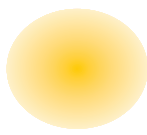


The Landscape of Persuasive Technologies

Aimed largely at children today, persuasion is already part of many technologies, but many more are on the way for everyone else.

PHILLIP KING AND JASON TESTER For better or for worse, persuasive technologies are already part of the everyday technological landscape we all live in. Since 1997, the Persuasive Technology Lab at Stanford University has tracked existing and emerging computing devices designed to change human attitudes and behaviors. As a result, we have identified about 50 such devices. The point here, however, is not to list them; instead, we want to offer the deeper insight we've developed by categorizing the landscape of persuasive technologies along four distinct axes—domains, users, form factors, and strategies—for delivering their messages of change. Not only is this insight important in understanding what's available now, it helps suggest what to expect in the future.

 While computers have long used motivational strategies (such as fantasy, competition, and positive reinforcement in educational software [2]), the emergence of persuasive technology artifacts is a significant—and potentially controversial—new direction in the design of computing systems. This area is important for computer professionals to understand so we can influence this new type of technology in a positive way. To this end, we share our views of the domains, target users, form factors, and key

strategies of today's persuasive technologies. And to explore the landscape of persuasive technologies, we have selected five artifacts as representative examples (see Table 1 and the sidebar Commercial Applications).

A Dozen Domains

At first glance, you might expect persuasive technologies to be just those that help sell products. But selling is only one region of the persuasive technology landscape—and the least interesting to view. There are at least 12 domains for which persuasive technologies have significant potential (see www.captology.org). We discuss the four that are the most significant today.

The most widely used is marketing, which

online marketing [4], we felt it unnecessary to address buying and branding technologies in detail here.)

Health is the next most significant domain for today's persuasive technologies, embracing technologies that motivate people to stay physically fit, take preventive measures against illness, and manage diseases effectively. The pervasiveness of health maintenance through technology isn't surprising; most people accept the idea that improving physical and mental well-being is a good thing to do. As a result, persuasive technologies promoting wellness benefit from a large and enthusiastic potential market and are unlikely to raise serious ethical questions (see Berdichevsky et al.'s "Toward an Ethics of Persuasive Technology" in this issue). Furthermore, in Western cultures, technology has long been valued for helping maintain and recover health. Adding computing devices that persuade to this tradition of technology is a small step, not a revolution.

Two of the representative examples in Table 1 concern health. The 5-A-Day Adventures, a CD-ROM produced by Dole Food Corp., uses animated characters, music, and games to encourage children to eat the number of daily servings of fruits and vegetables recommended by the U.S. Food and Drug Admin-

istration. While avoiding the outright promotion of the Dole brand, it effectively promotes better eating habits, an outcome most parents and teachers find attractive, and has been distributed widely in schools throughout the U.S. (see www.dole5aday.com).

Another example in the health domain is Baby Think It Over, a computerized doll used mostly in U.S. high school parenting classes [5]. This technology gives students a painfully realistic simulation of parenting. The "baby" is programmed to cry at random intervals during the day and night; only a key attached to the student "parent's" wrist, when held into the baby for 5 to 15 minutes, will quiet it. A small computer inside Baby Think It Over logs neglectful inattention to cries or other mistreatment of the baby for later analysis by a teacher (see www.btio.com). Like the 5-A-Day Adventures product, Baby Think It Over promotes widely held views, in the Western world at least, of good health behavior.

Our tracking of other health-related persuasive

Persuasive Technology Artifact	Description
Baby Think It Over (www.btio.com)	A computerized doll for teens simulating the difficulties of parenthood.
Hygiene Guard (www.hygieneguard.com)	An employee monitoring system to encourage hand-washing after bathroom use.
5-A-Day Adventures (www.5adayadventures.com)	A multimedia program to encourage kids to eat more fruits and vegetables.
Onsale.com (www.onsale.com)	An online auction system treating bidding as playing, and buying as winning.
Scorecard.org (www.scorecard.org)	A Web site providing information about local community pollution issues and helping take action.

Table 1. Representative persuasive technologies

includes technologies that promote the buying of products and services or increase mindshare for corporate brands. To be sure, the growth of e-commerce and branding on the Web has been explosive and will continue to grow, making buying and branding the main domain of persuasive technologies for the foreseeable future. However, these persuasive artifacts are generally Web sites or elements of Web sites; the strategies they use are largely variations on themes that have worked for decades in the consumer world.

An interesting exception in this domain is Onsale.com, one of our representative examples, a Web site extending far beyond traditional media to leverage the opportunities of an interactive experience. Onsale.com is a virtual auction space allowing people to competitively bid on items in real time (see www.onsale.com). (Because other articles have addressed

technologies found a similar pattern. These technologies tend to address a significant health issue for which society holds a nearly homogeneous view. We have identified technologies that persuade people to quit smoking, manage diabetes better, exercise more effectively, and more. What we have yet to see are persuasive technologies that promote controversial health behaviors, such as refusing blood transfusions. Undoubtedly, such technologies will appear when the costs of developing, manufacturing, and distributing them are reduced. But before this happens, we will continue to see a wide array of technologies addressing common, noncontroversial health behaviors.

After health, safety is the next most significant domain for persuasive technologies. As in promoting health, promoting safety and security has widespread appeal; for example, few people would find fault with a technology that seeks to persuade drivers to reduce their speed (see www.kustomsignals.com). However, unlike health, safety often hinges on collective behavior, and so can lead to disputes about related ethical issues.

Hygiene Guard is a representative technology for motivating safety behavior installed in restaurant and hospital employee restrooms to monitor workers' hand-washing behavior. Each employee is assigned a badge; during any trip to the bathroom, the employee has to use the sink for a set minimum period (timed by how long the water runs); failure to do so is recorded by a central server. The overseer role of Hygiene Guard is more adversarial than many persuasive technologies (see www.hygieneguard.com). Although some people concerned about privacy would object to such technology, others would suggest the outcomes it promotes—consumer safety and preventing the spread of disease—justify the means.

As for the future of persuasive technologies, another domain—environmental conservation—also has significant potential. Although few technologies motivate people to preserve, conserve, or restore the natural environment, this is an important domain because, like health and safety, environmentally friendly behavior is widely accepted as desirable.

Among the many opportunities for developing persuasive technologies in this domain is the Score-

card.org Web site, which is designed to motivate environmentally friendly behavior. Sponsored by the Environmental Defense Fund, an advocacy group promoting environmental protection, Scorecard.org provides information on community pollution at a local level; it also suggests actions users can take to address pollution problems, then facilitates taking them (such as sending template faxes to polluting companies).

The Internet has given ecological activism new life, and Scorecard.org is a natural extension of traditional community outreach efforts. Whereas before the Internet became a form of mass communication when a local ecology group might have distributed fliers about polluters in a particular neighborhood, Scorecard.org makes use of data from the U.S. Environmental Protection Agency to give the same sort of information on any community in the U.S. Because few companies champion environmental efforts in the interests of boosting revenue and earning profits, some environmentalists view the Web as a key solution for propagating information and motivating more ecologically minded attitudes and behaviors.

The strategies they use are largely variations on themes that have worked for decades in the consumer world.

User Age and Status

When considering the users of persuasive technologies, we notice two interesting and important trends involving age and socioeconomic status. According to an ongoing survey by the Persuasive Technology Lab, most existing persuasive technologies are aimed at teen and preteen children. This finding may seem surprising, but considering that most cultures are comfortable shaping the attitudes and behaviors of their younger members, it seems inevitable that the early examples of persuasive technologies would be geared toward children, not adults. Of our five representative artifacts, two are designed for children—Baby Think It Over and 5-A-Day Adventures. Both are deployed in school settings, implemented as tools of education, not persuasion. In this setting, minors do not elect to use them; they are part of the school curriculum. Far fewer persuasive technologies are designed for adults. Those in use today divide into two categories—those imposed on adults and those adults choose for themselves.

Commercial Applications

Alcohol 101 Persuasive Technology

Alcohol 101 is a CD-ROM-based virtual social environment designed to influence college students' attitudes and behaviors regarding alcohol consumption. We talked with Janet Reis of the University of Illinois where Alcohol 101 was created in partnership with The Century Council, a national not-for-profit organization funded by U.S. distillers to combat alcohol abuse (for more, go to www.centurycouncil.org).

How have people responded to Alcohol 101?

On the positive side, people like the program's interactivity and the opportunity it provides to test decisions regarding alcohol consumption. On the negative side, some people are concerned with technology substituting for people.

What is its key advantage?

The program can juxtapose decisions and consequences in a way that cannot be done in real time.

What is a key limitation?

Alcohol 101 is a brief intervention; students use it for one or two hours maximum. This is a good beginning, but such intervention requires ongoing support through various channels.

What surprised you most when developing the program?

The biggest surprise was the widespread acclaim it was given and speaks to the technology meeting a need in university settings.

How do you gauge its success?

The initial response has been very positive. The real test



will be determined by assessing the affect on young people's decision making.

What advice do you have for others creating persuasive technologies?

Be clear on your target audience and objectives before doing anything. Be willing to take some risk with content; otherwise, users will be bored with renditions of the same old stuff.

Baby Think It Over Infant Simulator

Baby Think It Over, Inc., created a computerized doll for high school programs designed to motivate teens to avoid becoming teen parents. We talked with Mary Jurmain, the company's president (for more, go to www.btio.com).

What inspired you to create Baby Think It Over?

My husband and I saw a television show in which teens carried sacks of flour to simulate caring for a baby. We felt teens needed a more demanding simulator.

How have people responded to the product?

Parents and teachers love our infant simulator. Teens are excited about it when they begin the simulation, but are tired of it when they bring it back.

What are the key advantages and limitations of the technology?

The main advantage is that the simulator makes demands, so users understand a baby isn't a doll—but a person with needs and behaviors of its own. The limitations are that one can never make a simulator real enough to satisfy everyone.

How do you gauge its success?

We've seen decreased teen pregnancy rates in organizations using it.

What are the ethical implications of your technology?

They are profound. Few technologies have the potential to change society as much as this one has. Teach people to take the decision to become a parent more seriously, and you've made a better future for everyone.

What advice do you have for others creating persuasive technologies?

Take the responsibility very, very seriously.



Click Health Interactive Games

Click Health creates interactive games intended to improve players' self-care behaviors and health outcomes. We spoke with Debra Lieberman, the company's vice president of research (for more, go to www.clickhealth.com).

What's the purpose of the Click Health games?

Our games improve people's health prevention behaviors (such as eating a balanced diet or resisting peer pressure to start smoking) and self-management of chronic conditions (such as asthma, diabetes, and cystic fibrosis).

How have people responded to the products?

The response has been extremely positive. Children, teens, and adults enjoy playing our games—for many hours per month, on average. Clinical trials have demonstrated the games significantly improve players' health behaviors and outcomes, and has given health-care providers the evidence they need to endorse the products and use them with their patients.

What are the advantages and limitations of these games?

Young people and adults spend an average of 1.25 hours per day playing interactive games, so the inherent appeal of game playing is a big advantage. Our games are especially engaging because they incorporate elements of fun, challenge, learning-by-doing, feedback, and social interaction. Interactive games, if designed well, provide a powerful learning environment that can positively influence motivation and behavior change. They cannot provide the caring and personal relationship a health-care provider can offer. But our games often bring people together. Clinicians, counselors, and health educators have found that playing or talking about them with patients can be a great ice-breaker.

What is your design process?

We collaborate with medical experts, instructional design-



ers, and game developers, doing extensive prototype testing with target user groups to create games that boost health-related self-efficacy, motivation, knowledge, skills, and social support.

What advice do you have for others creating persuasive technologies?

I urge them to create socially responsible and truthful messages that avoid portraying violence and hateful social stereotypes. Communication technologies have tremendous power to persuade and teach. Use them to make the world a better place.

Onsale.com is Online Auctions

Onsale.com is an auction Web site designed to motivate people to participate in live auctions and buy products. We talked with Dan Frank, a company director (to experience Onsale.com, go to www.onsale.com).

What attitudes or behaviors does Onsale.com aim to influence?

We set out to motivate people to buy things at our site. Our objectives are getting people to the site, getting them to register, and, finally, getting them to make a purchase.

HOW HAVE PEOPLE RESPONDED?

People have fun at our site, and feel they've gotten incredible deals. But at times we've seen addiction to the auction process, with users getting in trouble with their spouses.

What's one key advantage of the site?

The auction format can lead to a fair market price while providing social proof the price is fair.

What was the design process for creating Onsale.com?

It wasn't a clean process; it was very iterative. Doing business online allows us to post content quickly, see what works, and then adapt. We probably run a different test every week.

What advice do you have for others creating persuasive technologies?

Listen to customers and adapt to their needs. On the Web, it can be easy to lose sight of customers, because they're not in front of you. It's also important to use technology to give people an enhanced experience, not to manipulate them.



Like most persuasive technologies for children, those for adults can be imposed on their users. Hygiene Guard, the hand-washing monitoring system, is an example; employees don't choose to use this system, but have to use it as part of their work activities.

There are also examples of persuasive technologies adults choose for themselves. From our set of representative technologies, two are used voluntarily—Onsale.com and Scorecard.org—by adults who choose to use them, accepting as incidental the persuasive intent of their designers (see Tseng et al.'s "Credibility and Computing Technology" in this issue).

Although one might expect to find many persuasive technologies geared toward self-help issues, like how to break bad habits, remarkably few existing technologies fall into this category. One, however, is a handheld technology designed to help adults quit smoking. Although self-help technologies are not widespread in today's technology landscape, we expect they will become more common—perhaps even pervasive.

Overall, we see a trend in terms of age and these technologies. The early examples (those on the market today) are geared toward the young. But more and more, persuasive technologies—elective and nonelective—will likely be aimed at changing the attitudes and behaviors of adults.

The second trend we see among users of persuasive technologies is socioeconomic status; people or institutions with greater financial resources are most often those that can adopt or impose persuasive technologies. As a result, their users tend to be either those with significant personal resources or those affiliated with institutions with significant resources. For example, the 5-A-Day Adventures CD-ROM requires a multimedia computer to run it. Equipping a high school class with a set of Baby Think It Over devices also involves a significant financial investment. Installing Hygiene Guard requires a similar up-front commitment.

Although today's persuasive technologies are generally designed more for kids than adults, control of persuasive technologies belongs to those with significant financial resources. Both of these generalizations will be less true in the future.

Physical Manifestations

Like the users of persuasive technologies, the form factors, or physical manifestations, of persuasive technologies are varied and changing. They fall into three general categories—desktop-based systems, artifact-based systems, and environment-based systems. The most common form today—especially when factoring in the Web's persuasive applications—is one accessible through traditional personal computers. From our list of representative examples, 5-A-Day Adventures, Onsale.com, and Scorecard.org all fall into this category. These and many other persuasive technologies are effectively desk-bound, thus limiting where and when persuasion can occur.

In contrast, artifact-based persuasive technologies are often portable and can persuade in many locations. For example, the form factor of Baby Think It Over is essential to the effectiveness of the persuasion. The device is shaped like and weighs as much as a real, flesh-and-blood infant. And its head is weighted to require support when it is held.

When the "baby" cries, there is no externally accessible volume control, just as in a real baby. Users have to hold a spring-loaded key in place for an unknown length of time to silence it. The effectiveness of the persuasion lies in the similarity between the Baby Think It Over experience and that of being responsible for a real child. Clearly, this product would not be nearly as effective as a piece of desktop software.

Hygiene Guard is typical of a third type of form factor—environment-based technology. Such technologies are built into rooms or other spaces; as such, Hygiene Guard is not deskbound, nor does the user carry it, except for its identification badges. Instead, it is integrated into the usage environment. One key value comes from modifying behavior within that environment—in this case, hand washing in the bathroom. Integration of the persuasive technology with the environment—having it built into the bathroom, for instance—represents a higher cost barrier to using such a system. It must be installed, maintained, perhaps even made tamperproof.

Although many new persuasive technologies are

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likely to emerge in the near future, we expect to see a growing percentage of them built into ordinary objects and environments.

Persuasive Strategies

How do these technologies change our attitudes and behaviors? Our analysis of persuasive technologies has found that the influence tactics they use are not new. Without exception, the motivational and persuasion strategies in persuasive technologies are adaptations of basic strategies people have been using since long before computers were around. For example, positive feedback (giving compliments or encouragement) is a well-known persuasion strategy computers can now leverage [1].

Although computers have not introduced new strategies for persuasion, they have allowed people to implement old strategies in new ways (see Khaslavsky et al.'s "Understanding Seductive Experiences" in this issue). For example, role playing (acting out scenarios with others) has helped people think and behave differently [3]. Computing technology can facilitate role playing by providing people with virtual environments or simulated situations.

Each of the five representative technologies in Table 1 employs a strategy or set of strategies we find notable. In every case, these strategies are adaptations of—and sometimes improvements on—low-tech persuasion strategies. Although Table 2 lists only one strategy for each technology, these same strategies are used in many other persuasive technologies.

Simulated experiences. Simulation, a strategy used not only by Baby Think It Over but by a number of other persuasive technologies, has many benefits. The technology can present a user with an environment or object similar to its real counterpart. However, decisions in a simulation are the key to the strategy's persuasiveness; choices can be made in the simulation with no adverse consequences in real life. Wrong choices can demonstrate the negative results that might occur, while "better" choices result in positive outcomes. These choices can then be duplicated in the user's own life.

Surveillance (monitoring and tracking). Exemplified by Hygiene Guard, surveillance is a controversial persuasive technique. Knowing that one is being monitored or tracked can significantly affect a person's behavior, but the corresponding loss of personal

freedom or personal privacy can render surveillance closer to coercion and manipulation than persuasion. This strategy, though relatively easy to deploy, raises red flags. But loss of personal freedom doesn't mean surveillance is always unethical or undesirable. In the case of Hygiene Guard, surveillance technology benefits customers, diners, patients, and employees alike. Yet the cost can be significant, including heightened distrust in employer-employee relationships.

Environments of discovery. Creating such environments is not a single persuasive strategy. Rather, when done well, these environments combine many strategies into one coherent experience. In the case of 5-A-Day Adventures, people can enter the environment and explore games and activities designed to promote a central theme—like "Eating fruits and vegetables is a good thing to do." The three chief components of this environment of discovery are: providing a fantasy environment for users; giving them control over much of the environment; and giv-

Persuasive Technology	Leverages the persuasive power of computers by:
Baby Think It Over	• Simulating experiences
Hygiene Guard	• Monitoring or tracking activities
5-A-Day Adventures	• Creating environment of discovery (fantasy, control, positive feedback)
Onsale.com	• Motivating virtual groups (competition, recognition)
Scorecard.org	• Tailoring information

Table 2. Five persuasive technologies and related strategies

ing them positive feedback for performing target activities.

Virtual groups. Onsale.com makes use of group-level intrinsic motivators—competition and recognition—to motivate people in its online auction environment [2]. Auctions are naturally competitive, but Onsale.com makes the competitive aspect highly prominent in its interface and in the types of interactions it allows. Buying is framed not as spending money to receive goods but as "playing" in auctions to "win" the purchase. Participants are goaded with comments like, "You're not going to let that other bidder beat you, are you?" Those who "win" are recognized publicly in the online environment.

Personalizing Tailoring information to users can be (but is not always) a persuasive strategy. Scorecard.org aims to persuade people to protect the envi-

ronment by giving them information about environmental threats in their communities. The premise is that the need for action becomes apparent once the facts are known, so the strategy is to provide those facts. In general, tailored information receives more attention—and is therefore potentially more persuasive—than general information. But the key to Scorecard.org's strategy is that tailored information is likely to spur people to action by creating fear or concern. Technologies that tailor information don't always rely on fear; they often simply outline the best path for users, such as how to create and follow a personal budget. Although people have long tailored information to their audiences, computer technology takes us far beyond the realm of what humans can do manually or verbally.

Of all these persuasive strategies, two—simulation and surveillance—are especially noteworthy. Both are made possible by computer technology in ways human systems cannot match easily. They have a high potential for persuasion but work in very different ways. While simulations allow users to draw their own conclusions and

adopt appropriate behaviors, surveillance is almost the opposite, possibly compelling users to perform certain behaviors. In fact, a question that still needs an answer, at least in our minds, is whether surveillance is a type of persuasion or a type of coercion. The answer likely depends on the specifics of each persuasive computing system. Despite these differences, both strategies will be common in future technologies.

Conclusion

Analyzing the small but expanding landscape of persuasive technologies has given us a starting point for projecting into the future, as well as for creating a framework for categorization. The probable melding of persuasion and technology is that future persuasive technologies will be a superset of the current technologies. The domains we've outlined here—buying and branding, health, and safety—will certainly expand. Persuasive technologies will also likely be incorporated into other domains, including self-help. Users of persuasive technologies will also be more varied, including more adults. Finally, as more persuasive technologies are built into ordinary objects and environments, people using them won't view them as computers. Like using the telephone and the TV, persuasive computing may eventually become a seamless extension of a person's everyday activities. **■**

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