

Normative Social Influence in Persuasive Technology: Intensity versus Effectiveness

Master of Science Thesis

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ABSTRACT

Persuasion is a form of social influence that implies intentional but voluntary change of a person's behaviours, feelings or thoughts about an issue, object or action. Successful persuasion by means of persuasive technology relies on a number of factors and motivators. Recently, the so called social acceptance or rejection motivator has formed the backbone of a new type of persuasion, called Mass Interpersonal Persuasion, or MIP for short. This type of persuasion uses the social influence that is generated on online social networks to persuade people. Though it has been established that normative social influence can be used effectively in persuasive technology, it is unknown if the application of more social pressure also makes it more effective.

In order to test the hypothesis that the effectiveness of persuasion increases when the persuasion becomes more intense, a quantitative experiment was conducted on the online social network of Facebook. Although evidence to support the hypothesis was found, it cannot be concluded from this experiment that - when utilizing normative social influence in persuasive technology - more intense persuasion is also more effective.

Author Keywords

Persuasive technology, captology, normative social influence, mass interpersonal persuasion, social networks.

1. INTRODUCTION

Dan is waiting at his local car dealership while the engine of his old minivan is being serviced. A salesman has offered him a special deal for a brand new van, but he promised his girlfriend to save money for their honeymoon. He thinks of ways he can persuade her to spend their savings on a new van.

At the same moment, Jenny is getting ready for a late night cocktail party. She feels tired and doesn't really want to go, but since all her friends are going she has to be there too. Like most people, she thinks long and hard on how to dress.

What would the other girls wear? Does this necklace make me look rich? And is this dress still fashionable enough?

These examples illustrate the fact that every person is influenced by its social environment and especially by groups he or she belongs to, like family, colleagues or teams [24]. This is generally known as social influence. The definition of social influence that is used in this research is "[the] process whereby attitudes and behaviour are influenced by real or implied presence of other people" [17, p.236]. This can be illustrated by the following example.

Scott often forgets to call his grandmother. It's not that Scott does not want to call his grandmother. On the contrary, he loves his family very much. But he just does not think about it. Unlike Scott's relatives, who call grandmother at least weekly. Recently, Scott's mother remarked that he doesn't call his grandmother very often. Because of this, Scott feels pressured to give his grandma a call. He doesn't want to lose his image of a good grandson and therefore promises to call her more often.

In the example described above, Scott's mother uses her social influence to persuade her son. Zimbardo and Leippe define persuasion as "changing a person's behaviours, feelings or thoughts about an issue, object or action" [31]. Fogg defines persuasion as "an attempt to change attitudes or behaviours or both (without using coercion or deception)" [15, p.15]. In parentheses Fogg clarifies that the change is voluntarily and this is rather important. A villain that threatens you with a gun and tells you to give him all your money is not considered to be persuasive, but coercive (the gun would otherwise be an example of rather strong persuasive technology). So, persuasion implies voluntary change. The definition for persuasion that will be used for this research is therefore: "The attempt to change behaviours, feelings or thoughts about an issue, object or action, without using coercion or deception".

In 1997, a group of researchers at the CHI97 conference established an area of research that would explore a new form of persuasion: persuasion by means of technology [14]. This research area, called persuasive technology or

captology (Computers As Persuasive Technology), would focus on what Fogg defines as “any interactive computer system designed to change people’s attitudes or behaviours” [15, p.1]. Since then, research into the possibilities of persuasive technology has been carried out into a wide range of fields, including public safety, health-care and education [29, 3, 21].

One of the important reasons for this interest in persuasive technology is a number of advantages over human persuaders [15]. Not only are computers more persistent, they have access to an enormous amount of data ready to be used to persuade people, and this data may be presented in many ways: text, graphics, video, audio and animations, to name but a few. Whereas human persuaders have to rely on their own human memory and may ‘only’ use their voice, facial expression and gestures. Furthermore, because of its digital nature, persuasive technology can be replicated and distributed easily, allowing it to reach a far bigger audience. This digital nature also allows persuasive technology to be used in situations or locations where human persuasion is not an option. And because technology can be adapted to many physical forms, it allows incorporation in many types of devices or - for example - clothing [18].

Successful persuasion by means of persuasive technology relies on a number of factors and motivators. Recently, the so called social acceptance or rejection motivator has formed the backbone of a new type of persuasion, called Mass Interpersonal Persuasion, or MIP for short [13]. This type of persuasion emerged in 2007 on the Facebook platform, and has wide implications. It stands for the persuasion of large groups of people in an online social environment, by means of a software application that can be shared between friends. This type of persuasion relies on social acceptance or rejection and group dynamics to be effective [23]. The use of group dynamics and the social acceptance or rejection motivator is not limited to online use, but may also be used in other forms of persuasive technology [20]. This shows the potential of using social influence as a means of persuasion in technology.

As explained, technology can offer a number of advantages compared to humans when it comes to persuasion. This is also true for technology using social influence, since technology can enable this influence to be used in a variety of new ways and without the need for actual humans to deliver this social pressure. And since persuasive technology is not limited to the boundaries of human persuasion, it may go above and beyond these human boundaries and create a far more ‘intense’ form of persuasion. For instance, persuasive technology allows social influence to be used at any time of day and as often as one wants, something that is practically impossible when using real life social influence.

Though it has been established that normative social influence can be used effectively in persuasive technology [28], it is unknown if the application of more social

pressure also makes it more effective. The aim of this research is to find an answer to the question if - when utilizing normative social influence in persuasive technology - more intense persuasion is also more effective.

The next sections of this paper elaborate further on the topics mentioned in this introduction: section two focuses on social influence, section three on persuasive technology and groups and section four on a definition of effectiveness and intensity. These sections establish the foundations for the experiment that is described in the remainder of this paper, starting with the method for the experiment in section five. The results of this experiment are presented in section six, followed by the discussion in section seven.

2. SOCIAL INFLUENCE

In the introduction of this paper a definition of social influence is described. This section elaborates on this subject and introduces a number of principles that are commonly associated with it. These principles can be used to socially influence people by means of technology and form a model that forms the basis of our experiment. Figure 1 is a representation of this model, of which the terms will be explained in the following paragraphs and sections.

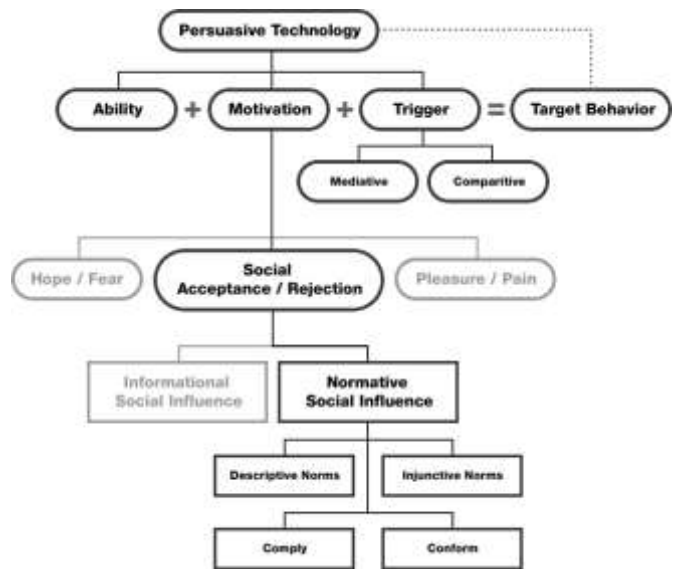


Figure 1. An overview of the principles of social influence and persuasive technology described in this paper and their interrelationships.

Deutsch and Gerard distinguish two processes of social influence: ‘informational social influence’ and ‘normative social influence’ [10]. Informational social influence can be defined as social influence that is based on the need to know what is right in a certain situation when we cannot form our own opinion (e.g. when we are uncertain about the right thing to do). We seek assurance by looking for

evidence or perceived expertise of other persons. For example, when a tourist wants to enter a temple in Thailand, he takes off his shoes because he sees that the locals are doing that too.

This research, however, is focused on the other form of social influence, called normative social influence. This form of social influence is based on the need to be accepted within a group, even if it conflicts with our own opinion. Psychologists also call this 'peer pressure' or 'pressure to conform' to the norms of a group. "Research on conformity shows that people tend to change attitudes and behaviours to match the expectations, attitudes and behaviours of classmates, a team, a family, a work group or other groups" [15, p.199]. For example, when you see people applauding for a bad speech, you also applaud because you don't want to be conspicuous. But this pressure does not by definition have to come from people that are actually present. It may also come from the implied presence of people. That means that one can for example suggest the presence of other group members to apply pressure to conform to a norm.

Cialdini et al. argue that, in order to successfully change behaviour, two types of norms need to be recognized: descriptive and injunctive norms [9]. Descriptive norms are based on what most other people do or like. Cialdini et al. explain this as: "If everyone is doing or thinking or believing it, it must be a sensible thing to think or believe".

Injunctive norms on the other hand tell us what we ought to do. In other words, what most other people approve or disapprove of. Cialdini et al. explain that aligning these two categories - what most people do or like and what most people approve and disapprove of - offers the best result in norm-based persuasive communications. Their experiments show that "people tend to do what is socially approved as well as what is popular" [7]. Or to get back to the example of Scott who feels like he should call his grandmother more often: he not only sees and knows that his relatives call grandma more often, but he also knows that this is socially approved. That raises the next question: what exactly drives Scott to call his grandma?

You could say that Scott just feels so much social pressure that he feels obliged to call his grandmother. In other words he *complies*, instead of *conforms*, to the norm of calling his grandma more often. There is a clear difference between conformity and compliance and the difference depends on whether a person has positive or negative feelings for a group [8]. In the example it is explained that not calling his grandma is not something Scott does deliberately. He just forgets it. It is also said that he loves his family very much, so Scott clearly has positive feelings towards his family. In that case Scott *conforms* to the norm of calling grandma more often. If Scott would have negative feelings towards his grandma, he might call his grandma more often, but then he would *comply* with the norm. In other words you could say that compliance is coercive influence and conformation is persuasive influence. So when persuasion

in groups is mentioned, conformation rather than compliance is implied (see also the definition of persuasive technology in the introduction). This means that a person is more susceptible to be persuaded when he or she has positive feelings towards the persuaders. But even when a group of strangers are placed together in a group, the pressure to conform is strong. So strong even that some set aside their own judgements and conform to the judgements of the majority. Even if the judgement from the majority is clearly wrong. This was demonstrated by the Asch conformity experiment.

In 1951 a scientist called Solomon Asch conducted an experiment that is known as the Asch conformity experiment [2]. In this experiment, participants were placed in a room. A number of these participants were not real participants, but secret accomplices who were aware of the experiment and were told beforehand to give wrong answers during the experiment. All participants were then asked to judge images like Figure 2. With this particular image, the participants were asked what line on the right side (A, B or C) has the same length as the line on the left. The participants needed to give the answer out loud and the accomplices ensured that they gave their answers before the real participants answered. In this way the real participants felt pressure to conform to the group. This gave very interesting results. In the control group (without pressure to conform) only 2.8% wrong answers were given by the real participants, but in the groups with secret accomplices 36.8% wrong answers were given.



Figure 2. An image used in the Asch conformity experiments. In this case, the participants were asked what line on the right side (A, B or C) has the same length as the line on the left [2] (Image source: Wikipedia.org).

It is important to note that the goal of the Asch conformity experiments was not to explicitly persuade the real participants to choose a specific (wrong) answer. The goal was to see how many people felt enough pressure to conform to give an answer they knew was wrong. It demonstrates the strong pressure people feel to conform to the norms of a group, even if the group consists of strangers.

The Asch experiment and the principles discussed in this section describe ways in which social influence can be used

to persuade people to show certain behaviour. In order to see how social influence can be used to persuade people using persuasive technology, the principles behind this type of persuasion need to be explored.

3. PERSUASIVE TECHNOLOGY AND GROUPS

Because of the advantages described in the introduction, persuasive technology offers many possibilities to improve our lives, by persuading us to do things that we want¹, but somehow find difficult to do or keep doing. Reducing CO₂ emissions for instance [25], or quit smoking [27].

In order to successfully persuade people and meet the advantages of persuasion by means of technology, persuasive technologies rely on a number of factors. Research by Fogg has shown that in order to persuade a person to change his or her behaviour using technology, the person has to be sufficiently motivated, have the ability to perform the behaviour, and be triggered to perform the

behaviour that a person needs to show. The focus of this paper lies on the social acceptance or rejection motivator, on which the social influence principles described in the previous section are applicable.

Fogg and Hreha established 15 types of target behaviour when using persuasive technology [11]. These types are defined by a combination of time (once, for a specific duration, or from now on) and an action (do unfamiliar, do familiar, increase, decrease or stop behaviour). See Table 1 for a complete overview of all 15 types of target behaviours.

To keep the descriptions of these behaviours as short as possible, the time part is described by a shape and the action part by a colour. For instance, increasing behaviour (action) for just one week (time) is defined as a PurpleSpan target behaviour. An example of this type of target behaviour would be to drink more water during one week.

	Green: Do <i>new</i> behaviour, one that is <i>unfamiliar</i>	Blue: Do <i>familiar</i> behaviour	Purple: <i>Increase</i> behaviour intensity or duration	Gray: <i>Decrease</i> behaviour intensity or duration	Black: <i>Stop</i> doing a behaviour
Dot: Behaviour is done <i>one-time</i>	GreenDot: Do new behaviour one time	BlueDot: Do familiar behaviour one time	PurpleDot: Increase behaviour one time	GrayDot: Decrease behaviour one time	BlackDot: Stop doing a behaviour one time
Span: Behaviour has specific <i>duration</i> , such as 40 days	GreenSpan: Do new behaviour for a period of time	BlueSpan: Do familiar behaviour for a period of time	PurpleSpan: Increase behaviour for a period of time	GraySpan: Decrease behaviour for a period of time	BlackSpan: Stop a behaviour for a period of time
Path: Behaviour is done from now on, a <i>permanent change</i>	GreenPath: Do new behaviour from now on	BluePath: Do familiar behaviour from now on	PurplePath: Increase behaviour from now on	GrayPath: Decrease behaviour from now on	BlackPath: Stop a behaviour from now on

Table 1: The fifteen types of target behaviours for persuasive technology, as defined by Fogg and Hreha [11].

behaviour [12]. These three factors – motivation, ability and trigger – have to be present at the same time in order for a person to be persuaded. This also works the other way around: in order to prevent certain behaviour, one or more of these factors have to be eliminated. So, as mentioned, persuasive technology can be used to either encourage or discourage certain attitudes or behaviours.

Of the three factors, the motivation factor can be split into three types of motivators: pleasure or pain, hope or fear, and social acceptance or rejection [12]. Each pair represents both a positive and a negative motivation. Which type of motivator can be used best depends on many factors, including the type of technology used and the type of target

When using normative social influence, there are two main roles technology can take to persuade someone: either by making this person aware of the behaviour of others, in this paper this is called a *comparing* role, or by making this person aware that others are aware of his or her behaviour, which could be called a *mediating* role.

Consider the example of Scott again, who does not call his grandmother very much, but who would like to do so more often. The target behaviour for Scott would thus be to call his grandmother more often, from now on (a PurplePath behaviour).

As noted before, in order to persuade Scott to behave in this way, he needs to be motivated, have the ability, and be triggered to do so. Since he already wants to call his grandmother more often, he is motivated to change his behaviour. Now he must be able and be triggered to call his grandmother. To allow for this, a good location to persuade

¹ An elaborate discussion on the principles of ethical persuasive technology can be found in the paper by Berdichevsky and Neuenschwander [4].

him would be his mobile phone, since that would give him the ability to make a call.

In order to trigger him to call more often, we can persuade him by taking a comparing role and showing him how often he calls his grandmother in comparison to his friends and family, right behind their names in the address book of his mobile phone. So whenever Scott makes a call, he will be made aware of his behaviour in comparison to others.

We may also take a mediating role, and show Scott's friends and family how often he calls his grandmother. Not only does this pressure Scott to call more often because of the way other people may think of him ("I should definitely give grandma a call before my family starts to think bad of me."), but others may also pressure Scott in real life to call her more often ("Scott, I see that you haven't called grandma for weeks, so...").

In both cases there are a number of ways in which to raise or lower the pressure on Scott or, in other words, vary the intensity of the persuasion. To be able to answer the question if more intense social influence is also more effective when using persuasive technology, the effectiveness and the intensity of persuasion have to be defined.

4. DEFINING EFFECTIVENESS AND INTENSITY

Measuring the effectiveness of an attempt to persuade is dependent on the target behaviour (i.e. the goal) of the persuasion. Effectiveness can be measured in two ways: by measuring the increase in target behaviour of individual people, or by measuring the percentage of people that show the target behaviour.

For example, imagine an experiment that focuses on a PurpleSpan target behaviour: increasing the number of times people visit the gym, during one month. In this case effectiveness may be measured by looking at individual people, by measuring how many times people visit the gym without and with persuasive technology present. So when people visit the gym two times during the first month, the baseline, and this increases to an average of four times during the second month when using persuasive technology, the effectiveness of the persuasion is 100%: the increase in target behaviour compared to the baseline.

However, effectiveness may also be measured by looking at the number of people that visit the gym more often, regardless of the number of visits. In this case effectiveness may be measured by determining the average number of times people visit the gym during the first month, the baseline, and measuring the percentage of people that visit the gym more often during the second month with some form of persuasive technology present for all subjects in the studies population. So if 60% of the target group visits the gym more often while being persuaded by technology, the effectiveness of the persuasion is 60%.

It should be noted that both ways of measuring effectiveness may also be used at the same time, by measuring the increase in the number of times people show certain target behaviour, while at the same time measuring the percentage of people that show this increase in behaviour.

There are many ways to persuade someone using normative social influence. For example, when persuading someone to come along to the movies, one could ask "Would you like to join me to the movies?" but one may also ask "Would you like to join us to the movies? All your friends are coming too." The normative social pressure in the latter makes the pressure to conform bigger, since all your friends are joining as well. Therefore, we argue that the second attempt to persuade is more *intense*.

The intensity of persuasion is dependent of a large number of variables. Ranging from the emotional state of the person that persuades [30] to the speed at which this person speaks [22]. Therefore, this research focuses on those variables that are linked to normative social influence and that can be used by persuasive technology. All other variables are kept constant. This led to the following variables, partially based on the three components of the social impact theory by Latané [19].

1. Peer relationship

A group of friends is closer and more valuable to you than a group of strangers. This influences the result of persuasion, as shown by Gravetter [16]. The value of this variable can be strong ties (friends, family), weak ties (acquaintances), or no ties (strangers).

2. Message frequency

How often a peer pressures you has an influence on conformity. Cacioppo and Petty established that repeating a message can have a positive influence on the effect of an attempt to persuade [6].

3. Group size

Research by Asch established that the number of people in a group influences the pressure to conform [2]. His experiment showed that the pressure to conform becomes stronger in larger groups. Recently, however, research seems to suggest that this is only true for groups of up to five people [5]. This shows nonetheless that group size influences conformity.

4. Number of peers

The number of peers in a group who pressure a person is also influential. Asch showed that persuasion is the most effective when the majority of a group pressures one person [2]. The effectiveness declined when only a minority of a group pressured a person.

In this paper it is argued that a closer relationship, more frequent messages, a larger group or a higher number of peers means more intense persuasion. A more distant

relationship, less frequent messages, a smaller group or a lower number of peers means less intense persuasion. The intensity of the condition “strong ties, daily messages, a group of five people, four peers” is therefore higher than the condition “no ties, monthly messages, a group of eighty people, one peer”.

5. METHOD

In order to test the hypothesis that the effectiveness of persuasion by technological mediation increases when the persuasion becomes more intense, a quantitative experiment on the online social network Facebook.com was conducted. The primary goal of the experiment was to see if people can be persuaded to continue to answer questions after they first decided to stop, by using various levels (i.e. intensities) of normative social influence.

Participants

Participants were recruited by sending them a Facebook or e-mail message with the request to voluntarily participate in an experiment about pictures on Facebook and how this influences emotions. These messages were sent to ‘media technology’ related Facebook groups and family and friends of the authors of this paper. Participants were required to have a Facebook account, and could choose to take part in either a Dutch or English version of the experiment.

Design

Setting up an experiment that uses both normative social influence and persuasive technology is quite complex, as it should be flexible enough to vary the amount of normative social influence while at the same time remain believable for the participants. It was decided to use an online social network, Facebook, as the setting for the experiment. This allowed for the use of existing social networks in a digital world, allowing for easy data collection and manipulation of variables.

In addition, it was decided not to disclose the real intentions of the experiment to the participants. This was done in order to reduce the risk of participants recognizing the persuasion as the main goal of the experiment, which would most certainly influence the participants in an undesired way and make the effects of the persuasion less effective and believable. Instead, participants were told they participated in a study on the effects that pictures have on emotions.

This façade-experiment, as it will be called here, consisted of a series of pictures. These pictures depicted scenes from nature, people and architecture. Participants were asked which emotions they felt while looking at the pictures. They could select two emotions from two drop-down lists containing a number of emotions, ranging from positive to negative. A possible answer could for example be: “This picture makes me feel sad and disgusted”. The answers to these questions were however not relevant for the actual experiment.

It was emphasized that the participants could rate as few or as many images as they chose to and that they could press the ‘stop and send’ button whenever they wanted to stop and submit their results. This was done so that the participants had no norm for the amount of images to be rated. When the ‘stop and send’ button was pressed, a message was displayed that attempted to persuade the participant to answer more questions (i.e. to conform to the norm supposedly set by other participants) using normative social influence.

The content of this message was dependant on the condition a participant was randomly subjected to. This could be one of the five conditions $C_0 - C_4$:

- C_0 (control group): The participant is not persuaded by means of normative social influence. When a participant decided to stop, the following message was displayed: “Would you like to answer some more questions or do you really want to stop?” (in Dutch: “Wil je nog meer vragen beantwoorden of wil je definitief stoppen?”).
- C_1 : Normative social influence by displaying the following message when a participant decided to stop: “Are you sure you want to stop? 11% of the participants in this experiment have answered 5 more questions than you. Would you like to answer some more questions or do you really want to stop?” (in Dutch: “Weet je zeker dat je wilt stoppen? 11% van de deelnemers aan dit experiment hebben 5 meer vragen beantwoord dan jij. Wil je nog wat meer vragen beantwoorden of wil je definitief stoppen?”).
- C_2 : Normative social influence by displaying the following message when a participant decided to stop: “Are you sure you want to stop? 87% of the participants in this experiment have answered 5 more questions than you. Would you like to answer some more questions or do you really want to stop?” (in Dutch: “Weet je zeker dat je wilt stoppen? 87% van de deelnemers aan dit experiment hebben 5 meer vragen beantwoord dan jij. Wil je nog wat meer vragen beantwoorden of wil je definitief stoppen?”).
- C_3 : Normative social influence by displaying the following message when a participant decided to stop: “Are you sure you want to stop? 11% of your Facebook friends who participated in this experiment have answered 5 more questions than you. Would you like to answer some more questions or do you really want to stop?” (in Dutch: “Weet je zeker dat je wilt stoppen? 11% van je Facebook vrienden die ook deelnamen aan dit experiment hebben 5 meer vragen beantwoord dan jij. Wil je nog wat meer vragen beantwoorden of wil je definitief stoppen?”).
- C_4 : Normative social influence by displaying the following message when a participant decided to stop: “Are you sure you want to stop? 87% of your

Facebook friends who participated in this experiment have answered 5 more questions than you. Would you like to answer some more questions or do you really want to stop?” (in Dutch: “Weet je zeker dat je wilt stoppen? 87% van je Facebook vrienden die ook deelnamen aan dit experiment hebben 5 meer vragen beantwoord dan jij. Wil je nog wat meer vragen beantwoorden of wil je definitief stoppen?”).

These conditions were based on the four levels of intensity that are described in Table 2, which in turn were based on the four variables described in Section 4: the peer relationship, the message frequency, group size and the number of peers. For this experiment, however, the message frequency variable was normalised to just one message and the group size variable was not used.

	Facebook friends	Other participants
11% of people (minority)	11% of Facebook friends (C ₃)	11% of the other participants (C ₁)
87% of people (majority)	87% of Facebook friends (C ₄)	87% of the other participants (C ₂)

Table 2: The four levels of intensity of normative social influence that were used in this experiment. The control group (C₀) was not influenced.

Majority and minority were expressed using the percentages of 87% and 11%, respectively. These percentages were not based on actual data from other participants or Facebook friends of the participant, but were used to express a believable minority or majority. Peer relationship was expressed using two opposites: Facebook friends (tie) and other participants (no tie).

As described in Section 3, Fogg and Hreha established 15 types of target behaviour when using persuasive technology. The type of target behaviour used for this experiment is PurpleDot (see Table 1), meaning that participants were persuaded to increase the number of questions they answered for one time. The intended motivation for participants was the social acceptance of answering just as many questions (or more) as the other participants or their Facebook friends. They were able to answer more questions, as they were presented in the same way as earlier questions and all it took to answer more questions was the press of a button. The comparative trigger was formed by the persuasive message that appeared when the participant indicated a desire to stop answering questions.

In order to measure the effectiveness of this persuasion, both the percentage of people that decided to answer more questions (after indicating a desire to stop) was measured,

as well as the number of questions that were answered and the time spent before and after persuasion.

Procedure

Participants were invited to voluntarily participate via e-mail and Facebook messages. When participating, the participants first had to log in with their Facebook account through a secure connection. After logging in, participants were asked to judge their feeling of a series of images by means of two drop-down lists that contained a number of emotions and feelings.

When a participant pressed the ‘stop and send’ button, one of the messages (described earlier in this section) was presented to verify the action. After a time-out of 5 seconds (this was done to prevent participants from proceeding without reading the message) participants could either choose to stop and end the façade-experiment or continue to answer questions. When a participant chose to continue, the experiment continued as before until the participant would press the ‘stop and send’ button again. At that moment the experiment ended.

Upon finishing the survey the participants were thanked for their participation and were asked to remark on things they noticed during the façade-experiment in a form field. One month after commencement, the façade-experiment was ended and each participant was informed of the real intentions of the experiment.

Data analysis

In order to be able to answer the question if - when utilizing normative social influence in persuasive technology - more intense persuasion is also more effective, the following sub questions were answered by analysing the experimental results:

1. “Is there a difference in the percentage of participants that were persuaded to continue between the groups that were persuaded (C₁₋₄) and the control group (C₀)?” This would indicate if the persuasion in general had any effect at all.
2. “Is there a difference in the percentage of participants that were persuaded to continue between the conditions 11% (C₁ & C₃) and 89% (C₂ & C₄) of peers?” This would indicate if the number of peers variable had any effect.
3. “Is there a difference in the number of participants that were persuaded to continue between the conditions Facebook friends (C₃ & C₄) and other participants (C₁ & C₂)?” This would indicate if the peer relationship variable had any effect.
4. “How do the groups conform to the norm of answering five more questions?” This would indicate if the norm of five more questions had any effect.

6. RESULTS

The group of participants consisted of 98 Facebook users²: 39 females, 41 males and 18 persons with an unknown gender³. The age ranged from 19 - 61 years, with an average of 27 years ($sd \approx 7$). Of the participants, 79 had the Dutch language preference and 19 the English language preference. Almost the same percentage of Dutch and English speaking participants continued to answer more questions (respectively 31.65% and 31.58%). A T-test revealed that there is no significant difference in mean number of questions answered between Dutch and English participants ($t = 0.36$; $df = 96$; $p = 0.72$).

The experiment ran from December 7th, 2010 until January 6th, 2011. Table 3 shows a general overview of the data that was registered during the experiment.

	N	Range	M	SD
Age	91	19 - 61	27.43	6.67
Questions answered before initial stop	98	1 - 159	31.69	27.05
Time spent before initial stop (in minutes)	98	0.25 - 38.93	8.96	7.95
Questions answered after initial stop	31	0 - 59	13.77	12.91
Time spent after initial stop (in minutes)	31	0.08 - 12.57	2.84	2.90

Table 3: A general overview of the data that was registered during the experiment.

Is there a difference in the number of participants that were persuaded to continue between the groups that were persuaded (C_{1-4}) and the control group (C_0)?

The null hypothesis tested was: “The number of participants that were persuaded to continue is the same for C_0 compared to C_{1-4} (combined).” An Independent-Samples T-Test showed there is a significant difference between C_0 ($n = 18$) and C_{1-4} combined, ($n = 80$); $t = -2.69$; $df = 36.44$; $p = 0.01$. The null hypothesis for this research question could therefore be rejected. This showed that the persuasion itself was effective.

² 10 of the 108 participants were excluded: 4 participants logged in but answered no questions; 3 participants did not finish the experiment; 3 participants remarked that they became aware of the real intentions of the experiment.

³ The gender was automatically read from the Facebook profiles, but not all profiles contained a gender.

⁴ The control group has very high standard deviation because one participant answered no questions and the other answered 59 questions. It therefore has no value.

Is there a difference in the percentage of participants that were persuaded to continue between the conditions 11% (C_1 & C_3) and 89% (C_2 & C_4)?

The null hypothesis tested was: “There is no significant difference between the conditions 11% and 89%.” Although slightly more participants continued with the ‘majority’ condition, the performed Chi² test revealed no significant difference ($Chi^2 = 1.46$; $df = 1$; $p = 0.23$). The null hypothesis for this research question could therefore not be rejected, showing that the number of peers does not seem to have a significant influence on the effectiveness of the persuasion.

Condition	N	Mean nr. Questions before message (SD)	Nr. of participants that continued	Mean nr. Questions after message (SD)
C_0 (control group)	18	25.50 (23.23)	2 (11.1%)	29.50 (41.72) ⁴
C_1 (11% participants)	20	28.70 (21.41)	7 (35.0%)	7.86 (6.39)
C_2 (87% participants)	19	33.27 (31.92)	9 (47.4%)	17.67 (13.11)
C_3 (11% Facebook)	23	30.70 (17.89)	6 (26.1%)	11.17 (9.95)
C_4 (87% Facebook)	18	40.72 (38.59)	7 (38.9%)	12.43 (6.05)
Total	98	31.69 (27.05)	31 (31.6%)	13.77 (12.91)

Table 4: An overview of the continuation and the mean number of questions answered before and after the message.

Is there a difference in the percentage of participants that were persuaded to continue between the conditions Facebook friends (C_3 & C_4) and other participants (C_1 & C_2)?

The null hypothesis tested was: “There is no significant difference between the conditions Facebook friends and other participants.” From Table 4 it appeared that the “other participants” conditions persuaded more participants to continue. However, the performed Chi² test revealed that this difference was not significant ($Chi^2 = 0.75$; $df = 1$; $p = 0.39$). The null hypothesis for this research question could therefore not be rejected, meaning that the relationship between the participant and the persuader seems to have no significant effect on effectiveness.

How do the groups conform to the norm of answering five more questions?

The null hypothesis tested was: “There is no significant difference in the number of answered questions between

groups C_{1-4} after normative social influence.” Table 4 shows the differences in mean number of questions answered before and after various levels of normative social influence were exercised. This shows a relatively high mean value for the number of questions after the message for condition C_2 ($m \approx 18$, $sd \approx 13$), compared to the other conditions.

T-tests were performed between every possible condition pair (excluding C_0). No significant differences were found between the conditions. The largest difference was found between C_1 and C_2 , but this was not significant; $t = -1.81$; $df = 14$; $p = 0.09$. The null hypothesis for this research question could therefore not be rejected, revealing that the different conditions had no significant effect on the number of questions answered. However, there does seem to be a trend towards significance in the differences between the minority and majority conditions (C_1 - C_2 and C_3 - C_4).

7. DISCUSSION

The results of the experiment show that normative social influence can be successfully applied to persuasive technology, which supports earlier findings by Fogg [13] and the hypothesis for this research.

The results also show that there were no significant differences in effectiveness between a minority and a majority of peers. This would contradict research by Asch that showed that people are more easily persuaded by a majority of people [2]. However, although it is not significant, the majority conditions (C_2 - C_4) appear to be more effective compared to the minority conditions (C_1 - C_3).

Furthermore, the results reveal that the peer relationship has no influence on the effectiveness of persuasion as well, although research by Gravetter showed that people are more easily persuaded by people with whom they have a strong tie [16].

Lastly, the results show that there were no significant differences between the different conditions. Of all five conditions, C_2 (“87% of the other participants”) was most effective. Not only more participants were persuaded, on average they answered more questions. An explanation for this could be that the C_2 participants wanted to do better than the other participants in two ways. They not only wanted to continue more often, they also wanted to surpass the norm of five questions that was given in the message.

Contrary to what was expected, C_3 (“11% of your Facebook friends”) was the least effective, apart from the control group. It was expected that this condition would at least have better effectiveness than C_1 (“11% of the other participants”). An explanation for this could be that the message was interpreted by the participants as a confirmation that they *almost* conformed to the norm of 5 questions. They interpreted it as if they actually did a good job and therefore they did not need to continue.

These results seem to indicate that the different combinations of variables do not influence the effectiveness

of persuasion, which does not support the hypothesis. It was expected that the theories by Latané [19], Asch [2] and Gravetter [16] would also apply to online social influence, but the results show otherwise.

The hypothesis for this research is therefore rejected. Although evidence to support the hypothesis was found, it cannot be concluded that - when utilizing normative social influence in persuasive technology - more intense persuasion is also more effective. Instead, the intensity levels that were used seem to have had no significant influence on effectiveness.

This may have been caused by the design of the experiment. Aspects like the way sentences are constructed or how usable the software is from an HCI perspective have influence on the results. The percentages used to show minorities and majorities may also have had undesired effects, as one participant mentioned that when she was confronted with the message that 11% of her Facebook friends answered more questions, she thought that she was actually doing quite well since 89% of her Facebook friends answered *less* questions than her.

The results may also have been influenced by a lack of believability of the façade-experiment. Especially for those participants who were aware that they share few or no Facebook friends with other participants. On the other hand there were clear indications from the feedback received that the participants *did* believe the façade-experiment.

The experiment described in this paper should therefore be repeated in different ways and with different conditions, in order to see if the intensity of persuasion has indeed no influence on effectiveness. Because if this is indeed the case, it could mean that the principles that are applicable to persuasion and social influence in the real world do not necessarily apply to the online world, or that there is simply not such a thing as intensity in persuasion. Judging from the results of the experiment, this will be a worthwhile effort that could shine new light on the ways normative social influence can be used in persuasive technology, and how this might lead to more effective ways to help people change their behaviour.

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