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based on the 3D-RAB model*

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# Designing Persuasive Third Party Applications for Social Networks: The 3D-RAB

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**Abstract.** The use of social networks services for promoting business, teaching, learning, persuasion and spread of information continues to attract attention as most social networks now allow third party applications to operate on their networks. In the field of persuasive technology, the ability of social networks to build relationships among their users and build momentum and enthusiasm through rapid cycles also give it a greater advantage over other persuasive technology approaches. In this paper we discuss the 3-dimensional relationship between attitude and behavior (3D-RAB), and demonstrate how it can be useful in designing third-party persuasive applications in social network services by considering external factors which affects persuasive strategies.

**Keywords:** Social Networking Services, Persuasive Technology, Behavior modeling

## 1 Introduction

The application of social networking services (SNS) continues to spread across various domains as recent SNSs allow third party applications to operate on their sites. Researchers now develop applications to promote teaching and learning, business, marketing, commerce, and news feed, among others. Recently, persuasive technology designers also have implemented third party persuasive applications on SNSs so as to reach a larger audience [1]. Persuasive technology is the use of computing technology to change or shape a person's attitude and/or behavior [2], which has been mainly used in healthcare, environmental and other social purposes [3]. Some persuasive technology designers design their applications to operate on social networks due to their ability to build momentum and enthusiasm through rapid cycles which is a recipe for promoting behavior and attitude change [4]. Applications such as the competitive carbon counting [5] is an example of a third party application designed to persuade users to reduce their energy usage. However, despite the

potential of such applications, there is little research on what methods or approach that such third party applications should follow, when designing for persuasion.

In this research we contribute to the existing study on the use of SNSs as a persuasive technology by demonstrating the need to understand the relationship between a user's attitude towards change, his/her attitude towards change in behavior or maintaining the behavior as compared to his/her current behavior. We demonstrate how the 3D-RAB model [6] can be applied to the design of third party persuasive applications on SNSs by considering factors which are external to persuasive technologies.

The remainder of the paper is presented as follows: the next section presents discussions on current research contributions in SNS relating to persuasive technologies. This is followed by a discussion on factors that affect persuasion. Section 3 is on the 3D-RAB model and it is followed by discussions and a conclusion.

## **2 Persuading via social networks**

Modern computing network technology has made social networks less bounded by providing tools to create and maintain relationships between individuals irrespective of geographical boundaries with social support, information, and a sense of belonging [7]. Social networking services are now characterized by mass participation and with usual functionalities such as personal profiling of participants, networking of friends, private messaging, discussion forums, events management, blogging, commenting and media uploading [8], which enable them to promote persuasive activities. This is because they serve as a platform for discussions and sharing of ideas within a larger community across geographical boundaries. As such both direct and indirect persuasions are possible. What differentiates them from many other persuasive technology platforms is that they are inherently collective and thus make use of group dynamics a powerful factor in the context of persuasion [9].

A research conducted by Fogg explained that the use of Mass Interpersonal Persuasion (MIP) have also become prominent in the area of social networking [4]. MIPs propose six components which promote SNSs as a perfect platform for persuasive activities, namely, persuasive experience, automated structure, social distribution, rapid cycle, huge social graph and measured impact. Persuasive experience is a form of experience that is created to change attitudes, behaviors, or both. As such the creator of the experience aims at making impact on people's lives. Persuasive experience can then be structured as a digital technology allowing the software to present the experience repeatedly, which is known as automated structure. Automated structure enables easy sharing of experiences with other users within a social network, whereas social distribution enhances the ability for the persuasive experience to be shared between peers on the network. In rapid cycling, persuasive experiences are distributed quickly within the network. Fogg continued that the experience is therefore capable of reaching millions of people who are connected through social ties or structured interactions thereby creating a huge social graph. Also the impact of the experience is readily observable by both users and designers as the system provides information on connected peers. He continued that even though

these components existed before, some SNSs have bundled them together, thus making them more useful for third party persuasive applications [4].

Another research [10] explained that persuasion happens in predictable ways and as such identified patterns of persuasion in online social networks and concluded that there are six patterns of SNSs that serve as persuasive tools. Four of the patterns lead to a large-scale viral adoption and are native to SNSs. These are: provoke and retaliate, reveal and compare, expression, and group exchange. The other two patterns which are adopted are competition and deception. In addition, in order to design a meaningful persuasive SNSs application, [9] explained that consideration should be given to a system in terms of its affiliation, access and participation.

## **2.1 Factors affecting persuasion**

Persuasive technology has introduced a new direction in the study of psychology in relation to information systems design, its usage and acceptance. Nowadays, systems are designed to promote psychological principles and theories in order to change a user's behavior to a predetermined one. For instance, [11] studied the psychological aspects of using SNS. In our research, the focus is on the relationship between attitude and behavior of users and external factors within the SNS community in relation to the development of third party persuasive applications that promote socially positive behavior. We argue that even though SNSs promote persuasion [4, 9], there is a need for third party persuasive technology designers who aim at using SNSs as the environment to consider the factors discussed below in order to follow a systematic procedure and avoid undesirable effects which can be created by the SNS's environment. Below we discuss the 3D-RAB model [6], which advocates that there are 3 factors that can be considered for analyzing the state of a user, namely, user current behavior, user attitude towards target behavior and user attitude towards change or maintaining the change. There are also two external factors, natural attitude/behavior change and planned behavior /attitude change, which are also discussed in relation to the model.

## **2.2 User current behavior (CB)**

One of the factors to consider when designing a third-party persuasive application is users' current behavior (CB). CB is defined as the existing actions of a person in relation to the environment and may be conscious or subconscious, overt or covert, voluntary or involuntary. The designer should consider the target behavior in relation to potential users, i.e. whether users are currently performing the behavior or not. This measure can be positive or negative. Consider an application aiming to promote drivers from not driving under the influence of alcohol. Users who are currently drinking and driving are considered to be exhibiting a negative behavior whereas those not doing so are considered to be exhibiting a positive behavior.

### **2.3 User attitude towards target behavior (ATTB)**

User attitude towards target behavior (ATTB) is defined as the like or dislike of target behavior; and it can be positive, negative or neutral. If user's attitude supports the target of design then they are deemed as having a positive attitude towards the target behavior. Again considering the case of drink-driving, users with a positive ATTB are those who believe and accept that one should not drive under the influence of alcohol. The case of the neutral attitude is not considered in the model.

### **2.4 User attitude towards changing/maintaining current behavior (ATCMB)**

A user's attitude towards change or maintaining behavior (ATCMB) is a measure of agreement or disagreement of the user in relation to a particular change or maintenance in behavior and can be positive, negative or neutral. In the case of drink-driving, ATCMB is considered to be positive when a user agrees to change to the target behavior (not drink and drive) or maintain the current behavior (not drink and drive), and negative otherwise. Again the neutral attitude was not considered since it does not provide interesting information. ATCMB provides information on a user's readiness to change, or to maintain the existing behavior [12]. Positive ATCMB promotes self-efficacy and it has been found to be an important determinant of choice of activities in which users engage, how much energy they expend on such activities, and the degree of persistence they demonstrate in failure and/or adversity [13].

### **2.5 External factors that may affect user to change behavior**

Apart from the 3 internal factors mentioned above, there are other external factors which need to be considered as they serve as triggers for behavior and attitude changes. As such they can significantly contribute to users developing negative or positive behavior or attitude. In other words, since the persuasive application will be operating in an SNS environment there is the need to consider the operations of the SNS itself and identify how it may promote or hinder the persuasive application. In this regard we consider natural attitude or behavior change (NABC). NABC is the natural behavior or attitude change that may naturally occur as users of SNS interacts with other users in or out of the SNS environment. Users' experiences result in constant change in their behavior and/or attitude as they interact with others.

Another external factor which affects persuasive applications in the SNS environment is planned attitude or behavior change (PABC). PABC is found in situations where activities are planned to change people's attitude or behavior and they may or may not be automated. Within an SNS community, users form groups in which they plan their activities in a particular way. They are governed by policies and rules so as to enable them to behave in a particular manner. In designing third party persuasive applications for SNSs, this factor should be considered because it may also promote or hinder the progress of the application. From the above internal and external factors, we present a model which describes the 3-dimensional relationships between the internal factors and how external factors act on them. This is intended to inform designers on how to design persuasive third party applications for SNS. Section 3 presents the 3D-RAB model and its external factors.

### 3 The 3D-RAB Model

The 3D-RAB model can enable an application designer to categorize SNS users into groups based on cognitive dissonance states during design so as to present persuasive messages and techniques for a particular target state. In total, 8 different user states were identified (table 1).

According to the theory of cognitive dissonance, two cognitions are considered to be in dissonance if one opposes the other and this creates an unpleasant psychological tension, and there is a motivational urge to minimize dissonance by changing an attitude, a belief or behavior [14, 15]. Hence by combining cognition with motivation, attitude and behavior change can be achieved [16]. Based on this premises we argue that cognitive dissonance can be at different levels, which when studied carefully, can be used for selecting appropriate persuasive techniques. Also, these levels of dissonance provide information concerning possible natural transitions that exist as a result of natural phenomenon which are external to a system. There are four levels of cognitive dissonance, which are strong, moderate, weak and no dissonance.

**Table 1:** State transition within 3D-RAB, showing natural state tendencies and target states

| State | CB | ATTB | ATCMB | Cognitive Dissonance | Stability of State | Natural State Tendency | Targeted State |
|-------|----|------|-------|----------------------|--------------------|------------------------|----------------|
| 1     | +  | +    | +     | No                   | Stable (+)         | 1                      | 1              |
| 2     | +  | +    | -     | Weak                 | Unstable (+)       | 1                      | 1              |
| 3     | +  | -    | +     | Moderate             | Unstable (-)       | 7                      | 1              |
| 4     | +  | -    | -     | Strong               | Unstable (-)       | 8                      | 2 or 3         |
| 5     | -  | +    | +     | Strong               | Unstable (+)       | 1                      | 1              |
| 6     | -  | +    | -     | Moderate             | Unstable (-)       | 8                      | 2 or 5         |
| 7     | -  | -    | +     | Weak                 | Unstable (-)       | 8                      | 3 or 5         |
| 8     | -  | -    | -     | No                   | Stable (-)         | 8                      | 4 or 6 or 7    |

Strong cognitive dissonance is formed when there is a very strong disagreement between one’s attitude (either ATTB or ATCMB) and behavior and it results in a strong unpleasant psychological tension with a greater probability that one may change his attitude or behavior in order to eliminate the dissonance. At such a state the user experiences a very uncomfortable cognition state that he or she recognizes the need for a change in attitude, behavior or behavioral beliefs. A moderate dissonance is formed when there is disagreement between one’s attitude and behavior; however the extent of unpleasant psychological tension experienced in this case is relatively moderate, hence the urge to change attitude or behavior is not intense. In weak dissonance the disagreement between one’s attitude and behavior is weak; although there is a form of dissonance it is insignificant and thus does not create a strong psychological tension. When one’s attitude agrees with his behavior there is no psychological tension. At such a state there is no dissonance. The variation in

dissonance creates both stable and unstable states which can be positive or negative in relation to the target behavior. In a positive unstable state a user is more likely to change either his attitude or behavior to favor the target behavior whereas it is vice versa in a negatively unstable state. See table 1.

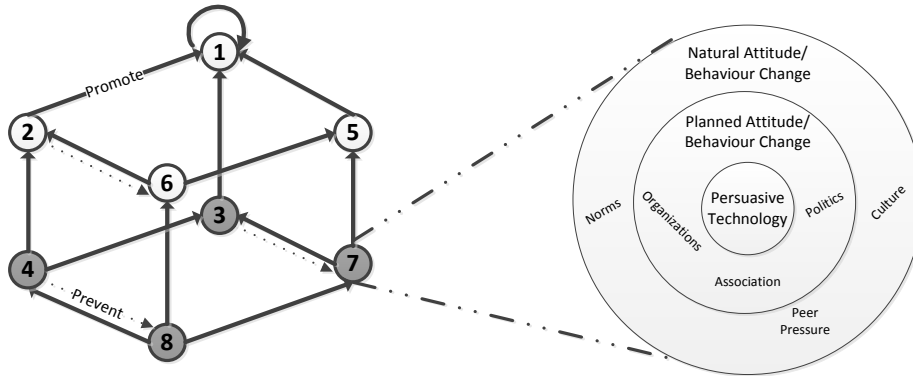


Fig. 1: Graphical representation of external factors and the 3D-RAB adopted from [6]

From table 1, it can be observed that in states 1-4, the target users are already performing the target behavior. However, the model reveals that though they are performing the behavior they have variable levels of cognitive dissonance states which can result in them changing their behavior. External factors can form triggers and make users move naturally to a particular state, which may be in favor of the target or not. In designing persuasive applications in an SNS environment, designers can employ techniques which will focus on moving the user to the suggested states in table 1 and in doing so consideration should also be given to the effects of external factors in relation to the target change.

For example, in the case of drink-driving, a consideration can be given to whether or not the SNS community on which the application will be operating promotes drinking. This is because this information will provide essentials on how to incorporate techniques which will not condemn drinking completely, but rather focus on drink-driving. users may ignore the application totally if it makes them believe that it is promoting drinking prohibition.

There are also situations where dissonance creates natural “pulls” or “pushes” towards the target behavior. Hence, without persuasion or persuasive technology, users in the SNS will naturally change as external factors acts on their current state. In such situations persuasive techniques should promoting directions which have natural tendencies of changing users to the target behavior.

## 4 Discussion

As mentioned earlier, the use of SNSs as a platform for promoting behavior and/or attitude change presents a promising future to persuasive technology. We argued for



the need for a systematic strategy to achieve the target behavior, and proposed the use of the 3D-RAB model. One of the major challenges in using the 3D-RAB model for designing persuasive technology is to identify at which state the user is in. In this regard, SNSs have a significant ability to collect user feedback which makes it possible for designers to collect information and possibly changes in users and thus tailor persuasive approaches. For instance in the case of drink-driving persuasive design, designers can implement strategies which can collect user states through daily status updates or tweets. Such information can then be used to identify the cognitive state the user is in, which in turn informs the persuasive application on the needed techniques which can be applied to effectively motivate or persuade a user. Moreover, feedback information will provide data on the effectiveness of the persuasive application. This is because designers will be in the position to identify and track progress of users as they transit from one state to another as they use the application.

Amidst these advantages of SNSs platforms for persuasion, there are some limitations which can result in undesirable effects on persuasion. Often, persuasive technology designers ignore the possibility of boomerang effects (the ability of the system to create a counter persuasion); but this can easily happen in persuasive design and in the case of SNS persuasion such an occurrence will have a negative effect on the target behavior relative to the persuasive system which do not operate on SNS. This is because the ability of SNS to spread information rapidly (which is useful in persuasion) can make users spread negative information about the system rapidly. In addition, existing applications are object-centered [17] and do not allow explicit connections between users from other different SNS application [8]. This limits the use of SNS for persuasive activities, because this hinders users to communicate with other potential users in other platforms. It therefore creates a bounded community of users and their shared objects and hampers interoperability.

## 5 Conclusion

In this paper we have discussed the need for third party persuasive applications designed to operate on social networking services to follow a systematic approach and demonstrated how the 3D-RAB model is useful for such designs. We presented the relationship between internal factors that determines the state of a user and the external factors which may promote or hinder persuasive activities naturally. However, since this model is still at the conceptual stage, subsequent research will focus on substantiating its theoretical claims with empirical evidence. Also, investigations will be conducted to identify appropriate techniques to facilitate or prevent transition of states. This will serve as a tool for designing effective persuasion which takes into account the external factors of the SNS community.

## References

1. Fogg, B. A behavior model for persuasive design. in 4th International Conference on Persuasive Technology. 2009. Claremont, California: ACM New York, NY, USA.

2. Fogg, B.J., *Captology: the study of computers as persuasive technologies*. 1997, New York: ACM New York.
3. Oinas-Kukkonen, H. and M. Harjumaa, *Persuasive Systems Design: Key Issues, Process Model, and System Features*. Communications of the Association for Information Systems 2009.
4. Fogg, B., Mass interpersonal persuasion: An early view of a new phenomenon. *Persuasive Technology*, 2008: p. 23-34.
5. Foster, D., M. Blythe, P. Cairns, and S. Lawson. Competitive carbon counting: can social networking sites make saving energy more enjoyable? 2010: ACM.
6. Isaac Wiafe, Keiichi Nakata, Stuart Moran, and Stephen Gulliver, Considering user attitude and behaviour in persuasive systems design, in *European Conference on Information Systems*. 2011: Helsinki, Finland.
7. Wellman, B., Computer networks as social networks. *Science*, 2001. **293**(5537): p. 2031.
8. Ahmadi, N., M. Jazayeri, F. Lelli, and S. Nesic. A survey of social software engineering. 2008: IEEE.
9. Khaled, R., P. Barr, J. Noble, and R. Biddle, Investigating social software as persuasive technology. *Persuasive Technology*, 2006: p. 104-107.
10. Weiksner, G., B. Fogg, and X. Liu, Six patterns for persuasion in online social networks. *Persuasive Technology*, 2008: p. 151-163.
11. Hogg, T. and L. Adamic. Enhancing reputation mechanisms via online social networks. 2004: ACM.
12. Prochaska, J. and C. DiClemente, Toward a comprehensive model of change. Treating addictive behaviors: Processes of change, 1986: p. 3-27.
13. Oldenburg, B., K. Glanz, and M. Ffrench, The application of staging models to the understanding of health behaviour change and the promotion of health. *Psychology & Health*, 1999. **14**(3): p. 503-516.
14. Festinger, L., *A theory of cognitive dissonance*. Row, Peterson, New York, 1957.
15. Aronson, E., Back to the Future: Retrospective Review of Leon Festinger's "A Theory of Cognitive Dissonance". *The American Journal of Psychology*, 1997. **110**(1): p. 127-137.
16. Griffin, E. and G. McClish, *A first look at communication theory*. 1991: McGraw-Hill New York.
17. Cetina, K., Sociality with objects: Social relations in postsocial knowledge societies. *Theory, Culture & Society*, 1997. **14**(4): p. 1-30.