

Report D3: Literature study on Persuasive Techniques and Technology.

Vlieghe, Joachim

Vrije Universiteit Brussel

De Troyer, Olga

Vrije Universiteit Brussel

This report is part of the EUFEDER 2014-2020 project TICKLE

Adaptive Persuasive ICT Tools to Tackle School Burnout Among Youngsters in Brussels

With the support of the European Fund for Regional Development (EFRO)



La Région et l'Europe investissent dans votre avenir ! • Het Gewest en Europa investeren in uw toekomst!



Abstract

In this report, we present an overview of the academic literature regarding persuasive techniques and how these have been adopted and adapted in digital technology. We first address the general topic of 'Persuasion' as we discuss two viable frameworks for developing persuasive interventions aimed at inducing and supporting behavioral change. As we continue, we take a closer look at some of the most powerful persuasive techniques that can be used to call people to action. In addition, we also consider the potential ethical pitfalls of persuasive technology. Next, we to address a small number of generalizable evaluation criteria, as well as the outcomes of various attempts to empirically validate the hypothesized impact and effectiveness of persuasive technology. We conclude by discussing a select set of evidence-based strategies and guidelines that can aid designers to create effective and ethically sound persuasive technologies.

Keywords: *Persuasiveness, Persuasive Techniques, motivation, reactivation*

Table of Contents

Introduction	1
Frameworks	3
Fogg’s Behavioral Model.....	3
Eyal’s Hook Model	6
Persuasive techniques	9
Altruism and reciprocity	9
Commitment and consistency	10
Comparison and social proof	12
Liking.....	12
Credibility	13
Scarcity	14
Ethics of Persuasion	15
Intrusion and surveillance	16
Manipulation and deception.....	17
Coercion	18
Empirical validation	20
Evaluation criteria.....	21
Outcomes	22
Tailoring and perception	22

Gender differences	22
Cultural differences.....	23
Personality differences.....	23
Motivation and reflection.....	25
Material rewards and personal goals.....	26
Social rewards and sharing of data	27
Design strategies and guidelines.....	28
Enabling control and reflection.....	28
Operate unobtrusively.....	29
Reinforce positively	30
Summary.....	32
Conclusions.....	33
Bibliography	34

Introduction

In this report, we present a state-of-the-art on research regarding persuasive techniques and persuasive technology. The report is part of the research EUFEDER 2014-2020 project called *Adaptive Persuasive ICT Tools to Tackle School Burnout Among Youngsters In Brussels (TICKLE)*. The research project will result in the development of innovative ICT tools that can aid educators and social workers to (re)activate and motivate youngsters who are experiencing school burnout. As such, the project will support a flexible and cost-effective approach to the prevention of ESL.

The research team aims to optimally use modern technologies and the popularity of digital media within the project. After all, prior research has clearly indicated that these technologies and media forms provide many opportunities for children, youngsters and adults to participate in culture and to engage in spontaneous learning processes (see Vlieghe, 2014). People who participate frequently in these learning processes often experience a positive effect in terms of self-confidence and the intrinsic motivation to engage in life-long learning. In previous reports we have pointed out that this boost in confidence and intrinsic motivation can have a positive influence on the reduction of school burnout and ESL (see Vlieghe & De Troyer, 2016a).

At the onset of the TICKLE project, the researchers undertook a number of exploratory studies to get a proper insight into the context of their work. These studies included topics such as influencing factors of ESL (Vlieghe & De Troyer, 2016a), media use among young adults (Vlieghe & De Troyer, 2016b), and persuasive technologies and design strategies. The current report represents the outcome of the last named study, which consists of a literature review on persuasive techniques and how these have been adopted and adapted in digital technology. Unlike the study of persuasion and persuasive techniques, research on persuasive technology is a

2 || Persuasive Techniques and Technology

fairly young scientific field (Fogg, 2002, p. 24). As a consequence, empirical evidence regarding the long-term effectiveness of persuasive technology is still rather scarce (IJsselsteijn, de Kort, Midden, Eggen, & van den Hoven, 2006) and limited to a small number of life-domains, mostly health and commerce.

Frameworks

We start this report by discussing two frameworks for understanding the process of persuasion and behavioral change. First, we address B.J. Fogg's Behavioral Model (Fogg, 2002), which represents a more abstract and minimalistic approach to this process. Secondly, we look into Nir Eyal's Hook Model (Eyal, 2014), which represents a more pragmatic approach.

Fogg's Behavioral Model

In his work on persuasion, B.J. Fogg (Fogg, 2002; Fogg, 2009) focuses primarily developing and understanding of how interactive computing products help to persuade people to change their attitudes or behaviors. He argues that many existing persuasive techniques can be transferred and applied in interactive technology. In addition, he also identifies a number of interesting advantages that computers have over humans. These advantages comprise a computer's potential for ubiquity through mobility, persistence, multimodality, scalability, anonymity, and their capacity for handling tremendous cognitive loads.

Fogg (Fogg, 2002) argues that the broad combination of characteristics enables interactive technologies to play three distinct roles in the process of persuasion, namely: as tools, as media, and as social actors. Fogg describes this as the Functional Triad of persuasive technology. Each role is associated with a particular set of persuasive techniques that can be used to leverage behavioral change. As a tool, technology persuades people to adopt new habits by increasing their capability and facilitating the target behavior. As a medium, persuasive technology provides experiences that enable people to rehearse the intended behavior, thereby creating a learning loop (see also Bang, Torstensson, & Katzeff, 2006). Finally, as a social actor, persuasive technology creates a relationship by providing social cues.

The role of persuasive technology as a social actor is particularly interesting because it enables these interactive systems to apply techniques that are also used to influence people's behavior in face-to-face situations (see also section *Persuasive techniques*). In fact, Fogg (Fogg, 2002) explains that people are naturally inclined to respond to social cues, even if they are presented by an inanimate object like a computer. These clues include things such as: physical attractiveness (i.e. appearance, lay-out, interface, etc.), psychological cues (i.e. similarity in personality, preferences, etc.), language (e.g. feedback, praise); social dynamics (i.e. reciprocity, consistency, etc.), social roles (e.g. authority, etc.). Given the many advantages that computers have over human persuaders, these persuasive techniques can become increasingly powerful.

In order to explain how the persuasiveness takes hold and influences behavioral change, Fogg developed an abstract Behavioral Model (see Figure 1 - Fogg's Behavioral Model (Fogg, 2009)). The model contains three controlling factors and their dynamic relationship that determines whether a person will perform a certain behavior or not. The first factor is motivation, which can be distilled to three pairs of essential core motivators: pleasure and pain; hope and fear; and social acceptance and social rejection (Fogg, 2009). The second factor is ability, which relates to resources and issues that determine perceived simplicity, such as: available time and money; required physical effort and brain cycles (i.e. cognitive strain); social deviance; and non-routine (i.e. unfamiliar) behavior. Other studies have also shown that these first two factors (i.e. motivation and ability) are crucial requirements for behavioral change to take place (e.g. Lo, et al., 2007). The third factor is the trigger, which is an element that sparks, facilitates or signals the target behavior.

Triggers are most powerful when they are provided at the right place at the right time. This principle is called Kairos. This principle is also applied in education (i.e. just in time

teaching, see also Simkins & Maier, 2010) and behavioral therapy (Lo, et al., 2007). According to Fogg, the adoption of this principle is precisely what makes persuasive technologies more powerful persuaders than humans. Modern technologies, like tablets and smartphones, are mobile and networked devices equipped with various sensors that can provide crucial information about the current context of the user. *“By knowing a user's goals, routine, current location, and current task, these mobile systems will be able to determine when the user would be most open to persuasion in the form of a reminder, suggestion, or simulated experience”* (Fogg, 2002, p. 188). This allows the system to intervene at the most opportune moment and in an authentic context. This is not always possible for human persuaders, since the physical presence of a person might be considered intrusive and unwanted in some situations. This problem is almost non-existent for mobile technologies that can therefore benefit from the Kairos principle to increase their chances of successfully altering people’s behavior.

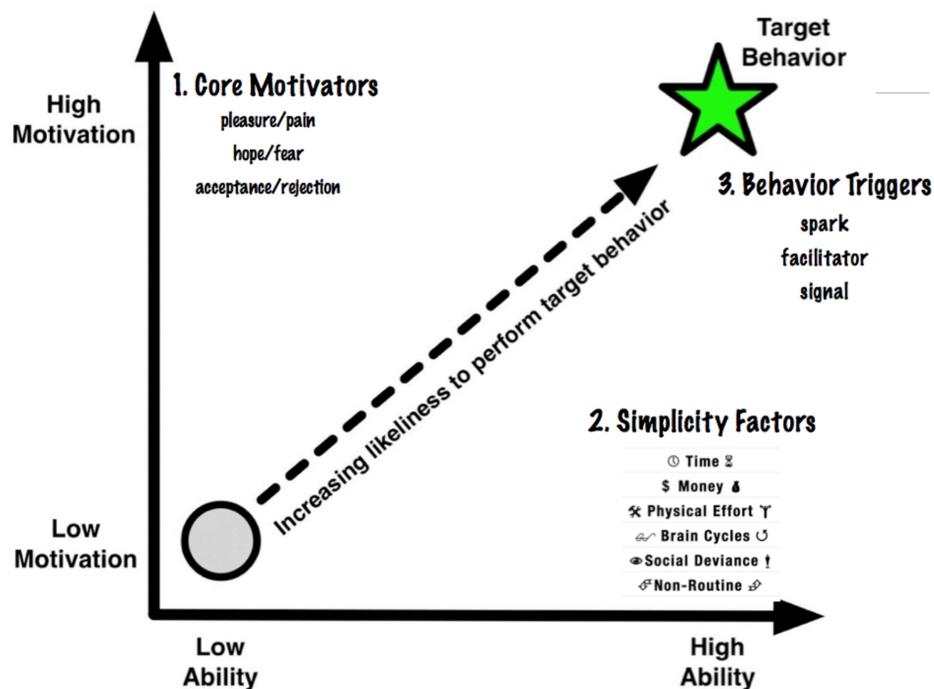


Figure 1 - Fogg's Behavioral Model (Fogg, 2009)

Eyal's Hook Model

Nir Eyal's Hook Model (Eyal, 2014) shows various similarities with Fogg's Behavioral Model. Like Fogg, Eyal identifies a number of key components that are essential for the process of persuasion. These components are: triggers, actions, (variable) rewards, and investments. In contrast to the Behavioral Model, however, the Hook Model emphasizes and discusses the relationship between these components. Furthermore, the Hook Model represents an approach to persuasion that draws from, but is not limited to, technological applications. As a consequence, the Hook Model provides a much more detailed understanding of the process of persuasion and its influence on behavioral change.

According to Eyal, the four key components are consecutive parts of a single cycle or iteration that help to build new habits (see Figure 2 - Nir Eyal's Hook Model (Eyal, 2014)). Ideally, that new behavior becomes an automatic or unprompted response to a situational cue or trigger. Unfortunately, "*successfully changing long-term user habits is exceptionally rare*" (Eyal, 2014, p. 16), since old habits die hard while new habits quickly dissipate. In order to increase the chance of success, the user must repeatedly move through the Hook cycle to gradually develop new neural pathways, i.e. internal triggers. In addition to frequency, Eyal also recognizes the (lesser) impact of perceived utility, importance and complexity (i.e. Fogg's simplicity factor) of the behavior on building new routines.

Each iteration of the Hook cycle begins with a trigger, either external or internal. External triggers are similar to Fogg's triggers. They present the first cue for users to perform an action, often in a very explicit way. By limiting options, designers of persuasive technologies can reduce the risk of hesitation or confusion, and therefore the likelihood of abandonment. Internal triggers are gradually developed as users move through multiple iterations of the Hook cycle. These

triggers represent a mental association between the new behavior and specific thoughts, emotions, or preexisting habits. As such, they align with Fogg's core motivators. These triggers are very powerful as they affect people's behavior in a predominantly unconscious way. When these triggers take effect, the new behavior becomes routine and external triggers are no longer needed. Examples of highly effective internal triggers are feelings of boredom, loneliness, frustration, confusion, and indecisiveness, as well as the positive emotions experience when this pain or irritation is taken away. Eyal notes that identifying these internal triggers or core motivators is a challenging task given the discrepancy between people's stated and exhibited preferences.

Every effective trigger is followed by an action from the user. In accordance with Fogg (2016), Eyal (2014) argues that actions can only be triggered if the user also possesses the sufficient motivation and abilities to perform the action. If these requirements are fulfilled, the behavior is very likely to be performed, often with very little conscious thought.

Such triggered actions are generally performed in anticipation of a reward. The purpose of these rewards is to reinforce the user's motivation for repeating the action when the next trigger is presented. What makes the Hook cycle so effective is its ability to create a strong desire by introducing a variable reward system that "*satisfy users' needs while leaving them wanting to reengage*" (Eyal, 2014, p. 75). This can be achieved by introducing a reward system with infinite variability. Eyal identifies to three types of rewards with infinite variability: rewards of the tribe, rewards of the hunt, and rewards of the self. The first type, the rewards of the tribe, are social in nature and arise from our desire to feel accepted, attractive, important, and included. This desire works as a strong learning mechanism known as social learning, which allows people to adopt a behavior simply by observing others being rewarded for that same behavior (Bandura, 1965;

1977). The second type, the rewards of the hunt, relate to the acquisition of resources, which can consist physical objects as well as information. The third type, the rewards of the self, entails the gratification derived from overcoming obstacles, which springs from our desire to gain a sense of competency (Deci & Ryan, 2013).

As Eyal points out, these types of rewards are frequently implemented in games and social media environments, often leading to increasing investments by their users. The concept of investment describes everything that the user voluntarily supplies to system as they move through the Hook cycle. This includes commitments by means of time and effort (e.g. acquiring skills to use the service), data (e.g. stating preferences, adding content, etc.), social capital (e.g. inviting friends, acquiring followers, building reputation, etc.), or even money (e.g. to build virtual assets). This can make triggers more engaging, actions easier or rewards more exciting. As such, the investment leads to a perceived improvement of the service for the next iteration, resulting in a better and more satisfying experience. This, in turn, increases the probability of future iterations through the Hook cycle as we are inclined to strive for consistency and avoidance of cognitive dissonance (see also section *Commitment and consistency*).

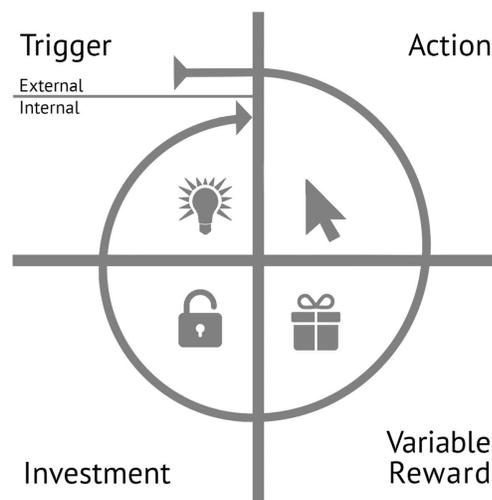


Figure 2 - Nir Eyal's Hook Model (Eyal, 2014)

Persuasive techniques

The presented frameworks indicate that persuasion and behavioral change rely heavily on subtlety and near automatic responses to situational cues. Indeed, according to Robert Cialdini (Cialdini, 2006; Goldstein, Steve, & Cialdini, 2008), persuasive techniques are most effective when they take advantage of our tendency to use shortcuts to assess and respond to social situations. This predisposition is the result of the multitude of social interactions in which we must engage with our limited resources in terms of time and energy. In most situations, our automated behavior is beneficial and even necessary. Because of their importance, the psychological processes that underlie these automated responses are embedded deep into our brain. This is why it is often hard to resist persuasive techniques that take advantage of our unconscious inclination to value reciprocity, consistency, social comparison, similarity, authority, and scarcity.

Altruism and reciprocity

As a social species, humans rely heavily on altruism in order to thrive and survive. In order to build a successful altruistic society, all members of that society need to adhere to the rule of reciprocity (Cialdini, 2006; Mertens, 2006). The rule instates the expectation that a favor should be repaid with a gesture of an equal kind. Like any unwritten rule that governs a society, the unwillingness to comply with it results in retaliation in the form of disliking or even social exclusion, thus taking full advantage of our desire for social acceptance. As Fogg (2002) points out, the feelings of liking or disliking as a result of reciprocity or the absence thereof can also transfer to objects like technology in its role as a social actor.

The power of the rule of reciprocity as persuasive means comes from its ability to invoke a strong feeling of indebtedness upon any person who finds himself at the receiving end of an altruistic interaction. Persuasive techniques that apply the rule of reciprocity therefore initiate interaction by performing an act of generosity. This instills a feeling of indebtedness on the receiver and enables the persuader to make a request to which the receiver is likely to agree. In his book *Influence: The Psychology of Persuasion* (2006), Robert Cialdini points out that the effect of this technique can be maximized by creating the illusion of compromise. By first asking for a large favor in return and allowing the receiver of the unrequested gift (i.e. target) to decline, the persuader creates the opportunity to retreat to smaller favor. This is known as the rejection-then-retreat technique. By declining the first request, the feeling of indebtedness is strengthened, increasing the likelihood of acceptance of the second request. Furthermore, the reaffirmation of choice often works to soothe the target and to lower the defenses against what would otherwise be considered a bad deal (Eyal, 2014). At the same time, the proposed compromise causes the target to “*feel more responsible for having ‘dictated’ the final agreement*” (Cialdini, 2006, p. 37) and ultimately living up to it.

Commitment and consistency

Much like reciprocity, human societies tend to value consistency as an important personal trait. This quality ensures that its members stay true to their commitments, making them trustworthy and predictable. Intellectual strength, honesty and personal stability are attributes often ascribed to persons who act and speak consistently, whereas people who do not are generally regarded as indecisive, confused or two-faced (Cialdini, 2006). Again, our desire for social acceptance comes into play and applies pressure to comply with societies standards. In

addition to external pressure, we also tend to experience internal pressure when we deal with matters of commitment and consistency. This pressure originates from our desire to make sense of our environment and our responses to it, as well as our desire to avoid cognitive dissonance or discomfort that results from not being able to do so (Festinger, 1957; Consolvo, McDonald, & Landay, 2009).

The pressure to be consistent can be induced by using a persuasive technique called the foot-in-the-door technique (Freedman & Fraser, 1966; Cialdini, 2006). Similar to the rejection-then-retreat technique, the persuader makes two requests to the target in order influence his or her behavior. However, instead of making a large initial request, the persuader starts by making a relatively small request that the target can easily agree to. By agreeing to this first request, the target willingly accepts a first, albeit small, commitment that the persuader can use as leverage when making a second, much larger request. *“Once an active commitment is made, then, self-image is squeezed from both sides by consistency pressures”* (Cialdini, 2006, p. 59). This dual pressure persuades people to extend their commitment, but also to rationalize their choices in order to bring their beliefs in line with their actions (see also Freedman, 1965; Freedman & Fraser, 1966). This rationalization can be used to create a self-maintaining support system that prolongs the commitment, even when the original reasons for that commitment have been taken away. Pressure of consistency can be further strengthened by asking expressing the commitment in writing (Cialdini, 2006), by making the commitment publicly visible to a person’s peers (Fogg, 2002), or by providing a reminder that represents the commitment in the form of established progress (Eyal, 2014).

Comparison and social proof

In light of our desire for social acceptance, we also need ways to determine to which rules we need to conform. A quick way of doing so is by observing the attitudes and behaviors of others in a given situation and comparing them to one's own attitudes and behaviors (Suls & Wills, 1991; Fogg, 2002). In order to automate our responses, we tend to accept the actions of others as proof of what constitutes correct behavior (Cialdini, 2006). As such, others become a model through which we learn to respond fast and appropriately in an ongoing situation (Bandura, 1969; 1977). This principle of social proof can be used as a persuasive means and is often applied as a basis for other persuasive techniques. The effect of social comparison and the principle of social proof can be increased if the consequences of the model's actions are also observed (Bandura, 1965; Fogg, 2002) and if many people exhibit similar behavior in the given situation (Cialdini, 2006).

Liking

The effect of social comparison is strengthened when the model perceived by the observer is someone she or he likes (Bandura, 1965; Fogg, 2002; Cialdini, 2006). A first reason for liking someone relates to observed similarities in terms of things like background and personality traits, but also life-style choices and opinions. A second reason for liking someone is the feeling familiarity, which can result from prolonged interaction or frequent exposure (Cialdini, 2006). A third reason for liking someone relates to the halo-effect created by physical attractiveness (Bang, Torstensson, & Katzeff, 2006). This causes us to attribute favorable traits like intelligence, honesty, kindness and success to people whom we find appealing.

Due to our desire for social acceptance, we often find it very hard to reject a request from someone we like. As a consequence, aspects such as similarity, familiarity and physical attractiveness can act as primers to persuade people to agree to a future request. This can be done through techniques, such as mirror-and-match (i.e. imitating the target's posture, mood, and verbal style), by establishing personal connections through shared traits, backgrounds of friends, by choosing the suitable attire, or by increasing exposure. Alternative techniques include the jigsaw route that uses shared goals and dispersed resources to invoke group dynamics (Cialdini, 2006), or the luncheon technique that establishes a positive association between a pleasant situation and the persuader or the request (Razran, 1938).

Credibility

The impact of persuasive techniques is strongly influenced by the amount of credibility that is attributed to the persuader. Credibility is established through a combination of perceived expertise and trustworthiness. The former represents knowledge and skills, whereas the latter is determined by the perceived goodness of the persuader (McGinnies & Ward, 1980; Mintz & Aagaard, 2012). A shortcoming in either of these dimensions can drastically reduce a persuader's credibility (Tseng & Fogg, 1999). When credibility is high, however, persuasive techniques can be highly effective and induce behavioral change, particularly in educational settings (Thweatt, S., & McCroskey, 1998; Teven & Herrin, 2005; Finn, Schrodt, Witt, Elledge, Jernberg, & Larson, 2009).

In order to assess a person's credibility, we often use the context of the situation and specific anchoring points like titles or symbols (Eyal, 2014). These anchoring points mostly relate to the persuader's educational or professional background and convey a certain sense of

authority. Various studies have shown that we are inclined to place our trust in people who exhibit these signs of authority, like Medical Doctors, scientists, police officers, or military personnel (see Cialdini, 2006). Unfortunately, these anchoring points can also be used to mislead or coerce people (see section deception).

Scarcity

A last popular persuasive technique is the use of the scarcity principle to affect people's perception of value and to increase their desire for this scarce service or item. The scarcity principle motivates people to act quickly in order to avoid potential loss. It can be established through a limited-number tactic, or through a deadline tactic, both of which signal a low availability of a particular service or item. "*As opportunities become less available, we lose freedoms; and we hate to lose the freedoms we already have*" (Cialdini, 2006, p. 184). According to psychological reactance theory (Brehm & Brehm, 1981) this feeling of diminishing personal control urges us to react by increasing our desire for what we have lost.

Ethics of Persuasion

Any of the persuasive techniques mentioned in the previous section can be used to encourage people to make behavioral changes that positively affect their lives, but also to coerce or deceive them into making choices that have a negative impact on their lives. Often, there is only a very thin line between persuasion and encouragement on the one hand, and coercion and deception on the other hand (Purpura, Schwanda, Williams, Stubler, & Sengers, 2011). Other ethical issues related to persuasive technology also include the over-rationalization, surveillance, control, quantification and optimization of human behavior. In this report, however, we limit our discussion to the ethical dangers of coercion and deception.

Whenever we consider the impact of persuasive technology, it is important to remember that all technology is designed and therefore never neutral. Indeed, despite designers' best intentions, persuasive technology takes away some of the agency of its users by attempting to steer their behavior. Furthermore, persuasive technologies can have unintended and undesirable outcomes (Verbeek, 2006). Scholars like Daniel Berdichewsky and Erik Neuenschwander (1999) have argued that designers have the moral responsibility to perform an assessment of the persuasive technology that takes into account the perspectives of the different stakeholders. This includes an evaluation of the designers' motives, methods, and intended outcomes. Furthermore, the authors stress that designers should also assess related work to predict potential unintended outcomes. The assessment can focus on utilitarian arguments related to a specific design, but it can – and should – also focus on deontological arguments related to moral principles like beneficence, preventing harm, and respect for autonomy. Discussions regarding deontological arguments in the context of persuasive technology often revolve around issues of intrusion and

surveillance, manipulation and deception, and coercion. We will address these topics in a bit more detail in the following three subsections.

Intrusion and surveillance

Persuasive technologies are quite intrusive by nature because they rely heavily on data about the users' lives. These data are either willingly supplied by the users themselves or acquired through active sensors. The information is used to send well-timed and appropriate cues to the users in order to persuade them to changes to alter their behavioral patterns. As such, persuasive technology can quickly seem to act like a surveillance tool. While small acts of intrusion and surveillance might be beneficial for the system to be successful (i.e. persuasive) and efficient, a heavy reliance might be harmful to the users' privacy as well as their autonomy (Lee, Kiesler, & Forlizzi, 2011; Purpura, Schwanda, Williams, Stubler, & Sengers, 2011). Whereas privacy relates to the recording of the data, autonomy relates to the representation of the data.

While many laws cover issues related to users' privacy needs, few address users' needs to control data representation. The ability to control how personal data is represented provides users a fair degree of autonomy in the form of active impression management. This is particularly important if the persuasive technology incorporates the users' social networks. Impression management allows people to maintain public consistency (see section Commitment and consistency), and to avoid social scorn (Consolvo, McDonald, & Landay, 2009). Any discrepancy between what is recorded and what is represented can inspire reflection on the part of the user.

Manipulation and deception

Studies focused on ambient persuasive technology show that behavior can be affected with the use of subliminal messaging. This can help to reduce cognitive efforts required by the user, thus increasing the efficiency. Unfortunately, this might also take away the user's opportunity to make a conscience choice, turning the persuasive technology into a form of manipulation and deception (Ham, Midden, & Beute, 2009; Ham & Midden, 2010). Indeed, any persuasive technology that obscures the persuasive design and thereby reduces the autonomy of its users can be considered unethical. It can even be said to be unhelpful, as it reduces the opportunities for conscience reflection, which aids in the development of sustained behavioral change (Fogg, 2009; Purpura, Schwanda, Williams, Stubler, & Sengers, 2011). In light of this observation, scholars like Rachel Page and Christian Kray (2010) have argued that it might be useful to clearly convey to the user who is the recipient, who is the commissioner, and what the means of delivery are.

In order to make an honest assessment of their own position in this matter, designers can use Eyal's manipulation matrix (see Figure 3 - Manipulation Matrix (Eyal, 2014)). The assessment considers two main questions: (1) whether the designer is prepared to use the technology, and (2) whether the technology improves the life of its users. Nir Eyal (2014) argues that designers who lack first hand experience with the problem their technology is trying to tackle are at a serious disadvantage. These designers might not be able to answer the two main questions of the manipulation matrix positively. If they answer both questions negatively, they might be creating a product that exploits its users. If they are inclined to use the product themselves, but cannot claim to be improving the life of the users, designers are most likely creating a product for entertainment purposes. If the product does improve the users lives, but the

designers are not likely to use the product themselves, they might be considered peddlers. Only when both questions can be answered positively, the designers can consider themselves to act as facilitators. From an ethical perspective, the golden rule of persuasion is that designers should strive to act as facilitators. This means that they “*should not create any artifact that persuades someone to do or think something that they (the designers) would not want to be persuaded of themselves*” (Page & Kray, 2010, p. 20).

Manipulation Matrix

Materially improves the user's life	Peddler	Facilitator
Does not improve the user's life	Dealer	Entertainer
	The maker does not use it	The maker uses it

Figure 3 - Manipulation Matrix (Eyal, 2014)

Coercion

Designers must avoid using excessive external pressure to persuade users to adopt particular behavior. As we have already seen, the social pressure created by techniques like public commitment and social comparison can be highly effective to persuade people. Unfortunately, the pressure to conform can also cause harm to the users and reduce their autonomy, thus becoming a tool for coercion rather than persuasion (Page & Kray, 2010; Purpura, Schwanda, Williams, Stubler, & Sengers, 2011). This is particularly the case when the

persuasive technology records the users' behavior and shares it with their peers without allowing impression management (Fogg, 2009). At that moment the users can start to experience shame and other negative feelings due to the public display of their nonconformity or inconsistency. Such negative feelings are likely to cause the users to abandon the persuasive technology and to reject the proposed behavioral changes.

Empirical validation

Over the past decade, the opportunities for creating and evaluating persuasive technologies have greatly improved as mobile technologies have made large advances and have become widely accessible. The largest advances have been made on the front of mobile and wearable sensors. Given the types of available sensors and devices, many of persuasive technologies currently focus on behavioral changes related to physical activity. This trend is undoubtedly also inspired by the increased global attention for physical health problems.

Another popular trend with respect to persuasive technology is the use of games or gamification. These approaches are often used in pedagogical and therapeutic programs in order to create environments where people can safely acquire new behaviors. These environments can take advantage of various persuasive factors, such as public commitment and social comparison featured in people's existing social networks (i.e. friends), scarcity through a well-designed reward system (e.g. points, collectibles, etc.), or altruism and liking through multi-player co-ops.

Both trends are clearly reflected in the academic literature related to the empirical validation of persuasive technology. Most works referenced in this report's section on empirical validation will therefore focus on health-related persuasive technologies, persuasive games, or a combination of both. In the first subsection, we discuss potential evaluation criteria for performing empirical validation studies. In the second subsection, we briefly discuss the general outcomes of empirical studies that focus on the effectiveness of persuasive technology related to tailoring and perception, and motivation and reflection. In the third subsection, we present a short overview of the main design strategies and guidelines proposed in the academic literature based on the available empirical data.

Evaluation criteria

The criteria for evaluating the impact and effectiveness of persuasive technologies often differ depending on the nature of the intended behavioral changes, the technologies or persuasive techniques used, and the focus of the evaluation itself. However, to increase the methodological rigor of these types of evaluation, scholars like Marc Adams and colleagues (Adams, et al., 2009; see also Cooper, Heron, & Heward, 2006) have proposed a framework based on behavioral theory. Such a framework takes into consideration the following dimensions of behavior:

- *Topography* refers to its form (i.e. how the behavior appears).
- *Latency* refers to the time interval between a trigger and the incidence of the behavior (i.e. how long does it take for the behavior to occur after a prompt has been presented).
- *Duration* refers to the time interval between the start and end of the behavior (i.e. how long does is the behavior performed in uninterrupted manner).
- *Intensity* refers to the strength of the behavior (i.e. how forcefully is the behavior performed).
- *Frequency* and *rate*, whereby the former refers to the overall number occurrences, while the latter refers to the number of occurrences within a specific period (i.e. how often the behavior is performed).

Such a framework allows for better comparison between results and is applicable for a wide range of studies: focusing both on short-term or long-term effects, performed in experimental or even natural settings. It must be noted that studies “*investigating the experiences of people who have adopted these technologies ‘organically’ and continued to use them over time*” (Fritz, Huang, Murphy, & Zimmermann, 2014, p. 487) are rather scarce. Indeed, most research on persuasive technology featured in the academic literature focuses on behavioral changes

observed or measured in experimental settings over a short period of time. In this report, we address both types of studies.

Outcomes

This subsection focuses on the results of experimental and observational research studying the impact and effectiveness of persuasive technology. We want to keep the focus of this literature on persuasive technology, rather than on the details of the individual studies. Thus, instead of explaining and discussing each study separately, we will address the recurring findings and relate them to the theoretical frameworks discussed at the beginning of this report. Most of these findings are strongly related to the theoretical suggestions concerning advantages of pairing mobile devices and sensor with persuasive technology. This interesting combination allows designers to create persuasive technologies that are highly tailored to the characteristics and needs of their users, while remaining consistent and persistent to ensure that triggers are always delivered at the right time and place.

Tailoring and perception

Gender differences

Though gender differences in terms of preferences or the exhibition of particular behavior can often be rather small (see e.g. Vlieghe & De Troyer, 2016a), studies on persuasive technology do suggest that gender-based tailoring can be very effective. In a recent study, Rita Orji, Regan Mandryk and Julita Vassileva (2014) found that there are significant differences between the persuasive strategies perceived as effective by female subjects compared to the perception by their male counterparts. Females attributed more persuasive power to strategies

such as cooperation, customization, personalization, praise, and simulation. In fact, the female participants in the study generally showed a higher degree of openness towards persuasive strategies than men. This can, of course, be influenced by culturally determined gender patterns and stereotypes that are frequently reproduced through education (see Eder & Parker, 1987).

Cultural differences

Culture has an undeniably strong influence on how we perceive and interact with the world around us. In light of this observation, studies like the one presented by Rilla Khaled (2008) have set out to explore the relationship between cultural differences and effective persuasive technology. The results of Khaled's study show that persuasive games are more effective in fostering new behaviors when they align more closely with users' cultural preferences and perceptions. The author notes that "*many of the interface components informed by our culturally-relevant design strategies were positively received and used by our target players, while being misunderstood and underused by non-target players*" (ibid, p.191). As such, Khaled affirms the importance of the relationship between users' perception of persuasive design strategies and the effectiveness of persuasive technology.

Personality differences

Studies on persuasive technology focusing on the differences between personality types also highlight the importance of perception. Given their social characteristics (i.e. responsiveness in the form of tailored feedback), persuasive technologies can be perceived as social actors exhibiting a particular personality type. Studies have found that users tend to attribute more positive feelings and competence to technologies that exhibit personality types

similar to their own (Fogg, 2002). As we have seen previously (section Persuasive techniques), likability and credibility play a key role in some of the most popular and effective persuasive techniques.

Personality types can help to predict users' inclination towards certain persuasive strategies, as well as their aversion for other forms of persuasive design. Indeed, Sajanee Halko and Julie Kientz (2010) found that their participants "*had a stronger sense of which technologies they would not favor compared to those that did*" (p. 157). They observed a number of interesting correlations between personality types and people's perception of persuasive strategies. Their study suggests that persons with a tendency towards negative emotions (i.e. neuroticism) enjoy negative reinforcement, but do not consider cooperative strategies as an improvement in their lives. People who feel strongly about norms, rules, planning, prioritizing and seeing thing through (i.e. conscientiousness) seem to perceive socially based strategies like competition and cooperation as being helpful and life improving. People characterized as altruistic, trustworthy, modest, compassionate and cooperative (i.e. agreeableness) show a liking for the facilitating effects of competitive strategies, as well as an aversion for the use of positive or negative reinforcement strategies. Persons who are very sociable, active, assertive and engaged in their environment (i.e. extraversion) tend to show a general disliking of persuasive strategies exhibiting no positive correlations with any of the strategies, while they express many negative feelings about extrinsic and intrinsic persuasive strategies, as well as positive and negative reinforcement strategies. The last type of people, those who delve into the wholeness and complexity of life through art, emotion and unique experiences (i.e. openness) appear to favor Competitive or Authoritative technologies, but do not highly regard extrinsic, intrinsic or negative reinforcement strategies. Even though these are tentative results, the outcome of this

study by Halko and Kientz (2010) stress to designers of persuasive technology the importance of thoroughly knowing and understanding the targeted users.

Motivation and reflection

In light of the discussion on the ethics (see Ethics of Persuasion), the impact and effectiveness of persuasive technology cannot be solely based on people's gender, cultural background or personal characteristics. The use of persuasive technology must be a conscious and unforced choice. The motivation to adopt a new behavior and the willingness to be persuaded to reflect on ones old behavior have been shown to strongly influence the impact and effectiveness of persuasive technology (Lee, Kiesler, & Forlizzi, 2011; Mintz & Aagaard, 2012; Fritz, Huang, Murphy, & Zimmermann, 2014). Studies have also shown that the immediate impact of persuasive technology on people's activities and their awareness of the value of that activity often helps to sustain the motivating effects that users initially associated with the technology, even over a long period of time (Fritz, Huang, Murphy, & Zimmermann, 2014). As such, persuasive technology is said to be able to provide durable support for behavioral change.

In order to achieve durable support, persuasive technology needs to help people first and foremost to accomplish their goals. In addition, persuasive technology needs to be consistent and persistent in delivering feedback and triggers with becoming obtrusive (Mintz & Aagaard, 2012). After all, *"the key point is that this persuasive technology concept is about helping people change behavior in ways that they choose"* (Fogg, 2002, p. 194). Various studies have examined how this can be done effectively through commitment and comparison leveraged by means of various rewards systems. We briefly discuss the main findings of these studies in the next two subsections.

Material rewards and personal goals

People often choose to perform a particular behavior because they expect to be rewarded for it. The rich body of studies in behavioral psychology has provided ample evidence of the effectiveness of external reward systems to reinforce or diminish behavior. Variable reward systems often offer the best results (e.g. Lo, et al., 2007) as they increase the anticipation and desire of the reward by loosely applying the scarcity principle (see section Scarcity). Nonetheless, studies have also shown that fixed rewards systems effectively help to increase people's motivation to change their behavior as they provide benchmarks to measure performance (e.g. Fritz, Huang, Murphy, & Zimmermann, 2014). Persuasive technologies often use these benchmarks as a target to which people can align their personal goals, allowing the designers take full advantage of persuasive techniques such as commitment (see section Commitment and consistency) and comparison (see section Comparison and social proof). By using these techniques, the persuasive technologies help to increase people's awareness of their current behavior and the intended behavior (Lee, Kiesler, & Forlizzi, 2011).

In order to sustain newly adopted behavior, users of persuasive technology must eventually internalize the reward system and ideally develop an internal motivation to perform the activity (see also Deci & Ryan, 2013). Studies of effective persuasive technologies have indeed indicated that after prolonged use "*participants also developed 'reward ecologies' for themselves that went beyond the explicit system goals and rewards*" (Fritz, Huang, Murphy, & Zimmermann, 2014, p. 493). Unfortunately, people often make biased decisions because they tend to favor the obvious over the alternative option (i.e. default bias), the better of the lesser option (i.e. asymmetric dominance bias), and present benefits over potential future benefits (i.e.

present bias). Research has suggested that successful persuasive technologies attempt to embrace these biases, rather than to avoid them, in order to leverage behavioral change without constricting users' ability to make free choices (e.g. Lee, Kiesler, & Forlizzi, 2011). This is particularly important given the persuasive power of freely chosen commitment (see section Commitment and consistency).

Social rewards and sharing of data

Besides material rewards like points and badges, people are also effectively motivated by rewards of a social nature. Research has shown that persuasive technology that incorporates rewards in the form of praise and flattery expressed by the technology itself makes the users feel better about themselves and their performance, feel powerful and engaged, and improves their mood (Fogg, 2002). This increases the liking (see section Liking) and credibility (see section Credibility) of the system, thereby stimulating users' willingness to continue working with the system. At the same time, the implementation of this reward system can also work against the system if it fails to credit the users at the proper time. Studies have shown that this can induce annoyance or irritation regarding the system, and can result in adverse effects whereby users start *“favoring activities that would be accounted, and avoiding activities that they knew would not be accounted”* (Fritz, Huang, Murphy, & Zimmermann, 2014, p. 492).

Peers could play a very powerful role when it comes to social rewards, enabling the use of persuasive techniques such as public commitment (see section Commitment and consistency), comparison and social proof (see section Comparison and social proof). Persuasive technologies can create opportunities for peer feedback and encouragement by stimulating public sharing of behavioral data (Toscos, Faber, An, & Gandhi, 2006; Khaled, Barr, Noble, & Biddle, 2006).

Unfortunately, this also increases the ethical risks associated with the use of these persuasive techniques (see sections Intrusion and surveillance and Coercion). Studies have shown that users are aware of this and were rather reluctant to share data with their peers (Fritz, Huang, Murphy, & Zimmermann, 2014). Furthermore, these studies suggest that when users do share the behavioral data captured by the persuasive technology, it is often with a very limited number of people with whom they share behavioral patterns.

Design strategies and guidelines

In light of the available empirical data and ethical considerations, scholars have proposed and studied various strategies and guidelines for designing effective persuasive technologies. In this subsection, we present a brief overview of the main strategies and guidelines that have been proposed.

Enabling control and reflection

Through instructions triggered by sensory data and carefully designed algorithms persuasive technology can give designers and users the ability to automate processes and behaviors. Unfortunately, this mode of operation takes away a lot of users' cognitive involvement in adopting new behavior. By reducing the users' active involvement in self-monitoring and making choice, persuasive technologies can take away a lot of the users' control and learning experiences. This approach is neither ethically appropriate, nor truly effective in everyday situations where flexibility and self-reliance are crucial.

Scholars have therefor argued that persuasive technologies should focus on increasing cognitive engagement and reflection by helping users *“to make self-beneficial choices and*

understand the implications of their decisions as well - all without restricting their freedom of choice” (Lee, Kiesler, & Forlizzi, 2011, p. 325; see also Arroyo, Bonanni, & Selker, 2005). This can be achieved mainly by providing data to the users in right amount and at the right time to raise (self-)awareness and stimulate self-monitoring, but also by providing data in the right format to enable reflection. With respect to the latter, scholars recommend the use of an abstracted form that is easy to interpret and allows for flexible representation (Toscos, Faber, An, & Gandhi, 2006; Consolvo, McDonald, & Landay, 2009; Purpura, Schwanda, Williams, Stubler, & Sengers, 2011). By doing so, persuasive technology can stimulate people to assess their own behavior, goals and future actions. At the same time, it enables them to engage in impression management. The opportunities for reflection and impression management allow users to make conscious decision about how to fulfill their personal or public commitments and to achieve internal and external consistency (Purpura, Schwanda, Williams, Stubler, & Sengers, 2011; Fritz, Huang, Murphy, & Zimmermann, 2014). As such, persuasive technology can help to foster behavioral change by supporting reflection and self-reliance.

Operate unobtrusively

Persuasive technology has the unique advantage of being able to provide behavioral triggers at almost any place and any time. Combined with the potential for persistence, this increases the technology’s risk of becoming obtrusive to the user thereby reducing its persuasiveness. Thus, in order to preserve the delicate balance between ubiquity and unobtrusiveness, researchers have argued that persuasive technology “*should also support occasional ignorability*” (Consolvo, McDonald, & Landay, 2009, p. 408). This can be accomplished by various means. One way of doing so is by reducing the cognitive effort that is

required by the user to interpret the data provided by the technology, for instance through process tunneling or reduction (Lee, Kiesler, & Forlizzi, 2011; Purpura, Schwanda, Williams, Stubler, & Sengers, 2011; Mintz & Aagaard, 2012). An alternative approach is to facilitate deep cognitive processing by increasing the aesthetic appeal of the technology. The improved aesthetic appeal enhances the technologies credibility and creates a seamless experience that allows for full immersion (Fogg, 2002; Bang, Torstensson, & Katzeff, 2006). Both of these methods require good knowledge and a thorough understanding of the needs of the targeted users.

In addition to ignorability, scholars have also stressed the importance of tailoring and adaptability. Tailoring can be done in various ways, but one important aspect includes the accommodation and support for a broad “*range of behaviors that contribute to the users’ desired lifestyles*” (Consolvo, McDonald, & Landay, 2009, p. 410). Similarly, adaptability can be achieved through various methods. Like tailoring, however, one crucial aspect of adaptability is to enable users to perform and monitor a wide variety of behaviors. In fact, if the persuasive technology needs to provide long-term support for behavioral change, then the designers need to foresee changes in users’ needs for particular forms of data and representation (Mintz & Aagaard, 2012; Fritz, Huang, Murphy, & Zimmermann, 2014). It is clear that tailoring and adaptability both require the designers to have a thorough knowledge and understanding of the targeted users.

Reinforce positively

Reinforcement is a powerful tool to increase or sustain users’ motivation to perform a particular behavior (see section Eyal’s Hook Model). While some research suggests that negative reinforcement (i.e. punishment) can be quite effective (Fogg, 2002; Mintz & Aagaard, 2012), many studies indicate that the persuasive technologies should focus on positive reinforcement

instead (Bang, Torstensson, & Katzeff, 2006; Consolvo, McDonald, & Landay, 2009; Fritz, Huang, Murphy, & Zimmermann, 2014). The latter group considers possible detrimental effect on users' motivation in case where goals might be temporarily unattainable due to obstacles like sickness or work related deadlines. Furthermore, these scholars suggest that the implementation of negative reinforcement through persuasive technology can also be considered harmful and unwanted from an ethical standpoint.

Of course, positive reinforcement should also be used cautiously to obtain the optimal effect. As recommended by Nir Eyal (2014), a reward system that incorporates variable ratio and interval schedules for the supply of positive reinforcement often works best. This introduces the scarcity principle (see section Scarcity) and takes into consideration that *“too much praise and explicit information can naturally impair the experience [of the persuasive technology] negatively”* (Bang, Torstensson, & Katzeff, 2006, p. 130). In addition to this dynamic reward system, some scholars propose the use of *“concrete ‘real world’ rewards in addition to system-specific symbolic rewards”* (Fritz, Huang, Murphy, & Zimmermann, 2014, p. 495). These ‘real world’ rewards can help to increase the transferability of the behavior adopted within the environment created by the persuasive technology, especially in the case of persuasive games. As such, the rewards system could help to gradually phase out the use of the technology whilst providing sufficient support for maintaining the new behavior.

Summary

In this report, we have presented an overview of the academic literature on persuasive techniques and persuasive technology. The overview represents a broad approach of the general topic, namely 'persuasion'. In the first section, we discussed two viable Frameworks for developing persuasive interventions aimed at inducing and supporting behavioral change. In the second section, we took a closer look at the most powerful Persuasive techniques that can be used to call people to action. In the third section, we continued by concentrating on the Ethics of Persuasion and thus considering the potential pitfalls of persuasive technology. In the fourth section, we briefly addressed the available Empirical validation. In this section, we focused on three topics, namely: a small number of generalizable evaluation criteria, the recurring findings of empirical studies related to the effectiveness and impact of persuasive technology, and a select set of evidence-based design strategies and guidelines.

Conclusions

Inducing, supporting and maintaining behavioral change through the use of persuasive technology should be regarded as an iterative process. This process can build on wide variety of persuasive techniques that mainly utilize people's desire for mental, social and material wellbeing. Each of the techniques has a number of distinct advantages that make them highly effective. Empirical research shows that successful persuasive technologies have a clear impact on users' perceptions regarding the technology itself, their motivation to adopt and maintain new behavior, and their ability to reflect on current and desired behavioral patterns.

At the same time, effective persuasive techniques can also introduce serious ethical dilemmas for designers involving issues such as intrusion, surveillance, manipulation, deception and coercion. Designers should thus proceed with caution and assess their own intentions for developing persuasive technology, as well as their familiarity with the problem they wish to address and their willingness to use their own product. Many ethical problems can be avoided or remediated by applying proper design strategies. These strategies can include enabling control and reflection, ensuring unobtrusive operating of the technology, and the implementation of an appropriate system for positive reinforcement.

Though research on persuasive technology is still rather scarce – particularly when it comes to long-term naturalistic studies – these findings provide a promising basis for future development. Designers can build on these findings to create effective and ethically sound persuasive technologies that support people in their attempts to initiate, commit to and maintain behavioral changes.

Bibliography

- Adams, M. A., Marshall, S. J., Dillon, L., Caparosa, S., Ramirez, E., Phillips, J., et al. (2009). A Theory-based Framework for Evaluating Exergames as Persuasive Technology. In S. Chatterjee (Ed.), *Proceedings of the 4th International Conference on Persuasive Technology*. Claremont: AMC.
- Arroyo, E., Bonanni, L., & Selker, T. (2005). Waterbot: Exploring Feedback and Persuasive Techniques at the Sink. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 631-639). Portland: ACM.
- Bandura, A. (1965). Influence of Models' Reinforcement Contingencies on the Acquisition of Imitative Responses. *Journal of Personality and Social Psychology*, 1 (6), 589-595.
- Bandura, A. (1977). *Social learning theory*. Englewood Cliffs: Prentice-Hall.
- Bandura, A. (1969). Social-learning theory of identificatory processes. In D. A. Goslin (Ed.), *Handbook of socialization theory and research* (pp. 213-262). Chicago: Rand McNally.
- Bang, M., Torstensson, C., & Katzeff, C. (2006). The PowerHhouse: A Persuasive Computer Game Designed to Raise Awareness of Domestic Energy Consumption. In d. K. IJsselsteijn W.A. (Ed.), *International Conference on Persuasive Technology, Lecture Notes in Computer Science. 3962*, pp. 123-132. Berlijn: Springer.
- Berdichevsky, D., & Neuenschwander, E. (1999). Toward an ethics of persuasive technology. *Communications of the ACM*, 42 (5), 51-58.
- Brehm, S. S., & Brehm, J. W. (1981). *Psychological reactance: A theory of freedom and control*. New York: Academic Press.
- Cialdini, R. B. (2006). *Influence: The Psychology of Persuasion*. New York: Harper Collins Business.

- Consolvo, S., McDonald, D. W., & Landay, J. A. (2009). Theory-driven design strategies for technologies that support behavior change in everyday life. *Proceedings of the Conference on Human Factors in Computing Systems* (pp. 405-414). Boston: Elsevier.
- Cooper, J. O., Heron, T. E., & Heward, W. L. (2006). *Applied Behavior Analysis*. Columbus, OH: Prentice Hall.
- Deci, E. L., & Ryan, R. M. (2013). *Intrinsic Motivation and Self-Determination in Human Behavior*. New York: Springer Science & Business Media.
- Eder, D., & Parker, S. (1987). The Cultural Production and Reproduction of Gender: The Effect of Extracurricular Activities on Peer-Group Culture. *Sociology of Education* , 60 (3), 200-213.
- Eyal, N. (2014). *Hooked: How to Build Habit-Forming Products*. London: Penguin Books Ltd.
- Festinger, L. (1957). *A Theory of Cognitive Dissonance*. Redwood City: Stanford University Press.
- Finn, A. N., Schrod, P., Witt, P. L., Elledge, N., Jernberg, K. A., & Larson, L. M. (2009). A Meta-Analytical Review of Teacher Credibility and its Associations with Teacher Behaviors and Student Outcomes. *Communication Education* , 58 (4), 516-537.
- Fogg, B. (2009). A Behavior Model for Persuasive Design . In S. Chatterjee, & P. Dev (Ed.), *Proceedings of the 4th International Conference on Persuasive Technology*. Claremont: ACM.
- Fogg, B. (2002). *Persuasive Technology: Using Computers to Change What We Think and Do* (1st ed.). San Fransisco, CA: Morgan Kaufmann.
- Fogg, B. (2016). *What Causes Behavior Change?* Retrieved 01 30, 2017, from BJ Fogg's Behavior Model: <http://www.behaviormodel.org/>

- Freedman, J. L. (1965). Long-term behavioral effects of cognitive dissonance. *Journal of Experimental Social Psychology*, 1 (2), 145–155.
- Freedman, J. L., & Fraser, S. C. (1966). Compliance without pressure: The foot-in-the-door technique. *Journal of Personality and Social Psychology*, 4 (2), 195-202.
- Fritz, T., Huang, E. M., Murphy, G. C., & Zimmermann, T. (2014). Persuasive Technology in the Real World: a Study of Long-term Use of Activity Sensing Devices for Fitness. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 487-496). Toronto: AMC.
- Goldstein, N. J., Steve, M. J., & Cialdini, R. B. (2008). *Yes! 50 Scientifically proven ways to be persuasive*. New York: Simon & Schuster Inc.
- Halko, S., & Kientz, J. A. (2010). Personality and Persuasive Technology: An Exploratory Study on Health-Promoting Mobile Applications. In T. Ploug, P. Hasle, & H. Oinas-Kukkonen (Ed.), *Persuasive Technology. PERSUASIVE 2010. Lecture Notes in Computer Science. 6137*, pp. 150-161. Heidelberg: Springer.
- Ham, J., & Midden, C. (2010). Ambient Persuasive Technology Needs Little Cognitive Effort: The Differential Effects of Cognitive Load on Lighting Feedback versus Factual Feedback . In T. Ploug, P. Hasle, & H. Oinas-Kukkonen (Ed.), *International Conference on Persuasive Technology. Lecture Notes in Computer Science. 6137*, pp. 132-142. Berlin: Springer.
- Ham, J., Midden, C., & Beute, F. (2009). Can ambient persuasive technology persuade unconsciously?: using subliminal feedback to influence energy consumption ratings of household appliances . *Proceedings of the 4th International Conference on Persuasive Technology* (pp. 1-6). Claremont: ACM.

- IJsselsteijn, W. A., de Kort, Y. A., Midden, C., Eggen, B., & van den Hoven, E. (2006). Persuasive Technology for Human Well-Being: Setting the Scene. In W. IJsselsteijn, Y. de Kort, C. Midden, B. Eggen, & E. van den Hoven (Ed.), *Persuasive Technology. PERSUASIVE 2006. Lecture Notes in Computer Science. 3962*, pp. 1-5. Heidelberg: Springer.
- Khaled, R. (2008). *Culturally-Relevant Persuasive Technology [doctoral thesis]*. Kelburn, New Zealand: Victoria University of Wellington.
- Khaled, R., Barr, P., Noble, J., & Biddle, R. (2006). Investigating Social Software as Persuasive Technology. In W. IJsselsteijn, Y. de Kort, C. Midden, B. Eggen, & E. van den Hoven (Ed.), *International Conference on Persuasive Technology. Lecture Notes in Computer Science. 3962*, pp. 104-107. Heidelberg: Springer.
- Lee, M. K., Kiesler, S., & Forlizzi, J. (2011). Mining Behavioral Economics to Design Persuasive Technology for Healthy Choices. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 325-334). Vancouver: AMC.
- Lo, J.-L., Lin, T.-y., Chu, H.-h., Chou, H.-C., Chen, J.-h., Hsu, J. Y.-j., et al. (2007). Playful Tray: Adopting Ubicomp and Persuasive Techniques into Play-Based Occupational Therapy for Reducing Poor Eating Behavior in Young Children. *International Conference on Ubiquitous Computing, Lecture Notes in Computer Science. 4717*, pp. 38-55. Berlin: Springer.
- McGinnies, E., & Ward, C. D. (1980). Better liked than right: Trustworthiness and expertise in credibility. *Personality and Social Psychology Bulletin*, 6 (3), 467-472.
- Mertens, J. (2006). *Van Zaadcel tot Liefde* (2 ed.). Ghent: Academia Press.

- Mintz, J., & Aagaard, M. (2012). The application of persuasive technology to educational settings. *Educational Technology Research and Development* , 60 (3), 483–499.
- Orji, R., Mandryk, R., & Vassileva, J. (2014). Gender and Persuasive Technology: Examining the Persuasiveness of Persuasive Strategies by Gender Groups. In L. Gamberini, A. Spagnolli, L. Chittaro, & L. Zamboni (Ed.), *The 9th International Conference on Persuasive Technology Adjunct Proceedings* (pp. 48-52). Padua: University of Padova.
- Page, R. E., & Kray, C. (2010). Ethics and Persuasive Technology: An Exploratory Study in the Context of Healthy Living . *1st International Workshop on Nudge & Influence Through Mobile Devices*, (pp. 19-22). Lisboa.
- Purpura, S., Schwanda, V., Williams, K., Stubler, W., & Sengers, P. (2011). Fit4life: the design of a persuasive technology promoting healthy behavior and ideal weight. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 423-432). Vancouver: ACM.
- Razran, G. H. (1938). Conditioning Away Social Bias by the Luncheon Technique. *Psychological Bulletin* , 35 (9), 693.
- Simkins, S., & Maier, M. (2010). *Just-in-time Teaching: Across the Disciplines, Across the Academy*. Sterling, Virginia, US: Stylus Publishing.
- Suls, J., & Wills, T. A. (Eds.). (1991). *Social comparison: Contemporary theory and research*. Hillsdal: Lawrence Erlbaum Associates Inc.
- Teven, J. J., & Herrin, J. E. (2005). Teacher Influence in the Classroom: A Preliminary Investigation of Perceived Instructor Power, Credibility, and Student Satisfaction. *Communication Research Reports* , 22 (3), 235-246.

- Thweatt, S., K., & McCroskey, J. C. (1998). The impact of teacher immediacy and misbehaviors on teacher credibility . *Communication Education* , 47 (4), 348-358.
- Toscos, T., Faber, A., An, S., & Gandhi, M. P. (2006). Chick Clique: Persuasive Technology to Motivate Teenage Girls to Exercise. *CHI '06 Extended Abstracts on Human Factors in Computing Systems* (pp. 1873-1878). Montreal: ACM.
- Tseng, S., & Fogg, B. (1999). Credibility and computing. *Communications of the ACM* , 42 (6), 39-44.
- Verbeek, P.-P. (2006). Persuasive Technology and Moral Responsibility. Toward an ethical framework for persuasive technologies. *Persuasive* , 6, 1-15.
- Vlieghe, J. (2014). Literacy in a social media culture: an ethnographic study of literary communication practices. (Doctoral dissertation: Ghent University).
- Vlieghe, J., & De Troyer, O. (2016a). *Report D1: State-of-the-art on media use in Belgium, Flanders & Belgium*. Vrije Universiteit Brussels, Department of Computer Science. Brussels: TICKLE reports.
- Vlieghe, J., & De Troyer, O. (2016b). *Report D2: State-of-the-art on Early School Leaving and Dropouts*. Vrije Universiteit Brussel. Brussels: TICKLE reports.