My Freedom: Assessing Reactance in a High Freedom Persuasive Website

*Oluwande Adewoyin and Bosede Ayogu

Department of Computer Science, Federal University, Oye-Ekiti, Nigeria

{oluwande.ajayi|bosede.ayogu}@fuoye.edu.ng

Abstract - The freedom concept has been an important one, to daily engagement in activities and everything that becomes so close to people. One of them is computing systems that we use every day and they serve several purposes in moulding human lives. An important aspect of this is behaviour change as many have been successful while others have failed because they are too restrictive for use. However, the presence of freedom does not guarantee the success of many systems. Therefore, this work focuses on how reactance can still be experienced in a persuasive website that ensures freedom and non-forced compliance. Specifically, the work studied anger, compliance and perceived usability of a persuasive website that was developed to provide intervention for users in the area of healthy meal planning through manipulation of freedom levels. Results indicated that participants exposed to high freedom text had lower anger, higher perceived usability and higher compliance than participants exposed to low freedom text and social high freedom message. This led to the conclusion that users’ freedom feeling during a persuasive attempt can be boosted with the inclusion of high freedom message design and that the integration of social agents for persuasion enhancement must be done with great care.

Keywords - Psychological Reactance, Freedom, Behaviour change, Social Influence, compliance, persuasion, computing devices

1 INTRODUCTION

The use of computing devices for behaviour change intervention is not a new idea anymore. It is an established fact that there is need for positive behaviour change in people, most especially for people with health challenges like cancer, stroke, and heart diseases are caused by unhealthy behaviours like smoking, alcohol misuse and physical inactivity, while obesity and diabetes are majorly caused by unhealthy food choices, in developed countries (Scarborough et al., 2011). Therefore, bringing healthy behaviour change intervention more closely to people becomes a necessity.

Securing a modification of people’s behaviour in health starts with formation of intention for good behaviour. As Human Computer Interaction discipline is concerned, behaviour change relates to the use of computing systems as intervention to bring positive behaviours to individuals. For this to happen, most of these systems influence their users through persuasion. The need for better healthy behavioural intervention is growing higher every year. For example 484,700 hospital admissions were as a result of smoking behaviour between 2016 and 2017, while 77,900 deaths were caused by smoking in 2016 in UK (Digital, 2018).

Larger proportion of people use behaviour change applications every day to monitor their physical activity, calorie intake and other related behaviours (Mobiquity, 2014). For example Bewell+ app for sleep pattern monitoring (Lane et al., 2014), JITAI app for user’s health context sensing (Jaimes, Llofriu, & Raij, 2014) and the “Health Lifestyle Coach” for physical activity monitoring (Gasser et al., 2006). The major question is; how effective are they? Many people get these systems with many problems that developers failed to address during the development of such systems. Therefore, persuasion from these applications results to two likely outcomes; compliance or non-compliance through reactance to suggestion from these applications. This opposite reaction to persuasion from computing devices forms the motivation for this study.

Several authors have studied reactance to behaviour change applications through several ways in which message is displayed. Ghazali, Ham, Barakova, & Markopoulos, (2018b); Roubroeks, Ham, & Midden, (2011) discovered that psychological reactance can be regulated or minimised through the number of social stimuli of a personified virtual system. However, the work did not emphasise how reactance can be elicited in the presence of high freedom and non-forced compliance behaviour change system. On the other side, Ghazali, Ham, Barakova, & Markopoulos, (2018a) used the intertwined model (negative cognition and anger) to study reactance to a persuasive system and revealed that people in a trustworthy face condition had minimal reactance feelings although the study did not give insights into the user’s freedom level, perceived usability and compliance with the system.

This work examines how reactance can be elicited in the presence of high freedom, non-forced compliance persuasive website. Specifically, this work focuses on healthy food choices as an aspect of human behaviour that needs intervention through a persuasive meal planning website. The work is organized as follows: section 2 discusses the Psychological Reactance Theory (PRT), section 3 focuses on experiment, section 4 presents the results and section 5 concludes the study.

2 PREVIOUS WORKS

Many works on people’s reactions to suggestions from either people or technology has been carried out (Brinson, Eastin, & Cicchirillo, 2018; Cheung & Ho, 2017; McCoy, Everard, Galletta, & Moody, 2017). Generally, there are two possible outcomes; reactance or compliance. Therefore, Psychological Reactance Theory (PRT) has been an important concept that relates to people’s responses to proposition, influence and suggestion attempts in the domain of human-to-human and human-to-computer interactions. The theory states that for an individual at any specific time, there are sets of free behaviours for an individual. A behaviour is free if an individual possesses the essential “physical and psychological” abilities to involve in it cognisant of his free will to engage in the specific behaviour through experience, general custom, or a formal agreement (Brehm 1966). However, few times, a person may be...
uncertain about his freedom. This may due to ignorance or lack of adequate skill to engage in such actions and therefore, may not be able to identify the guidelines for such behaviour, but for individuals with awareness, if one of his free behaviours is threatened, he/she will experience reactance, leading to display of opposite behaviours to to restore a threatened freedom through behavioural and mental efforts (Brehm & Brehm, 1981; Rains, 2013).

Therefore, PRT was a tool to maximize the satisfaction needs for people that are conscious of their liberty and associated behaviours for people with little or no required freedom. Reactance can prompt both undesirable and desirable outcomes in people (Steindl, Jonas, Sittenthaler, Traut-Mattausch, & Greenberg, 2015). For desirable outcomes, the sense of reactance can intensify enthusiasm for enhanced achievement as the experience of reactance has been associated to anger and arousing positive affect, like perseverance and determination (Steindl et al., 2015). This is also likened to the intertwined nature of reactance, as studied by Dillard and Shen, (2005) to consist of cognitive elements and emotion which were believed to be undividable. Shen (2014) revealed that any aggressive persuasion will prompt reactance in individuals; therefore suitable message framing becomes a necessity. Sinclair, Felmlee, Sprecher, & Wright, (2015) showed that independent people will disregard negative social network opinions about their preferences, indicating that reactance regulates people’s emotions on social network sites. Lastly, Kim (2017) indicated that antismoking campaign from a reliable media is viewed to be less biased than messages from an unpleasant media. This is associated to the perceived threat to freedom which is also connected to psychological reactance, causing undesirable attitudes towards the message advocated. For computing devices, several works have studied reactance through social agency and freedom while others studied reactance through the intertwined model.

For example, Roubroeks et al., (2009) affirmed that reactance can be aroused through social agency but the work did not indicate the effect of reactance in users relative to freedom or the effect of freedom on reactance. In a recent study, the authors discovered that psychological reactance can be regulated or minimised through the amount of social stimuli of a personified virtual system (Ghazali et al., 2018b; Roubroeks et al., 2011). However, the work did not emphasize how freedom can be used to minimise reactance and enhance usability and compliance to behaviour change technologies. On the other side, Ghazali, Ham, Barakova, & Markopoulous, (2018a) studied reactance through the intertwined model (negative cognition and anger) and revealed that people in a trustworthy face condition had minimal reactance feelings although the study did not give insights into the user’s freedom, usability and compliance with the system.

In addition to these limitations, a study showed that a system may have high usability without any appeal, if the user’s freedom for another choice is threatened (Murray & Häubl, 2011). Adewoyin, Oluwadare, & Daramola, (2017), revealed that forced compliance made users to experience reactance and lower perceived usability when they were confined to only one choice. However, reactance does not happen in forced compliance only. A better approach and focus of this study is to see how reactance occurs in a persuasive website that ensures non-forced compliance (full freedom) with social agency, high and low freedom text. The social agency has been discussed in a previous study, therefore, we refer our readers to Adewoyin et al. (2017). This is applied to food selection in a persuasive meal planning site. Previous studies have focused on using digital video games to influence people’s food choices (Alblas et al., 2018) and how mobile apps can be used to minimise obesity in young girls (Nollen et al., 2014). None has studied how reactance occurs in meal planning persuasive systems. This work will extend researches in healthy food choices through PRT. Specifically, how reactance occurs in a meal planning site that allows users plan their meal the way they want it, without forcing compliance to influence attempts.

### 2.1 Perceived Usability

Usability refers to satisfaction, effectiveness and efficiency with which users attain their goals during interaction with systems (DIS, 2009). However, there has been several attention to user experience by bringing individuals’ perceptions that arrived as a result of system’s usage during and after interaction and this includes beliefs, emotions, psychological and physical responses (Thanh, Hornbaek, & Subramanian, 2017). Within behaviour change context, perceived usability implies that any system that causes psychological reactance in its users has a higher tendency of being abandoned through appropriation of a negative perception (Ehrenbrink, Hillmann, Weiss, & Möller, 2016). An example is Samsung’s pre-installed bloatware on Smartphone products, which cannot be uninstalled by its customers. This led to the increase in the overall sales of those applications. However, from the other end, it has led to psychological reactance through angry comments and bad usability assessments of those applications. To correct this, Samsung reduced the quantity of pre-installed bloatware on its new products and also allows the un-installation of these bloatware based on user’s choice (Sammobile.com., 2015).

In this view, as many systems become closer to users on daily basis and as the need for behaviour change becomes higher, perceived usability becomes an important factor for the acceptability of systems because reactance determines perceived usability and acceptance of such systems by its users. Therefore, psychological reactance could be a damaging bias that can hinder any system from being seen as usable and acceptable (Ehrenbrink et al., 2016). The belief is that there will be little or no perceived usability and high non-compliance for a system that triggers reactance in people. This is a new dimension to the assessment of reactance in persuasive websites.

### 2.2 Non-Compliance

Noncompliance means refusal to comply or obey. With respect to behaviour change, non-compliance simply
denotes the act of not following a proposal from either a fellow human or an influencing system. Many people view noncompliance as having positive effect in people (Lalley and Malloch, 2010,) while others view it as an alternative route to avoid any disturbance when they perceive the initial proposition as harmful (Saleem et al., 2011; Schoville, 2009).

There is an analogy between reactance and noncompliance as many scholars believed that the elicitation of reactance in people leads to noncompliance. Tatum, Olson and Frey, (2018) demonstrated that participants did not agree with discouraging cell phone use for noneducative purpose in a classroom setting. These two variables predicted noncompliance and gave detail insights about how reactance elicitation triggers noncompliance and other freedom restoration behaviours in people (Tatum et al., 2018). However, the study only reflected how reactance and noncompliance could be triggered through implementation of rules, and not computing devices themselves. Therefore, this study will look at how we could study reactance and noncompliance in persuasive website through comparison of various freedom levels to see which one enables compliance and reactance in people.

3 METHODOLOGY
3.1 OBJECTIVES
The objective of this work is to assess psychological reactance to a high freedom, non-forced compliance persuasive meal planning website. Meal planning was chosen as a domain because there was need to influence people’s healthy food choices. In this study, an experiment was designed to access users with respect to emotional responses (anger), perceived usability and compliance to a recommendation from a website. If there is absence of negative emotions like anger and presence of compliance to recommendation, then reactance has not been elicited.

To accomplish this, participants were assigned to control group which is a high freedom text only group or any of two treatment groups in which one is a low freedom text only group while the other is a social high freedom message group, through a between-subject design (Charness, Gneezy, & Kuhn, 2012). Therefore, each participant is allowed to participate in one group only. This determines whether participants hold a different view in their responses when the dependent variables (perceived usability and anger) are assessed in different groups. It also guides against leftover effects like providing similar responses to previous and present freedom condition associated with within-subject design. The only constraint of this arrangement was the large number of participants, but this does not override the power and advantages of the design. After assignment, they were advised to organize their meals on a website. During this process, they were interrupted by popups based on the groups they belong to and were asked to access the website for perceived usability, anger towards the website.

We have introduced perceived usability as a new feature for the evaluation of reactance. In this view, any reactance eliciting system will be perceived as having zero or low usability with low compliance, even if it is highly functional. However, in the presence of high-freedom system, message design and display also plays an important role in reactance elicitation or minimization (Shen, 2015). Therefore, high, low-freedom text-only messages, as well as animated popups were included as interrupts to access the effect of social agency in reactance, whether they can elicit more reactance as proposed by Roubroeks, Ham and Midden, (2011) and Ghazali et al., (2018) or minimise reactance. Therefore, this work measured reactance through low freedom text-only messages, high freedom text only messages, high freedom text and social messages.

3.2 EVALUATION
The study consists of both treatment and control conditions. High freedom text only messages were presented to participants in the control group. Low freedom text messages or high freedom social messages were presented to participants in the treatment groups. These are well discussed in section 3.6. The study was conducted through a website to assess participants’ reactance in terms of anger, perceived usability and noncompliance to a high freedom text messages, low freedom text messages and high freedom social messages for a month with each session lasting for fifteen minutes. Invitation was through emails and social network sites, enlightening them that the study is to evaluate the website for usability and to motivate them to give impartial assessment of the website’s usability.

3.3 HYPOTHESES
Hypothesis 1: Low-freedom text-only messages will initiate more reactance than high freedom text messages in a persuasive website.
Hypothesis 2: High-freedom and social messages will initiate more reactance than high freedom text messages in a persuasive website.
Hypothesis 3: High freedom text messages will have higher perceived usability than low freedom text messages.

3.4 DATA COLLECTION
Before commencement, link was sent to participants via social network sites and mails. One hundred and six people responded to the study. Data gathering was organised in a manner that allows participants’ demographic and personality data to be gathered before they were allocated to the different treatment groups, which is made of meal planning. At the end of the task, participants were directed to the anger and System Usability Survey page.

Brooke’s System Usability Survey Brooke, (1996) was adapted for perceived usability assessment because it provides a more direct assessment of systems usability like websites. There are also other instruments like the Hongs scale (Hong & Faedda, 1996) and Task Completion Rate (TCR) (DeVita, Schaefer, Lutz, Wang, & Dongilli, 2005). The Hongs scale was not used because it reveals reactance assessment motive to participants and this can make participants to provide biased responses. The TCR was not used because it only provides a percentage of essential tasks completed during a task.
session without insights into user’s reactance feelings as there are many reasons for task completion or incompletion apart from reactance. More so, users can successfully finish many tasks within a short period and still have a negative perception of the system. It is believed that a low freedom/high threatening system will have a low usability rating and low compliance while a high freedom/low threatening system will have a high usability rating and high compliance by its users. Dillard and Peck, (2000) developed the anger survey and it is made up of four items. It has been adapted in several studies on reactance to access emotional levels of individuals relative to influence attempt. In this present study, the anger survey was utilized to ascertain participants’ level of happiness while indirectly accessing their reactance with respect to anger to the website’s influence attempt as it is believed that any low freedom system will elicit anger in users. These items were accessed with a five-point Likert scale from strongly disagrees to strongly agree.

3.5 SAMPLE SIZE ESTIMATION
This study estimated an effect size (d) of 0.70 and desired for a statistical power of 0.87 at a probability level of 0.05 for two tailed tests. The sample size (N) are estimated as follows:
With d = 0.70
Power = 0.87,
Non-centrality parameter Delta (𝛿) = d(√(N/2))
For power of 0.87 at 0.05 probability level, 𝛿 = 3.10
3.10 = 0.7(√N/2)
N = 27.46 estimated to 28 participants per group.

3.6 PROCEDURE
The study began by sending a mail containing a brief study introduction to the participants. Participants were told that the meal-planning page is to be evaluated for usability to minimise prior reactance feelings. The screenshot is shown in fig 4. Within the message, is a link to the consent page. Clicking on the OK button takes the participants to the demography page which is made up 5 items. After responding to the questions, they were expected to click on the “Next” button, which directs them to the task page.

The task page was designed to be a meal-planning page. There are various food items on the left pane and participants were instructed to plan their meals by choosing from these food items. There are different categories for food items; the “All”, “main course” and the “desserts”. Each of these categories were contained in a canvas for proper grouping. They are “ALL”, “Main course” and “desserts”. The “ALL” group is made up of all food from the main course and the desserts. It provides users with all available food items at once. This is shown in figure 2. The main course group is made up of food items like grilled salmon, green beans, boiled peas, fried beef, fried chicken, macaroni cheese, refried beans, boiled potatoes, grilled chicken, fried rice, chips, and baked beans. The dessert category consists of food items like rice pudding, sponge pudding, fruit salad and brandy snaps.

In addition, food items in the “ALL” category were logically divided into nourishing and non-nourishing foods. Participants could organize their meals in the beginning and implement their own arrangement for the foods. This decision is based on the notion of freedom as described by Brehm (1966) that people must be cognizant of their freedom to participate in any activities they like. These food items were purposely chosen to be appropriate for individuals from various ethnic backgrounds and in addition to allow people make use of suitable and healthy food combinations. For instance, a meal can be made up of grilled chicken, chips and fruit salad. As participants make their food selections, the selected food items appear on the right empty pane.

The messages were low freedom text, high freedom text or high social freedom message. The low freedom text does not give participants enough freedom to explore other. In the current study design, this is reflected in the high-threatening and controlling tune of the message like “replace chips with boiled potatoes now”, as depicted in figure 1. This restricts participants to only one option. The high freedom text allows participants to explore other behavioral choices with respect to their current food selection. This is reflected in the non-threatening and non-controlling tune of the message like “you can replace fried beef with grilled salmon if you like as shown in figure 2. In addition, the interrupts could also be high freedom texts with animated gif to depict social interaction of high freedom message as shown in figure 3. The current study design ensures that compliance is not enforced with recommendations as participants can decide to neglect the propositions and proceed with their meal planning task. After finishing the meal-planning task, participants clicked the “Next” button, which directs them to the SUS and the anger survey page.
4 RESULTS

4.1 DEMOGRAPHICS

A total of one hundred and six participants responded and finished the task. 60.38 percent of participants are under 18, 33.96 percent are within the age range of 18-24, 33.96 percent are within age range 25-34 while 5.66 percent participants are within age range 35-54. No participant was above 55. These confirmed that larger percentage of the population were young adults.

Sex: 41.51 percent of participants are male while 58.49 percent of participants are females.

Marital status: 88.68 percent of participants are single, 10.38 percent are married, and 0.94 percent i.e. 1 participant was a widow while no participant was divorced. These data confirm that a larger percentage of the population were single.

Most frequent language spoken: 56.60 percent are English speakers 1.89 percent are Arabic speakers, 1.89 percent) participants are Spanish speakers, 0.94 percent are Portuguese speaker while 38.68 percent are Mandarin speakers. This is because a lot of people responded to the survey through emails and social network sites as majority of people in my social network sites are English and Mandarin speakers.

4.2 DESCRIPTIVE STATISTICS

Table 1 shows the results gotten from the anger and SUS.

|                          | High freedom text (N=32) mean | Social high freedom text (N=38) mean | Low freedom text (N=36) mean |
|--------------------------|--------------------------------|-------------------------------------|-----------------------------|
| Mean                     | 6.81                           | 8.89                                | 10.14                       |
| Standard Deviation       | 2.01                           | 2.90                                | 2.94                        |
| Anger                    | Perceived usability           | Mean                                | Std                          |
|                          | 75.23                          | 69.21                               | 66.46                       |
|                          | 7.79                           | 10.01                               | 10.68                       |
|                          | Non-compliance                 | Mean                                | Std                          |
|                          | 37.50                          | 39.48                               | 44.5                        |

Result from Hypothesis 1

T-test results indicated that low-freedom text category had a higher anger score (mean = 10.14, std dev = 2.94) than participants in the high freedom text group (mean = 6.81, std dev = 2.01) at t = -5.38 with df = 66, p-value < 0.01, CI [-4.97, -1.69] at d=1.32, which shows a statistically significant difference. This led to the conclusion that low-freedom text message will elicit more reactance with respect to anger than high freedom text message in any influencing system like persuasive website.

In terms of non-compliance, 31.25 percent of participants ignored all the messages in the high freedom text group while 38.89 percent of participants ignored all the messages in the Low-freedom group. 43.75 percent of participants complied initially and later ignored the messages in the high freedom text group while 50 percent of participants complied initially and later ignored the suggestions in the low freedom group. 25 percent of participants obeyed all the messages in the high freedom group throughout while 11.11 percent participants obeyed throughout in the low freedom group.

Result from Hypothesis 2

T-test showed that high freedom-text group had a lower anger score (mean = 6.81, std dev = 2.01) than participants in the social high freedom message group (mean = 8.89, std dev = 2.90 at t= -3.43, df = 68, p < 0.01, CI [-3.69, -0.47], d = -0.82, which signifies a significant difference between the means. This led to acceptance of the alternative hypothesis (H1) with an important inference that if social agents are not properly integrated into any persuasive message design, feelings of anger can be aroused in people even when they are meant to elicit social interaction between users and the systems.

For non-compliance, 31.25 percent of participants ignored all the messages in the high freedom text group while 36.84 percent of participants ignored all the messages in the high freedom and social message group. 43.75 percent of participants complied initially and later ignored the messages in the high freedom text group while 42.11 percent of participants complied initially and later ignored the messages in the high freedom message group. 25 percent of participants obeyed all the messages in the high freedom group throughout while 21.05 percent participants obeyed throughout in the high freedom and social message group.

Result from Hypothesis 3

Participants in high freedom text group had higher perceived usability score (mean 75.23, std dev = 7.79) than participants in low freedom text group (mean = 66.45, std dev = 10.68 at t = 3.83, df = 66, p-value < 0.01, CI [2.69 to 14.85], d = 0.93, indicating a statistically significant difference. This led to the rejection of the null hypothesis and the conclusion that high freedom texts will lead to higher perceived high usability in persuasive systems like websites than low freedom texts.

4.3 DISCUSSIONS AND CONCLUSION

Results from the anger study indicated that participants within the high freedom text group had a smaller mean anger score than participants within the low freedom text group. High freedom (low control) communications will elicit no reactance in people than low freedom (high control) communications. Therefore, hypothesis 1 was confirmed. This is also related to the presence of high control in human to human communications when people are coerced to follow an instruction, reactance feeling, in the form of anger is elicited, but when people are advised and given autonomy of decision making, anger feelings are minimised.

Hypothesis 2 was confirmed for the Social Agency Theory, as participants in the social high freedom message group had more anger scores than participants in the high freedom text group. One major expectation for this is the presence of high freedom will minimise reactance. However, this is not the case as more reactance were recorded. A major justification for this is that in the context of meal planning, everyone has his own way of preparing a meal. Therefore, reinforcing a high freedom persuasion with agents stimulated anger feelings but not as intensive when compared with the low freedom text group. This is also in line with previous studies like Williams et al. (2018) and Ghazali.
et al. (2018) where social agents failed to yield intended persuasive results, one can infer that with a well-designed high freedom message, there is no need to reinforce a persuasion with agents as users can perceive an agent’s social interaction as threatening or deciding for them. Therefore, the inclusion of social agents to enhance persuasion must be considered very well before integrating them into persuasion design.

Two insights were gotten from these results. Firstly, perceived usability of any persuasive system can be enhanced with high freedom messages. This is reflected in the results from hypothesis 3 as participants in the high freedom group had positive perceived usability rating than participants in the low freedom group. Secondly, for social interaction, the social high freedom group had better perceived usability rating than the low freedom text group. Again, the moderating effect of high freedom messages is reflected here as participants still perceived the meal planning site to be usable in the presence of social agents. However, this perceived usability is still lower than the high freedom text only group. This insight can also apply to other factors like satisfaction, usefulness, learnability and others, but they are not within the scope of this study, we recommend them for further studies.

For compliance, minimisation of reactance made compliance to be higher in high freedom text group than low freedom text group for hypothesis 1. This brings an important insight that compliance to persuasive communication can be realised through proper design of high freedom messages. Also, compliance was higher in social high freedom group than low freedom text group, but this is not as high as the high freedom text only group. One major reason for this observation is the moderating effect of the presence of high freedom text in social interaction. The effect of agents was not noticeable in the persuasion process. For future research, we recommend a better approach to accessing reactance in people. We suggest monitoring people’s feeling through ambient intelligence and making inference from recorded data. This will minimise bias responses gotten from self-reports.

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