

Original Research Article

Attitudinal Reactance: Another Response to Influence Attempts in Websites

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Abstract

The use of behavioural change systems in providing interventions for people is common in this present era of information technology. Many people depend on these systems for many reasons like safe driving, healthy food consumption, energy conservation, etc. Some of these systems have been successful in making people change positively while a larger percentage have not been successful due to many issues that were not addressed during the development of such systems. One of them is psychological reactance, a motivational state that is aroused when a person's freedom is threatened or eliminated. It has major focus restoring any freedom that has been threatened. This forms the motivation for this work and it starts with a brief study of the theory of psychological reactance with a new view of accessing it from perceived usability perspective. To study reactance in people, a survey was conducted. It focussed on accessing reactance through attitudes to forced compliance in a persuasive website in the context of meal-planning. Results from this study showed that participants with high freedom text had better attitude to the website in terms of anger and perceived usability than participants with low-freedom text. This work confirmed the social agency proposition that the presence of social cues in a multimedia message can stimulate the social interaction pattern in people's learning. Once this social interaction pattern is initiated, there is a high possibility for pupils to act as if they are interacting with another individual. Therefore, to some degree, social convention of human-to-human interaction sets in as participants with high freedom message had a lower anger score than participants with high freedom plus social message.

Keywords: Social influence; Behaviour change; Psychological reactance; Habits.



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1.0 Introduction

During the last decade, there have been improvements to computing devices introduced to people. They range from computers, mobile phones, wearable, etc. Nowadays, people have access to the internet through these devices. This easy access to the internet has provided lots of online resource for people to use. One of which is bringing behavioural intervention close to people to effect positive behavioural change.

Behaviour change relates to the modification of people's activities and conduct. It starts with development of intentions to change from bad to good behaviours. As the discipline of Human Computer Interaction is concerned, behavioural change refers to the provision of interventions through computing systems to enact positive behaviours in people. In order to accomplish this goal, computing systems use persuasion to inform people of their behaviour change goals.

In a study conducted by Mobiquity, (2014), a large proportion of people use computing devices on daily basis to monitor their calorie intake, physical activity and other aspects of their lives. This statistic shows that computing devices are really being used for ensuring positive behaviour change in people but a question that remains unanswered is how effective are these behavioural change computing systems? There are many behavioural change systems in the market. A lot of people get these systems and they are faced with so many issues which were not addressed in the design of such systems. Therefore, when people are persuaded by such systems, two things are likely to happen, it is either people comply with the suggestion or react against the suggestions from these devices. This opposite reaction to persuasion from computing devices forms the motivation for this work.

Psychological reactance is a motivational state that is aroused when a person's freedom is threatened through influence attempts of persuasion. It happens in many influence attempts found in human to human communication and also in human to computer communications. The focus of reactance is to restore freedoms that have been threatened by persuasion attempts from people or persuasive systems (Brehm, 1966). Looking at the human nature, people love to be in charge of their lives without any control from an external party. They love to have a sense of autonomy and self-determination (Deci and Ryan, 1985). From this view, any influence from a third party may likely be considered as an encroachment into personal lives or as disturbance to people's normal activities.

With this issue in mind, it has been observed that many persuasive systems have been developed without consideration for people's sense of control and autonomy. For example the "Health Lifestyle Coach" app that encourages smartphone users to engage in physical activity through self-monitoring, goal setting and social facilitation (Gasser et al., 2006), Bewell+ app that helps users monitor their sleep patterns through stated goals by examining several patterns of behaviour and providing feedback to users (Lane et al., 2014) and JITAI app that forecasts peoples' health state through context sensing (Jaimes et al., 2014). These applications were reported to be successful without

detail reports of reactance consideration in their design and development. Therefore, this becomes a major issue that needs to be addressed in order to get successful results and long-term effects for positive behaviour through behavioural change systems. Therefore, this work will be focusing on how reactance occurs with respect to persuasive websites.

2.0 Previous Work

There has been some previous works on people's reactions to suggestions from either people or technology. In general terms, it is either that they comply or react against the suggestion. One of the most important concepts that relates to people's reactions is the Theory of Psychological Reactance. This concept was introduced by Brehm, (1966). In his work, he stated that for a particular individual at any given time, there is a set of behaviours in which he can engage in. This set of behaviours is called "free behaviours" and can include smoking, drinking, dancing, reading, playing etc. A behaviour is said to be free if a person has the required "psychological and physical" capabilities to participate in it and he must be conscious of his freedom to participate in it either by a formal agreement, general tradition or experience (Brehm 1966).

At times, an individual may not be sure whether he is free to engage in a particular behaviour. This may be due to inadequate information or lack of required experience to participate in such behaviour and therefore, he may not distinguish the rules guiding such behaviour. The theory of psychological reactance can be stated as follows:

"Given that a person has a set of free behaviours, he/she will experience reactance whenever any of those behaviours is eliminated or threatened with elimination" (Brehm, 1966).

This means that if an individual has three free behaviours and one out of those free behaviours is threatened with elimination, he/she will experience reactance.

Brehm and Brehm, (1981) advocated that the loss or threat to freedom motivates an individual to restore the threatened or lost freedom. Therefore, the most sincere manifestation of reactance is engaging in a behaviour focused towards re-establishing the freedom that was threatened or eliminated (Brehm and Brehm 1981) through cognitive and behavioural efforts to reinstate someone's freedom followed by the feeling of emotion. Threatened individuals usually feel angry, uncomfortable, violent and unfriendly (Rains, 2013). For example, a person whose current freedom to buying inorganic onions has been threatened not to buy inorganic onions may look for ways of getting his freedom by looking for different sellers of inorganic onions, even when the sellers are far from his house. This relates to a direct consequence of reactance as it causes more attraction for the threatened behaviour. The attempt to restore threatened freedom is also likened to the boomerang effect which refers to the unplanned effects of a persuasion attempt leading to the adoption of an opposite behaviour (Brehm and Brehm 1981). In addition to

this, there is personal attractiveness for a threatened choice than when the choice was not threatened (Brehm and Brehm, 1981). According to Brehm, (1966) reactance arousal is highest when a freedom is totally removed. This means that when there is no other alternative to re-establish the freedom, reactance is provoked and has the effect of making the choice more desirable (Brehm, 1966).

The theory of psychological reactance has some implications for the understanding of behaviour, most especially to persuasive websites and behaviour change in general. It proposes that people may occasionally be driven to repel or act contrary to a tried social influence like persuasion, and that people may prevent their personal space or privacy from been invaded. They may reject favours that are likely to obligate them. They can even threaten or eliminate their own choices thereby increasing the difficulty of choosing an option when they have to pick from two or more alternatives (Brehm and Brehm 1981). Therefore, the theory of psychological reactance was seen as an instrument to take full advantage of satisfaction for people that are cognisant of their freedom and related behaviours for people that do not have the required freedom.

Additionally, reactance can elicit both unfavourable and favourable results in people (Steindl et al., 2015). It has been seen, that the feeling of reactance can stimulate enhanced achievement enthusiasm. Latest studies have also revealed that the feeling of reactance can be related not just with undesirable feelings, like anger, but also with stimulating positive affect, like strong-mindedness and determination (Steindl et al., 2015)

There are many studies conducted on people's reactance to influence attempts after the formulation of Psychological Reactance Theory (PRT) by (Brehm 1966). For example, the work of Milgram, (1973), focused on how far people could obey an authority. In this study, a researcher instructed participants to give electric shocks to people complaining and refusing to continue with the experiment. Sixty five per cent of the participants finished the task by giving shocks to people while other stopped and could not continue administering shocks due to the torture. The study concluded that people who tend to obey an authority figure are unlikely to experience psychological reactance (Milgram, 1973). In addition, (Dillard and Shen, 2005) worked on the nature of psychological reactance and came up with an intertwined model comprising of emotion and cognitive elements which are inseparable, (Shen, 2014) showed that any threatening persuasive message will invoke reactance in people, hence the need for appropriate messages framing. (Sinclair et al., 2015) showed in their work that people who are independent are capable of ignoring negative network views about their choices. This shows that reactance moderates people's emotional feelings social network sites. Lastly, in the work conducted by Kim, (2017) results showed that antismoking campaign from a consistent media is believed to be less biased than the same message from an hostile media. This is related to perceived threat to freedom which is also linked to psychological reactance, leading to undesirable attitudes towards

These studies are psychological studies on reactance and they

relate to how persuasion and reactance happens in human-to-human communications. In the area of reactance to persuasive messages from computing devices, behaviour change and HCI as a whole, few studies have been carried out. For example, the study conducted by Edwards et al., (2002), showed that the more entertaining and informative a popup ad is, the less intrusive it is viewed. Also, the more intrusive an ad is, the more irritating it becomes. Roubroeks et al., (2009) revealed that there is a positive relation between social agency of the message source and psychological reactance experienced through the message. In their later work, the authors found that psychological reactance can be controlled or minimised through the number of social prompts of an embodied virtual system (Roubroeks et al., 2011). In addition, Kwon and Chung (2010) identified psychological reactance as one of the major problems of recommendation in e-commerce sites. The authors examined likely causal relationships between quantitative and qualitative factors and included them in the process of recommendation to minimise reactance against recommended products (Kwon and Chung, 2010). Lastly, Murray and Häubl (2011) only used the paradigm of psychological reactance to broaden HCI field by concluding that freedom perception of choice has vital role to play creation of interface preferences for users. Their study revealed that a system may be easy to use relatively but it may not be appealing if user's freedom to explore an alternative is threatened (Murray and Häubl, 2011)

These evidences showed that there are studies on how reactance happens in computing systems but they do not relate to healthy behaviour change in people with respect to reactance processes. Therefore, a need arises to study how reactance happens in persuasive websites and how they can be minimised.

The theory of psychological reactance can be traced back to self-deterministic theory by Deci and Ryan, (1985) and autonomy theory (Hodgins and Knee, 2002). There are also some theories related to psychological reactance. They are Social Agency theory and the boomerang effect theory but the social agency theory will be discussed in detail as it forms the major theoretical background for this work.

2.1 Social Agency Theory

The social agency theory was proposed by Mayer, Sobko, & Mautone, (2003) and it is related to education. It states that the presence of social cues in a multimedia message can stimulate the social interaction pattern in people's learning. Once this social interaction pattern is initiated, there is a high possibility for pupils to act as if they are interacting with another individual. Therefore, to some degree, social convention of human-to-human interaction sets in (Mayer, Sobko, and Mautone, 2003). Basically, the theory postulates that using verbal and social visual prompts in computer environments can aid the development of connection between learners to view their interaction with the computer to be related to their expectations from human to human communication (Atkinson et al., 2005).

This theory had its source from the work of Reeves and Nass,

(1998) that in the manner that a computer communicates, directs and interacts with people, they are close to people, to the extent that they motivate social reactions and responses in people. The motivation may not be much but if there are some behaviours that denote social presence, people will react accordingly. Therefore, any close medium to humans will be treated the way humans are treated. This was confirmed in their study on politeness to computers. Participants who gave responses to questions on the same computer that engaged them in a task gave more positive answers than the participants who gave response to questions on a computer different from the one that engaged participants in a task. This means that computers were given the same polite treatment given to people (Reeves and Nass, 1998).

This theory is also in line with Computers as Social Actors (CASA) by Nass et al., (1994), which states that people respond to computers as if they are responding to other people (Nass et al., 1994; Klein, 2016). The paradigm embraces the theory of Mindless Behaviour by Langer, (1992) which states that when people are in state of mindlessness, they act on an automatic model and they do not consciously think about their behaviour (Adams et al., 2015).

Therefore, their attention is directed to relevant information about the recent task thereby giving no chance for any alternative information (Langer, 1992). From this idea, when people relate with computers, they mindlessly create an early engagement with social display of human-human communication seen in the past. This happens because of the conscious devotion to a category of contextual cues. These cues activate the different labels, scripts and expectations, which centres people's attention on some information while directing their attention away from other information. People reacting mindlessly often commit too early to very simple scripts drawn from the past. Therefore, the description of mindlessness gives the standard for indicating that social reactions to computers are mindless. It also provides means for getting these mindless social responses (Nass and Moon, 2000). Therefore, the CASA paradigm suggests that the presence of social cues activates social rules and people respond according to these social rules (Nass et al., 1994).

However, Shneiderman, (1997) had a contradictory view by stating that direct interaction is better and more beneficial than an indirect interaction through an animated agent because these agents do not and will never get to the full level of human intelligence as there are many anthropomorphic projects that were turned down by users. (Shneiderman, 1997). In addition, Dehn and Van Mulken, (2000) reviewed thirty studies that involve the use of animated agents in conversation and resolved that the effect of these agents on human engagement and performance is inconclusive (Dehn and Van Mulken, 2000).

Relating this to reactance theory, Roubroeks et al., (2011) suggested that the Social Agency Theory also holds for psychological reactance. They stated that the presence of an artificial social agent could trigger reactance in people. From the social cue hypothesis, if there are social cues like human voices or facial representations in an interaction, people tend to perceive

the computers better and rate them more positively (Louwerse and Graesser, 2005). In the study conducted by Lusk and Atkinson, (2007), results showed that participants in the fully embodied condition notably scored higher than participants in the voice condition (Lusk and Atkinson, 2007). From this analogy, Roubroeks et al., (2011) proposed that the more social the persuasive pressure, the more the reactance that will be experienced if the social presence is not well integrated into the message design.

2.2 Perceived Usability

Within the context of HCI, this signifies that any application that causes psychological reactance has a higher risk of being abstained from by people or given a negative perception (Ehrenbrink et al., 2016). A very common example is the bloatware that Samsung used for pre-install on most Galaxy smartphones. Samsung provides smartphones with many pre-installed applications that cannot not be removed by its users. This increases the total sales of those services. However, this lead to psychological reactance, as it can be noticed by the outraged comments and bad evaluations of those applications. Instead of enabling those applications, the act probably destroyed the services' and Samsung's reputation. In a view to correct this, Samsung desisted from this act by minimising the number of pre-installed bloatware on its new devices and also allows uninstallation (Sammobile.com., 2015).

In this view, any technological system that is been used by people must have high acceptance by its users as they use them on daily basis. Therefore, problems related to usability and user experience must be avoided in order to minimise difficulties. In addition, these systems become very close to people as they become private and present in sensitive areas of its users, they usually make use of sensors that gather personal data, which all determine the acceptance of such system or device by its users. Therefore, psychological reactance could be a negative bias that affects the acceptance of any specific system (Ehrenbrink et al., 2016). This forms the rationale for this work by accessing reactance in a persuasive website through perceived usability. The assumption is that there will be little or no perceived usability for a system with low freedom message.

3.0 Methodology

3.1 Objectives

The aim of this work is to measure psychological reactance to a suggestion from a persuasive system, specifically a website. This will be measured in terms of people's attitude (reactance) to a suggestion from a website. If people obey a task suggestion, it means reactance is not experienced, but if people do the opposite of what was suggested, then reactance has been experienced.

In order to access reactance, participants were asked to plan their meals on a website. During this task, participants were interrupted by popup messages to change their food items with the following groups of messages, representing the three freedom

conditions, after which their perceived usability and anger towards the website was accessed.

High freedom text (control group)

Low freedom text (treatment group)

High freedom social message (treatment group)

The work was designed to measure reactance in people through a website that enforces compliance. This was designed to restrict people's freedom in their meal planning task. The goal of this work is to access participants' attitudes with respect to perceived usability of the website and anger. This forms a new dimension for the measurement of reactance as Hossain et al., (2012) was of the view that any persuasion or persuasive system that restricts people's freedom can initiate reactance in people. In this view, a persuasive system that causes reactance in people will be perceived as having low usability because people will rate the system as been too restrictive for use. In this line of thought, reactance to low/high freedom messages will be measured by using the System Usability Survey designed by Brooke, (1996) to access the usability of a system and at the same time, accessing people's reactance. Therefore, this work measured reactance through the following ways:

- Low/high freedom text messages in a low freedom website
- High freedom text/high freedom social message in a low freedom website.

3.2 Evaluation

The study was made up of both control and treatment conditions. Participants in the control groups were exposed to high freedom texts while participants in the treatment groups were exposed to either low freedom texts or high freedom social messages. The study was carried out through a website to evaluate participants' non-compliance to a high freedom, low freedom messages and high freedom social message. The study was conducted for one month with each participant's session lasting for ten minutes. Participants were introduced to the study through emails and social network sites, informing them that the study is to assess the website for usability and to encourage them to give an unbiased evaluation of the website's usability.

Participants were allocated to each of the conditions by using a between subject design in which a participant is allowed to partake in one condition only. Between subject design is chosen because it determines whether participants differ in their responses when the dependent variable (anger, perceived usability) is measured in different conditions. It also ensures that there are no carryover effects like participants having the same response to previous and current freedom condition as it happens in within subject design. The only limitation of this design was the required large number of participants but this does not outweigh the strength and benefits of the design.

3.3 Hypotheses

There were three hypotheses for the study and they all relate to participants' freedom to engage in an activity the way they like but in different conditions. The hypotheses are given below:

Hypothesis 1: Low-freedom text will cause more reactance than high freedom messages in a persuasive website.

Hypothesis 2: High-freedom and social messages will cause more reactance than high freedom text in a persuasive website.

Hypothesis 3: High freedom messages will cause high perceived usability.

3.4 Data Collection

Prior to the commencement, link to the work was sent to participants via mails and social network sites. Data collection for the study was structured in such a way that participants' demographic and personality data were collected before participants were assigned to the different conditions. After participants filled the demographic and personality questionnaire, they were directed to the task page in order to commence their meal planning task. On completion of the task, participants were directed to the SUS and anger survey page. Therefore, the study used two instruments to collect data from participants. They are System Usability Survey and Anger survey.

The System Usability Survey (SUS), developed by Brooke, (1996) is made up of ten items. It was adapted to measure participants' assessment of a website's usability while indirectly measuring their compliance/non-compliance (reactance) to a suggestion from a website. The anger survey, developed by Dillard and Peck, (2000) is made up of 4 items. It has been used in many reactance studies to access how happy people are with persuasion attempt. In this study, the anger survey was used to determine how happy people are while indirectly measuring their reactance to the website's persuasion attempt. All these items were accessed by using a five point Likert scale from strongly disagree to strongly agree.

3.5 Sample size estimation

This work anticipated for an effect size (d) of 0.80 and desired for a statistical power of 0.80 at a probability level of 0.05 for two tailed tests. The sample size (N) are estimated as follows:

$$\text{width } d = 0.8, \quad \text{Power} = 0.8,$$

$$\text{Noncentrality parameter Delta } (\delta) = d(\sqrt{N/2})$$

$$\text{For power of 0.8 at 0.05 probability level, } \delta = 2.80$$

$$2.80 = 0.8(\sqrt{N/2})$$

$$N = 24.50 \text{ approximated to 25 subjects per group.}$$

3.6 Procedure

The study started by sending mails to participants. The mail contained a brief introduction to the study. Participants were informed that the website is to be accessed for usability in order to ensure that they do not have a fore knowledge of the assessment of their reactance levels.

In addition, the mail also included a link to the study. The first

link that was made available for participants is the demography and personality questionnaire link. On clicking this link, the consent page appears which allows participants' consent to giving

unbiased responses. Participants must click the OK button to move on to the demography and personality questionnaire page. This page contains fifteen (15) items in total.

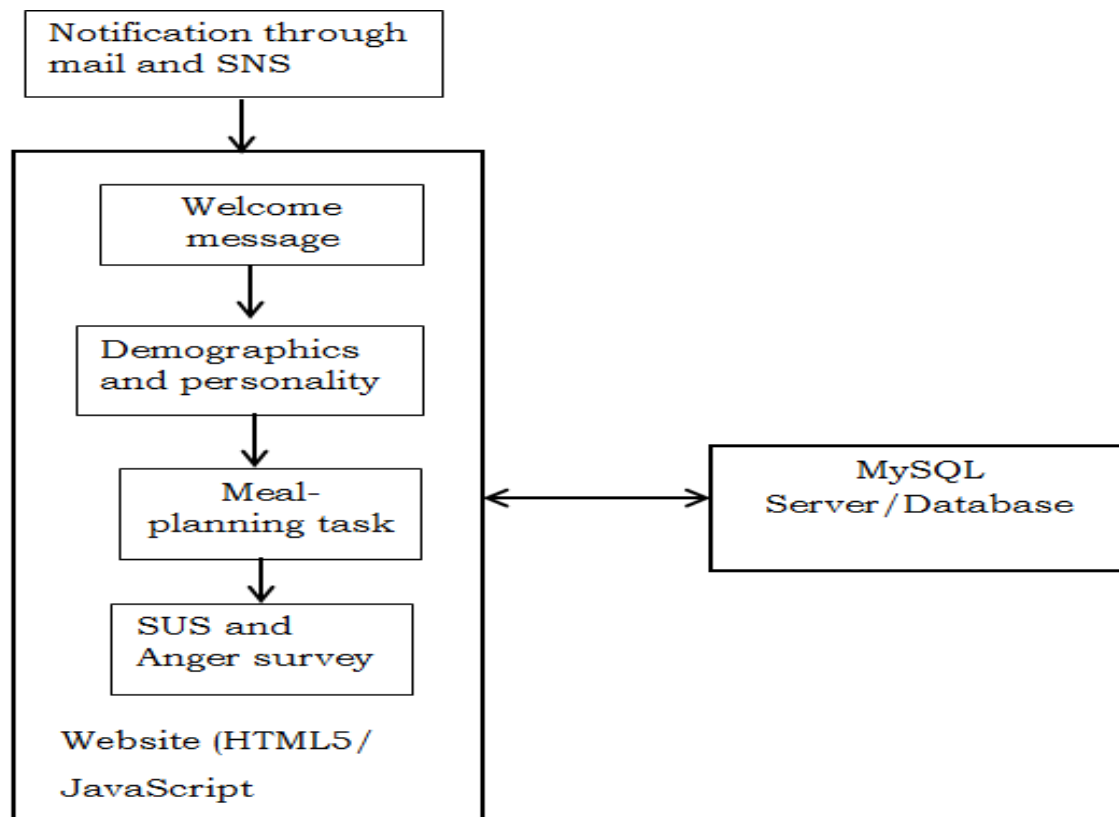


Fig.1: Schematic Diagram showing procedure used for study

The demographic section is made up of five (5) items (age, sex, marital status, educational qualification and language) while the personality section is made up of ten (10) questions. After participants answered the questions, they were required to click on the “Next” button, which takes them to the task page.

The task page was designed to contain a meal-planning activity. Participants were asked to plan their meals by selecting from the food items that was made available on the left pane. The task page was structured in such a way that a canvas contains different food items for main course and desserts while another canvas was provided for the selected food items. As they click on the available food items, they appear on the selected items pane on the right. After selecting their initial food items, they clicked on the “next” button which triggers the interrupts to appear one by one.

The interrupts were to influence them to choose another food item if their current food selection is not considered healthy. The interrupts were in form of a popup windows to display message to participants. The messages were either high freedom text which allows participants to engage or explore other behavioural choices, low freedom text which does not give participants freedom to explore other choices but restricts them to only one option or high freedom texts with animated gif to depict social

interaction in an high freedom message. This depends on participants' assignment to different treatment conditions. After completing the meal-planning task, participants clicked the “Next” button, which takes them to the page containing the SUS and the anger survey. The following diagram depicts the procedure for the study. The procedure is shown in fig 1 below

3.7 Task Design

The task is meal planning. A website was developed to allow people plan their meals the way they like. The food items in the meal planning page were structured into three categories. They are “ALL”, “Main course” and “desserts”. The main course category contains food items like fried beef, grilled salmon, fried chicken, grilled chicken, fried rice, macaroni cheese, boiled potatoes, chips boiled peas, baked beans, green beans and refried beans. The dessert category is made up of food items like brandy snaps, rice pudding sponge pudding and fruit salad. These food items were specifically chosen to be suitable for people from different ethnic background and also to allow people to plan their meals with suitable food combinations. For example, a meal can contain chips and grilled chicken, chips, fried beef and fruit salad. The “ALL” category contains all food items from both main course and desserts. It allows users to see all available food items

at once. This is shown in Figure 2.

In addition, all food items were logically categorised into healthy and unhealthy foods. Participants were initially allowed to decide how they wish to plan their meals and follow their own plan for the task.

This rationale is based on the concept of freedom as explained by Brehm (1966) that users must be conscious of their freedom to engage in any behaviour they like. After selecting their favourite food items and clicking on the “NEXT” button, participants were interrupted by popup messages to change some food items, if it is not considered healthy.

In addition, if participants selected healthy food items initially, they were still interrupted to replace their choices meals with tasty items. This was done to ensure that every participant get interrupted, no matter the kind of food item chosen initially.

The popup messages were a high freedom text with an animated gif to show some social interaction, a high-freedom text only consisting of a message showing the participants freedom to engage in an action or behaviour (food item choices) the way he or she likes or a low-freedom text-only which does not allow a participant to engage or explore other behaviours or choice. It only gives order on what to do through controlling voice to the participant. This will not allow participant to proceed in the study unless they comply with what was proposed. These are shown in fig 3, fig 4 and fig 5 respectively. With these interruptions, participants were forced to respond to these popup messages by choosing food items proposed by the popup messages. This forced compliance was made available through the “Close” button. The rationale for this decision was to access participants’ attitude to forced compliance with respect to perceived usability and anger across the three conditions. Therefore, in this study, the only freedom given to participants was the initial freedom to plan their meals the way they like it.

The prediction is that any persuasive communication from a system that restricts people’s freedom and enforces compliance will be perceived as having little or no usability. This was done by altering the freedom text in each of the popup message conditions to reflect different levels of freedom and by forcing participants to change their choices before they can move to the next section of the survey. This conforms to the view of Dillard and Shen, (2005) on accessing people’s reactance to persuasive communication by considering the emotion evoked by a persuasive communication. Therefore, this study accessed people’s reactance through perceived usability and anger of a system that ensures that people comply with a persuasive message.

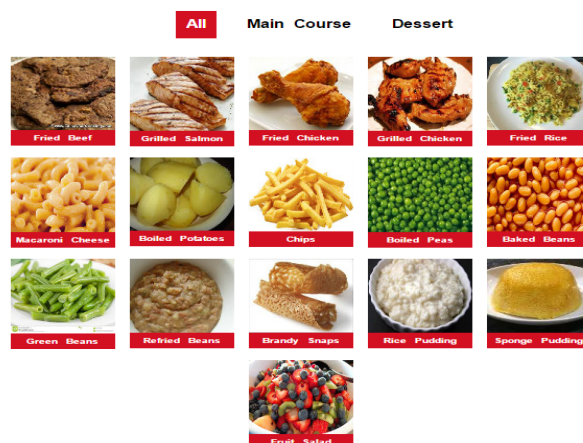


Fig. 2: Screenshot of the “ALL” category

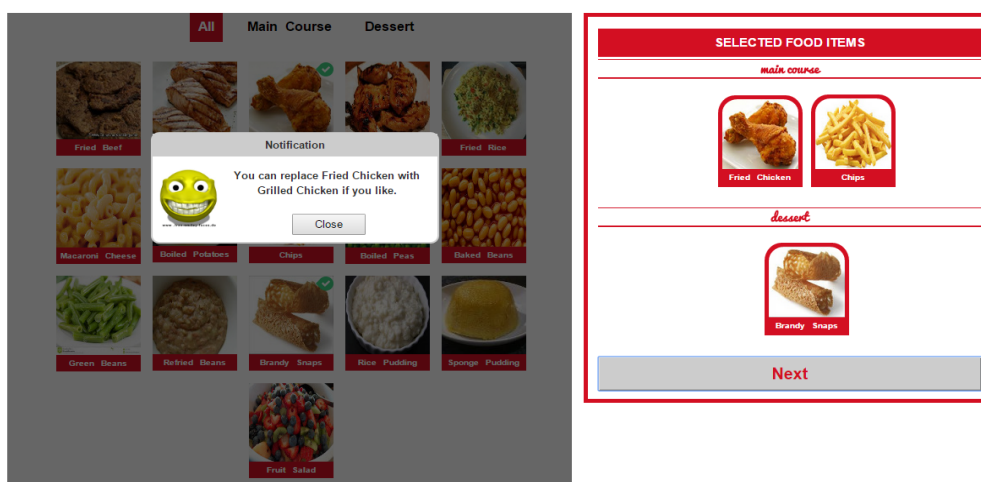


Fig. 3: Interruption from the high freedom social message condition

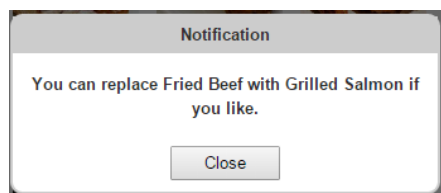


Fig. 4: High freedom text condition

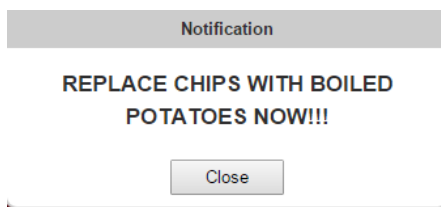


Fig. 5: Freedom text condition

All initially selected food choices were checked whether they are healthy or not and interrupts were displayed for each unhealthy food item. Therefore, as participants responded to an interrupt for a particular food, the next interrupt for another unhealthy food appeared until interrupts for unhealthy foods were displayed and participants respond to them by clicking on the “Close” button.

4.0 Results

4.1 Demographics

Age: There was only one participant (1.05%) whose age range was below 18 years. There were 37 participants (39.95%) who had their ages between the range 18-24 years, 42 participants (44.21%) with ages within the range of 25-34 years, while 15 participants (15.79%) had their ages in the range of 35-54 years. This shows that the larger percentage of the population were young adults.

Sex: 57 participants (60%) were male while 38 participants (40%) were females.

Marital status: 67 participants (70.53%) were single, 24 (25.26%) participants were married and 2 participants (2.11%) were divorced and widowed.

Highest Educational Qualification: 1 (1.05%) participant had GCSE, 4 (4.21%) had AS/A level, 4(4.21%) participants had HNC/HND, 38 (40%) had Bachelor degree, 42 (44.21%) participants had Master’s degree, 2 (2.11%) participants had Ph.D. while 4 participants (4.21%) had qualifications different from the list specified in the questionnaire.

Most frequent language spoken: That 70 participants (73.68%) were English speakers, 1 participant (1.05%) was an Arabic speaker, 2 participants (2.11%) were Spanish speakers, 1 participant (1.05%) was a Portuguese speaker and 21 participants (22.11%) were 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 speakers.

4.2 Descriptive Statistics

The table below shows the results gotten from the anger Survey.

Table 1: Anger results

Condition/group	N	Mean	Standard deviation
High freedom text	30	7.47	3.05
Low freedom text	30	11.70	2.41
High freedom + social message	30	9.17	3.41

From table 1, thirty (30) participants were assigned to each of the study’s conditions by the website. High freedom text-only condition has a mean anger score of 7.47 and a standard deviation of 3.05, low freedom text-only condition has a mean anger score of 11.70 and a standard deviation of 2.41 while high freedom social message condition has a mean anger score of 9.17 and a standard deviation of 3.41.

Result from Hypothesis 1

Hypothesis 1 required comparison to be made between high freedom text condition and low freedom text condition for any significant difference. In order to investigate hypothesis 1, the data were entered into RStudio for statistical test. T-test has been chosen as an appropriate statistical test because the mean of two groups were to be compared for statistical significance.

Results of Rstudio on hypothesis 1 indicated that high freedom text group had a lower anger score (mean = 7.47, stddev = 3.05) than participants in the low-freedom text group (mean = 11.70, stddev = 2.41). A t-test on the difference between means indicated a value of $t = -5.97$ with $df = 58$, at $p\text{-value} < 0.01$, which indicated a statistically significant difference with confidence interval of -6.12 to -2.34. Also, the effect size $d = 1.53$ indicated a large effect of difference between the two groups. This lead to the rejection of the null hypothesis and the conclusion that low-freedom text will cause more reactance than high freedom text- in a persuasive system like website that ensures forced compliance.

Result from Hypothesis 2

In order to study hypothesis 2, comparisons were made between the control group (High freedom text) and high freedom social message. T-test was also chosen because comparison is between two conditions and the sample means are also required. R studio results on hypothesis 2 indicates that high freedom group has a lower anger score (mean = 7.47, stddev = 3.04) than participants in high freedom plus social message group (mean = 9.17, stddev = 3.41).

A t-test on the difference between the means indicates a value of $t = -2.04$, $df = 58$, $p < 0.05$, which indicates a significant difference with confidence interval of -3.37 to -0.298 . However, it was observed that the upper limit of the CI is close to zero, this indicates a slight significant difference between the means of the two conditions. Also, the effect size, Cohen's $d = -0.53$ indicates a medium effect of differences. This leads to acceptance of the alternative hypothesis with an important conclusion that if social interaction is not well implemented in any persuasive communication, it can arouse feelings of anger in people even though they allow people to interact with systems socially as if they are interacting with humans.

Result from Hypothesis 3

In order to study hypothesis 3, comparison was made for perceived usability between the control group (high freedom text) and low freedom text group using t-test.

Results from R-Studio indicated that participants in high freedom text group had high perceived system usability score (mean 70.92, $stddev = 11.61$) than participants in low freedom text condition (mean = 59.92, $stddev = 8.72$). A t-test on the difference between the means indicates a $t = 4.15$ at $df = 58$ and $p\text{-value} < 0.05$ which indicates a significant difference with a confidence interval of 5.69 to 16.31. This lead to the rejection of null hypothesis and acceptance of the alternative hypothesis. In addition, the effect size $d = 1.07$ shows that there is a large difference between the two groups. This lead to the conclusion that high freedom texts will lead to high perceived usability in persuasive systems.

Table 2: Anger/Usability table.

	N	High freedom text	Low freedom text
Anger	30	7.47	11.70
Usability	30	70.92	59.92

Table 2 depicts the various anger and usability score across the two treatment conditions. It was observed that the group with the lowest anger score (Higher freedom text, mean = 7.47) had the highest usability score (mean = 70.92) while the group with the highest anger score (Low freedom text, mean = 11.70) had the lowest usability score (mean = 59.92).

It was also observed that as the anger score increases, perceived usability score decreases across the groups. This observation still confirms the alternative hypothesis that high freedom messages will lead to higher perceived usability and lower reactance (anger) in people.

4.3 Discussions

The study was conducted with ninety-five participants and their demographics data showed that the participants were slightly

heterogeneous in terms of language, sex and marital status.

Results from the anger survey showed that participants in the high freedom group had a lower anger score than participants in the low freedom text group. This is in agreement with previous studies from Dillard and Shen (2005), Rains and Turner, (2007) that high freedom (low-threat) messages generate little reactance feelings in people than low freedom (high-threat) messages. Therefore, hypothesis 1 was confirmed because t-test results showed that high freedom texts in the website did not elicit anger feelings while the low freedom texts elicited more anger feelings in people. This study has helped to contribute to researches on psychological reactance and threat messages in persuasion with special emphasis on websites.

For the social agency theory, hypothesis 2 was also confirmed. Comparison was made between the high freedom text group and the high freedom social message group. There was a significant difference in the means. This lead to the conclusion that social agents in persuasive messages can evoke reactance in people if they are not well integrated. This is also in line with the work of (Roubroeks et al., 2011) where participants in the text-only condition had fewer reactance than participants in the high social agency condition.

Another observation about the survey is that about two hundred and six participants started this survey but only ninety-five participants completed the survey. This may be due to two reasons. The first one is that the website ensured forced compliance on the meal planning page. Therefore, some participants started the meal planning task but did not continue because the interrupts forced them to comply. Therefore, they closed the tab. The second reason is that some uncompleted surveys may be created during the testing phase of the website development. However, the number of test trials was minimal. Therefore, majority of these uncompleted surveys came from participants who closed the tab because of forced compliance. This can also be likened to reactance.

5.0 Conclusion

Behavioural change is an area of study that will continue to be of interest to many HCI researchers as many people will depend on persuasive computing devices for their behavioural change needs. This work has provided a detailed study on reactance to persuasive systems, specifically, websites. The study focused on people's reactance to persuasive websites with respect to people's attitudes to forced compliance.

The results from this study indicated that people tend to show attitudinal reactance to systems that ensure forced compliance. The results showed that participants in the high freedom text group had a lower anger score than participants in the low-freedom text group even with forced compliance. Also, the effect of social agency was checked and results indicated that social presence can evoke reactance in people if it is not well incorporated. This serves as a tip for developers of persuasive

messages to carefully decide the kind of social presence to include into the development of these persuasive systems.

From this study, it can be inferred that high freedom messages can lead to lesser reactant attitudes in people even in forced compliance situation. This was seen as people changed their food items in order to continue with the survey while the use of low-freedom text in a forced compliance situation will lead to more reactance attitudes. It can also be deduced that in forced compliance situation, messages expressing high freedom can make people perceive that the system is useable while the use of low-freedom messages in forced compliance system will make people to view the system as having little or no usability.

6.0 Conflict Of Interest

All Authors have declared that there are no conflicts of interest.

Authors Contribution

OOA and COD designed the research
OOA and COD Collected Data
SOO Analyzed Data
OOA and COD Discussed the results

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