

# A Review on Persuasive Technology (PT) Strategy in Awareness Study

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## Abstract

**Objectives:** This paper reviews empirical research on persuasive technology with the following aims to (i) to examine the result of the 25 persuasive technology studies related to awareness as the intended outcome, (ii) to explore the strategy used in creating awareness to users and (iii) to identify the persuasive strategies used and (iv) investigates the domain of studies selected. **Methods/Statistical analysis:** This study employs two activities which are literature review and systematic review. Accordingly, 25 related models were compared and systematically analyzed. **Findings:** Result from the reviews indicates that persuasive technology has the ability to increase user awareness toward certain context or issues. Most of the studies show that the computer role as a media and social actor gives more impact to increase awareness compared to the computer role as a tool. In terms of persuasive strategy used, it shows that suggestion, cause and effect, and attractiveness are the most used strategies implemented in the applications. **Application/Improvements:** This study suggests that understanding the appropriate persuasive strategy is important in helping researchers developing an effective applications towards the intended outcome.

**Keywords:** Persuasive Technology, Awareness Study

## 1. Introduction

The advancement of persuasive effects usage embedded in computer system with the intention to change attitude and behavior has established a wide range of applications in health care, marketing, education, entertainment, safety and ecosystem environment <sup>1</sup>. This includes the potential of interactive applications such as multimedia, web apps, mobile devices, games and wearable computing in assisting the delivery of persuasive messages. As elaborated by <sup>2</sup>, the use of interactive applications is believed to have the potential as a digital persuader as effective as human which enables attitude or/and behavior change in a selected target.

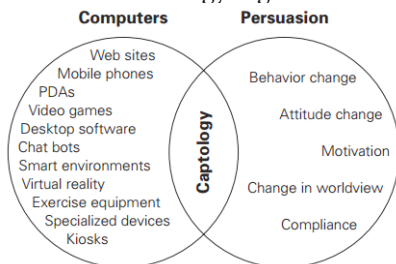
The use of appropriate interactive technology can enhance learner's cognitive and social abilities. This technology also attracts the learner's attention in term of meaningful learning, self-explored and retention in

content understanding <sup>3,4</sup>, thus helps learners to integrate information more efficiently. Therefore, persuasive messages would be enhanced by using appropriate interactive technology. It provides great solutions for various fields such as social aspect and promotes positive behavior learning environments.

The interactive nature of computer technology that allows designers to use computer as a persuasive tool to modify human behavior is known as persuasive technology (PT). <sup>5</sup> define PT as an interactive technology that is designed to change attitude or behavior through persuasion and social influence, not through any force and action. This unique potential of the use of persuasive computing has generated increasing interest in the application of persuasion to the design of persuasive computing. Hence, has further explored the overlapping area of study between persuasion and computing technologies

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and derived a term known as “catalog” or Computers as Persuasive Technology Figure 1.



**Figure1.** Computers as Persuasive Technology; Catalog.

According to <sup>6</sup>, persuasive technology can change people’s lives in three related ways based on the functional role or how user respond to the computer system, which are; computer as a tool, as a media and as an actor Figure 2.



**Figure2.** Functional Role of Computer.

Functional role of computer performs as a guideline or framework for designers and developers in developing interactive technology applications. Functional role of the computer is based on how users reflect during performance of task using computers. Thus, analyzing the computer role is important to increase the power of persuasion in computers. Explains the functional roles as follows:

1. As a tool - Computer can increase people’s ability to make target behavior by making it easier to do. For example, during installation, the computer system will guide users to perform specific task and motivate to perform the completion, or health monitoring devices that help users monitor their health with specialist.
2. As a media - The interactive technologies can provide interactivity and narrative to create persuasive experiences to users. These aspects help people rehearse their behavior and allowing them to explore the cause-and-effects relationship. For example, SimCity game

assists city planner observed the growth of the city by making necessary arrangements.

3. As a social actor - Computer can be persuasive by giving a variety of social clues (e.g. reward, praise, animated icon) to trigger users to respond. Digital pet is a very good example of how computers persuade users to accomplish certain task and maintain their behavior during a period of time.

A summary of persuasive technology roles and its related strategy are organized in Table 1.

**Awareness**

In a broad term, awareness can be defined as the state or quality of being aware of something. In psychological terms, awareness can be defined as a state in which people are aware of their feelings and behavior. Alternatively, it also can be defined as the understanding of mind self as an individual entity <sup>7</sup>. Since awareness is a relative concept, it also can be translated as a conscious to objects or sensory patterns. As stated <sup>8</sup>, awareness is one of the important criteria in measuring the emotional intelligence components in managing and self-control and to achieve the desired outcome.

Thus, self-awareness is the fundamental emotional intelligence on which other components such as self-management, social-awareness and relationship-management are integrated. As suggested <sup>9</sup>, in order for a person to be aware of a given experience, three conditions must be applied. First, the person must show a behavioral or cognitive change as a result of the experience. Second, the person must respond and aware of their own experience when the situation happened. Lastly, the person must be able to describe their own experience and evaluate themselves.

For the purposes of this study, the awareness term is referred as the ability to evaluate, give attention and self-evaluation which compare current behavior to internal standards and values. In other words, awareness is related to how to manage and self-control as and achieving the desired outcome.

**2. Materials and Methods**

The review process starts with the selection of relevant sources for article search. Springer database is selected as the main database with the search term such as “per-

**Table 1.** Persuasive Technology Strategy.

<p><b>Computer as a tool</b></p> <p>Principle of Reduction: Emphasize on reducing complex activities into a simple steps. Example: A “one-click” shopping by Amazon.</p> <p>Principle of Tunneling: The computer guides the users through a sequence of step or events. Example: A software installation that provides users with simple task by following through the process.</p> <p>Principle of Tailoring System that proposes additional item based on the customers’ interest and tailored information that suites their individual need. Example: YouTube will tailor information based on customer’s interest.</p> <p>Principle of Suggestion The system provides users with a suitable suggestion in the right time. Example: A smart car will inform driver to slow down after the speed limit is exceeded.</p> <p>Principle of Self-Monitoring People can achieve a predetermined goal or outcome if they think they are being monitored. Example: A heart rate monitoring sensor to track heart rate accurately and easily.</p> <p>Principle of Surveillance Authority or administrator monitors the selected behavior. Example: A mobile surveillance apps that monitor specific human behavior.</p> <p>Principle of Conditioning Positive reinforcement to change existing behaviors into a new habit through rewards. Example: Computer games that engage users to keep on playing.</p>
<p><b>Computer as a media</b></p> <p>Principle of Cause and Effect Cause-and-effect enables users to experiment and explore the real-world consequences in a safe environment. Example: SimCity games explore the cause and effects during urban development.</p> <p>Principle of Rehearsal Simulated environment to the users with a means to rehearse the target behavior and to explore new behaviors and perspectives. Example: Flight simulation during flight training.</p> <p>Principle of Virtual Rewards System that provides virtual rewards for real activity in order to give credit for performing the target behavior. Example: Fitness apps.</p> <p>Principle of Simulation in Real-World Context Simulating something in the context to which it belongs. Example: “Baby think it over” infant simulated baby doll (www.realityworks.com).</p>
<p><b>Computer as a social actor</b></p> <p>Principle of Attractiveness A more attractive technology (interface or hardware) will have greater persuasive power than the unattractive. Example: Visual appearance of the Apple products in creating consumers loyalty.</p> <p>Principle of Similarity It is suggested that products may be more persuasive if they match the personality of target users or are similar in other ways.</p> <p>Principle of Praise Praise or reward usually used to appreciate certain achievement just after a person accomplished certain task which is easily achieved by using computer.</p> <p>Principle of Reciprocity People will feel the need to reciprocate when computing technology has done a favors for them.</p> <p><b>Principle of Authority</b> This principle emphasizes on the credibility of the system to influence behavior. People are more likely to take action if the message comes from a credible and authoritative source.</p>

suasive technology”, “catalog”, “persuasive multimedia” and “awareness”. These keywords are searched in titles, abstracts, and keywords. IEEE Explore Digital Library and ACM Digital Library are also selected as secondary databases.

In related to this study, the focus of this review is stated as follows:

- Examining the persuasive technology studies related to awareness as the intended outcome.
- Exploring the strategy used in creating awareness to users.
- Analyzing the effects of strategies used to target users.
- Investigating the domain of selected studies.

Initial searches of the Springer database has resulted 1626 articles, whereas with the IEEE database and ACM Digital Library returns 1459 and 126 articles respectively. Next, all the articles are compared to determine any duplication among the search database for exclusion. The title and abstract are independently reviewed and the relevant articles are selected to determine if they fulfil the criteria. The second part of the review is to screen the content of the article and determine the suitability of the article for this study.

**Review Criteria**

A result of 25 studies (articles) related to persuasive technology and awareness are selected for review purpose (see Appendix A). The articles are selected based on the following criteria:

- The article is an experimental study related to awareness as the outcome of study.
- The research methods are explained by the researchers.
- The studies are related to the effects of persuasive technology and interactive technology to attitude or behavior related to awareness to the selected target.
- The literature are been published between 2008 and 2014 from various countries.

Result of the review is presented in a form of table with the description of the findings. Finally, the results are discussed in the findings section.

### 3. Findings

**Persuasive Strategy**

Examining the strategy in developing successful persuasive system is crucial for designer and developer to make

sure the target users will be persuaded. Table 2 reports the result reviewed based on the strategy used by the researchers. Off all the persuasive strategy reviewed in 25 articles, it shows that “suggestion” (92%) is the main strategy used in computer as a roles, this followed by conditioning strategy (72%), self-monitoring (44%) whereas for the reduction and surveillance strategy only a few articles employed it in the applications. As depicted in Table 2 reduction and surveillance shows the lowest persuasive strategy used by the researches.

For a computer as a media and simulation “cause and effects” strategy is comprised of 92% of the articles. It is logically understandable since “cause and effects” is considered as the key components to support and engaged towards awareness. It is followed by simulation in real-world (52%), virtual rewards (32%) and virtual rehearsal (16%).

Whereas for the computer roles as a social actor it is obviously shown that the attractive appearance of the developed system found to be popular in developing awareness to the target users that covers 96% of the strategy. This suggests that the application of computing technology is supposed to be visually attractive in order to engage and create user’s awareness.

Another strategy that is significantly related to the human behavior is praise (80%). Study reported that computer users feel better about themselves after receiving praise from the computers, subsequently creating motivation and awareness<sup>10</sup>.

**Table 2.** Review of Persuasive Strategy

Roles	Persuasive Strategy	Total	Percent
Computer as a tool	Reduction	2	8%
	Tunneling	5	20%
	Tailoring	7	28%
	Suggestion	23	92%
	Self-Monitoring	11	44%
	Surveillance	4	16%
	Conditioning	18	72%
Computer as a media	Cause and Effect	23	92%
	Virtual Rehearsal	4	16%
	Virtual Rewards	8	32%
	Simulation in Real-World Context	13	52%

Computer as a social actor	Attractiveness	24	96%
	Similarity	15	60%
	Praise	20	80%
	Reciprocity	0	0
	Authority	0	0

**Persuasive Effect**

Table3 summarizes the result of persuasive effect of the reviewed studies. The result is categorized into three types of effect; positive, partially positive and negative or no effects. In summary, a total of 21 studies reported positive results from the persuasive technology treatment in creating and raising awareness of the selected target which comprised 80% of the reviewed studies. While partially positive results were reported in three studies that comprised 12%, whereas only a few paper discuss the outcome of studies with negative or no effects.

**Table 3.** Review of Persuasive Effects (Code refer to appendix A)

Result	Study	Total	Percent
Positive	A1, A2, A4, A5, A6, A7, A8, A10, A12, A13, A14, A16, A17, A18, A19, A21, A22, A23, A24, A25	20	80%
Partially Positive	A3, A20, A15	3	12%
Negative/ No effects	A9, A11	2	8%

**Role of Computers**

Table4 reports the result of the reviewed studies based on the role of computers: (i) as tool (ii) as media and (iii) as social actor as a strategy in creating awareness to the selected target. Overall, from the studies examined, it shows the majority of studies had employed social actor strategy which encompassed 40% of the paper reviewed. It also revealed that media simulation is also the most frequent strategies adopted by the researchers which comprise 36% of the studies. Meanwhile, the effects of computer as a tool account only 24% as a strategy applied by the researchers.

**Table 4.** Review of roles of computer (Code refer to appendix A)

Computer Roles	Study	Total	Percent
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Tool	A5, A6, A7, A8, A9,A10,A11, A12, A14, A17, A19, A21,	12	24%
Media	A1, A2, A3, A4, A5, A8, A12, A14, A15, A17, A18, A19, A20, A21, A22, A23, A24, A25	18	36%
Social Actor	A1, A2, A3, A4, A6, A7, A10, A11, A12, A13, A15, A16, A17, A18, A20, A21, A22, A23, A24, A25	20	40%

**Domain of Studies**

Table5 reports the result of the reviewed studies based on the domain of the target behavior of the persuasive technology. Overall, from the studies examined, persuasive technology in health context is the most studied by the researchers encompassed 24%. The second most studied is environmental (20%) followed by security and safety, conservation and community/social (16%). Although education and learning are the lower among the studies, the implementation of the persuasive learning technique is also embedded in others domain of studies.

**Table 5.** Review of domain of target behaviour (Code refer to appendix A)

Domain	Study	Total	Percent
Environmental	A1, A4, A10, A18, A20	5	20%
Security & Safety	A2, A3, A13, A16	4	16%
Conservation	A6, A7, A12, A19	4	16%
Health	A8, A9, A14, A17, A21, A22,	6	24%
Education & Learning	A5, A11	2	8%
Community & Social	A15, A23, A24, A25	4	16%

**4. Discussion**

The emerging sub-discipline of Human Computer Interaction (HCI): Persuasive technology, gives an opportunity to researchers to implement persuasive design that can potentially bring behavior or attitude change to the selected target. Referring to the title of this systematic review, where awareness is the main focus on the psy-

chological behavior, it can be concluded that, from the published articles, persuasive technology do persuade people to increase their awareness toward certain context or issues.

Overall, most of the reviewed article showed that persuasive technology can be an effective tool for changing attitudes and awareness as the learning purposes. This review also provides researchers with in-depth view on how to develop awareness using available principle which could be designed into a persuasive system with the aim to facilitate attitude or behavior to the users.

This study shows that the effects of persuasive strategy are significantly dependent on the context in which the interactive element or content is being implemented, as well as on the users who are willing to use the persuasive application and the system. Therefore analyzing the type of persuasive strategy is crucial to the developer to make sure the users will be persuaded and received the intended outcome.

From the reviewed studies, it also shows a diverse domain of study is discussed by implementing a different type of persuasive strategy. Although in reality, the computer has act as a tool in our daily life, however, most of the studies show the computer as a media and social actor give more impact to increase the awareness of the respondent in facilitating the awareness element in the computer system.

## 5. Conclusion and Future Works

In conclusion, previous studies shows that, in order to develop successful persuasive computers, it is necessary for designers to evaluate persuasion strategies to make sure that the target user, will be persuaded, and make use the benefit of this technology. Thus, certain guidelines should be followed to ensure the developed persuasive application will match with the targets users.

On top of that, this study is also provides valuable information for future research related to the design of persuasive system and suitable persuasive approach that enable designer to engage users with the persuasive computing system. Thus the next stage of the study is to explore on how the persuasive strategies should be com-

bined with the suitable persuasive approach in a way to ensure the developed application fits to the users need.

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## 7. References

1. Fogg B J, Cuellar G, Danielson D. Motivating, influencing, and persuading users. *The human-computer interaction handbook*. 2002 , pp.358-370.
2. Salam, Abdul S R, Yahaya W A J W, Ali A M. Using persuasive design principles in motivational feeling towards children dental anxiety (CDA). *International Conference on Persuasive Technology*, Springer Berlin Heidelberg. 2010, pp.223-237.
3. Liu, Min, Jones C, Hemstreet S. Interactive multimedia design and production processes. *Journal of Research on Computing in Education* .1998, 30(3),pp. 254-280.
4. Mayer, Richard E. Incorporating motivation into multimedia learning. *Learning and Instruction*. 2014 Feb,29, pp. 171-173.
5. Fogg B J. Persuasive technologies. *Communications of the ACM*. 1999 May, 42(5),pp. 26-29.
6. Fogg B J. *Persuasive Technology: Using Computers to Change what We Think and Do*. Morgan Kaufmann. 2003.
7. Crisp R J, Turner R N. *Essential social psychology*. London: Sage Publications. 2010 Mar.
8. Catherine U O. Individual Variables and Principals Emotional Management Competencies in Secondary Schools in Rivers State. *Global Academic Group*. 2001,pp. 1 -11.
9. Miller C R, Eisner W, Allport C. Creative coping: a cognitive-behavioral group for borderline personality disorder. *Archives of Psychiatric Nursing*. 1994 Aug ,8(4), pp. 280-285.
10. Clark R C, Mayer R E. *E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning*. John Wiley & Sons. 2012 Jan .