

Persuasive system design principles for pandemic: A workshop-based inquiry into the comprehensibility of designers

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Abstract

In the development of digital health applications, particularly during the COVID-19 pandemic, the application of Persuasive System Design principles is critical for influencing user behavior. However, the complexity of these principles may impede their effective implementation. This study aims to identify PSD principles that designers find obscure and to reformulate them from a designer's perspective to enhance comprehensibility. Through a workshop method, a panel of xx participants rated the comprehensibility of each PSD principle on a Likert scale and then rephrased the least comprehensible principles. The findings suggest that certain PSD principles are not universally intuitive and require contextualized interpretation to be effectively applied in the specific context of digital health applications.

Keywords

Persuasive System Design, Workshop, Pandemic

1. Introduction

The emergence of COVID-19 has not only challenged global healthcare systems but also required the adoption of technology-mediated solutions to mitigate its spread. Persuasive System Design (PSD) [1] has emerged as a thoughtful tool that aims to influence user behavior through meticulously crafted design principles. Despite their widespread application, the clarity and universality of these PSD principles in the context of a public health crisis remain largely unexplored. This study seeks to bridge this gap by investigating the comprehensibility and applicability of PSD guidelines among design practitioners, with a particular focus on COVID-19 mobile application development.

However, the application of these principles in unprecedented contexts, such as a pandemic, requires a re-evaluation of their efficacy and comprehensibility. As designers play a pivotal role in the translation of PSD principles into useful and efficient digital services, the understanding and interpretation of these guidelines are of paramount importance.

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Furthermore, the unique circumstances presented by the COVID-19 pandemic have raised questions regarding the adaptability of existing PSD principles. Are the current guidelines sufficiently robust to address the nuances of pandemic-related users' behaviors and needs? To answer this question, we follow a workshop methodology, engaging graduate design students as proxies for professional designers, to scrutinize and reformulate PSD principles, ensuring their relevance and clarity in the high-stakes scenario of a health crisis.

By examining the perspectives of those at the intersection of learning and applying PSD guidelines, this research aims to identify potential disparities in the interpretation of PSD principles and to propose rearticulated guidelines that could enhance the design of more effective, user-friendly health applications during and beyond the COVID-19 pandemic. By means of this study, we would like to contribute to the design of persuasive technology in public health.

The importance of this research is underscored by the ongoing impact of COVID-19 on populations. As we navigate through waves of infections, variants, and vaccine rollouts, the design of persuasive health applications remains a critical component of each public health strategies. By refining the PSD framework through an empirical evaluation of its understandability among designers, this study provides valuable insights for the development of persuasive technologies that are not only theoretically sound but also practically applicable and easily comprehensible to those who implement them.

2. Literature review

The rapid growth of mobile applications during the COVID-19 pandemic underscores the importance of assisting in crisis management and public health initiatives. Functionalities such as contact tracing, health information dissemination, and real-time updates have emerged as critical components of the public health response [2].

PSD has been broadly applied in specific issues such as weight control [3], alcohol and smoking [4], and environmental protection [5]. It has also been used to mitigate sedentary workplace behavior[6], enhance personal well-being through mobile apps [7], and assist in smoking cessation [8]. PSD model seem also relevant to foster social interactions among the elderly [9], support mental well-being [10], and promote responsible gambling[11]. Each of these studies reflects the effective application of PSD principles in designing systems that encourage positive behavioral changes. These projects demonstrate the effectiveness of persuasive techniques such as social learning, social comparison, and recognition in changing behaviors.

Behavior changes during a crisis such as the COVID- 19 pandemic are important to protect themselves and others and to control the spread of COVID-19 [12]. PSD model is a set of 28 persuasive principles: each principle trigger users to perform certain behaviors [1]. PSD model focuses on analysing the context of persuasion, underlying any purpose and intent, and identifying the right moment and opportunity to decide on a persuasion strategy. PSD principles are grouped into four categories: primary task support, dialogue support, social support and system credibility support [1]. The first category involves persuasive principles that help the user to complete an activity efficiently; "dialogue support" involves a set of persuasive principles that lead the user to act toward the target goal or behavior; "social support" involves some persuasive principles related to the concept of connectivity and how to design the system to motivate users by leveraging social influence. Finally, the "System

Credibility Support" includes some persuasive principles that improve the user's perceived credibility of the digital service.

3. Methodology

This study a two-part workshop methodology to assess the understandability and practicality of each of 28 PSD principles.

3.1. Participants

We recruited 13 participants, all of whom were graduate students in digital design. This sample fits our research goal: we want to explore the understanding of the PSD principles amongst people who are not expert in persuasive technology but aware of the design process. At the end of the workshop, each student received a bonus of 0.5 points to be added to his or her average grade in one of the courses in his or her curriculum. We did not collect student's personal data and their personal answers were anonymous. The participants' age ranged from 20 to 25 years old, with a gender distribution of 40% male and 60% female. They were organized in three groups of 4 students and one group of 5 students: this organization was deliberately chosen to stimulate in-depth conversation and collaboration.

3.2. Part one: Rating the understanding of Persuasive System Design

In the first phase of the workshop, the four groups were introduced to the PSD theory to ensure a foundational understanding of the principles. This introduction lasted 30 minutes and let unpack the overarching concepts of PSD and ensure a knowledge baseline about the overall concepts and specific PSD principles among all participants. After this introduction, each participant was asked to evaluate the understandability of each principle by means of 5-point Likert scale, rating from "1 - very comprehensible" to "5 – not very comprehensible." Participants were then instructed to select the principles that they perceived as least comprehensible and to rephrase them to improve their understanding.

3.3. Part two: Applicability in the COVID-19 pandemic context

The second phase of the workshop shifted the focus to the applicability of PSD principles in the specific context of the COVID-19 pandemic. Participants were tasked with scrutinizing the PSD guidelines because they pertain to the design of COVID-19 mobile applications. They were asked to pinpoint any principles that they deemed inapplicable to pandemic-related situations and to articulate their reasoning, by means of the same 5-point Likert scale. After selecting these principles, participants were asked to propose new PSD principles that would be relevant to the design of COVID-19 user functions in digital services.

4. Outcomes

4.1. Part one: Which PSD principles are understandable?

This section reports on the main outcomes of the rephrasing task, where participants were instructed to evaluate the comprehensibility of any principles and attempt to reformulate by using their own words. As a result, we found "Self-monitoring" as the difficult to understand

(44.6% of total score), whereas "Personalization" ranks as the easiest to understand (3.1%) : please find the full ranking in Table 1.

Table 1
Ranking and Score of Principles

Rank (from Less to Low Understandable)	Psd Principles	Score	Rate %
1	Self-monitoring	36	44.6
2	Simulation	40	38.5
3	Surface credibility	45	30.8
4	Authority	47	27.7
5	Social learning	49	24.6
6	Suggestion	50	23.1
7	Reminders	50	23.1
8	Tunneling	51	21.5
9	Social role	51	21.5
10	Reduction	52	20.0
11	Tailoring	52	20.0
12	Rehearsal	52	20.0
13	Third-party endorsements	52	20.0
14	Similarity	53	18.5
15	Normative influence	56	13.8
16	Social facilitation	56	13.8
17	Real-world feel	57	12.3
18	Cooperation	57	12.3
19	Recognition	57	12.3
20	Expertise	58	10.8
21	Verifiability	59	9.2
22	Praise	60	7.7
23	Competition	60	7.7
24	Rewards	61	6.2
25	Social comparison	61	6.2
26	Liking	62	4.6
27	Trustworthiness	62	4.6
28	Personalization	63	3.1

About "self-monitoring", 6 of 13 participants redefined this principle in terms of "*technological autonomy*" and replace external monitoring with "*self-administered, technology-assisted performance tracking*". Both principles Authority and Surface Credibility received five comments: 2 of 13 participants redefined "Authority" in terms of "trusted sources", "official declarations" instead of credibility and "initial assessment" with "first impression".

The principle of "Simulation" obtains four rewordings: two participants suggested "simulations of real situations" and two other participants suggest "*providing evidence*" to

replace “*link between cause and effect*”. Tailoring and Reduction each received two rewording proposals: the former has been reworded as the customization of persuasive messages to the user's individual context; for the latter, participants adding “*help users feel more confident*”.

Suggestion and Tunnelling also garnered two comments, reflecting on their roles in guiding user behavior: one participant rewords “*navigate*” and another suggest to use “*relevant areas*” instead of “*fitting suggestions*”.

In conclusion, the feedback distribution across the PSD principles highlighted the different levels of understandability. The rephrasing task not only served to enhance clarity but also provided a useful feedback of the difficulties encountered by novice designers to understand these principles.

4.2. Part two: Which PSD principles cannot be applied in a design process for pandemic?

Based on participant' experiences with COVID-19 and COVID-19 mobile applications, as well as their understanding of PSD principles. They identified and selected specific design principles that they deemed inappropriate or ineffective for crisis situations like a pandemic. For each PSD principle selected, the participants justified their choices, that we summarize here below.

Third-party support (4 picks): This principle involves using third-party sources to support and recommend the use of an application. However, during a pandemic, it can be challenging to find credible and impartial sources that do not convey misleading information. This is because there is often conflicting information from various sources, making it difficult to identify the most reliable ones. Moreover, it is crucial to ensure that third-party sources are not influenced by financial or political interests, which could bias their recommendations.

Social comparison (3 picks): This principle involves encouraging healthy behavior by showing that most people are behaving in the same way. However, collecting data on the behaviors of other users and presenting it in a way that encourages healthy behavior can be challenging during a pandemic. Additionally, protecting user privacy while collecting and sharing data is crucial and may require additional safeguards.

Praise (3 picks): This principle involves giving praise to individuals for their actions, which can be a powerful motivator. However, during a pandemic, it is essential to give praise in subtle and intelligent ways to avoid suspicion or patronization. For instance, praising someone for wearing a mask or following social distancing guidelines in a public setting could make them feel uncomfortable or embarrassed.

Rewards (2 picks): This principle involves granting rewards to users for engaging in desired behaviors. However, rewards can have the opposite effect during a pandemic, as users may simulate actions to receive rewards. This could lead to undesired behaviors or actions, such as pretending to wash hands or wear a mask to receive a reward.

5. Conclusion

This study sought to explore the comprehensibility and crisis-context applicability of Persuasive System Design (PSD) principles among graduate design students, with a focus on their relevance during the COVID-19 pandemic. Through a workshop-based approach, students critically evaluated, rephrased, and analyzed the principles, providing valuable insights into the challenges of implementing PSD in urgent public health scenarios.

From the outcomes of Part one, it was evident that principles such as Self-monitoring, Authority, and Surface Credibility were not immediately comprehensible, requiring significant rephrasing efforts. The "Design with Intent" toolkit[14] and the "Behavior Change Wheel"[15] are essential tools that have enhanced our understanding of Persuasive System Design (PSD) by providing structured methods to apply behavioral theories in practical design contexts. These tools complement the PSD framework, offering actionable strategies to effectively encourage user behavior change.

We adopted the workshop as a research technique that is particularly effective in fields that benefit from hands-on learning and collective problem-solving [16]. Within this framework, users are elevated to the role of designers, actively contributing their experiences and insights to shape the outcomes. This participatory design process not only democratizes the development of solutions but also ensures that the products are closely aligned with the real-world needs and preferences of the end-users. Consequently, this approach facilitates a more user-centered design, inherently imbued with the practical wisdom and creativity of the very individuals it aims to serve.

Our endeavor focuses on adapting PSD for crisis contexts, distinctly informed by user participation and improvement of guidelines. The distinctive nature of our tool lies in two key aspects. This tool is designed with a twofold advantage. Firstly, it clarifies the principles of Persuasive System Design for non-expert users, offering a simplified and more accessible understanding of its application. By distilling complex concepts into user-friendly interfaces and functionalities, the tool empowers users to intuitively apply PSD strategies without requiring specialized knowledge.

Secondly, this tool addresses a significant void in existing resources by focusing specifically on crisis scenarios. Unlike prior tools that offer broad strategies applicable to a range of contexts, this tool incorporates considerations unique to emergency situations. It integrates these considerations into the design process, ensuring that the resulting strategies are tailored to the acute needs of users during times of crisis. This focus on emergency-specific design allows for the development of PSD applications that are both relevant and critical in supporting users through the unique challenges presented by crisis conditions. This highlights an important finding: even well-established PSD principles may not be inherently intuitive to designers, particularly when taken out of a general context and placed within the specific and high-pressure context of a pandemic.

The feedback produced by participants in the second part emphasized that the applicability of PSD principles in crisis situations is not always straightforward. Principles such as Similarity and Third-party Endorsements faced practical implementation challenges, whereas others like Tunneling Effect and Authority were viewed with scepticism regarding their persuasive effectiveness during a crisis. Additionally, the nuances of Reward systems, Recognition, and Personalization were scrutinized for their potential to either genuinely motivate users or inadvertently lead to counterproductive behaviors.

The study's critical analysis suggests that while PSD principles are valuable for designing persuasive technologies, their application must be context-sensitive, particularly in crisis situations. Designers must navigate the delicate balance between applying these principles to motivate users and avoiding the pitfalls of misapplication that could undermine the technology's credibility and effectiveness.

Furthermore, the study underlines the need for an iterative and user-centered design process, where PSD principles are not only tailored to the context of use but also to the psychological and behavioral nuances of the target users. The feedback on principles like Praise, Reminders, and Easy Verifiability indicates that user engagement and trust are paramount, and persuasive technologies must be designed with a deep understanding of these factors to be successful.

In conclusion, the findings call for a re-evaluation of how PSD principles are conveyed and adapted to the designers, suggesting that clarity and context are crucial for the effective use of PSD in health communication technologies. As the global community continues to grapple with the COVID-19 pandemic and future public health crises, the role of PSD in shaping user behavior remains vital. This study contributes to the body of knowledge by providing a framework for understanding and applying PSD principles in a manner that is both comprehensible to designers and sensitive to the unique challenges of crisis situations.

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