

A Longitudinal Study Examining the Sustainability of the Behavioural Intention to Stop Smartphone Zombie Behaviour

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Abstract. Smartphone zombie behaviour has been defined as “the pedestrian act of using a smartphone while walking”. It is dangerous because it leads to the risk of traffic accidents. According to previous studies, behavioural intention and behavioural willingness are important to stop smartphone zombie behaviours. Therefore, we examined the behavioural sustainability of intention and willingness to stop these behaviours through a longitudinal survey (5 times in total). In the survey, we randomly assigned participants to Group 1, Group 2, or Group 3. We then presented interventional materials for each group and assessed smartphone zombie behaviours, behavioural intention, and behavioural willingness. The results of ANOVA showed that there is no significant group effect on smartphone zombie behaviours and behavioural willingness. However, there was a significant effect of group on behavioural intention. We discussed the sustainability of behavioural intention to stop smartphone zombie behaviours while comparing each group.

Keywords: Smartphone zombie • Transtheoretical model • Fear-arousing communication • Behavioural change • Longitudinal study

1 Introduction

Smartphone zombie behaviour has been defined as “the pedestrian act of using a smartphone while walking” [1, p. 87]. We should stop smartphone zombie behaviour because it has led to the risk of traffic accidents. Previous studies [1-2] have found the mechanisms of smartphone zombies based on the prototype/willingness model [3]. According to the prototype/willingness model, behavioural intention and behavioural willingness are important to directly stop smartphone zombie behaviours. However, no studies have examined the sustainability of behavioural intention and behavioural willingness to stop smartphone zombie behaviours. Therefore, our aim was to examine its sustainability by a longitudinal survey.

2 Related Work

The transtheoretical model (TTM) assumes that behavioural change involves progression through six stages of change: precontemplation, contemplation, preparation, action, maintenance, and termination [4]. According to Prochaska [5], precontemplation is the stage in which people have no intention to take an action within the next 6 months. In the contemplation stage, people intend to take an action within the next 6 months. In the stage of preparation, people intend to take an action within the next 30 days and take the action. People in the action stage have changed their overt behaviour for less than 6 months. Maintenance is the stage in which people have changed their overt behaviour for more than 6 months. People in the termination stage have no temptation to relapse and are 100% confident.

The TTM makes it possible to explain the difference between a person who is not yet committed to a behavioural change and a person who maintains a behavioural change. Based on this model, we can quit habitual behaviours such as smoking. A prior study examined the effect of a TTM-based self-help intervention on smoking cessation [6]. In this research, a total of 2471 smokers were randomized to either a control group or a TTM-based self-help intervention group and followed up for 12 months after beginning the experiment. There was no evidence that the TTM-based intervention was effective in this trial.

However, the TTM is valuable in examining the sustainability of behavioural change for smartphone zombie behaviour. The current study posited that smartphone zombie behaviour is a habitual behaviour that should be stopped. We focused on the participants who were either in the “precontemplation”, “contemplation”, or “preparation” stages of the TTM because they needed to change their smartphone zombie behaviour.

We also needed effective intervention materials to change their smartphone zombie behaviour. The current study considered intervention materials that maintain behavioural intention to stop smartphone zombie behaviour and continuously reduce behavioural willingness for smartphone zombie behaviour. We utilized a fear-arousing appeal to inform the risk of smartphone zombie behaviour by the intervention materials. A fear-arousing appeal is a form of communication that arouses fear emotions in the receiver that are related to the persuasion topic and uses them to persuade the receiver [7]. As an example, our intervention materials informed users of the ordained fines for an accident involving smartphone zombie behaviour (See Section 3.1). The receivers who understood the danger of smartphone zombie behaviour by our intervention materials considered stopping the use of their smartphone while walking. Based on fear-arousing communication, the present study assumed that our intervention materials would have the effect of loss aversion to motivate people to avoid smartphone zombie behaviour.

Our intervention materials were presented multiple times in the current study. Previous research [8] has examined the effects of message repetition (1, 3, or 5 times) and the level of the threat (high or low) on the acceptance or rejection of persuasion. In the study [8], positive effects of the persuasive message were found in the low threat condition, but resistance to persuasion was induced in the high threat condition. The effect

of the message first increased and then decreased as the frequency of exposure increased in the low threat condition, but the opposite results were found in the high threat condition. More specifically, the inverted U-shaped pattern was found to have the greatest effect when the message was repeated three times in the low threat condition. In light of these results, we decided to provide the information about the danger of smartphone zombie behaviour three times. We also considered that smartphone zombie behaviour is a low threat for people because it does not necessarily result in accidents. It may cause psychological reactance [9] if the message of smartphone zombie behaviour was repeated more than three times for the receivers.

In summary, the current study examined the sustainability of behavioural intention to stop smartphone zombie behaviour by repeating the information regarding the danger of smartphone zombie behaviour three times.

3 Method

3.1 Intervention Materials

We developed the intervention materials before starting the longitudinal survey. The intervention materials were designed to make people aware of the dangers of smartphone zombie behaviour and to motivate people to not use their smartphones while walking.

As shown in Figure 1, Image 1 provides information regarding the possibility of imprisonment for up to five years if the other person is injured in an accident caused by using a smartphone while walking. Image 2 shows that one in 10 people who walked while using a smartphone bumped into others. Image 3 asks the question if it bothers the people around you when you use your smartphone while walking.



Fig. 1. Intervention materials

3.2 Longitudinal Survey

The longitudinal survey in the current study is shown in Figure 2. Participants were recruited from a sample of an online survey company in Japan. The longitudinal survey lasted from December 1, 2021, to December 23, 2021.

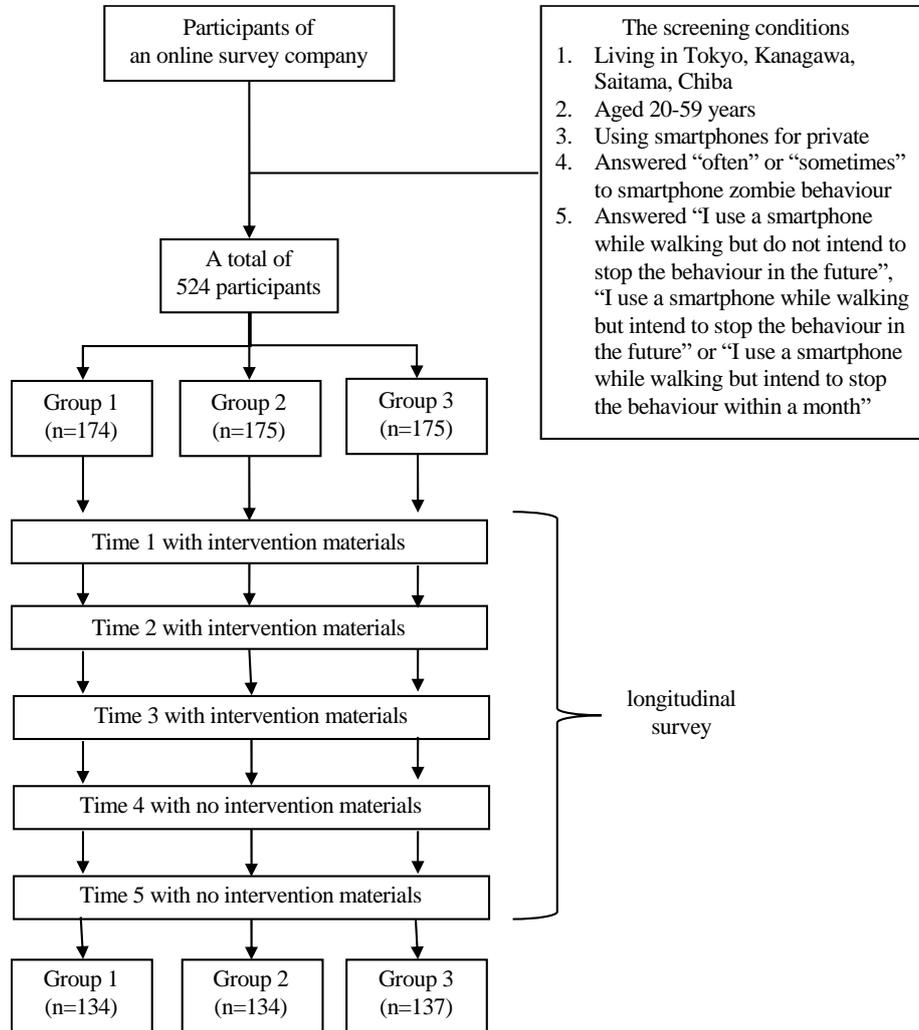


Fig. 2. The longitudinal survey used in the current study

There were five screening conditions for recruiting participants: 1) participants who lived in Tokyo, Kanagawa, Saitama, or Chiba; 2) participants aged 20-59 years; 3) participants who used private smartphones; 4) participants who answered “often” or “sometimes” to smartphone zombie behaviour; and 5) participants who answered “I use a smartphone while walking but do not intend to stop the behaviour in the future”, “I use a smartphone while walking but intend to stop the behaviour in the future” or “I use a smartphone while walking but intend to stop the behaviour within a month”. The reason to ask the question 1 is due to expect that people who live in the city near Tokyo are more likely to use a smartphone while walking. The reason to ask the question 2 is,

according to prior study [10], due to examine that people aged 20-59 years tend to use a smartphone while walking. Question 5 was based on the TTM.

After screening, a total of 524 participants ($M_{\text{age}}=39.49\pm 11.03$ years, 263 men and 261 women) gave their consent in Japanese to participate in the longitudinal survey. The participants were randomly assigned to Group 1 ($n=174$), Group 2 ($n=175$) or Group 3 ($n=175$). They responded to the psychological scales (see Section 3.3) in a total of five longitudinal surveys every three days based on considering their costs of responses. The number of participants who participated in the survey until completion was 405 ($M_{\text{age}}=39.91\pm 11.02$ years). We used the results of these responses for analysis.

The intervention materials (see Figure 1) were presented in different ways depending on the group. In Group 1, only "Image 1" was provided. In Group 2, "Image 1" and "Image 2" were shown. In Group 3, "Image 1" to "Image 3" were presented. Each group was presented with different intervention materials in the first through the third of the five surveys. The groups were not presented with the intervention materials in the fourth and fifth surveys to examine the maintenance of behavioural intention and behavioural willingness to stop smartphone zombie behaviours.

3.3 Measurements

In the five surveys, we used each psychological scale to assess smartphone zombie behaviour, behavioural intention, and behavioural willingness, for which reliability and validity have been confirmed in previous studies [1]. The participants were asked to answer the questions of each psychological scale while the intervention materials were presented in the first three of the five surveys.

1. Smartphone Zombie Behaviour

To investigate smartphone zombie behaviours, we used the Smartphone Zombie Scale. This scale measures how often a person uses a smartphone while walking with 3 items on a 5-point scale (1: not at all to 5: often). The higher the scale score, the more a person uses a smartphone while walking. The reliability (Cronbach's alpha) of the scale was confirmed separately for high-risk situations ($\alpha = .86$) and low-risk situations ($\alpha = .84$) in a previous study [1].

2. Behavioural Intention

We used the Psychological Scale for Behavioural Intentions. This scale measures behavioural intention with 3 items on a 5-point scale (1: not applicable to 5: applicable). The higher the scale score, the more a person intends to stop using a smartphone while walking. The reliability (Cronbach's alpha) of the scale was confirmed separately for high-risk situations ($\alpha = .69$) and low-risk situations ($\alpha = .82$) in a previous study [1].

3. Behavioural Willingness

The Psychological Item for Behavioural Willingness [1] was used. This item measures the behavioural willingness with 1 item on a 5-point scale (1: will never do to 5: will

always do). This one item measures a respondent's tendency to use a smartphone while walking and wherein many people around the respondent are smartphone zombies. The higher the score is for this item, the more willing a person is to use a smartphone while walking.

3.4 Data Analysis

The longitudinal survey had a 3 (Groups: 1/2/3) \times 5 (Times: 1/2/3/4/5) design. Therefore, we used two-way mixed analysis of variance (ANOVA) to examine the differences among groups and times. We analysed the maintenance of behavioural intention and behavioural willingness to stop smartphone zombie behaviour. In the analysis, we used the data of 405 participants (Group 1: n=134, Group 2: n=134, Group 3: n=137) with no missing values for the psychological assessments in all surveys.

4 Results

We calculated the average of the surveys on smartphone zombie behaviour, behavioural intention, and behavioural willingness for the 3 groups from Time 1 to Time 5. The results are shown in Table 1.

Table 1. Descriptive statistics for each variable in longitudinal survey

Variables	Group	Time 1	Time 2	Time 3	Time 4	Time 5
Smartphone Zombie Behaviour	1	3.71 \pm 0.83	3.66 \pm 0.93	3.66 \pm 0.91	3.61 \pm 0.96	3.58 \pm 1.02
	2	3.63 \pm 0.87	3.64 \pm 0.92	3.61 \pm 0.91	3.63 \pm 0.95	3.58 \pm 0.96
	3	3.79 \pm 0.78	3.76 \pm 0.83	3.76 \pm 0.81	3.78 \pm 0.79	3.76 \pm 0.85
Behavioural Intention	1	3.81 \pm 0.98	3.83 \pm 1.01	3.83 \pm 1.03	3.79 \pm 1.00	3.81 \pm 1.06
	2	3.97 \pm 0.86	3.87 \pm 0.85	3.95 \pm 0.85	3.96 \pm 0.89	3.93 \pm 0.88
	3	3.71 \pm 0.83	3.63 \pm 0.93	3.58 \pm 0.88	3.61 \pm 0.92	3.59 \pm 0.90
Behavioural Willingness	1	3.05 \pm 1.11	3.10 \pm 1.13	3.02 \pm 1.16	3.06 \pm 1.19	2.95 \pm 1.19
	2	3.15 \pm 1.05	3.08 \pm 1.06	3.04 \pm 1.17	3.05 \pm 1.14	3.11 \pm 1.16
	3	3.18 \pm 0.96	3.23 \pm 1.06	3.22 \pm 1.09	3.21 \pm 1.09	3.18 \pm 1.12

We compared each group to examine the change by presenting intervention materials. The ANOVA results showed that there is no significant main effect of group on smartphone zombie behaviour ($F_{(2, 402)} = 1.51$, ns, $\eta^2 = 0.01$) or times ($F_{(3.43, 1379.08)} = 1.27$, ns, $\eta^2 = 0.00$). In addition, there was no interaction between the groups and times ($F_{(6.86, 1379.08)} = 0.46$, ns, $\eta^2 = 0.00$). There was no significant main effect of group ($F_{(2, 402)} = 1.04$, ns, $\eta^2 = 0.01$) or time ($F_{(3.55, 1425.42)} = 0.66$, ns, $\eta^2 = 0.00$) on behavioural willingness. Moreover, there was no interaction between the groups and times ($F_{(7.09, 1425.42)} = 0.87$, ns, $\eta^2 = 0.00$).

The results of ANOVA showed that there was no significant group effect on smartphone zombie behaviour and behavioural willingness. However, there was a significant effect of group on behavioural intention ($F_{(2, 402)} = 4.78, p < .01, \eta^2 = 0.02$). Multiple comparisons showed no significant difference between Group 1 ($M = 3.81 \pm 1.01$) and Group 2 ($M = 3.94 \pm 0.87$) or between Group 1 and Group 3 ($M = 3.62 \pm 0.89$). However, the results showed a significant difference ($p < .05$) between the behavioural intention scores of Group 2 and Group 3. In addition, there was no significant main effect of time on behavioural intention ($F_{(3, 54, 1422.47)} = 1.06, ns, \eta^2 = 0.00$) and no interaction between the groups and times ($F_{(7, 08, 1422.47)} = 1.08, ns, \eta^2 = 0.01$).

5 Discussion

Our research aimed to examine the sustainability of behavioural intention and behavioural willingness to stop smartphone zombie behaviour by a longitudinal survey. We repeated the presentation of the intervention materials to each group and examined the change in smartphone zombie behaviour, behavioural intention, and behavioural willingness in the first three of the five surveys. We then examined the maintenance of behavioural intention and behavioural willingness to stop smartphone zombie behaviour by providing no intervention materials in the fourth and fifth surveys.

In the current study, the result was that behavioural intention was significantly different between Group 2 and Group 3. The difference was in whether Image 3 in Figure 1 was presented. Image 3 was about the inconvenience to the people around the respondents but unlike Images 1 and 2, did not include the factual dangers of smartphone zombie behaviour. The result suggests that providing people with some information of the factual dangers of smartphone zombie behaviour is effective in maintaining the behavioural intention to stop it. In addition, Group 2 significantly maintained the behavioural intention compared to Group 3. Participants in Group 2 understood the danger of smartphone zombie behaviour by the combination of Image 1 and Image 2, which informed them of the factual dangers of smartphone zombie behaviour. The combination of Image 1 and Image 2 in Group 2 increased the sustainability of the behavioural intention to stop smartphone zombie behaviour.

6 Conclusion

Our study found that it is important to inform users of the factual danger of smartphone zombie behaviour to prolong their behavioural intention. However, we have limitations of the work. One is that we examined the sustainability of behavioural intention in the short-term. Therefore, future research needs to examine the sustainability of stopping smartphone zombie behaviour in the long term. In addition, we could not evaluate our intervention materials by respondents. Future work should do so to perform effective interventions. In conclusion, for people stop using their smartphones while walking, we need to inform them of the danger of smartphone zombie behaviour to maintain the behavioural intention to stop it. As an empirical contribution, the results of this study

suggest informing users about the dangers of smartphone zombie behaviour based on evidence can be one persuasive technology.

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