First Study to Enhance Self-Determination Theory by Utilizing Social Justification.

Yukitoshi Kashimoto[1,*], Cao Lian[1], Yudai Yamazaki[1] and Daisuke Kamisaka[1]

1KDDI Research Inc., Fujimino, Japan

Abstract

These days, there are various types of applications that utilize persuasion to support behavior change. Persuasion encourages target behaviours, such as quitting light smoking, which an application user engages by their own volition easily. However, there are other targets, such as prosocial behaviour and volunteer, that are difficult to promote using Persuasion alone. This study aims to develop a behaviour change technique that uses social justification to encourage users to engage in these behaviors. Our first study focuses on Patrol-run, which is one of the prosocial behaviours, and tested the effectiveness of Social Justification. To validate this technique, we have conducted an online questionnaire survey with 206 participants. The results showed that the number of participants in the experimental group who were willing to engage in Patrol-run was statistically higher than that in the control group.

Keywords

Behaviour Change Support System, Persuasion, Prosocial behaviour, Social Justification

1. Introduction

Thanks to the progress in Information Technology, there exist various types of Behaviour Change Support Systems (BCSS)[1]. These systems realize the target Behaviour Change (BC) by utilizing intervention. H.Oinas-Kukkonen et al.[2] categorizes the interventions into three types: Persuasion, Inducements, and Coercion. Persuasion relies on the power of verbal and non-verbal symbols and allows people voluntary participation in the persuasion process. Especially in Persuasive Technology research domain, there are various researches and BCSS which utilize Persuasion[3]. One specific BCSS example is a smoking cessation smartphone app that supports the user's health[4]. The smartphone app encour- ages the user to achieve their goal by utilizing self-monitoring. Other examples of researches utilizing Persuasion are also health[5] or computer security prac- tice[6]. However, some target behaviours, such as prosocial behaviours and heavy smoking addiction, are hard to promote using Persuasion. Here, we note that prosocial behaviour is a social behavior that benefits other people or society as a whole such as helping, sharing, donating, co-operating, and volunteering. In addition, we define these behaviours as Laborious Target Behaviour (LTB). Based on the definition of Persuasion, the target behaviours that use it assume that the user has the mindset to change. However, especially for LTB, the user needs to start to nurture their mind to change, which means that Persuasion is not effective for promoting it.

In this paper, we study a behavior change technique targeting LTB to induction and habituation by utilizing BCSS. In educational and social psychology, extrinsic and intrinsic motivation are defined as necessary motivations for behavior change [7]. Extrinsic motivation generally refers to motivation to act based on requests or rewards from others, while intrinsic motivation refers to motivation to engage in behavior spontaneously because it is enjoyable or

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meaningful. Additionally, self-determination theory categorizes extrinsic motivation based on the degree of self-determination into four types, rather than dividing motivation into extrinsic and intrinsic [7]. According to self-determination theory, human motivation for behavior change gradually moves from extrinsic to intrinsic as self-determination increases. The higher the degree of self-determination, the more likely behavior will be promoted and habituated. However, in the process of starting and habituating the target behavior, it is rare for behavior to be spontaneously habituated from the beginning. Typically, we start the target behaviour with extrinsic motivation. Then, through repeated success in our daily life, a sense of achievement and competence increases, leading to intrinsic motivation. Finally, we achieve the highly self-determined target behavior as a habit.

In cases where behavior change is relatively easy, such as promoting daily health walking among users who have a certain level of health promotion aware- ness, it is considered that the use of BCSS should be started for users who have approached to a certain extent the state of intrinsic motivation. In this case, behavior change techniques are used to maintain and enhance the user's intrinsic motivation state. On the other hand, for LTB to initiation and habituation, it is necessary to transition from extrinsic motivation to intrinsic motivation by inducing the target behavior rather than relying on extrinsic motivation. There- fore, to achieve behavior induction and habituation through BCSS, the following research questions (RQ) need to be addressed:

RQ1 Development of behavior change technique that enables the transition from extrinsic motivation to intrinsic motivation
RQ2 Study of the psychological characteristics of users with high compatibility with the behavior change techniques in RQ 1

In RQ1, intervention methods for transitioning from an extrinsic motivation to an intrinsic one have remained limited to instructional cases in the field of education[8], and the establishment of intervention methods that can be applied to BCSS is a challenge. In this study, we examine an intervention technique for transitioning from extrinsic motivation to intrinsic one for Patrol-run, which are one of LTBs of prosocial behaviours. Patrol-run is an activity in which individuals conduct surveillance of their habitual town during their daily light exercise, contributing to the safety and security of it1. To address RQ1, we propose a transition from extrinsic motivation to intrinsic one using Social Justification (SJ). SJ is defined as the process of shifting from extrinsic motivation, which has already been induced (extrinsic motivation state), to intrinsic one by recognizing the practical significance of the behavior that benefits society, even without intending to perform the target behavior.

In RQ2, we elucidate the psychological characteristics of users that are effectively influenced by SJ used in this research. Previously identified psychological traits that are associated with prosocial behaviors include social value [9][10], empathy [11], and the Big Five personality traits [12]. In this study, we assume that SJ is similarly highly correlated with these psychological traits and verify this assumption by conducting an investigation. By revealing the psychological characteristics that are effectively influenced by SJ, it becomes possible to choose interventions tailored to the user's psychological traits.

Table 1
Screening questionnaire items

Item #	Questionnaire item	Exclusion condition
SQ1	How frequently do you exercise outdoor (walk or run)?	seldom or never
SQ2	Will you continue the exercise?	never
SQ3	Do you exercise outdoor in non-residential area?	seldom or never
SQ4	When you exercise, how frequently do you see others?	seldom or never

2. Online questionnaire survey

In order to examine the proposed BC technique, we have conducted an online-survey. The first objective of the survey is whether SJ promotes the attitude toward Patrol-run corresponding to RQ1. The other objective is to verify the relationship between SJ and psychological features corresponding to RQ2. Then, we designed a questionnaire. The questionnaire consists of screening and main survey.

The screening survey (Table 1) includes four parts focused on the following: frequency of light exercise (walk or run) outdoor, future mind to do it, environments while light exercise. The participant answers each question with five point scale (5. Frequently — 1. Never). Then, we omit the participant who answers that they rarely conducts light exercise outdoor, will not do it, does it in non-residential area, rarely see others.

In the main survey, the participant reads a web article on Patrol-run. For the experimental group, the web article first introduced Patrol-run to the participant. Second, we notified: "Your daily light exercise has been already Patrol-run. Then, let's keep in mind to do it in conscious with Patrol-run as well as for your health promotion!" which works as SJ. Then, they answer a questionnaire which includes three parts focused on the following: impression on Patrol-run article (QG1), whether their light exercise helpful to others(QG2-1), whether they want to conduct Patrol-run in future(QG2-2), and psychological features(QG3) listed in Table 2. We ask QG2 questions limited to the experimental group. QG1 and QG2 have five point scales (1. Strongly-disagree — 5. Strongly-agree).

Table 2
Main questionnaire items

Group#	Item #	Questionnaire item	# of sub-Qs	Exp. √	Ctrl √
QG1	Q1	Do you think if your daily light exercise (walk or run) outdoor has been beneficial to others?	1	√	
QG2	Q1	Do you think if Patrol-run is a good activity?	1	√	
	Q2	Can you be aware of Patrol-run when you do further light exercise outdoor?	1	√	√
QG3	Q1	(Prosocial behaviour for others)	7	√	√
	Q2	(Social-worth)	8	√	√
	Q3	(Empathy)	14	√	√
	Q4	(Big Five)	29	√	√

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The psychological features consist of four items: Prosocial behaviour for others, Social-worth, Empathy and Big Five as QG3 in Table 2. QG3-1 includes questions about their degree of the prosocial behaviour based on "The Japanese Version of Self-Report Altruism Scale Distinguished by the Recipient (SRAS- DR)", which derives from [13]. With the SRAS-DR Scale, we measure how frequently an individual performs prosocial behaviours to others. QG3-2 includes questions about their degree of the social worth based on the Social Mental Act Scale (SMAS), which derives from the Value-intending Mental Act Scale[14]. With the SMAS, we can measure how much an individual feels a sense of value in connection with others and contributes to others' well-being. QG3-3 includes questions about their degree of the empathy based on the Interpersonal Re-activity Index (IRI)[15]. In this study, we use Perspective-taking (Empathy-P) and Empathetic concern (Empathy-E), because they handle the empathy toward others. QG3-3 includes questions about their degree of the Big Five based on the Big Five Inventory (BFI)[16]. With the BFI, we can

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[1] Patrol-run: http://patorun.com/

measure how much an individual feels a sense of value in their basic attitude on Openness (Bigfive-O), Conscientiousness (Bigfive-C), Extraversion (Bigfive-E), Agreeableness (Bigfive- A), and Neuroticism (Bigfive-N). Thus, we measure those features from the BFI. Each participant completed the questionnaire on a seven point scale to allow each individual to express how much they agreed or disagreed with each statement. We note that a high score in each feature means a high sense of it.

We collected data between 9.Dec.2022 and 13.Dec.2022. First, we recruited 10,000 participants from online panel of a crowdsourcing service and asked them to answer the screening questionnaire. We collected the data from a web-based questionnaire system. On 13.Dec.2022, 206 participants completed the main questionnaire. We have assigned 103 participants to the experimental group (OG ex) and the later to the control one (OG ct) randomly. Participants were between 20 to 69 years of age (M 2= 48.2, SD3= 12.5). 56.3% of the participants were male and 43.7% were female.

Table 3
The intervention result on statistics and t-test (*p < .05)

Component	Group	Value	Difference	t	df	p_value
QG1 - 1	Experimental	3.298	0.298	2.273	83	.026*
	Control	3.194	0.194	0.194	102	.123
QG2	Experimental	3.404	0.405	3.481	83	.001*
	Control	3.184	0.184	0.194	102	.133

Table 4
The ratio of the difference between QG1-1 to QG2-2 and residual analysis result (*p < .05)

Difference	Experimental Group	Control Group	Std-diff	p_value
Positive (+)	37.12%	20.39%	+/-2.130	.033
0	44.19%	58.25%	+/-1.555	.120
Negative (-)	18.60%	21.36%	+/-0.375	.707

3. Result

First, we examine the effect of intervention by comparing the difference between the value of QG1-1 and the neutral value of the questionnaire 3 as described in Table 3. Accordingly, we compared the QG2-2 and the neutral value. For OG ex, both QG1-1 and QG2-2 results show that the SJ intervention statistically improves their attitude toward Patrol-run, while OG ct does not.

Table 5
The correlation between each parameter (p < .01,* p < .05,+ p < .10)**

#	Variables	2	3	4	5	6	7	8	9	10	11
1	QG1-1: Past Pt.-run	.69**	.25**	.23**	.05	.10	.26**	.04	.18*	.08	-.01
2	QG2-2: Future Pt.-run	-	.22**	.30**	.17	.18*	.28**	.11	.21**	.18*	-.05
3	QG3-1:Prosocial Behaviour		-	.45**	.24**	.23**	.36**	.16*	.49**	.27**	-.28**
4	QG-3-2: Social-worth			-	.31**	.40**	.36**	.32**	.58**	.48**	-.15*
5	QG-3-3: Empathy-P				-	.44**	.09	.22*	.12*	.35**	-.10
6	QG-4-1: Empathy-E					-	.11	.31**	.13*	.27**	.03
7	QG-4-1: Bigfive-O						-	.22**	.52**	.27**	-.30**
8	QG-4-1: Bigfive-C							-	.16*	.44*	.29**
9	QG-4-1: Bigfive-E								-	.32**	-.36**

10	QG-4-1: Bigfive-A	-	-.43**
11	QG-4-1: Bigfive-N	-	

In addition, we calculate the difference between QG1-1 and QG2-2 for each participant and ratio of increase (+), not-change (0), and decrease (−) based on the difference as described in Table 4. This difference indicates that a participant who has a positive difference is willing to start Patrol-run. Residual analysis shows that the ratio of positive difference (+) is significantly higher in OG ex. In the next, we have found that some psychological features have significant correlation with willingness to Patrol-run as described in Table 5. QG2-2 as well as QG1-1 has strong correlation with Prosocial Behaviour (PB), Social-worth, and Bigfive-O. In addition, QG2-2 also correlates with Empathy-E. As a result, we have confirmed that the proposed SJ works as an intervention to promote prosocial behaviour as reported in [9], [11], and [12].

4. Discussion

The objective of this study is the development of a new intervention technique which enables us to change the recognition of daily exercise from personal objective to prosocial one in a realistic scenario. In order to examine that objective, we have defined the RQs and conducted the preliminary experiments. We discuss the result of the experiments along with each RQ.

4.1. RQ1: Development of behavior change technique that enables the transition from extrinsic motivation to intrinsic motivation

The online questionnaire survey result (Table 3) shows that the average score of QG2-2 in OG ex is statistically higher than the middle value: 3. In addition, the ratio of increase is also significant higher in OG ex as described in Table
4. Hence, we have confirmed that the proposed SJ works effectively change the participants' attitude to positive one. The reason why we do not show the result of the difference which directly compares OG ex and OG ct score is that there is no significant difference between these two. We have determined that this result might derive from the difference of social-worth value between OG ex (M = 3.359, SD = 0.666) and OG ct (M = 3.461, SD = 0.644). Table 5 and [9]
show that Social-worth effectively influences the prosocial behaviour. Therefore, the distribution difference of it would result in the nonsignificant result.

4.2. RQ2: Study of the psychological characteristics of users with high compatibility with the behavior change techniques in RQ1

From the correlation analysis result, we determine that SJ intervention has significantly affected to promote prosocial behaviour attitude as well as is interrelated with Social-worth, Empathy-E, and Bigfive-O. The correlation is also lined with [9], [11], and [12], because QG2-2 correlates with QG3-1: PB, QG3-2: Social- worth, QG3-3: Empathy-E, and QG4-1: Bigfive-O. Social-worth is most relevant to QG2-2 (.30). And more, Bigfive-O, Prosocial behaviour, and Empathy-E score come in the relevance order, which is indicated in Table 5. The participant who regards relationships with others as important results in the positive attitude to- ward Patrol-run. In addition, the authors have studied the correlation between Social-worth and Prosocial behaviour before [10]. The study reports that Social- worth has the strong correlation with Prosocial behaviour, that is more than .40. Therefore, we have determined that the participant who has higher Social worth score is willing to conduct Patrol-run effected by SJ intervention. The participant who has Big-five openness tends to try to new things, which results in the statistically significant correlation. Since Patrol-run is one of prosocial behaviours, the correlation between QG1-1 and QG2-2 is the statistically significant. The participant who has Empathy-Empathetic-concern is willing to take care of others, which results in the statistically significant correlation. On the other hand, contrary to our expectation as mentioned in Chapter 1, Empathy-P is not relevant to QG2-2. According to

[15], Perspective-taking ability in Empathy allows an individual to anticipate the behaviour and reactions of others. In other words, the mere social significant intervention is not enough to encourage those Perspective-taking user to conduct Patrol-run, because they take care of the effect of it. One idea to tackle this challenge is that we introduce gratitude feedback. According to [9], individuals who report habitually experiencing gratitude engage in prosocial behaviours. Therefore, the SJ intervention following the gratitude feedback would encourage those participants to engage in Patrol- run. The further study should combine the gratitude feedback function with a smartphone app when the user conducts Patrol-run.

5. Limitation and Future work

In this study, we developed the behavior change technique that employs social justification to encourage users to engage in specific behaviors. To validate this technique, we conducted an online questionnaire survey with 206 participants. The results showed that the number of participants in the experimental group who were willing to engage in Patrol-run was significantly higher than that in the control group.
In this study, the proposed SJ intervention was one shot intervention at a particular timing and did not take the intervention's compatibility with participants. Then, we also need to develop an adaptive intervention in which the information system measures the response of the user and conduct appropriate intervention for several times. One of the ideas would be utilizing gratitude feedback. According to Grant[9], gratitude encourages prosocial behaviour. When the performance of the current intervention decreases, the system would send gratitude to the user, which would encourage the target prosocial behaviour. Based on the above-mentioned ideas, we are going to develop next BCSS and conduct another experiment to measure the performance of it.

References

[1] Oinas-Kukkonen, H.: A foundation for the study of behavior change support sys- tems. Personal and Ubiquitous Computing 17(6), 1223–1235 (8 2013)
[2] Harjumaa, M., Oinas-Kukkonen, H.: Persuasion theories and IT design. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics) 4744 LNCS, 311–314 (2007)
[3] Oyebode, O., Alqahtani, F., Orji, R.: Exploring for Possible Effect of Persuasive Strategy Implementation Choices: Towards Tailoring Persuasive Technologies. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics) 13213 LNCS, 145–163 (2022)
[4] Ham, J., Langrial, S.U.: Learning to Stop Smoking: Understanding Persuasive Ap- plications' Long-Term Behavior Change Effectiveness Through User Achievement Motivation. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics) 12064 LNCS, 139– 149 (2020)
[5] Oyebode, O., Graham-Kalio, B., Orji, R.: HeartHealth: A Persuasive Mobile App for Mitigating the Risk of Ischemic Heart Disease. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics) 12064 LNCS, 126–138 (2020)
[6] Ganesh, A., Ndulue, C., Orji, R.: Smartphone Security and Privacy – A Gamified Persuasive Approach with Protection Motivation Theory. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics) 13213 LNCS, 89–100 (2022)
[7] Deci, E.L., Ryan, R.M.: Self-determination theory. Handbook of Theories of Social Psychology: Volume 1 pp. 416–437 (1 2012), /record/2011-21800-020
[8] Fujita, T., Sugihara, T.: . 52(1), 19–28 (1 2007)

[9] Grant, A.M., Gino, F.: A little thanks goes a long way: Explaining why gratitude expressions motivate prosocial behavior. Journal of personality and social psychol- ogy 98(6), 946–955 (6 2010)

[10] Yukitoshi, K., Tomohiro, S., Atsunori, M.: Preliminary study on the correlation between gratitude activity and prosocial behaviour. In: BCSS 2022 Adjunct Proceedings of the 17th International Conference on Persuasive Technology (2022)

[11] Dovidio, J.F., Banfield, J.C.: Prosocial Behavior and Empathy. International Encyclopedia of the Social & Behavioral Sciences: Second Edition pp. 216–220 (3 2015)

[12] Carlo, G., Okun, M.A., Knight, G.P., de Guzman, M.R.T.: The interplay of traits and motives on volunteering: agreeableness, extraversion and prosocial value motivation. Personality and Individual Differences 38(6), 1293–1305 (4 2005)

[13] Philippe Rushton, J., Chrisjohn, R.D., Cynthia Fekken, G.: The altruistic personality and the self-report altruism scale. Personality and Individual Differences 2(4), 293–302 (1 1981)

[14] Spranger, E.: Lebensformen Geisteswissenschaftliche Psychologie Und Ethik der Pers¨onlichkeit (1925)

[15] Davis, M.H.: Measuring individual differences in empathy: Evidence for a multidimensional approach. Journal of Personality and Social Psychology 44(1), 113–126 (1983)

[16] Rammstedt, B., John, O.P.: Big Five Inventory. Encyclopedia of Personality and Individual Differences pp. 469–471 (2020).