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Normative Social Influence in Persuasive Technology: Intensity versus Effectiveness

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Abstract. It has been established that normative social influence can be used effectively in persuasive technology. However, it is unknown whether the application of more social pressure makes it more effective. To test this hypothesis, a quantitative experiment was conducted on the online social network Facebook. Although evidence to support the hypothesis was found, it cannot be concluded from this experiment that more intense persuasion is more effective, when utilizing normative social influence in persuasive technology.

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

1 Introduction

Every person is influenced by his or her social environment, in particular by groups he or she belongs to such as family, colleagues or teams [1]. This is generally known as social influence; “[the] process whereby attitudes and behaviour are influenced by real or implied presence of other people” [2, p.236].

Deutsch and Gerard distinguish two processes of social influence: ‘informational social influence’ and ‘normative social influence’ [3]. The former can be defined as social influence based on the need to know what is right when we cannot form our own opinion, and seek assurance by looking for evidence or perceived expertise of other persons. This research, however, is focused on normative social influence, which is based on the need to be accepted within a group, potentially in conflict with our own values, intentions or opinions. Psychologists call this ‘peer pressure’ or ‘pressure to conform’ to the norms of a group [1, p.199].

Persuasion is a form of social influence that Zimbardo and Leippe define as “changing a person’s behaviours, feelings or thoughts about an issue, object or action” [4]. Fogg defines it as “an attempt to change attitudes or behaviours or both (without using coercion or deception)” [5, p.15]. Fogg clarifies that persuasion is restricted to voluntary change: a villain threatening you with a gun and telling you to give him all your money is *coercive* rather than persuasive, (a gun would otherwise be an example of rather potent persuasive technology). 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 explores persuasion by means of technology [6]. This research area, called persuasive technology or captology (Computers As Persuasive Technology), focuses on what Fogg defines as “any interactive computer system designed to change people’s attitudes or behaviours” [5, p.1]. Since then, research into the possibilities of persuasive technol-

ogy has been carried out into a wide range of fields, including public safety, health-care and education [7–9]. A new form of persuasive technology, called Mass Interpersonal Persuasion (MIP) which focuses on persuading large groups of people in an online social environment, emerged in 2008 [10]. It uses group dynamics, and social acceptance and rejection to be effective [11]. MIP can tirelessly apply social pressure to large groups, and thus create a more 'intense' form of persuasion.

Though it has been established that normative social influence can be used effectively in persuasive technology [12], it is unknown if the application of more social pressure also makes it more effective. The aim of this research is to study whether more intense persuasion is also more effective when utilizing normative social influence in persuasive technology.

The organisation of this paper is as follows. In section two we focus on related work on social influence and persuasive technology, in section three on the different roles social influence can take in persuasive technology, and in 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 of these results in section seven.

2 Related Work on Social Influence and Persuasive Technology

When persuasion within groups is mentioned, conforming rather than compliance is implied. This means that a person is more susceptible to be persuaded when he or she has positive feelings towards the persuaders. But even when this person would be persuaded by a group of strangers, the pressure to conform is strong. So strong, that some set aside their own judgement and conform to the judgement of the majority, even if the judgement of the majority is clearly wrong, as was demonstrated by the Asch conformity experiment [13].

This can further be explained by the social impact theory by Latané [14]. He suggested that the impact of social pressure is determined by three factors: strength, immediacy and number. Here, strength is the power, importance or intensity of the source of the pressure to the target. Immediacy being the closeness of the source to the target, in both space and time. And number meaning the number of people pressuring the target. According to this theory, you feel more social pressure from a large group of relatives in the same room than from a small group of strangers that pressure you by sending a letter. Although Bond suggests that the impact of the number factor decreases for larger groups [15].

The social impact theory and the principles discussed in this section describe how social influence can be used for persuading people to show certain behaviour. In addition to this, research by Fogg has shown that 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 has to be triggered to perform the behaviour [16]. For a person to be persuaded and show the desired target behaviour, these three factors — motivation, ability and trigger — have to be present at the same time.

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

3 Comparing and Mediating Technology

As mentioned in the previous section, three factors — motivation, ability and trigger — have to be present at the same time in order for a person to be persuaded using technology. We argue that, in addition to the three pairs of motivators described earlier, there are also two main roles technology can take to trigger someone. We say that technology takes a *comparing* role if it makes a person aware of the behaviour of others, or that it takes a *mediating* role if it makes the person aware that others are aware of his or her behaviour.

Consider 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. He just does not think about it, unlike Scott's relatives, who call grandmother at least weekly. Recently, Scott's family remarked that he doesn't call his grandmother very often. Because of this, Scott feels pressed 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.

To trigger Scott to call more often taking a comparing role, we would show him how often he calls his grandmother in comparison to his friends and family. For example, we could put the number of 'granny calls' behind the names of friends and family in the address book of his mobile phone. Whenever Scott makes a call, he would be made aware of his behaviour in comparison to others.

If we take a mediating role, we show Scott's friends and family how often he calls his grandmother. Not only does this raise the pressure on Scott 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 his grandmother more often ("Scott, I see that you haven't called grandma for weeks, so...").

In both cases there are several ways to raise or lower the pressure on Scott or, in other words, to vary the intensity of the persuasion. This research is focussed on the comparing role.

4 Defining Effectiveness and Intensity

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. 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. 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 to show a certain target behaviour 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 our friends are coming too." The normative social pressure present in the second question 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 [17] to the speed at which this person speaks [18]. Therefore, this research focuses on those variables that are linked to normative social influence and that can be controlled with persuasive technology. All other

variables are kept as constant as possible. This led to the following variables, mainly based on the social impact theory by Latané.

1. Strength (or peer relationship). The closeness of the people in a group to the target of the persuasion. The value of this variable is based on the theory by Granovetter [19] and can be strong tie ('friends, family'), weak tie ('acquaintances'), or no tie ('strangers').
2. Number (or group size). The total number of people in a group.
3. People pressuring. The number of people in a group that are persuading the target. The value of this variable could either be the minority or the majority of the people in the group.
4. Message frequency. The number of times one or more people in the group pressure the target of the persuasion. Cacioppo and Petty established that repeating a message could have a positive influence on the effect of an attempt to persuade [20].

In this paper it is hypothesized that a closer relationship, a larger group, a higher number of people pressuring, or more frequent messages means more intense persuasion. A more distant relationship, a smaller group, a lower number of people pressuring, or less frequent messages means less intense persuasion.

The main hypothesis for this research is therefore: "When utilizing normative social influence in persuasive technology, more intense persuasion is more effective". To falsify this hypothesis, the experimental results were analysed with the following null hypotheses:

1. "Participant of the groups that were persuaded (C_{1-4}) and the control group (C_0) are equally likely to continue". Rejecting this null hypothesis would indicate that the persuasion in general had an effect.
2. "Participants that were persuaded subject to the conditions 'minority' ($C_{1, 3}$) and 'majority' ($C_{2, 4}$) are equally likely to continue". Rejecting this null hypothesis would indicate that the *people pressuring* variable has an effect.
3. "Participants that were persuaded subject to the 'ties' conditions ($C_{3, 4}$) and 'no ties' conditions ($C_{1, 2}$) are equally likely to continue". Rejecting this hypothesis would indicate that the *strength* variable has an effect.
4. "Participants that were persuaded subject to any of the conditions C_{1-4} or any other of the conditions C_{1-4} are equally likely to have answered the most questions after normative social influence". Rejecting the null hypothesis would indicate that suggesting a norm of five or more questions has an effect.

5 Method

To test the main hypothesis, a quantitative experiment on the online social network Facebook was conducted. The main goal of the experiment was to see whether people could be persuaded to continue to answer more questions after they first decided to stop, by using various levels (i.e. intensities) of normative social influence.

5.1 Participants

Participants were recruited by sending a Facebook- or e-mail message with an invitation to participate in an experiment, falsely described as studying how photographs on Facebook influence emotions. Participants were required to have a Facebook account, and could choose to take part in either a Dutch or English version of the experiment. The authors of this paper used their personal networks to recruit participants.

5.2 Design

Setting up an experiment that uses both normative social influence and persuasive technology is quite complex. 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. It allowed the use of existing social networks, allowing easy data collection and manipulation of variables.

It was also decided not to disclose the real intentions of the experiment to reduce the risk of participants recognizing the persuasion as the main goal of the experiment. Instead, participants were told they participated in a study on the effects that photographs have on emotions. This façade-experiment, as it will be called here, consisted of showing a series of 200 photographs depicting scenes from nature, people and architecture. Participants were asked which emotions they felt while looking at the photographs. They could select two emotions from two drop-down lists containing emotions, ranging from positive to negative. For example, a possible answer could 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 photographs as they chose to (although it was actually limited to 200 photographs) and that they could press the 'stop and send' button whenever they wanted to stop and submit their results. This way the participants had no norm for the number of photographs 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 using normative social influence, i.e. to conform to the norm supposedly set by other participants (comparing role, see section 3).

The application for the experiment was built with the scripting language PHP in combination with the Facebook API and photographs collected using Google Images¹.

A participant was randomly subjected to one of five conditions $C_0 - C_4$ below. The content of the message was dependant on the condition:

- 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?"
- 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?"
- 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?"
- 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?"
- 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

¹ Used options: image size: 800x600, image type: Photo, usage rights: Only images labeled for reuse.

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?"

These conditions were based on four levels of intensity that are shown in Table 1, which in turn were based on the four variables described in Section 4: the peer relationship, group size, people pressuring and the message frequency. For this experiment the message frequency variable was normalised to one message and the group size variable was not used.

Table 1. The four levels of intensity of normative social influence that were used in this experiment. The control group (C_0) was not influenced.

	Facebook friends	Other participants
11% of people (minority)	11% of Facebook friends (C_3)	11% of other participants (C_1)
87% of people (majority)	87% of Facebook friends (C_4)	87% of other participants (C_2)

Majority and minority were expressed using the percentages of 87% and 11%, respectively. These percentages were made up and are not based on actual data from other participants (and therefore do not add up to 100%). Peer relationships were expressed as 'Facebook friends' (ties) and 'other participants' (no ties).

The target behaviour for the persuasion in this experiment was: *Increasing the number of questions a participant answered.* The comparative trigger was formed by the persuasive message that appeared once when the participant indicated a desire to stop answering questions. The assumed motivation of the participants was the social acceptance of answering just as many, or more, questions as the other participants. The required ability to answer more questions was the press of a button.

To measure the effectiveness of this persuasion the following was measured: the number of people that decided to answer more questions (after indicating a desire to stop), the number of questions that were answered, and the time spent before and after persuasion.

5.3 Procedure

The participants first had to log in with their Facebook account through a secure connection. After logging in, participants were asked to judge a series of photographs.

When a participant pressed the 'stop and send' button, one of the messages was presented to verify the action (see the conditions in the design section for the messages). After a time-out of 5 seconds to prevent participants from proceeding without reading the message, participants could either choose to actually 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 no message was shown and the experiment ended.

Upon finishing the façade-experiment, 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.

The experiment ran from December 7th, 2010 until January 6th, 2011.

6 Results

The 98 Facebook users² were classified as 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 a Dutch and 19 an English language preference. Almost the same percentage of Dutch and English speaking participants continued to answer more questions (respectively 31.7% and 31.6%). A T-test could not detect a significant difference in mean number of questions answered between Dutch and English participants ($t = 0.36$; $df = 96$; $p = 0.72$). Table 2 shows an overview of the general data that were registered during the experiment.

Table 2. General data 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 min.)	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 min.)	31	0.08 – 12.57	2.84	2.90

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

A Mann-Whitney U-Test rejected the null hypothesis 1 ($p = 0.039$). We therefore conclude that in the experimental data there is a significant difference between using no persuasion (C_0 , $n = 18$) and persuasion (C_{1-4} combined, $n = 80$).

Is there a difference in the number of participants that were persuaded to continue between the 'minority' conditions ($C_{1,3}$) and 'majority' conditions ($C_{2,4}$)?

Although on average slightly more participants continued with the 'majority' condition (Table 3), the performed Mann-Whitney U-Test did not reject the null hypothesis 2 ($p = 0.23$). We may therefore not conclude from the experimental data that the number of peers has a significant influence on the effectiveness of the persuasion.

Is there a difference in the number of participants that were persuaded to continue between the 'ties' conditions ($C_{3,4}$) and 'no ties' conditions ($C_{1,2}$)?

Although on average slightly more participants continued subject to the ties than to the 'no ties' conditions (Table 4), the performed Mann-Whitney U-Test did not reject the null hypothesis 3 ($p = 0.39$). We may therefore not conclude from the experimental data that the relationship between the participant and the (pretended) persuader has a significant effect on the effectiveness.

Do the groups conform to the norm of answering five more questions?

Although there are differences in mean number of questions answered before and after various levels of normative social influence (Table 3) were exercised (in particular for the number of questions after the message for condition C_2 ($m \approx 18$, $sd \approx 13$), a Mann-

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 this information.

Whitney U-Test did not reject the null hypothesis 4 for any of the condition pairs (excluding C_0). The least likely null hypothesis (i.e. the one closest to rejection, $p = 0.11$) is for the comparison of the groups subject to the least intense persuasion C_1 and most intense persuasion C_4 . Nonetheless, we may not conclude from the experimental data that there is a significant effect of the intensity of persuasion on the number of questions answered.

Table 3. An overview of the continuation and the mean number of questions answered before and after the message.

Condition	N	Mean no. of questions before message	No. of participants that continued	Mean no. of questions after message
C_0 (control)	18	25.50 (sd 23.23)	2 (11.1%)	29.50 (sd 23.23)
C_1 (min., no)	20	28.70 (sd 21.41)	7 (35.0%)	7.86 (sd 6.39)
C_2 (maj., no)	19	33.27 (sd 31.92)	9 (47.4%)	17.67 (sd 13.11)
C_3 (min., tie)	23	30.70 (sd 17.89)	6 (26.1%)	11.17 (sd 9.95)
C_4 (maj. tie)	18	40.72 (sd 38.59)	7 (38.9%)	12.43 (sd 6.05)
Total	98	31.69 (sd 27.05)	31 (31.6%)	13.77 (sd 12.91)

7 Discussion

The results of the experiment indicate that normative social influence can be successfully applied to persuasive technology, which supports our hypothesis and earlier findings by Fogg [10].

We could not find significant differences in effectiveness between a minority and a majority of peers ($C_{1, 2}$ and $C_{3, 4}$) on the $\alpha = 5\%$ level. However, although it is not significant, the majority conditions ($C_{2, 4}$) do seem to be more effective than the minority conditions ($C_{1, 3}$). Furthermore, our results do not allow us to conclude that the peer relationship has influence on the effectiveness of persuasion.

Although we came fairly close to rejecting the null hypothesis comparing between the least intense and most intense persuasion ($C_{1, 4}$), it cannot be concluded that when utilizing normative social influence in persuasive technology, more intense persuasion is more effective. The effect, if any, does not seem to be strong enough to, with our limited number of participants, detect a significant influence of the intensity levels that were used on the number of questions answered.

These results are most easily explained by the limited number of participants, and the high variability of their responses. The high and non-Gaussian variability also led us to use non-parametric Mann Whitney U-tests and a matching relatively broad null hypothesis. This makes the null hypothesis harder to reject and if rejected, gives less strong evidence to our main hypothesis, but the tests require far less assumptions and are much more robust to outliers.

⁴ The control group has a very high standard deviation because one participant answered 59 questions while another participant answered no questions at all. It therefore has no importance.

During the experiment we also found some weaknesses in its design. Aspects like the way sentences are constructed or how usable the software is from an HCI (human-computer interaction) perspective have influence on the results.

The percentages used to show minorities and majorities might 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 most of her Facebook friends answered *less* questions than her. The same goes for the message "87% of the participants in this experiment have answered 5 more questions than you", as participants might have thought that these other participants would (at least partially) include their friends⁵.

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 several indications from the received feedback that the participants *did* believe the façade-experiment. We received multiple feedbacks along the lines of: "The possible choices to answer my feelings do not reflect the way I feel". Though this qualitative data is of course difficult to objectively quantify.

The experiment described in this paper should be repeated in different ways and with different conditions and above all with more participants, in order to see if the intensity of persuasion *does* have influence on effectiveness. 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, feelings or thoughts.

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⁵ It should also be noted that Facebook friends do not necessarily have to be real friends. They may also be relatives or total strangers.

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