Socially-oriented Persuasive Strategies and Sustainable Behavior Change: Implications for Designing for Environmental Sustainability

Makuochi Nkwo[1]* Banuchitra Suruliraj[2], Rita Orji[2] and John Ugah[1]

[1] Department of Computer Science, Ebonyi State University Abakaliki, Nigeria
[2] Faculty of Computer Science, Dalhousie University, Halifax NS, Canada
makuonkwo@gamil.com

Abstract. This research evaluates 148 mobile apps for sustainable waste management with a view to identifying all the socially-oriented persuasive strategies used and how they are implemented to promote sustainable environmental behaviors. The results show that the apps employed a total of 71social support strategies, distributed as follows: social learning (4), social comparison (8), normative influence (6), social facilitation (40), cooperation (9) and recognition (4). In addition, waste collection, sorting, recycling, awareness creation, and general waste management were some of the focus behaviors that the sustainable mobile apps supported.

Contribution Statement. This paper contributes to research on ways of tailoring socially-oriented persuasive strategies in sustainable behavior change interventions (SBCIs) to promote a clean and sustainable environment. It also contributes to research on improving the effectiveness of persuasive systems for sustainability in encouraging users to perform target behaviors.

Keywords: Social Influence, Sustainability, Behavior Change, Persuasive Technology, Waste Management, Sustainable Development Goals (SDG), Mobile App

1 Introduction

Studies shows that persuasive apps for behavior change encourage individual and communal actions in various sustainability domains like water, energy, mobility, and waste mgt [2, 6, 9, 10, 16, 17]. The findings from recent studies suggests that amongst these sustainability application domains, persuasive technology (PT) interventions to improve sustainable waste management behaviors are gaining traction [4, 8]. However, research into tailoring socially-oriented PT strategies for sustainable waste management in particular and environmental sustainability in general, is just getting underway. Berkovsky et al. [3] opines that tailoring persuasive strategies has a "huge untapped potential to maximize the impact of persuasive applications".

Therefore this paper examines how persuasive technologies for sustainability otherwise referred to as sustainable behavior change interventions (SBCIs) can be tailored to improve their effectiveness in encouraging users to adopt pro-environmental behaviors. We achieve this by evaluating 148 mobile apps (in the sustainable waste management domain) to identify the socially-oriented persuasive strategies (Fogg [5] and Oinas-Kukkonen [13]) employed in the design and how they are implemented to promote a clean and healthy environment. The results from our study show that cumulatively, 71strategies were employed. Specifically, social learning, social comparison, normative influence, social facilitation, cooperation and recognition were the socially-oriented persuasive strategies implemented in the mobile apps. In addition, waste disposal, collection, sorting, recycling, and general waste management were some of the

Persuasive 2020, Adjunct proceedings of the 15th International conference on Persuasive Technology.

focus behaviors that the sustainable apps supported. We also discussed the implications for operationalizing socially-oriented persuasive strategies in developing PT for sustainability.

2 Method

This study addresses the following research questions: 1) what social support strategies were implemented in mobile apps for waste management? 2) How can we adapt and implement these strategies in future SBCIs for environmental sustainability to improve their effectiveness.

To answer our questions, we searched and downloaded apps on the Apps Store and Google Play that align with our research objectives using various criteria such as purpose, language, availability of demo, etc. Apps that appeared in both places were counted as one (See **Fig. 1**). Also, we coded the apps to uncover the socially-oriented strategies employed and how they were implemented based on the Persuasive System Design (PSD) framework described by research [13]. We chose this framework because it is a widely used model for deconstructing persuasive systems to identify strategies that are effective at abetting users to accomplish desired tasks and target behaviors.

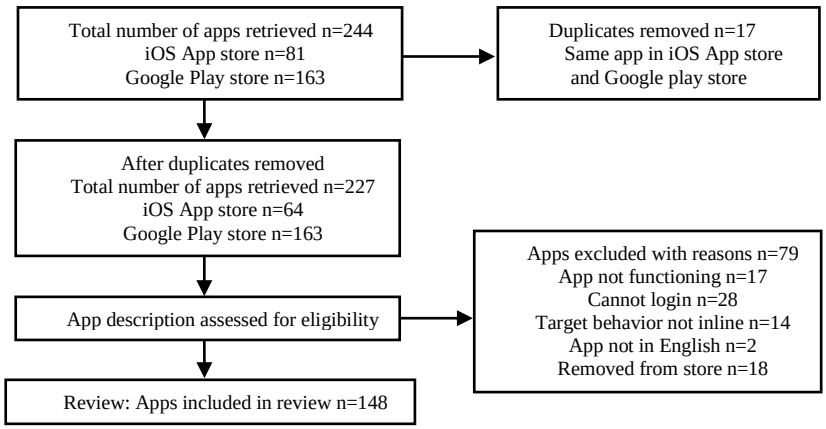

Fig.1. Flow diagram illustrating exclusion criteria in various stages

We agreed on initial codes and ensured a mutual understanding of the coding decisions. We organized and analyzed our data as follows:

1. Categorized mobile apps based on their purpose and target behaviors.
2. Conducted descriptive analysis on the collected data to get the actual socially-oriented persuasive strategies implemented in the interventions.

Table 1 is a summary of the apps or sustainable behavior change interventions (SBCIs) we evaluated.

Table 1: Information on Accepted Mobile Apps

Mobile Platforms	iOS (23%), Android (77%)
User ratings	5(5.4%), 4-4.9 (57.4%), 3-3.9(8%), 2-2.9(2.6%),1-1.9(0.6),0 or No rating (26%)
Waste Management Activity Category	Productivity(21.6%), Education(15%), Business(15%), Lifestyle(13.5%), Food and Drink (9%), Social(4%), Other 15 categories (22%)

3 Results, discussion and design implications

The findings from our study uncover that amongst the 148 mobile apps evaluated, a total of seventy-one (71) socially-oriented strategies from the social support category of the persuasive System Design (PSD) framework [13] were implemented (see **figure 2** below). They are distributed as follows: *social learning (4)*, *social comparison (8)*, *normative influence (6)*, *social facilitation (40)*, *cooperation (9)* and *recognition (4)*. In addition, *waste collection*, *sorting*, *recycling*, *awareness creation*, and *general waste management* were some of the focus behaviors that the sustainable mobile apps supported (see **figure 3** below).

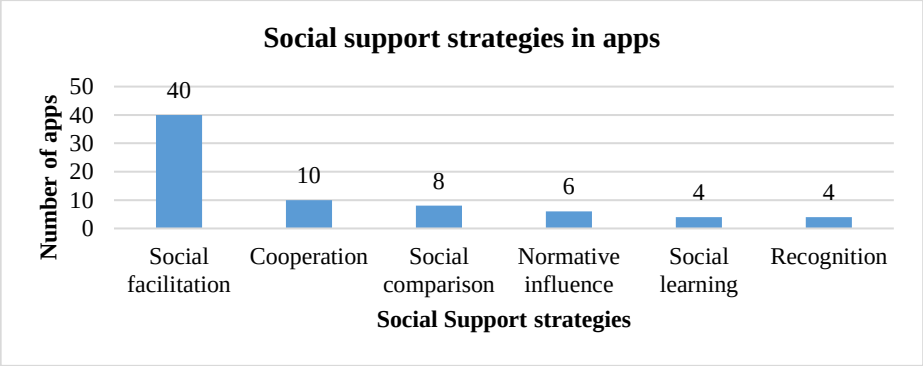

Fig.2. Socially-oriented persuasive strategies and number of occurrences

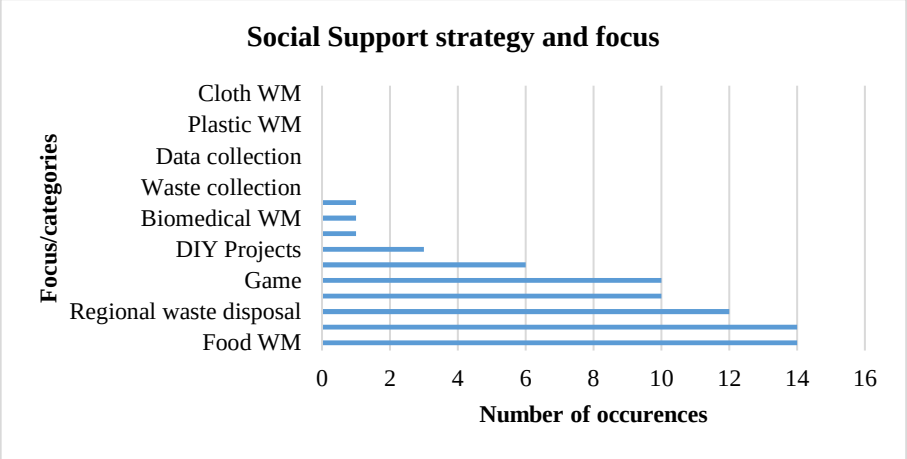

Fig.3. Socially-oriented persuasive strategies and focus

Our findings show that in general, socially-oriented strategies are effective at promoting sustainable and pro-environmental behaviors. In contrast to passive participation, they are purposely designed to stimulate active participation of users to achieve communal objectives [15]. These findings and many other related results are discussed in detail in separate papers [7][16].

Specifically, the ***Social Facilitation*** strategy provide means to detect other users who are performing target behaviors[11, 13]. It is implemented through chat features, forums and event suggestions on regional waste management apps (see **Fig 3**), in which every user could see

what others are saying, doing or planned to do. The implication for design is that developers of sustainable behavior change interventions (SBCIs) for environmental sustainability should focus on incorporating social facilitation features that allow users to recognize other users performing the same behaviors. This way the app will be more engaging and persuasive.

The ***Social Learning*** strategy provides means for users to see the outcome of other user's behaviors. It is implemented in the form of activity posts from other users which can be liked, shared or marked favorite; this is similar to what is obtainable in social media applications. In addition, new users could also look up the comments from other users and get an understanding of what to expect from a system. This is consistent with findings from Nkwo *et al.* (2018) which suggests that social learning will help users to learn about a product and service from others [12]. The implication for design is that developers of SBCIs for environmental sustainability could integrate features such as reviews and ratings which inspire social learning. Opening for users to look up questions and answers posted by other users about a product or services should be created. This way, users can learn and get motivated to perform target behaviors.

The ***Social Comparison*** strategy offer opportunity for users to compare their performances with other users. Although according to Almutari et al. (2019), social comparison is effective and most preferred strategy in physical activity domain [1], it was only implemented (n=8). This is surprising, considering that many people are naturally driven to compare and compete with one another [8, 11, 13, 14]. The apps evaluated in this study operationalized the social comparison strategy through leaderboards in game apps, a list of participants with scores, comparing cities based on waste management practices and comparing personal contribution on carbon-di-oxide emission reduction against the average of all other users. The implication for the design of SBCIs for environmental sustainability is that incorporating the features inspires healthy comparison among users and groups will be effective in promoting pro-environmental behaviors. Such features include an instant messaging component that will allow users to share and compare information related to their sustainability activities and behaviors.

The ***Normative Influence*** strategy allows users to share their issues, thoughts, emotions with others to find support [11–13]. They were implemented via the "invite friends" feature and social walls that encourage people to share activities with other users on the platform. Only one app implemented it via the creation of virtual groups based on target goals. The implication for the design of SBCIs for environmental sustainability is that providing opportunities for users and groups to interact amongst themselves and feel norm will increase engagement and inspire them to adopt communally beneficial and sustainable behaviors.

The ***Recognition*** *strategy* shows publicly available ratings for garbage service providers, a wall of fame to display exceptional performers in reducing food waste, public leaderboard and display names to all users when the user starts using the app. These findings are significant and agree with research [11, 13] because by providing public recognition to exceptional performers, other users could be motivated to perform target behaviors. The implication for the design of SBCIs for sustainability is that integrating features which offer public recognition to users and groups will be effective in encouraging pro-environmental behaviors amongst them. Such features may include a public display of praised and/or awarded user/group which is published on a conspicuous location on the app window. Success stories of individuals and groups who have successfully performed target behaviors could also be published as a means of recognizing their efforts and inspiring other users/groups to perform similar target behaviors.

4 Conclusion

Sustainable behavior change interventions (SBCIs) appear to promote sustainable behaviors in environmental domains such as waste management examined in this paper. In general, our results show that amongst other things, social facilitation strategy emerged as the most widely used; n=40 (significantly higher than other socially-oriented persuasive strategies), whereas

social comparison and recognition were the least employed; n=4. They were mostly used to motivate, influence, and assist potential users/groups to embrace new and communally helpful attitudes and behaviors that will benefit them and their society. This implies that tailoring relevant socially-oriented persuasive strategies in sustainable behavior change interventions (SBCIs) may be effective in encouraging users to perform target behaviors. It also suggest that the conscious and sustained application of these strategies will potentially result to a change in the behavior and attitudes of users and groups, which are essential to the attainment of the United Nations Sustainable Development Goals (SDGs) as it concerns environmental sustainability (such as climate change), the health and wellbeing of the people.

References

1. Almutari, N., Orji, R.: How effective are social influence strategies in persuasive apps for promoting physical activity? A systematic review. In: ACM UMAP 2019 Adjunct - Adjunct Publication of the 27th Conference on User Modeling, Adaptation and Personalization. pp. 167–172 Association for Computing Machinery, Inc (2019). https://doi.org/10.1145/3314183.3323855.
2. Anagnostopoulou, E. et al.: Persuasive Technologies for Sustainable Urban Mobility.
3. Berkovsky, S. et al: Influencing Individually. ACM Trans. Interact. Intell. Syst. 2, 2, 1–8 (2012).
4. Comber, R. et al.: BinCam : Designing for Engagement with Facebook for Behavior Change. 99–115 (2013).
5. Fogg, B.: A behavior model for persuasive design. In: In: ACM International Conference Proceeding Series. (2009). https://doi.org/https://doi.org/10.1145/1541948.1541999.
6. Gustafsson, A.: Positive Persuasion Designing enjoyable energy feedback experiences in the home .
7. Nkwo, M. et al.: Apps to Promote Sustainable Waste Management: Evaluation of Behavior Change strategies and State-of-the-art.
8. Nkwo, M. et al.: Bota : Towards the Design of a Mobile Persuasive App for Sustainable Waste Management. 1–14.
9. Nkwo, M. et al.: Mobile Persuasion : Promoting Clean and Sustainable Environment. 3–6 (2018).
10. Nkwo, M.: Mobile persuasive technology: Promoting positive waste management behaviors in developing African nations. Conf. Hum. Factors Comput. Syst. - Proc. CHI'19 Ext. Abstr. (2019). https://doi.org/10.1145/3290607.3299071.
11. Nkwo, M. et al.: Persuasion for Promoting clean and sustainable environment. In: ACM International Conference Proceeding Series. pp. 259–262 Association for Computing Machinery (2018). https://doi.org/10.1145/3283458.3283515.
12. Nkwo, M., Orji, R.: Persuasive technology in African context deconstructing persuasive techniques in an African online marketplace. In: ACM International Conference Proceeding Series. pp. 89–98 Association for Computing Machinery (2018). https://doi.org/10.1145/3283458.3283479.
13. Oinas-Kukkonen, H., Harjumaa, M.: Persuasive systems design: Key issues, process model, and system features. Commun. Assoc. Inf. Syst. 24, 1, 485–500 (2009). https://doi.org/https://doi.org/10.17705/1cais.02428.
14. Orji, R.: Why Are Persuasive Strategies Effective ? Exploring the Strengths and Weaknesses of Socially-Oriented Persuasive Strategies Why Are Persuasive Strategies Effective ? Exploring the Strengths and Weaknesses of Socially-Oriented Persuasive Strategies. October, (2017). https://doi.org/10.1007/978-3-319-55134-0.
15. Stibe, A., Oinas-kukkonen, H.: USER ENGAGEMENT IN COLLABORATIVE. In:

European Conference on Information Systems (ECIS) 2014, Tel Aviv. (2014).
16. Suruliraj, B. et al.: Persuasive Mobile Apps for Sustainable Waste Management : A Systematic Review. 1–12.
17. WatERP Water Enhanced Resource Planning " Where water supply meets demand " GA number : 318603. (2015).