Actual Persuasiveness: Impact of Personality, Age and Gender on Message Type Susceptibility

Ana Ciocarlan[1], Judith Masthoff[1,2], and Nir Oren[1]

[1] University of Aberdeen, Aberdeen, UK
[2] Utrecht University, Utrecht, The Netherlands
{ana.ciocarlan,j.masthoff,n.oren}@abdn.ac.uk

Abstract. Persuasive technologies use a variety of strategies and principles to encourage people to adopt and maintain beneficial behaviours and attitudes. In this paper we investigate the influence of Cialdini's seven persuasive principles on people's choices, actions and behaviour. In contrast to related work investigating perceived persusaion, this study analyses actual persuasion. We also investigate the impact of personality, age and gender on people's susceptibility to different message types. Furthermore, we investigate if people's susceptibility to different persuasive messages is consistent over time. The findings suggest that certain persuasive principles have a greater influence on a person's actions than others, with Reciprocity and Liking being the most effective. Our results differ from work investigating perceived persuasiveness, suggesting that what people perceive to be more persuasive is not necessarily what will persuade them to perform an action. Moreover, the study showed that people's susceptibility to different principles is dependent on their personality traits, and it remains constant with time. The findings from this study have implications for future work on personalising persuasive strategies and designing digital behaviour change interventions.

1 Background

Persuasive technologies and interventions motivate, shape and reinforce beneficial behaviours and attitudes through the use of of a wide range of strategies. Some of the most commonly employed strategies in the design of behaviour change interventions have been identified by Cialdini [1, 2], Fogg [6], Michie et al. [16], and Oinas-Kukkonen and Harjumaa [18].

While digital behaviour change interventions can be delivered using various approaches, persuasive games have attracted attention in recent research work, due to their strong motivational pull [22]. Persuasive games are very interactive and require active engagement from participants, which can increase the emotional quality of the intervention [17] and act as an incentive to keep users engaged with the intervention [13].

Recent work has shown that persuasive interventions are more effective if they are personalised [9, 14] and an increasing number of persuasive games have been developed in recent years as novel solutions for motivating healthier behaviours,

such as encouraging physical activity and balanced nutrition [11, 24, 12]. For example, the game by [24] encourages healthy eating and physical activity to prevent diabetes and obesity among adolescents, the *Re-Mission* game improves self-efficacy in young adults undergoing cancer treatment [11], and the work of Orji [19] investigated personalisation to gamer types to motivate healthy eating.

With a growing interest in tailoring persuasive technologies and games, many studies investigate people's *perceived* persuasiveness of different strategies [23, 20, 21, 25]. Some studies have focused on investigating whether persuasive messages have an effect on behaviour, such as [10] who showed that using persuasive cues can increase compliance to a perform request. However, there remains a need to further analyse *actual* persuasiveness, or the direct influence different persuasive strategies and principles have on people's actions and behaviour. Furthermore, we need to investigate whether people's susceptibility to these strategies and principles is consistent over a longer period of time.

In this paper, we present the results of a study which investigates the influence of different persuasive principles on people's direct actions and behaviour. Moreover, we analyse the relationship between people's characteristics and their susceptibility to different principles. We also investigate whether people's susceptibility to Cialdini's persuasive principles varies with time. The findings from our study will allow us to develop personalisation algorithms for further experiments and will inform the design of effective persuasive interventions for wellbeing.

2   Study Design

The aim of this study was to investigate how choices, actions and behaviour are influenced by messages using different persuasive principles. We wanted to investigate if certain persuasive principles have a greater impact than others and which persuasive principles are most suited for people of different personality types, age and gender. Additionally, we investigated if people's susceptibility to persuasive principles is consistent over time.

2.1   Research Questions

The study was designed to investigate the following research questions:

1. How effective are different persuasive principles in influencing people's behaviour and actions?
2. What is the effect of age, gender and personality on people's susceptibility to different persuasive principles?
3. Is susceptibility to different persuasive principles consistent over time?

2.2   Participants

We recruited a total of 130 unique participants to take part in the the experiment (79 females and 51 males, age ranges between 18 and 70 years old). A subset

of 55 participants (29 females and 26 males, age ranges between 18 and 53 years old) agreed to return one week later for a second session. The second session was intended to investigate whether people's susceptibility to different persuasive principles is consistent over time, but participants were not aware of this. Participants were recruited using email lists and social media platforms. Participants reported that they generally played games a few times per year (19 participants), a few times per month (20 participants), a few times per week (22 participants), every day (45 participants) and almost never (24 participants). Participants were not offered any monetary payment or reward to take part in this study. Table 1 shows participants' demographics.

Table 1. Participants' demographics

Study Session	Participants			Age Range
	Total	Males	Females	
Session A	130	51	79	18 - 70
Session A and B	55	29	26	18 - 53

2.3   Procedure

Participants were told that the purpose of this experiment is to investigate how persuasion principles influence people's behaviour and actions. Consent forms and information sheets were provided and participants were informed that taking part in the study was voluntary and that they could withdraw at any time and for any reason. All materials produced by the participants were stored securely. Ethical consent for our experiments was obtained from the Physical Sciences and Engineering ethics board of the University of Aberdeen.

Participants completed a brief demographics questionnaire, as well as the Ten Item Personality Inventory [7] to determine their personality traits. Additionally, participants were asked to play a short text adventure game in which they were shown a scenario and a list of quests displayed in a randomised order. The quests required participants to help various fictional characters and each quest reflected one of Cialdini's seven principles of persuasion. Table 2 shows the mapping of Cialdini's persuasive principles to the quests in the adventure text game.

Participants were told that they could only help one of the characters and they must choose one of the seven quest options. They were informed that they would receive the same reward, independent of the quest they choose to complete. We asked participants not to roleplay when taking decisions in the game, but instead, consider the choices as they would in real life. Figure 1 shows an example with the first game scenario and quests displayed in a randomised order.

After selecting a quest, participants received a randomly generated amount of gold and experience points. They were also given feedback about their progress through the game. A new round would start in which participants were shown a new list of quests to choose from, excluding any they selected in previous rounds,

Table 2. Mapping of Cialdini's persuasive principles to adventure game quests

Persuasive Principle	Quest
Authority	The king of these lands would really like you to help this character.
Liking	You have always admired this character and you enjoy their company.
Scarcity	This character is a traveling merchant who will be leaving tomorrow, so this is your only chance to help them.
Reciprocity	This character has done a favour for you in the past, so now you can help them too.
Commitment	You have already agreed to help this character with another task, so you could help them with this one too.
Social Proof	The majority of those living in this village would like you to help this character.
Unity	This character is originally from the same village as you.
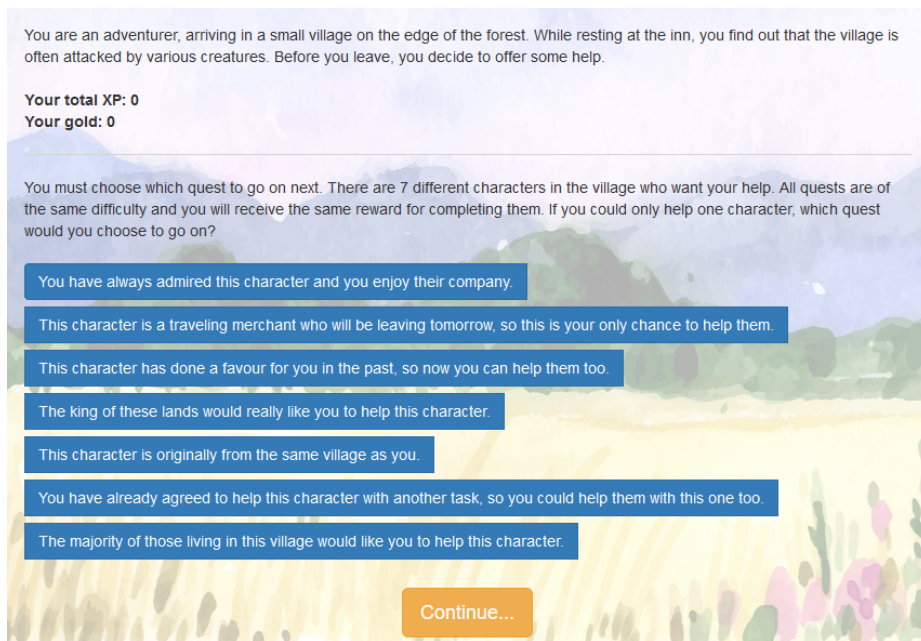
Fig. 1. Example of the first scenario in the text adventure game, followed by a list of quests displayed in a randomised order, reflecting Cialdini's principles of persuasion.

until only two choices remained. Thus, participants made a quest selection over a total of seven rounds. To maintain the influence of scarcity throughout the game, the quest would refer to a different character requiring help for a limited period of time during each round. Through this method, we were able to observe the action paths taken by participants in the adventure game. The order in which they selected quests resulted in a ranking for each persuasive principle, thus

showing the direct influence the messages have on behaviour. Figure 2 shows an example of the scenario in the fourth round when participants are left with four quest choices to select from.
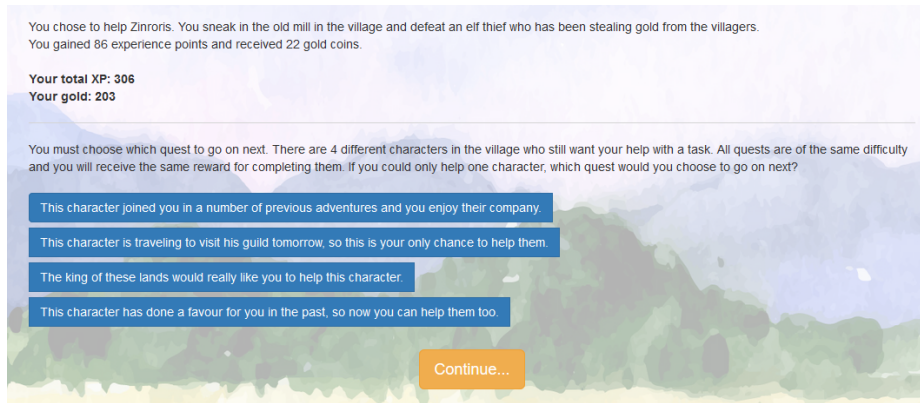

Fig. 2. The fourth scenario in the text adventure game showing feedback and rewards received, as well as a new list of quests displayed in a randomised order

After one week, 55 of the participants took part in the second session of the adventure game. We wanted to investigate whether the selections they make in the game after some time has passed are similar to their previous ones. Participants' progress was saved from the first session, so they kept any gold and experience points they earned in the previous week. The scenario and quests were slightly changed to provide continuity to the story in the game. Figure 3 shows an example of a scenario from the second session of the study. The quests were displayed in a randomised order.

3   Results

3.1   Influence of persuasive principles on behaviour

Overall, we identified that people are more susceptible to certain persuasive principles than others. Table 3 shows the frequency and percentages of what participants selected in each round of the game during the first session of the study. The highest proportion of participants chose to complete the quest reflecting the Reciprocity principle (32.8%) in the first round. They also preferred to complete the quests representing either the Reciprocity or Liking principles (29.9%) in the second round, followed by the Scarcity principle (24.6%) in the third round. This suggests that people are more persuaded by Reciprocity, Liking and Scarcity when they must make a choice regarding their next action. The least selected persuasive principle was Authority, with 28.4% of participants completing this quest last.
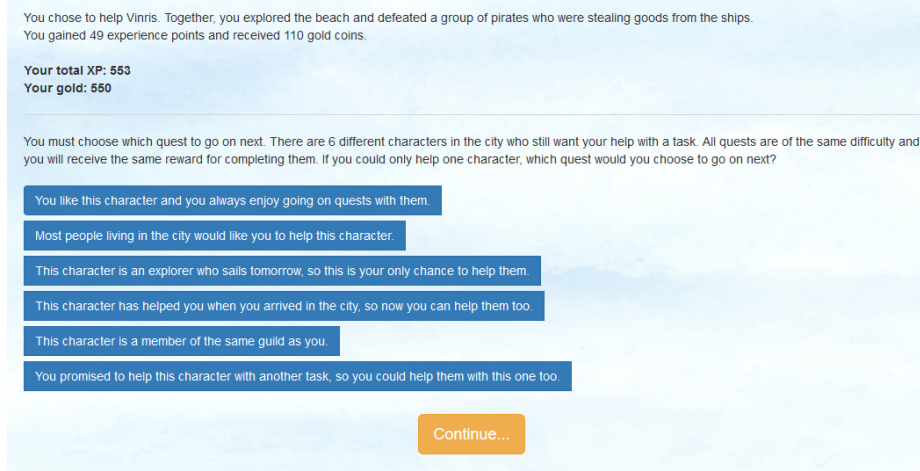
Fig. 3. Example of scenario in the second session of the study and the list of quests displayed in a randomised order

Table 3. Frequency and percentages of selections of quests reflecting persuasive principles across rounds R1 to R7 in Session A (N=130)

	Liking	Scarcity	Authority	Reciprocity	Unity	Commitment	Consensus
R1	30 (22.4%)	11 (8.2%)	7 (5.2%)	**44 (32.8%)**	4 (3%)	10 (7.5%)	24 (17.9%)
R2	**40 (29.9%)**	11 (8.2%)	7 (5.2%)	**40 (29.9%)**	7 (5.2%)	9 (6.7%)	16 (11.9%)
R3	18 (13.4%)	**33 (24.6%)**	10 (7.5%)	14 (10.4%)	16 (11.9%)	19 (14.2%)	20 (14.9%)
R4	17 (12.7%)	16 (11.9%)	20 (14.9%)	17 (12.7%)	18 (13.4%)	20 (14.9%)	**22 (16.4%)**
R5	14 (10.4%)	17 (12.7%)	25 (18.7%)	5 (3.7%)	**30 (22.4%)**	19 (14.2%)	20 (14.9%)
R6	7 (5.2%)	21 (15.7%)	23 (17.2%)	6 (4.5%)	**31 (23.1%)**	25 (18.7%)	17 (12.7%)
R7	4 (3%)	21 (15.7%)	**38 (28.4%)**	4 (3%)	24 (17.9%)	28 (20.9%)	11 (8.2%)

A Chi-Square Test showed that there is a significant overall difference between people's susceptibility to the various principles ($\chi^2(36) = 260.938$, $p < 0.001$). Pairwise comparisons (with Bonferroni corrected p-values to account for the 21 comparisons made) showed that Liking and Reciprocity were significantly different from all other principles ($p < 0.05$), but not from each other. Authority was significantly different from all other principles ($p < 0.05$) except from Unity and Commitment. Unity was significantly different from Consensus ($p < 0.05$). Other comparisons were not significant. Combining the results with Table 3, this seems to indicate that people were most susceptible to Liking and Reciprocity principles, and least susceptible to Authority, Unity and Commitment principles. Analysing whether the principles were used differently over different rounds, there is a significant difference for each principle (Liking $\chi^2(6) = 51.677$, $p < 0.001$; Scarcity $\chi^2(6) = 18.508$, $p < 0.01$; Authority $\chi^2(6) = 42.092$, $p < 0.001$; Reciprocity $\chi^2(6) = 90.662$, $p < 0.001$; Unity $\chi^2(6) = 35.954$, $p < 0.001$; Commitment $\chi^2(6) = 16.031$, $p < 0.05$), with the exception of Consensus ($\chi^2(6) = 6.015$, $p = 0.421$).

3.2   Influence of age, gender and personality on susceptibility to persuasive principles

To analyse the influence of different characteristics on susceptibility, we investigated the relationship between age, gender, personality traits, and the ranking of principles which resulted from participants' actions. We found a weak positive correlation between participant age and the ranking of the Authority principle (r = 0.278, p<0.01), as well as a weak negative correlation between participant age and the ranking of the Commitment principle (r = -0.240, p<0.01). This suggests that people's susceptibility to the Authority principle increases with age, while their susceptibility to the Commitment principle decreases as they grow older.

An Independent t-test was used to evaluate differences in susceptibility to different persuasive principles between female and male participants. We found that female participants had statistically significantly lower susceptibility (3.96 ± 1.8) to the Scarcity principle compared to male participants (4.73 ± 1.8), t(128) = -2.295, p = 0.023. This suggests that gender does not generally influence susceptibility to principles, but Scarcity could persuade male participants more than female participants.

To observe the effect of personality, we investigated the relationship between the five personality traits of the Five Factor Model [15] and the rankings obtained for each persuasive principle. We identified several significant correlations, shown in Table 4. For Extraversion, we found two weak negative correlations with Liking and Authority, as well as two weak positive correlations with Reciprocity and Commitment. A weak negative correlation was found for Agreeableness and Scarcity, as well as a weak positive correlation for Conscientiousness and Authority. Emotional Stability was positively correlated with Scarcity and Commitment principles, but negatively correlated with the Consensus principle. For Openness we found a weak negative correlation with Authority and a weak positive correlation with Commitment. These findings suggest that people's personality traits have an impact on their susceptibility to different persuasive principles.

Table 4. Correlations between personality traits and rankings of principles in Session A (N=130; * = p<0.01; ** = p<0.001)

	Liking	Scarcity	Authority	Reciprocity	Unity	Commitment	Consensus
Extraversion	**-.180***	-.052	**-.242****	**.183***	-.081	**.178***	.170
Agreeableness	.064	**-.232****	.072	.019	.082	0.57	-.036
Conscientiousness	.018	-.060	**.216***	.015	-.127	.110	-.171
Emotional Stability	-.092	**.173***	.054	-.097	-.068	**.175***	**-.173***
Openness	-.070	-.063	**-.193***	0.008	-.010	**.249****	.059

3.3   Consistency in susceptibility to persuasive principles

Our findings show that people's susceptibility to different persuasive principles does not vary over time. In general, participants who completed both sessions of the experiment were consistent in their choices and followed similar paths of action in the second session of the adventure game. A Paired Samples t-test was used to compare participants' rankings from the first session and the second session of the experiment. As shown in Table 5, we found no significant average difference between the scores of the two sessions, with the exception of the Commitment principle[3]. Table 6 shows that all the pair scores were significantly positively correlated. This suggests that people's susceptibility to different messages remains consistent over time.

Table 7 compares the mean and standard deviation for the rankings in the first and second sessions of the adventure game. We found that percentages of selections of quests reflecting different persuasive principles were similar in sessions A and B. Figure 4 show the percentages for the first three rounds of the adventure game. The majority of participants selected Reciprocity, Liking and Scarcity during the first round for both sessions, while only a small proportion of participants chose Authority or Unity.

Table 5. Paired differences between rankings of persuasive principles in sessions A and B (N=55; df=54; * = p<0.05);

	Liking	Scarcity	Authority	Reciprocity	Unity	Commitment	Consensus
Mean (SD)	-.400 (1.5)	.109 (1.7)	.200 (1.7)	.145 (1.7)	-.164 (1.4)	.436 (1.5)	-.327(1.6)
t score	-1.903	.457	.870	.629	.852	2.058*	-1.496
p-value	.062	.650	.388	.532	.398	.044	.140

Table 6. Paired Samples Correlations between rankings of persuasive principles in sessions A and B (N=55; * = p<0.01; ** = p<0.001)

Liking	Scarcity	Authority	Reciprocity	Unity	Commitment	Consensus
.599**	.653**	.458**	.348*	.582**	.655**	.614**

Table 7. Mean and standard deviation of rankings for Sessions A and B (N=55)

	Liking	Scarcity	Authority	Reciprocity	Unity	Commitment	Consensus
Session A	2.82 (1.7)	4.07 (1.9)	4.89 (1.6)	2.33 (1.5)	5.11 (1.5)	4.82 (1.9)	3.96 (1.7)
Session B	3.22 (1.7)	3.96 (2.2)	4.69 (1.6)	2.18 (1.3)	5.27 (1.5)	4.38 (1.8)	4.29 (1.8)

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[3] This was only borderline significant (p=0.044), so, if a Bonferroni correction was applied given the number of statistical tests performed, it would not be significant.
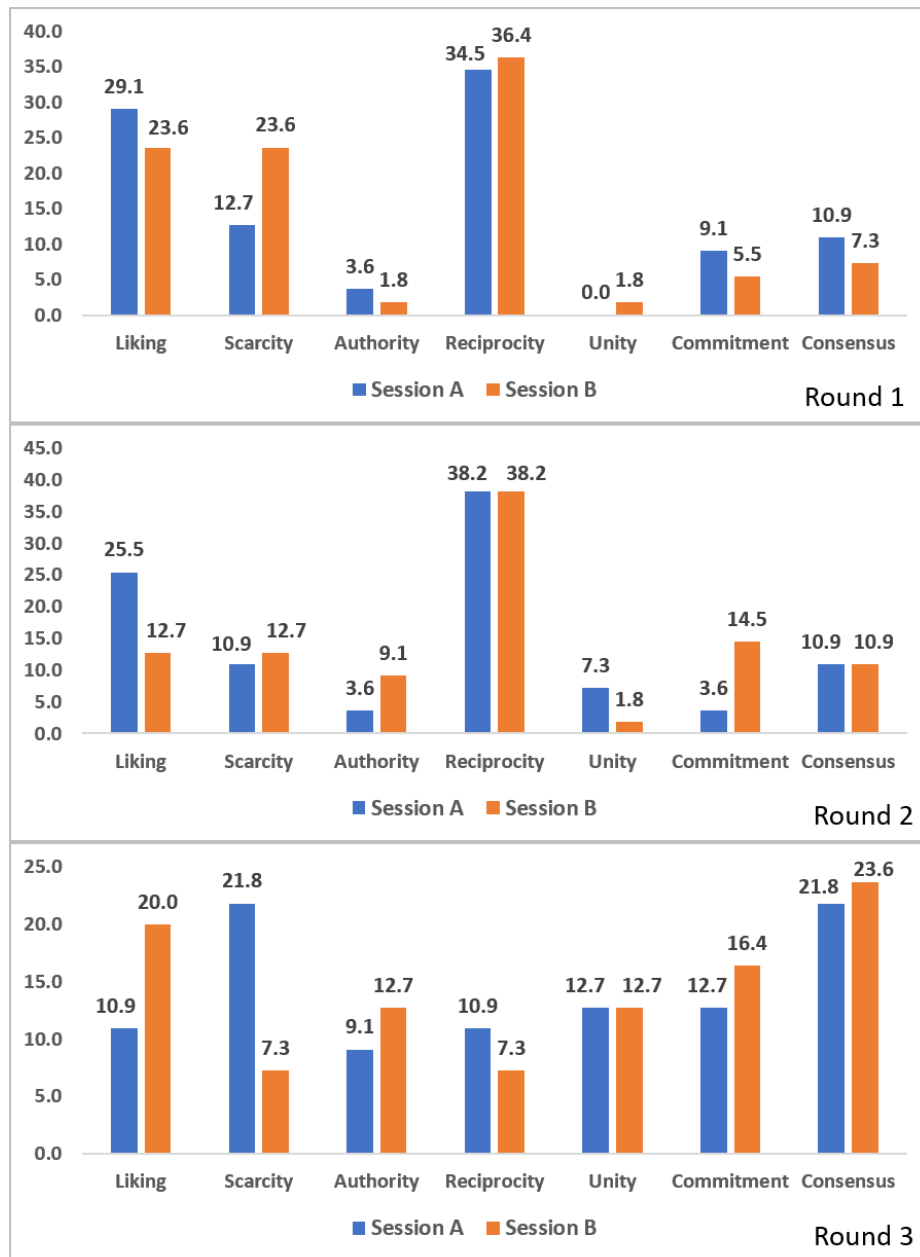
Fig. 4. Percentages for selections of quests reflecting different persuasive principles in the first three rounds of sessions A and B (N = 55)

4   Conclusions and Future Work

Our findings in this study lead us to conclude that people are influenced to take an action due to certain persuasive principles more than others. In general, Reciprocity and Liking were the most effective persuasion principles, while Authority and Unity are the least effective persuasion principles. The findings differ from work investigating perceived persuasiveness, such as [23] who found that people perceived messages using the Authority or Liking principles to be the most persuasive. This is an indication that what people perceive to be more persuasive is not necessarily what will persuade them to complete a certain action. Further investigation is required to identify differences between *percieved* and *actual* persuasiveness.

Recent work has shown that perceived persuasiveness to different message types is influenced by personality [8, 20, 21]. While our study focused on investigating actual persuasion, our results also show that personality influences people's susceptibility to different principles, while gender and age seem to have a small effect. Furthermore, we found that susceptibility to persuasive principles remains stable over time. This could be explained by the fact that people's personality does not change and, therefore the level of influence different persuasive principles has on them remains constant. In this study we investigated consistency over time with one week in between the two sessions. An additional study could investigate if susceptibility to different persuasive messages remains constant after a longer period of time.

The results of the study could support future work in personalising persuasive strategies and designing digital behaviour change interventions. We have done some initial research on how a gamified digital behaviour intervention can be adapted to encourage people of different personality types to perform kind activities [3, 5]. We also conducted a qualitative study on how to adapt activity complexity to personality, stress level and attitude [4]. Further investigation is necessary to find out whether other attributes such as an individual's mood states or need for cognition can impact susceptibility to persuasive principles.

In this study, participants did not have the choice to select no quest, so the results only show relative behaviour when individuals are exposed to all persuasive principles. Hence, it does not provide an absolute measure of actual persuasiveness, but a relative measure. A future study could investigate whether participants are persuaded at all. Future work could also explore actual persuasiveness in a different domain, such as persuading people to engage in healthy or sustainable behaviours.

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