly guessing at a solution or imitating techniques that work without understanding why. Persuading a user is a multi-phased and

complex task, and therefore determining what is preventing the receptive audience from performing the target behavior should always be part of the design process [1]. However, existing frameworks for the design of persuasive technology [2, 3] largely focus on content and software functionality rather than provide a concrete set of methods to think properly about the target behavior one attempts to influence and its determinants. According to Fogg [1], the answer why users do not perform the target behavior always refers to (a combination of) the following three factors: lack of motivation, lack of ability, or lack of a well-timed trigger to perform the behavior. Thus, Fogg supposes that barriers or enablers to perform the target behavior all relate to the individual user. In our opinion, this approach is too rigid.

Well-known behavioral models such as the Elaboration Likelihood Model, the Health Belief Model, Social Cognitive Theory, the Theory of Reasoned Action, and the PRECEDE model identify three major groups of factors determining the user's intention to perform the target behavior: predisposing (micro), enabling (meso), and reinforcing (macro) [4, 5]. Suppose a designer is planning to develop a PT intervention aimed at reporting minor crime incidents among citizens; this PT intervention can only be effective if it influences behavioral determinants at all three levels:

1. *Predisposing factors (micro)* provide the motivation or reason behind a behavior; they include motivation, knowledge, attitude, cultural beliefs, readiness to change, and so on. E.g., when a citizen personally highly values to live in a safe neighborhood, he or she will be more inclined to report a minor crime incident.
2. *Enabling factors (meso)* make it possible for a motivation to be realized; that is, they "enable" persons to act on their predispositions; they include available resources, supportive policies, assistance, and services. E.g., the presence of a service such as a telephone number or a website where citizens can easily report minor crime incidents.
3. *Reinforcing factors (macro)* come into play after a behavior has begun, and provide continuing rewards or incentives; they contribute to repetition or persistence of behaviors. Social support, praise, and reassurance

might all be reinforcing factors. E.g., when neighbors frequently report minor crime incidents to keep the neighborhood safe, the individual citizen will be more inclined to perform the behavior as well and persist in it, since he or she copies social behavior.

Designers should address determinants on all these three levels, since multifaceted interventions satisfy a larger variety of situational demands and a combined impact is always greater than the impact of individual strategies [6, 7].

In order to develop a multifaceted PT intervention aimed at enhancing minor crime incident reporting among citizens, we developed an analysis grid consisting of the three levels of behavioral determinants (micro, meso, and macro) that together reinforce behavioral change. This paper illustrates how PT designers could systematically analyze the determinants which might best influence the desired behavior in order to focus on specific, realistic behavioral objectives which can be measured for evaluation, and to make a well-founded choice of effective PT channels and triggers to include in the intervention.

## CASE STUDY

### Study Context

The Utrecht area Police Department (located in the middle of the Netherlands), the Dutch Center for Innovation and Safety, and the editors of the national Dutch television program “Investigation Required” noticed the powerful capabilities and near-ubiquitous ownership of mobile phones among citizens and its potential to contribute to public safety. In the United States, various applications like CitixenMe, iWatchDallas, and RaveAlert have been successfully implemented. Using their smartphone including an integrated camera and location services (GPS on newer devices), users can report behaviors and activities that make them feel uncomfortable or do not look right. The application usually is part of a partnership between local organizations, such as the community, police, and fire department. Inspired by these existing initiatives abroad, the three Dutch parties approached this paper’s authors. The assignment was to develop a working prototype of a “Mobile Safety Watch”-app for the smartphone aimed at “increasing reporting behavior of minor crime incidents among citizens in order to improve public safety”.

In order to ensure that the PT intervention fitted our target group’s needs and daily habits, we involved users at the very heart of the design process by means of co-design [8]. We applied and complemented Fogg’s Eight-Step Design Process [2] with our multifaceted analytical approach to design our PT intervention.

### Choice of a Simple Behavior to Target and a Receptive Audience

This first step in the design process -choosing a simple behavior to target- is the most important aspect of designing successful PT. The overall project assignment was too vague and ambitious and therefore had to be narrowed. We started with conducting cultural probes to

generate information about users’ experiences with regard to safety and mobile phone use in their everyday life. Cultural probes are a method of context mapping, which literally means creating a map of the users’ context of use [9]. We created a sensitizing package (see Figure 1) including a booklet and a poster with diverse provocative tasks and questions regarding the neighborhood in which the participant lived, to illustrate some situations in which they felt (un)safe and take pictures of these situations, the type of mobile phone they owned and its functionalities. Twelve participants representing various age categories and education levels filled out the sensitizing package and returned it to the design team. The materials served as inspirational input and were not intended to be extensively analyzed, but solely to empower our understanding of the user context. The materials were analyzed in a joint session of the design team and some of the participants.



**Figure 1. Cultural probes used in the case study**

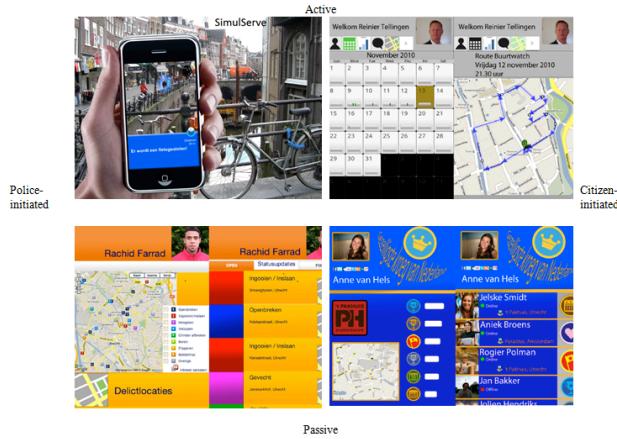
During the session, user insights generated by the cultural probes were summarized into three personas. Personas are fictitious people representing user information. Personas make the user context livelier and enabled us to achieve empathy for the users and to get past our personal opinions and presuppositions to understand what users really need [10]. The three personas are presented in Figure 2.

After creating personas, the design team performed desk research in order to search for relevant PT examples. It appeared that each application could be attributed to one quadrant alongside a two-dimensional diagram. Each app was either police- or citizen-initiated on the one hand, and had an active or passive user role on the other. During a brainstorm session, the design team used the desk research insights to develop a PT concept for each of the four quadrants in the diagram, which can be found in Figure 3. Each concept was attributed to a persona, except for the SimulServe-concept, which was designed to be used by all personas. We will shortly elaborate on each concept:



- 20 years old
  - Studies law
  - Lives in a student flat in a middle SES neighborhood
  - Plays hockey
  - Prefers to do volunteer work during holidays
  - Annual income: 10000€
  - Hates the bicycle tunnel in her street
- 27 years old
  - Works as a car mechanic
  - Lives in a small townhouse in a low SES neighborhood
  - Loves sport cars
  - Prefers to go on a party holiday
  - Annual income: 30000€
  - Avoids dark alleys
- 36 years old
  - Works as a bank manager
  - Lives in a downtown penthouse in a high SES neighborhood
  - Loves gadgets and social media
  - Prefers to spend the holiday in the Caribbean
  - Annual income: 100000€
  - Avoids places where fringe group youth is concentrated

**Figure 2. Personas resulting from the cultural probes**



**Figure 3. PT concepts coupled to personas**

- SimulServe: a simulation game through Layar, initiated by the police department, which teaches civil users how to act in case of and report a (minor) crime incident. The user can select the type of incident he/she wants to report and then receives a fictitious assignment to search for the delinquent who appears on the smartphone screen via augmented reality.
- NeighborhoodWatch: Citizen-initiated app that is aimed at Neighborhood Watch-members. The app includes a schedule through which the user can indicate his/her availability, request walking routes addressing hazardous situations, and obtain an overview of solved and dissolved incidents. Of course, users can report a crime incident and choose to upload relevant information related to the crime, by video, pictures, sound clips, or typed text in a notes field.
- Tips & Hints: this police-initiated app is similar to SimulServe, but not game-oriented. It provides the user with information regarding crime incidents in his/her neighborhood and with textual information on how to act in case of a hazardous situation, e.g., by means of

an instruction video. The app also includes a map with an overview of reported crime incidents.

- PubContest: a citizen-initiated game that is aimed at stimulating the positive atmosphere in pubs and discotheques by distributing awards and credits to users when the night went by safely, i.e. there have been no fighting, thefts, drug and alcohol abuse, etc. Users can earn different badges, such as SphereKeeper, SphereSteward etc.

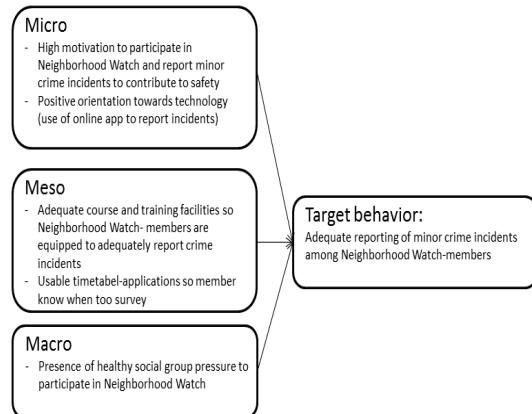
In order to identify the most promising concept, and to inform the design team to select a target behavior and a receptive audience, an expert review with representatives from the three originating institutions (police, television program and Center for Innovation and Safety) was organized. After describing the research results, a decision grid was presented according to which the experts could evaluate and prioritize the concepts. The criteria comprised the concept's innovative character, feasibility regarding time and budget, users' ability and motivation to use the app (in line with [1]), and expected success rate. The experts judged the "NeighborhoodWatch" and "SimulServe" concepts as the most promising. NeighborhoodWatch was highly valued given the positive side effects; it would stimulate citizens to go outside and get fresh air, increase social control, enhance perception of safety among citizens, it fitted the concept of PT, and could be extended to different scenarios. The SimulServe-concept on the other hand appealed to the experts because of its "hot and innovative character" and it would attract youth: a target group that is hard to reach with regard to enhancing public safety. The expert review's conclusion therefore was to concentrate on the Neighborhood Watch, but integrate game elements from SimulServe in order to maximize its potential effects. The design team could never have come up with this focus without the user and expert insights.

Now, the co-design methods had provided the design team with sufficient information to select a general behavior and a receptive audience. The most receptive audience appeared to be tech-savvy members of neighborhood watches, like our persona "Reinier Tellingen". A neighborhood watch is an organized group of citizens devoted to crime and vandalism prevention within a neighborhood. When suspecting criminal activities, members are encouraged to contact authorities and not to intervene. Neighborhood Watch-members such as Reinier Tellingen are likely to be familiar with the technology channel (smartphone) and already show a positive attitude towards contributing to neighborhood safety. The selected target behavior now concerned "enhanced reporting of minor crime incidents among neighborhood watch-members".

#### **Find what is preventing the target behavior on a micro, meso, and macrolevel**

In this step the design team had to determine what is preventing the audience from performing the target behavior. The design team therefore conducted two direct observations among Neighborhood Watches in The Hague and Berkel and Rodenrijs, respectively, to investigate the

micro, meso and macro determinants of adequate report behavior of minor crime incidents among Neighborhood Watch-members. The observation studies gave insight into the physical context of Neighborhood Watches and how the members acted in daily practice [11]. In direct observations, as we performed, people know they are being watched. The design team mingled among the Neighborhood Watch-members and walked with them on their rounds. During and after the surveillance round, we observed the activities of the members, watched them reporting several incidents and asked about the reasons behind the behavior. We recorded findings manually, electronically, and visually. After the observation studies, the design team analyzed the results in a joint session and grouped observed behaviors into the three levels of behavioral determinants: micro, meso, and macro. The main findings are displayed in Figure 4. Remarkably, few barriers of the target behavior could be identified, but only facilitators. Neighborhood Watch-members appeared to be already highly motivated and able to perform the target behavior, and used technology to report crime incidents to the police or community service.



**Figure 4. Determinants of initial target behavior**

The real barriers for performing the target behavior, as the observations demonstrated, happened to be a lack of active members of the Neighborhood Watch, and too few citizens that actively contribute to neighborhood safety, caused by limited possibilities for citizens to report minor crime incidents (meso), lack of motivation among (young) neighborhood inhabitants to join the Neighborhood Watch (micro), and lack of social cohesion within the neighborhood (macro). The Neighborhood Watch-members, who we initially perceived as our target group, recommended us to rather focus on citizens with a positive attitude towards contributing to neighborhood safety rather than on the members themselves, because the latter are already positively inclined to perform the target behavior. Based on the observations, we therefore changed our receptive audience, target behavior, and its determinants. The receptive audience became tech-savvy citizens with a positive attitude towards contributing to neighborhood safety. And even more precise, the design team decided to

concentrate on dog owners with a smart phone, since dog owners leave their house at least twice or three times daily to stroll around the neighborhood and have an active interest in keeping their neighborhood safe. The revised target behavior and its determinants can be found in Figure 5.



**Figure 5. Determinants of revised target behavior**

### Choose an appropriate technology channel

Various technology channels for persuasion are available: Web, software installed on personal computers, mobile phone applications, texting on mobile phones, social platforms like Facebook, online video, platform games, and so on. A smartphone appeared to be the ultimate channel for our receptive audience: tech-savvy dog owners with a positive attitude towards contributing to neighborhood safety, and particularly youngsters, since youth has a higher smartphone penetration than adults. We chose not to focus on citizens without a smartphone, because the likelihood of behavioral change is lower when the audience has to learn a new channel. We therefore selected channels the target group already uses (see Table 1) and combined them in one multifaceted PT:

**Table 1. Overview of target behavior determinants and selected technology channels**

Determinant of target behavior	Technology channel
Micro: lack of motivation among young neighborhood inhabitants to join the Neighborhood Watch	Platform game
Meso: limited possibilities for citizens to report minor crime incidents	Mobile Safety Watch-app for smartphones with active citizen role
Macro: lack of social cohesion in neighborhood	Social platform

### Find relevant examples of PT on a micro, meso, and macrolevel

Desk research was carried out to search for relevant, specific examples of PT channels to address the determinants on the three levels. Since so many successful examples of PT exist, we did not have to reinvent the wheel. Desk research generated a list of successful examples on the three determinant levels, which can be found in Table 2. This list is not exhaustive, but was used

as a source of inspiration for the design team. On the micro level, the successful examples comprised games aimed at earning badges and awards for reporting crime incidents, as is the case in SnapScouts and Foursquare. Such applications are a major success, given the fact that a system that keeps track of one's own performance or status supports the user in achieving goals, in line with the principles of self-monitoring and the reward-system that both have great persuasive power [1-3]. The meso level demonstrated a wide availability of all same types of applications: using camera and text messages to report minor crime incidents. In order to stimulate users to report an incident, principles of reduction (system reduces the effort that users expend with regard to reporting a crime incident), and dialogue support (suggesting situations to be alert of) appeared to be successful [1-3]. The macro level generated examples referring to regular social media like Twitter and Facebook, catering to the principles of social role: the application adopts a social role by enabling the user to stay in touch with local authorities and peers, which triggers behavioral change [1-3]. We incorporated the aforementioned examples and its PT principles into our functional design.

### Imitate successful examples

The next step in the persuasive design process is to imitate what appeared to work in the gathered successful examples. Identifying and adapting successful technology examples to the design project at hand is the fastest, surest way to create effective persuasive technologies [2]. In a brainstorm session, the design team among whom a social scientist, a lecturer in PT, and an interaction designer were represented, evaluated the identified examples from a psychological perspective and created a functional design comprising principles from each of the three levels of determinants. Next to principles of primary task and dialogue support, we decided to incorporate the principles of system credibility support [3]. Figures 6 to 8 represent the functional design of our app, each with a description of the relevant examples and PT principles they were based on.



**Figure 6. Functional design of app micro level: platform game based on Foursquare and SnapScouts (self-monitoring and rewards)**

**Table 2. Overview of relevant PT examples**

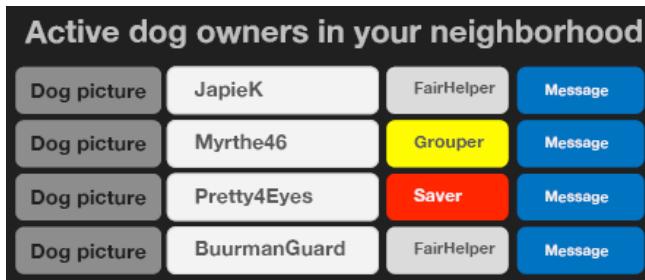
Level of determinant and channel	Relevant examples
Micro: Platform game	<ul style="list-style-type: none"> <li>• FourSquare: a location-based social networking website for users with GPS-enabled mobile devices, such as smartphones. Users "check-in" at venues using a mobile website, text messaging or a device-specific application by running the application and selecting from a list of venues that the application locates nearby. Each check-in awards the user points and sometimes "badges".</li> <li>• SnapScouts: Android phone-app in order to start patrolling user's own neighborhood. If user sees something suspicious, he/she can snap it and earn badges and prizes while competing with friends. Makes reporting a potential crime fun and easy.</li> </ul> <p><i>PT principles: self-monitoring and rewards</i></p>
Meso: Mobile Safety Watch app for smartphones with active citizen role	<ul style="list-style-type: none"> <li>• CititizenMe</li> <li>• iWatchDallas</li> <li>• RaveAlert</li> </ul> <p>Various apps with similar functionalities: Using their smartphone including the integrated camera and location services (GPS on newer devices), users can report traffic hazards, dangerous drivers, and even crimes and nuisances in seconds. Once reported, local law enforcement, fire department, and municipalities have access to reports in real-time.</p> <p><i>PT principles: reduction and suggestion</i></p>
Macro: Social platform	<ul style="list-style-type: none"> <li>• Stumble Safely: for those interested in walking: a mashup that combines a crime map of Washington DC with a map of local bars, clubs, and eateries, helping the user find the best places for safe nightlife.</li> <li>• SpotCrime: free crime alerts by email, and also sells crime tracking iPhone applications</li> <li>• Twitter and Facebook: several police departments use mainstream social networking to keep the public informed and connected: E.g., the Police Department in Dallas uses Twitter to put out crime alerts. The Safe Atlanta for Everyone neighborhood watch program uses a Twitter account in addition to a blog to stay connected with the public</li> </ul> <p><i>PT principles: social role</i></p>

Figure 6 shows the app's main screen. Each time when the user lets the dog out and leaves the house, he or she can active the app. The length of the walk is being showed, next to an overview of the latest walks (self-monitoring), and the number of credits and badge the user has earned (rewards). Four types of badges can be earned:

- "Fair Helper": by frequently logging in and walking active rounds (microlevel);

- “Saver”: by reporting relevant incidents to the neighborhood watch (mesolevel);
- “Grouper”: by being logged in simultaneously with other users or walking together with other users (in order to stimulate social cohesion [macrolevel]);
- “Partner”: when having earned all of the aforementioned badges (micro, meso, and macrolevel).

Figure 7 refers to the social platform aspect of the app, aimed at stimulation of social cohesion. The screen shows a picture of the user’s dog, the name and badge of the user, and enables the user to send a text message to other users, for instance to suggest to walk together. The feeling that others are present and are able to see user’s badge might stimulate the user to perform the target behavior (social role).

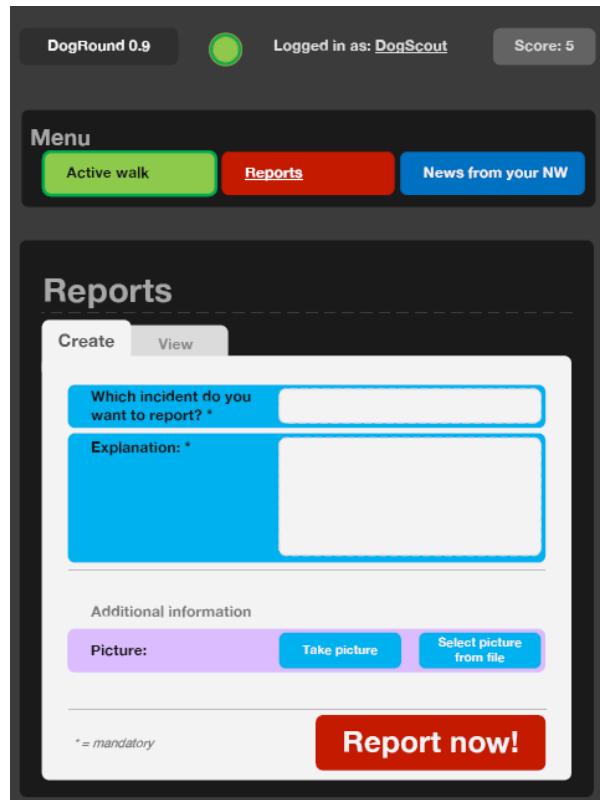


**Figure 7. Functional design of app macro level: social platform based on Stumble Safely and Twitter/Facebook (social role)**

Figure 8. depicts the mobile safety watch-part of the app. The screen enables the user to report a minor crime incident by entering text and a picture. We attempted to minimize the number of actions the user has to take in order to make a report, in line with the principles of reduction. When the user clicks on the button “View reports”, he/she obtains feedback regarding the status of the user’s own reports and those of other users. When clicking on “News from your Neighborhood Watch”, the user receives updates, events, and suggestions where to look at on the street (suggestion).

#### Test and iterate quickly

We started the test phase with paper prototyping the functional design among six representatives of the receptive audience: dog owners. The majority of them owned a smartphone and therefore was tech-savvy. Paper prototyping is a variation of usability testing where representative users perform realistic tasks by interacting with a paper version of the interface that is manipulated by a person ‘playing computer,’ who does not explain how the interface is intended to work [12]. We used sketches of the smartphone screen representing our app, as depicted in Figure 6 to 8. These rough sketches stimulated respondents to suggest changes, since the sketches suggested that the final choices regarding the look and feel of the app still had to be made, and that their suggestions were seriously taken into consideration by the design team.



**Figure 8. Functional design of app mesolevel: mobile safety watch app based on CitixenMe (reduction and suggestion)**

We asked the respondents to perform several fictitious tasks and think aloud while performing them, such as *“You notice a damaged dustbin while letting your dog out. You would like to report this to your neighborhood watch, using this application. Could you demonstrate aloud how you would do this?”* Also, we asked several questions regarding the app’s functionalities and the user’s intention to adopt the app. Most important results concerned the registration process (respondents did not like to use a social media- or Gmail account to log in, but preferred to create a separate account; respondents did not perceive answering questions regarding their dog as useful; they needed more explanation regarding the badges and credits, and suggested to add more feedback such as distance walked, etc). Overall, the respondents were optimistic regarding their intention to use the app. All suggestions were clustered according to the three levels of behavioral determinants and channels and the majority was processed into the working prototype.

This is the point of the design process we currently are involved in. At the moment, the working prototype is being developed, based on the results of the paper prototyping and will be finished May 1<sup>st</sup>, 2011. Subsequently, we will conduct high fidelity prototyping with at least five tech-savvy dog owners in neighborhoods with an active Neighborhood Watch. High-fidelity prototyping take the users as close as possible to a true representation of the user interface [13]. We will ask respondents to perform the same

tasks as the respondents in the paper prototyping test had, but instead of conducting the usability test at home, we will conduct the test in the open air with the respondents using their smartphone that displays the working prototype. The results of the high fidelity prototyping will serve as input for the design team to finalize the app before it will be launched in the appstore. Prior to real world implementation, we intend to conduct a quasi-experimental field trial in order to determine the app's influence on the target behavior among our receptive audience.

## DISCUSSION

In order to encourage PT designers to develop multi-faceted interventions for behavioral change, they should be equipped with an applicable design framework. Because, to our knowledge, available PT design frameworks solely distinguish behavioral determinants on an individual (micro) level (e.g., motivation), we developed an analysis grid that enables PT designers to not only detect determinants on the microlevel, but also on the meso (e.g., available resources) and macro (e.g., social support and praise) level. When tailoring PT channels and strategies to these three levels of factors, PT interventions are more likely to be successful.

Only two relevant PT design frameworks seem to exist, i.e., the Eight-Step Design Process by Fogg [2] and the Persuasive Systems Design (PSD)-framework by Oinas-Kukkonen and Harjumaa [3]. Fogg's framework comprises eight steps to follow as best practices in the early stages of PT design. Fogg's process, which we followed in our case study, begins with defining the persuasion goal to match a target audience with an appropriate technology channel. Subsequent steps include imitating successful examples of persuasive design, performing rapid trials, and building on small successes. The PSD-framework discusses the process of designing and evaluating persuasive systems and describes what kind of content and software functionality may be found in the final product. It also highlights ways to analyze the persuasion context (the intent, the event, and the strategy). Although both frameworks emphasize the systematic character of the design process, it is notable that both frameworks fail to provide tangible methods for how to systematically understand the factors that lead to the target behavior.

Our analysis grid enabled us not only to systematically study the determinants of our target behavior, but also to justify the choices for our target behavior, receptive audience, technology channel and PT principles. Without distinguishing the micro, meso, and macrolevel-determinants, we would have selected an inadequate target behavior (i.e. reporting minor crime incidents in general instead of reporting minor crime incidents to neighborhood watch), a too broad receptive audience (i.e. neighborhood watch-members instead of tech-savvy dog owners), and could not have selected specific PT principles and examples based on the understanding of why they might work, and thereby decreasing the likelihood of success of our intervention. The systematic analysis also helped us to

break down the scale of the problem we were asked to design an intervention for and using co-design methods effectively.

## Study Limitations

More research is required to validate our analysis grid. A quasi-experimental field study, on which we will elaborate in the next section, will verify whether or not our targeted PT intervention actually leads to behavioral change among the receptive audience. Furthermore, a note should be made regarding our PT channel choice. We selected the smart phone as our technology channel since people carry their mobile device always with them and it would enable them to immediately report a minor crime incident at the right time and place (mesolevel). Next, mobile technology provides a cost effective platform for communicating personalized descriptive social norms that compare individual performance with relevant social group performance (microlevel), and finally, social network sites running on the mobile device facilitate communication of personalized descriptive social norms that relate to the participant's self-defined community (macrolevel). Moreover, according to Fogg and Eckles [14], mobile technology is the most promising to realize behavior change. However, ethical considerations should be made when deploying mobile technology for persuasion (as was also mentioned by the participants of the paper prototyping): Information sent by mobile technology can be tracked and stored in databases and users fear the abuse of this information by authorities in a negative manner. When using mobile technology for persuasive reasons, the provider should guarantee his receptive audience that information will be used for no other purposes than the provider claims and that collected user information will be never shared with anyone unless expressly requested by the user [15].

## Future Research within the Case Study's Scope

Soon, the working prototype of our PT intervention will be finished and will be evaluated by means of high fidelity prototyping in a field setting. The app should, after adaptations based on the prototyping results, then be ready for download and use by citizens. However, before we will actually implement the app in daily practice, we intend to conduct a quasi-experimental field trial in order to determine the app's influence on the target behavior among our receptive audience. Although a true experiment would be preferable for the purpose of reliability and validity, randomization will be impossible given the limited amount of physical neighborhood watches in the Netherlands, and the voluntary basis on which respondents will participate. Therefore, we will set up a quasi-experimental field study, which has the advantage of minimizing threats to external validity, as natural environments do not suffer the same problems of artificiality as compared to a well-controlled laboratory setting. Of course, we acknowledge the threats to validity inherent to quasi-experimental research, such as the deficiency in randomization that makes it hard to control for confounding variables and the limited possibility of

determining causal relationships.

Our quasi-experimental design will look as follows: In a neighborhood with a neighborhood watch, several dog owners with a smartphone will be asked to download our Mobile Safety Watch app and use it during a four-week time period. This group will serve as the experimental group. In a second, control neighborhood with a Neighborhood Watch, no intervention will occur. Prior to the intervention period, a pretest will be conducted among 30 respondents in both the experimental and control group. The posttest will be performed among the same respondents immediately after the intervention period has ended. Independent variables will incorporate subjective (questionnaire) and objective (observation, desk research) parameters at the micro (e.g., perception of safety among citizens), meso (e.g., number of volunteers that participate in neighborhood watch) and macrolevel of the behavioral determinants (e.g., perceived social cohesion within neighborhood). The dependent variable (target behavior) will be measured by several questionnaire items and desk research, e.g., by comparing the number of reported incidents in a weekly time frame before and after the intervention. Confounding variables such as reporting crime incidents through other media will be taken into account.

Only when the quasi-experimental trial will have proven that our PT intervention positively influences the target behavior, the app will be brought to the appstore. If not, another round of co-design studies will be conducted to discover the barriers for success. Only after significant indication of behavioral influence, we will launch the app. After that, we can expand on the success and scale up the intervention, for instance by making the target behavior more difficult. E.g., instead of having citizens report one minor crime incident, the expanded intervention can focus on persuading citizens to become a member of their neighborhood watch. Another way to spread out the intervention scope would be to reach out to a new audience, for instance joggers or walkers, and see how the intervention works with these new audiences. A third way would be to expand the scope of distribution, reaching a wider audience with the intervention [2].

## CONCLUSION

Our case study illustrated how systematic analysis of the multifaceted factors that lead to behavioral change may contribute to realizing successful, innovative persuasive technology interventions for society that have a real impact on people's lives. With our analysis grid, we attempted to provide PT designers with a tool for the systematic analysis of determinants which might best influence the desired behavior in order to focus on specific, realistic behavioral objectives which can be measured for evaluation, and to make a well-founded choice of effective PT channels and triggers to include in the PT intervention.

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