This paper reviews the emerging research literature on persuasive design models, while at the same time counterbalancing it with a comparative review of the most popular models as well as findings from the field of Technology Enhanced Learning (TEL). These models are systematically compared and analysed with regard to producing technology enhanced learning experiences. The results of this comparison can be used when selecting models for designs, in addition to concurrently serving as an offset for creating new models.

**Keywords:** Persuasive Technology Design, TEL, Design Models, Persuasion

**Introduction**

Persuasive design (PD) is centred on the concept that humans may delegate the act of persuasion to non-human entities, deliberately seeking to change or reinforce behaviours and attitudes. In 400 B.C., Aristotle defined rhetoric as “…the faculty of observing in any given case the available means of persuasion” (Aristotle 2010). PD (Redström 2006) is increasingly becoming an area of interest across multiple domains. Persuasion can be used in multiple domains, and in observing how Aristotle, Cicero and other modern scholars (Dillard, Pfau 2002) describe persuasion, it soon becomes evident that ‘persuasion’ is not the automatic result of certain steps engaged in by an individual. On the contrary, persuasion is a complicated and somewhat unpredictable social process tied to the rhetorical situation in which persuaders seek to persuade (Bitzer 1968, Vatz 1973, Torning 2008). In the field of PD, the topic of ‘health’ has especially attracted particular attention (Torning, Oinas-Kukkonen 2009, Chatterjee, Price 2009, Kamal, Fels 2012). Problems such as alcoholism, obesity and lack of exercise all provide a multitude of interesting research questions, since their singular real remedy lies in individuals changing their behaviour patterns and remaining consistently motivated towards maintaining the behavioural change thus initiated (WHO Regional Committee for Europe 2008, IJsselsteijn et al. 2006). As with ‘health’, ‘learning’ is also a complicated social process dependent on the behaviour and attitude change of individuals, as well as continuous self-motivation. However learning may not occur even if learners are both motivated and have a positive attitude towards learning. We can speculate that addressing ‘learning’ with persuasive design in numerous settings might be a more difficult proposition than addressing ‘health’. Like persuasion, learning too is rooted in ancient Greece and rhetoric. Subsequently, Cicero went on to describe the three functions of the rhetorician: “Docere, Delectare, Movere,” or “To Teach, To Delight, To Move.” (Christensen, Hasle 2007). Thus, it becomes obvious that teaching has been an integrated part of rhetoric for many years. Persuasion and learning are very situational and dependent on the interplay of many different factors (Wang, Hannafin 2005). For this very same reason, we cannot expect to find a unified theory or model of either concept, as they are bound by a certain context comprised of (for example): student/audience, teacher/speaker, classroom/venue, topic, values, zeitgeist and culture. In the domain of learning, a relatively recent change is the adoption of interactive technologies (especially Learning Management Systems, which are being increasingly adopted by various institutions). Wang and Hannafin (2005) offer a broad definition of such technologies: “Technology Enhanced Learning
Environments (TELEs) are technology-based learning and instructional systems through which students acquire skills or knowledge, usually with the help of teachers or facilitators, learning support tools, and technological resources.” In combining PD with TEL, we are able to identify the outline of a problem that is characterised by a staggering level of complexity. How can we begin to address these many different variables combined with nuances of numerous abstract social concepts? What exactly are practitioners and researchers expected to accomplish, if they wish to design a persuasive TELE? Typically, researchers have used PD to address several health educational issues. Some examples of PD would be a computerised doll designed to teach adolescents about the consequences of not using birth control (Realityworks 2010, Fogg 2003); teaching women in rural India about their menstrual cycle and personal hygiene (Parmar, Keyson & deBont 2008); changing office workers' sitting habits in order to prevent back strain (Obermair et al. 2008) and designing kitchens that promote calorie-awareness cooking (Chi et al. 2008). It is interesting to note that all these studies were conducted by researchers who were not specialists in the field of education. If researchers are to address ‘learning’ and education at the macro level of persuasion (Fogg, 2003), they should design models that difficult as this may be, specifically address the rhetorical situation surrounding ‘learning’ and include findings from educational research including TEL.

Methodology

If researchers aim at developing a TEL specific PD-model tailored to address the domain of learning and technology, an accepted starting point is a thorough review of some existing PD-models. In this paper, PD-models are coupled with TEL, by subjecting PD-models to evaluation employing the nine TEL research design principles developed by Wang and Hannafin (2005). The authors arrive at the nine principles as a result of their literature review of design-based research paradigms and state that: “To generate practical, credible, and contextual design theories, however, rigorous, disciplined, and iterative inquiry is needed […] we identify nine principles central to planning and implementing TELE design-based research” (p.15). In this paper however, the principles are applied to evaluate design models and in that sense one could argue, that the principles are being stretched beyond their intended domain. However, it is debatable if design models can be regarded as a form of meta-designs, and if they are in addition, expected to comply with sound standards of design research. The analysis presented here can be seen as a small first step towards creating a TEL centric PD-model and the resultant overview of PD-models is also intended to make the task of selecting a design strategy easier, for those wishing to mix persuasion, learning and technology.

Persuasive Design Models

Since PD is a fledgling area of research, one does not have the option to choose from numerous existing models. Three frameworks were selected for the purpose of this analysis: The Design with Intent (Dwl) Method (Lockton, Harrison & Stanton 2010); the Persuasive Systems Design (PSD) Process Model (Oinas-Kukkonen, Harjumaa 2009); and the Eight-Step Design Process (Fogg 2009). These models can be considered first generation PD-models and they were selected based on general work in the field of PD. The three models originate from the Persuasive Conference Series, which is currently the main outlet for scientific dissemination centred on PD. Emerging PD-models created by practitioners (Futerra 2013) or a mix of practitioners and researchers (Fabrique 2013) were omitted. Although Fogg’s first model: The Functional Triad (Fogg 2003) has often been widely used, it was omitted in favour of his newer 2009 design process.
Design with Intent (DwI) Method

Early on in the Persuasive Conference series Dan Lockton et al. addressed behaviour change from a perspective dubbed “Design with Intent,” (DwI) defined as “design intended to influence or result in certain user behaviour” (Lockton, Harrison & Stanton 2008, Lockton et al. 2009, Lockton 2013). The DwI Method is intended to be generally applicable in influencing user behaviour. The latest iteration of the model (Lockton, Harrison & Stanton 2010) is comprised of two modes: ‘Inspiration’ and ‘Prescription’.

In the 'Inspiration' mode, the designer takes inspiration from a set of headline design patterns, which are applicable to a wide range of target behaviours, grouped into six different ‘lenses’, representing particular disciplinary perspectives on using design to influence behaviour.

In the ‘Prescription’ mode, the designer formulates a range of target behaviours (intended outcomes), describing interactions and as a consequence, a subset of the most applicable design patterns from each ‘lens’ is presented for each target behaviour. The total number of patterns will vary depending on the chosen target behaviour(s) (according to the authors' typically 15–25 applicable patterns). This mode effectively ‘prescribes’ a set of patterns, which are deemed especially applicable or have already been applied to similar problems by other designers, in other contexts.

The ‘lenses’ themselves, are a way of grouping design patterns which share similar considerations, behavioural understanding or assumptions about how to influence users: to some extent, these groups resolve into particular ‘worldviews’, the way that a designer versed in a particular discipline might approach a brief on influencing behaviour. The six ‘lenses’ thus target specific domains: 1) The “Architectural Lens” is based on techniques utilised to exert influence on user behaviour in architecture, urban planning and related disciplines. 2) The “Errorproofing Lens” tackles deviations from the target behaviour by treating them as ‘errors,’ which design facilitates in evading, either by making it more uncomplicated for users to work, with no possibility of being prone to errors. 3) The “Persuasive Lens” makes use of computers with interfaces in order to convince users into transforming attitudes and behaviour. 4) The “Visual Lens” seeks to merge ideas from product semantics, semiotics, ecological psychology and Gestalt psychology on the subject of the manner by which users distinguish patterns and meanings. 5) The “Cognitive Lens” is based on research in behavioural economics and seeks to understand by what method people make decisions. 6) The “Security Lens” symbolises a ‘security’ worldview, which states that it is possible to discourage and/or avert unacceptable user behaviour. When designers seek to employ the ‘lenses,’ a free cards based solution is available. The cards serve as a very tangible way to explore the various design patterns (Lockton 2013).

Persuasive Systems Design (PSD) Model

Oinas-Kukkonen & Harjumaa (Oinas-Kukkonen, Harjumaa 2009) offer a model grounded in previous research. The model is comprised of three distinct phases: 1) Understanding key issues behind persuasive systems, 2) Analysing the persuasion context and 3) [Selecting] Design of system qualities. The optimal result of this linear model is “Behaviour and/or attitude change”.

The first phase in the words of the authors addresses the understanding of basic concerns fundamental to special persuasive information technology systems, prior to implementing these systems. Oinas-Kukkonen & Harjumaa (Oinas-Kukkonen, Harjumaa 2009) state that, “Only after obtaining a reasonable level of this understanding can the system be analysed and designed.” Seven postulates behind persuasive systems are also offered.
In the second phase, seven core elements are offered, to create a better understanding of the context of persuasion:

1. **Persuader**: the designer who is deliberately seeking to change the behaviour or attitude of the system user.
2. **Change type**: the type of change in behaviour and/or attitude the designers aim at invoking via their design.
3. **Use context**: the features arising from the problem domain target, which the persuasion design addresses e.g. features specific to ‘health’ or ‘learning’.
4. **User context**: the traits of the targeted user, e.g. goals (including current progress toward achieving them, and potential past performances), commitment, lifestyle etc.
5. **Technology context**: The strengths and weaknesses, as well as the risks and opportunities, of specific technological platforms, applications and features.
6. **Message**: the form and content delivered to the user who has to be persuaded. The form is how the message is presented, e.g. as raw text, in a dialogue, or in a game. The content of the message has to fit the form.
7. **Route**: persuasion can be direct, indirect or both. A direct route would be one wherein the message contains only a few strong arguments, while an indirect route has numerous arguments.

In the third phase of the design model, the qualities of the information system being designed are modelled. Here the designer can select from an extensive catalogue listing 28 design principles for persuasive system content and functionality. The principles are ordered in the following main categories: primary task support, dialogue support, system credibility support and social support. For each category, several approaches are offered with concrete advice and examples of implementation.

**The Eight-Step Design Process**

Benjamin J. Fogg can be regarded as one of the founding fathers of ‘persuasive technology’ and at least, the most widely cited (Fogg 1998, Fogg 1999, Fogg 2003). In his eight step model, he states that, “The goal of Steps 1 through 7 of the design process is to create a digital product that reliably persuades someone — not everyone — to adopt the target behaviour.” Following the steps, the designer (or design team) is guided towards creating a persuasive technology. However, Fogg asserts that, “The eight steps are not intended to be a rigid formula; instead, the steps serve as milestones to make the design process more effective.”

1. **Choose a simple behaviour to target**: Here designers decide on an appropriate behaviour to target for change.
2. **Choose a receptive audience**: If the project does not demand otherwise, it is best to ensure that the audience is familiar with the technology channel, thus making them more responsive to change.
3. **Find out what is preventing the audience from performing the target behaviour**: As reported by Fogg, it may be either a) lack of motivation, b) lack of ability or c) lack of a well-timed trigger to perform the behaviour. However, the design process offers little evidence, which makes it difficult to assess that claim.
4. **Choose a familiar technology channel**: The “best” channel usually depends on three factors: the target behaviour, the audience, and what is preventing the audience from adopting the behaviour—i.e., the first three steps in the design process.
Optional (unnumbered) step: Re-ordering the First Four Steps: Designers usually perform the first four steps in sequence, but according to Fogg, in some cases designers will make an exception and carry out the steps in a different order.

5. Find suitable examples of persuasive technology: Search for examples of successful persuasive technologies that are relevant to the intervention, by seeking out solutions that succeed in getting people to change their behaviours.

6. Imitate successful examples: Rather than going back to square one, a more appropriate and desirable approach is to imitate successful examples of what is already working.

7. Test and iterate quickly: After imitating successful examples, test the designed user experience promptly and repetitively. A series of small, very quick tests (not scientific experiments) is preferable to one big test. The purpose is rapid prototyping, best achieved by measuring behaviour.

8. Expand on success: Even a small behaviour change is a milestone. The technique of expansion should be systematic, by varying only one or two attributes from the success achieved in Step 7. Fogg states that as perceived from a scientific perspective, step 8 is the starting point for a controlled experiment.

Results and recommendations

The application of Wang and Hannafin's nine principles for design based TEL research served to shed light on various traits of the PD models. Each model was evaluated against the nine principles to reveal their strengths and weaknesses as outlined in Table 1 below.

Some common issues were discovered in all the models. For instance, with regard to Principle 1 (“Support Design with Research from the Outset”), it is surprising that all of the models largely ignore the opportunity to integrate previous findings from the research areas of communications, rhetoric and ethics, as these areas predate research on PD and should be specifically addressed when presenting any model prescribing how to conduct ‘persuasion’. The models also presume that anyone can generate data and analyse the user context for persuasion. Principle 5 (“Implement Research Methods Systematically and Purposefully”) and Principle 6 (“Analyze Data Immediately, Continuously, and Retrospectively”) are not addressed by any of the models, which thus display a common weakness, by omitting to explicitly concentrate on and tackle the generation and analysis of empirical data for informing a persuasive design. Perhaps the authors take these activates for granted. When informing a design from the User Centred-Design (Beyer, Holtzblatt 1998, Holtzblatt, Wendell & Wood 2005) prospective researchers are dominantly seeking to support tasks' completion by lowering the cognitive burden of those tasks, whereas PD seeks to transform and motivate behaviours. It appears counterintuitive that such an apparently large difference and distinction in objectives, should not somehow affect how researchers generate data and analyse it when informing the designs. However, developing clear PD research guidelines for data generation with regard to observations, interviews, surveys, document analysis or field studies etc. is a daunting task, and perhaps it would be premature, if researchers were to address that issue before designing more robust models.

The Design with Intent (DwI) model and the Persuasive Systems Design (PSD) model both fail to address Principle 7: (“Refine Designs Continually”), and therefore, testing and social interactions with users are not addressed. Another general issue with the models is that ‘persuasion’, supposedly resides in a right mix of strategies for the right rhetorical situation by creating a fitting (technology) response (Bitzer 1968, Torning 2008). When we speak of
Table 1. Persuasive Design frameworks measured against Wang and Hannifin’s nine design principles.

|--------------------------------------|---------------------------------------------------------------|-----------------------------------------------------------------------|--------------------------------------|
| 1: Support Design with Research from the Outset [Integrating previous findings i.e. by literature review] | • Clearly offers many references to previous work from a plethora of research fields. The model’s perspective on ‘design’ is made very clear.  
• Each ‘lens’ is backed up by clear references. | • Offers a variety of references anchoring the work mainly in Information Sciences, Psychology, Social Psychology and Human Computer Interaction (HCI). | • Builds mainly on the author’s personal experience.  
Offers author's website as a reference, where several references are listed. However it is unclear, how these references were integrated into the design process. |
| 2: Set Practical Goals for Theory Development and Develop an Initial Plan | • Does not explicitly mention or address theory development.  
• Offers very clear research goals for the model by offering a section (2.1.3) elaborating on the evolution of the method. | • Explicitly addresses theory development i.e. “This article is conceptual and theory-creating by its nature…”  
• Clearly synthesizes several theories (that are described as such).  
• Offers very clear research goals with regard to developing the model. | • Does not explicitly mention or address theory development, but rather refers to the design process as ‘best practice’: “…in this paper I draw on my 15 years of experience in studying and creating persuasive technologies to offer what I consider to be “best practices”…” |
| 3: Conduct Research in Representative Real-World Settings | • Offers a comparative clear design case using the design of an ATM machine. It is however an armchair study (no users involved). The behaviour targeted is to ensure that people don’t forget their credit card, when withdrawing money. | • Offers an example design (Nike 2013) in the form of a thorough and convincing analysis employing the Persuasive Systems model. | • Does not offer research representative of a real-world setting, but uses plausible thought up examples to exemplify some points. |
| 4: Collaborate Closely with Participants | • The Method was developed through a series of workshop sessions (with design students and recent graduates).  
• Does not offer clear guidelines for involving users in applications of the DwI model. | • The Persuasive Systems Design Model was developed by two researchers and does not mention validation with others.  
• The model does not offer clear guidelines for involving users in applications of the model. | • The Design Process is centred on the activities of a ‘design team’, but was developed by a single researcher, by drawing upon his personal experiences and does not mention validation with other designers/practitioners. |
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<td>5: Implement Research Methodologically, and Purposefully</td>
<td>The Method does not offer advice or research guidelines e.g. observations, interviews, surveys, or field studies etc.</td>
<td>The Persuasive Systems Design (PSD) Model does not offer advice or research guidelines e.g. observations, interviews, surveys, or field studies etc.</td>
<td>The Design Process does not offer advice or research guidelines e.g. observations, surveys, or field studies etc.</td>
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<td>6: Analyse Data Immediately, Continuously, and Retrospectively</td>
<td>The Method does not offer advice or research guidelines for data analysis.</td>
<td>The Persuasive Systems Design (PSD) Model does not offer advice or research guidelines for data analysis.</td>
<td>The Design Process does not offer advice as to how to measure 'persuasiveness'.</td>
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<td>7: Refine Designs Continually</td>
<td>The Method does not explicitly recommend that designers work in an iterative fashion. The Method suggests that designers innovate novel solutions but the Method does not go beyond that.</td>
<td>The Persuasive Systems Design (PSD) Model does not explicitly recommend that designers work in an iterative fashion. The general approach suggested is linear.</td>
<td>Explicitly addresses contextual influences with clear domain specific design principles i.e. use context.</td>
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<td>8: Document Contextual Influences with Design Principles</td>
<td>Does not explicitly address contextual influences with design principles.</td>
<td>The Persuasive Systems Design (PSD) Model does not explicitly address contextual influences with clear domain specific design principles in the form of 'lenses'.</td>
<td>Explicity addresses contextual influences with clear domain specific design principles.</td>
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<td>9: Validate the Generalisability of the Design</td>
<td>Suggests that the design team must perform &quot;Step 7: Test and iterate quickly [...], the next step is to test various persuasive experiences quickly and repeatedly. A series of small rapid tests will teach more than one big test.&quot;</td>
<td>Design case analysis is offered as proof of generalisability. The authors openly state that the work is conceptual and theoretical i.e. based on postulates.</td>
<td>Mentions that the model is tailored for the early stages of persuasive technology design but does not address generalisability.</td>
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the ‘persuasiveness’ of applications, we need to discuss simple features or the whole systems effect. An obvious problem is that none of these suggested tactics by themselves individually appear to be persuasive. For instance, is a tactic such as reduction (making a task easier to complete) in fact a persuasive strategy or just a prerequisite? From one perspective, the models are seemingly collages of such tactics adopted from various fields of research.

The Design with Intent (DwI) model meets four of the Principles: 1, 3, 8, and 9 (but with little proof). It fails to adhere to Principles 4, (considering that the model itself was developed iteratively) 5, 6 and 7 (again, the model itself was developed iteratively). Principle 2 was partly met, on account of the fact that the model offers very clear research goals but it does explicitly mention or address theory development as such. With respect to TEL a clear advantage of this model is that it is very well grounded and corroborated, as it draws on many diverse sources of scientific knowledge by offering a plethora of references. With reference to persuasion in the domain of educational research, the DwI model seems to offer the most especially in situations, where one is designing a physical environment or an actual product e.g. for a classroom setting. It is very positive that the model is component based with an offset in specialist domains. It thus offers researchers the possibility to extend the model in developing new domains and context specific ‘lenses’.

The Persuasive Systems Design (PSD) model also meets four of the Principles, namely 1, 2, 3 and 8. Principle 9 is partly met, as the authors demonstrate very clear awareness issues with robustness and validation, describing the work as both conceptual and theoretical. This model leaves Principles 4, 5, 6 and 7 unaddressed. The PSD model is clearly inspired by formal approaches in Information Sciences (i.e. “software requirements”). If researchers are to address web-based e-education Learning Management Systems (such as Fronter, Blackboard or Moodle), the PSD model will certainly offer significant guidance. The many clear design principles offered are reasonably straightforward; however there is not much guidance as to the right mix of principles.

B.J. Fogg, is by far the single most influential PD researcher and is generally credited with being the founding father of the field of PD. However, his Eight-Step Design Process model only adheres partly to Principle 1 and (as the only model) Principle 7. Fogg openly states that the model is the result of informal synthesis of “best practices”, condensed from his personal work experience. But, despite Fogg’s undeniably strong ethos, from a scientific standpoint, this is problematic. Fogg claims that the model can facilitate rapid prototyping in design teams and states that scientific research experiments can only begin after Step 8. Nonetheless, even if one were to experiment i.e. measure the success of the resulting design, the foundation would not be optimal from a research-based perspective. The Eight-Step model seems most appropriate if researchers wish to get quickly acquainted with PD-thinking and reasoning. In fact, the model is a good starting point, if one is not familiar with PD and wishes to grasp the concept of PD more thoroughly. Nonetheless, this model may not be the optimal choice for more advanced scientific projects.

In delegating persuasion to non-human entities, we are left with an entirely new set of challenges regardless of which models we choose. Many difficult questions arise especially regarding ‘target behaviours’. What are we really persuading someone about, when we seek to persuade someone into learning something?... To spend time on studying? If students are dealing with cognitive problems, what are we to persuade them about? ‘Learning’ might not automatically occur even if students change both their behaviour and have the right attitude; we cannot persuade students into being able, if they are not. Another general problem with technology mediated persuasion is that it is problematic both for researchers, practitioners and users to fully understand how persuasive designs persuade. When we persuade in speech or writing, we – hopefully – strive to present cogent arguments and may employ appeals such as
logos, ethos and pathos. We have models if we want to analyse such arguments (Weston 2000, Walton, Reed & Macagno 2008, Toulmin 2003), but how do physical objects or interactive systems persuade users and how can users evaluate the validity of the ‘claims’ presented by designs? None of the models – for good reasons – help us answer these problems.

Conclusion

The application of Wang and Hannafin's nine principles for design based TEL research served to shed light on various traits of the PD-models. The models each had their own strengths and weaknesses and perhaps it is not surprising, that a fledgling area of research fails to address the entire complexity offered in the nine principles. Moreover, these are certainly issues that new iterations of frameworks would somehow have to integrate and therefore, there would be several larger issues left to discuss. But a first step has been taken towards addressing the possibilities of creating a ‘learning’ centric Persuasive Design model. It is clear that a successful model would have to address an extremely complex mesh of social science concepts. When we seek to apply persuasion to a rhetorical situation centred on learning, we are faced with considerably large and diverse challenges. An initial challenge is that it would be very difficult to be a true specialist of learning, pedagogic, rhetoric and technology design, and thus the effort of creating a Persuasive Design (PD) model for TEL would appear to be an inherently multi-disciplinary task.

References


