

embedded health

The past decade gave rise to a variety of products and services aimed at improving our health by giving us more information for making decisions and avoiding health risks, ranging from expanded food labeling to consumer-driven health care. In the coming decade, efforts will take a different approach: using real-time filtering tools and feedback to curate information, choices, and options for advancing health and well-being. Some of the more innovative solutions will involve individuals and groups creating their own custom filters, and embedding feedback mechanisms and rules into personal devices, local environments, and even their own bodies to encourage themselves to stick with their long-term health goals by reshaping the context of their daily lives.

In many ways, we already engage in health practices, such as checking weight daily, that put some aspect of health into the context of our daily lives. In the years to come, techniques for consciously shaping the context around us to improve long-term health will become more effective, personalized, and persuasive.

bodies: personalizing health feedback

As tools for self-monitoring health information data become more widespread and mainstream through mobile phones, wearable patches, and other devices, the information we have about ourselves has the potential to become more valuable but also more challenging to navigate. Using this behavioral and biochemical data to shape how we design the physical world will transform this confusing stream of data into meaningful feedback that can improve health choices.

networks: shaping spaces through local collectives

There's more to managing health than individual efforts to monitor one's biochemistry; there are also collective actions by government bodies, corporations, or citizen organizations—actions that include ad hoc and formal agreements to create restrictions or shape environments for improved health. For years, homeowners associations in the American suburbs have actively worked to preserve the visual environment by placing restrictions on landscaping and construction. Now local collectives are shifting their focus to health. Both New York and Los Angeles are implementing municipal restrictions on food. The next decade will see widespread efforts to use local governments to embed local health values into communities. Not only will the values governing collective agreements continue to move toward well-being, but these types of agreements will expand to other locations and domains as local populations work to regulate food available for purchase, air quality, and a variety of other health factors.

environments: understanding how environments influence behaviors

Taken together, these individual and collective efforts signal a broader effort to reshape the environment with tools that include traditional urban planning and cutting-edge technologies. Although these efforts will continue to focus on the effect of chemicals on health and well-being, they will also introduce a new area of concern for environmental health—the decision-making environment—that considers how the design of physical environments indirectly influences our health decisions. This shift will accelerate efforts to transform homes and communities into environments that, like aging-in-place communities, actively promote health and well-being.

—Bradley Kreit

an interview with **barry schwartz**



Barry Schwartz is a professor of psychology at Swarthmore College in Pennsylvania. He has been there since receiving his PhD from the University of Pennsylvania in 1971. Schwartz has written ten books and more than 100 articles for professional journals. In 2004, Schwartz published *The Paradox of Choice: Why More Is Less*, which was named a top business book of the year by *Business Week* and *Forbes*. His latest book, with colleague Ken Sharpe, is about “practical wisdom” and is due out in January, 2011.

by **bradley kreit**

Research Manager,
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Brad builds on his background in anthropology and history by exploring how every day decisions effect our well-being.



Bradley: Give a quick overview of your research—particularly *The Paradox of Choice*.

Barry: *The Paradox of Choice* is really an attempt to review what was, at the time I started writing the book, pretty much new research that choice is not an unmixed blessing, that people need freedom of choice in order to be fully human, and freedom is an incredibly important determinant of well-being, but there can be too much of a good thing. And trying to solve problems simply by throwing more choices at people and letting each of us decide for ourselves is a recipe for disaster and a recipe for misery.

Bradley: What were some of the more unexpected findings in the book?

Barry: Everyone just took it for granted that since some choice is good, more choice must be better.

You know, if you're happy with Corn Flakes and Rice Krispies, what the hell does it hurt you if I put another 20 kinds of cereal out there? And if I'm not happy with Corn Flakes and Rice Krispies, maybe one of those other 20 will be exactly what I'm looking for. So every time you add an option, you improve somebody's life and the people who aren't interested just ignore it.

What [Columbia University Professor] Sheena Iyengar showed is that that's not true, because when people have a lot of options, instead of being liberated, they're paralyzed. So that's big finding number one; that too many options produces paralysis. And often, that can be extremely consequential. You know, if you skip your breakfast cereal, it's no big deal. But if you don't go to the doctor, or don't take medication because you don't know which one to take, well then it can be a big deal.

Finding number two is that if people overcome paralysis and choose, when there are a lot of options, they are likely to choose badly. That is to say, they're likely to make mistakes. It's complicated, you're making decisions about multi-

dimensional things, there's a lot to keep track of, and often what people will do is they'll choose on the basis of what is easy to evaluate rather than on the basis of what's most important.

Number three, the thing that I personally have been most interested in, is that if people overcome paralysis and choose and manage to choose well, when you choose from a lot of options, you will be less satisfied with what you've chosen than if you choose exactly the same thing from a smaller set of options. And the reason for that is that as you're experiencing whatever it is that you've chosen, you're thinking about all those other attractive things that you've passed up.

Bradley: How do you think the landscape for choice has changed since you began looking at these questions?

Barry: We are certainly encountering more things. There are more varieties of X for pretty much any X than there ever were before. And you don't know that most of these varieties are essentially interchangeable with one another until you've devoted a fair amount of time and effort to research. You know, the cereal aisle of the grocery store is about a mile long. How do you know that it doesn't really make a damn bit of difference which one you choose? You don't know. So it looks like the world is giving you a big problem that needs to be solved.

To raise the stakes a lot, in the case of health care, doctors don't tell patients what to do anymore. They give them the options. You know, do you want surgery or do you want chemotherapy? It's preposterous, but that's what they do. And this is the so-called doctrine of patient autonomy; doctors shouldn't be telling patients what to do ... This puts a burden on patients that's a nightmare.

Bradley: I think a lot of people would react pretty negatively to what you said about patients not having any control over how they want to plan their own outcomes. How do you strike a balance between choice and restriction?

Barry: Unfortunately, I don't think that there's a simple answer. You know, this patient autonomy idea, it was a reasonable reaction to a completely unacceptable, sort of paternalistic arrogance on the part of doctors who wouldn't even bother telling you what was wrong with you. You know, they'd just tell you what to do. And I think that's an outrage and needed to be corrected, but it's been overcorrected.

So finding the right balance between telling patients what to do and offering them options and basically demanding that they make their own decisions is the challenge. And I think the thing that makes it such a challenge is that there is no one-size-fits-all answer.

Bradley: What are the tools that people need to manage these little things more effectively?

Barry: The biggest tool, I think, the one that's most feasible given the society that we're living in, is to implement what Richard Thaler and Cass Sunstein call “libertarian paternalism.”

Their argument is that we should be paternalistic in designing environments where, when people do nothing, they get what's good for them. But they're not forced to do that; they could always opt out.

If you make high-fructose-corn-syrup products expensive, with a tax, and fresh fruits and vegetables cheap, you're not stopping people from drinking soda, but you're making it harder for them to drink soda and easier for them to consume what's good for them. Or, you put the desserts in the cafeteria line across the room from the rest of the cafeteria line. And then that way you may reduce the number of people who actually choose a dessert. You're not preventing them from taking a dessert; you're just making it more difficult.

Bradley: How do you think the landscape for day-to-day choices could evolve over the next decade?

Barry: I think that people used to think that the challenge was to get people information. Google solved that. And what we have learned is that having all of the world's information is about as useful as having none of it. And the result is a shift from getting all the information to people, to finding ways to order, filter, select, structure, edit the information so that it will actually be useful. You know, Google does it, Netflix does it extremely well, Amazon does it pretty well.

The task will be organizing and filtering information, not providing it.

With respect to health, I don't know. Near as I can tell, there's a class divide that just keeps getting bigger and bigger. And the chronic health problems that we have to deal with will be increasingly restricted to the lower economic classes and they will come to be pervasive in those classes, while the privileged will take full advantage of all the information medicine provides about how to live a healthy life and do it. So I sort of expect that the gap in life expectancy—that the relationship between income and life expectancy will grow in the United States because of that. And I don't see a way around that at the individual level.

total temptation management solutions

Set in 2020, these three scenarios illustrate potential strategies and technologies for embedding feedback loops and filters to increase capacities for well-being. The scenarios suggest possible approaches for embedding health at different scales—bodies, networks, and environments—and also highlight some of the dilemmas we face in finding a balance between embedding feedback and enabling choice.

Every evening when Carol returns home from work, she gets a text message. “You’ve consumed 1200 calories today,” it might say, “400 below your allotted calorie count.” This is her body talking to her. Or, more accurately, it’s Carol’s Calorie Counter patch talking to her. The device reads her body’s metabolic rhythms and gives her feedback that helps her stick to her diet. Worn on the arm, the patch employs an array of sensors and accelerometers that track the number of calories Carol consumes and burns over the course of the day.

The Calorie Counter is one component of an integrated system developed by Total Temptation Management Solutions™ (TTMS) that helps Carol avoid unhealthy behaviors. Thirty-nine years old and recently divorced, Carol has gained 40 pounds in the past two years and her blood pressure has shot up. She’s also taken up smoking again—a habit she kicked back in college.

When her doctor expressed concern about her health, she decided to schedule an appointment with an advisor at TTMS. After an hour of discussion, they set some goals for her: Lose the extra 40 pounds and quit smoking. Carol agreed that TTMS services would intervene at moderate levels of intensity to reduce food intake, and at maximum intensity to limit smoking.

TTMS provided Carol with several sensors that monitored her body rhythms and activities to provide a more complete picture of her daily health. These sensors are connected wirelessly to her phone and other devices around her house to give her real-time feedback she can use to successfully manage her choices. For example, an LED panel on her refrigerator glows red when she reaches her daily calorie limit, and her alarm clock displays an optimal bedtime to compensate for a poor night’s sleep the previous evening.

Carol’s TTMS augmented reality glasses layer a warning symbol over any cigarettes or junk food that come into her field of vision. She set some personal preferences on the TTMS system that give her an occasional break from the diet so desserts are free of warning tags on the weekend. But because she wants to quit smoking cold turkey, the interventions to keep her from smoking are much stronger. Should Carol inhale any cigarette smoke, a patch on the back of her neck delivers a moderate electric shock to encourage her to put her out the cigarette.

TAGS

SELF-TRACKING

CONTINUOUS
BIOMONITORING

SENSORS

CONTEXTUAL FEEDBACK

AUGMENTED REALITY

SELF-CONTROL

SCENARIO 2: NETWORKS

the chicago grotto

When Kim and a small group of associates who also do contract work agreed to lease a shared office space, they decided to incorporate new technologies that would help them manage the stress of freelance work. Under the name of the Chicago Grotto, they set up an open office space that encourages a collaborative approach to both work and health management.

The Grotto features webcams that track facial expressions and biomonitors bracelets that measure physical mood indicators. When a freelancer displays signs of stress, that person's workflow automatically adjusts: new email alerts stop appearing and a small light on the individual's desk changes color to let others know that the worker does not want to be interrupted. The system also syncs up with each worker's calendar; when it sees a gap in the daily schedule, it replaces whatever is showing on the screen with a screen saver consisting of a message like, "Take a five-minute break."

Kim and her associates had expected the new technologies to reduce stress and improve emotional well-being, but they were pleasantly surprised to discover other positive influences on health. For example, freelancers working in the Grotto found they were less prone to nervous snacking and overeating, a benefit of reduced stress that Kim later learned has been observed through more formal research.



Kim and co-workers

Source: IFTF

TAGS
BIOMONITORING
SENSORS
AMBIENT AWARENESS
STRESS
SENSORY DESIGN
MENTAL HEALTH
FOCUSED ATTENTION

Following the initial success of the pilot program, Grotto members made more workplace productivity and health tools available to workers. Some Grotto members chose to purchase chairs outfitted with sensors that can detect unhealthy postures, which vibrate or use bursts of compressed air to encourage adjustments in posture.

A new Grotto pilot project uses air additives to enhance health. The air conditioning system releases a steady stream of vitamin C into the air to raise immunity levels. After seeing studies that mint fragrances can improve productivity, parts of the office were outfitted with aromatherapy emitters that infuse the air with mint.

Four years on, the program is a success. Kim and her Grotto associates have seen their productivity rise each year, along with reductions in stress, obesity, and other chronic health problems.

There are drawbacks, however. Several members complained about missing urgent messages when their system acted to reduce stress by halting alerts of new email. And privacy challenges have been a major source of debate. New members often leave within a couple months due to feelings that their privacy is being violated.



Ambient desk orb

Source: Ambient Devices

SCENARIO 3: ENVIRONMENTS

north bay intergenerational health

Life is a lot more manageable for the Hopkins family since they moved to the North Bay Intergenerational Health (NBIH) community a few hours north of San Francisco. Eleanor Hopkins, 71, first heard about the community through some friends, but it was her daughter Abby, 42, who decided to relocate her mom, husband, and two children to NBIH.

Founded by a group of families as the nation's first intergenerational health in place community, NBIH operates on the simple principle that many of the tools used to help residents thrive in aging-in-place communities can also increase quality of life for their children and grandchildren. Health professionals and architects designed NBIH to strengthen connections between the generations while making it easier for everyone to stay healthy.

Eleanor's granddaughters, Alex and Eilene, attend a nearby elementary school that serves only healthy lunches made using fruits and vegetables grown on-site. After reading studies that demonstrated that smaller plates lead people to eat less food, school officials replaced students' plates and bowls with smaller dinnerware to control portion size.

Recognizing that food in the home plays a key role in determining the health of everyone in the family, residents added rules to the community charter that extended food guidelines to restaurants and retail settings. The community banned all products containing high-fructose corn syrup from its grocery stores and added a two-dollar luxury tax to the price of desserts sold at local restaurants. Proceeds from the luxury tax subsidize the cultivation of fruits and vegetables in community gardens.



Abby with children

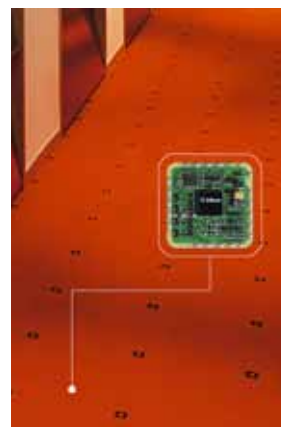
Source: IFTF

TAGS
SANDWICH GENERATION
AGING-IN-PLACE
CHOICE ARCHITECTURE
AMBIENT AWARENESS
ENVIRONMENTAL HEALTH
SELF-TRACKING
HEALTH LOCALISM

Physical spaces within the community are also designed to encourage healthy living. Extra-wide sidewalks encourage walking. Every morning, a group of senior citizens collects children from their homes and walks them to school.

Like most of their neighbors, the Hopkins family has outfitted their home and their bodies with sensors that simplify health management. Eleanor's room on the first floor includes floorboard sensors that measure how fast and frequently she moves around the house to monitor for early signs of declining mobility. The kids' cell phones include activity trackers that automatically text the children and their parents if the kids are spending too much time sitting on the couch. The text messages include suggestions for nearby activities that will help the children stay in shape.

The presence of an electronic support system means that Abby spends less time worrying about the health of her family and more time in creative pursuits. Although everyone in the family misses aspects of their life in San Francisco, they all agree the move was worth it.



Thinking carpet

Source: Vorwerk & Co.

scenario explanations

Over the next decade, we'll know a lot more about our bodies and gain a better understanding of how to use this information to guide us toward better health. We'll also have at our disposal new tools such as ambient feedback and choice architecture that will help shape our choices and guide us toward better health.

These three embedded-health scenarios depict how these strategies could be employed at different scales to improve health.

Total Temptation Management Solutions

For individuals seeking to improve long-term health and well-being, some factors—for example, the general availability of cigarettes—lie outside their control, while fleeting desires for tempting things can often make it difficult to stick to health goals. Research into the effectiveness of automated text messages in managing health has shown that their immediacy makes them an effective tool for promoting health. As the TTMS scenario suggests, timely feedback will become a major component of health behavior change efforts. New tools such as contextual reminders and real-time bio-feedback will intervene to help individuals resist momentary temptations. These same techniques can also help motivate people to eat healthy foods and exercise regularly.

The Chicago Grotto

For many people, e-mail has become one of a series of streams of burdensome information. In the Chicago Grotto scenario, networked workers rely on smart filters that increase focus and improve mental and physical health. Grotto partners also use ambient signaling—in the form of desk lights—to unobtrusively ask each other for support. By reducing the stress imposed by information technology, groups in built spaces will be able to limit distractions while improving their overall health.

North Bay Intergenerational Health

The North Bay Intergenerational Health scenario highlights the potential to integrate health strategies across individuals, groups, and communities and to use techniques such as social influence, choice architecture, and timely reminders to embed health into the environment. What's driving these efforts is the recognition that the environment not only influences the physical makeup of our bodies, but also influences our actions. In step with measures to limit pollution, the redesign of human spaces to promote healthy choices and behavior will become a new form of health localism.

enabling technologies

The three scenarios depict ways the following specific emerging technologies can help shape behavior that promotes healthy lifestyles.

Continuous biomonitoring:

Biosensors will monitor the foods and chemicals that enter our bodies as well as our overall activity levels. These personal information streams will help us better understand our own bodies and will encourage better health choices.

Visual analysis systems:

Prototype software that can detect if a person in a desk is yawning already exists. Over the next decade, a combination of visual and physical detection systems will provide new ways to collect information and provide real-time feedback.

Augmented reality:

Powerful tools already available on mobile phones will migrate to eyeglasses that add digital information overlays on the physical world. Next generation AR tools will identify potential risks in our environment and enable people to filter out temptations or unwanted information.

Ambient signaling and awareness:

Tools that monitor workspaces and communicate contextual information through lights and other ambient signals will help organizations shape complex social interactions in physical spaces.

Sensors and sensor networks:

The decreasing size and cost of sensors is setting the stage for embedding detection, processing, and communication technology in our environments and living spaces. Linking these sensors to communication and monitoring devices will encourage support from peers and family members (see forecast perspective, Tools: Making Sense of Sensors).

Many of the challenges we face in making healthy choices relate to disconnects between our short-term and long-term health goals. We know a healthy diet promotes long-term health, but the in-the-moment temptation of dessert often overrides our resolve. Other challenges involve our reliance on defaults and other subconscious influences within complex environments. Rethinking how to cope with these factors, both conscious and unconscious, will improve our capacities for developing long-term health. The following are response strategies to the forecasts in this perspective. They can be mapped onto the “Well-being Response Landscape” described in the Overview: they are immediate, intermediate or long-term, and are aimed at either treating or managing illness or building new health capacities.

Design feedback for behavior change

Some of the most fruitful opportunities for innovation involve embedding different types of feedback that make it easier for people to stick with long-term goals. However, while these types of feedback have the potential to positively guide choices, they may also create frustration or anger. To promote long-term health effectively, developing feedback mechanisms that are easy to understand and control, and that use positive rewards as well as negative feedback, will be key. (Long-term illness response)

Understand the role of design in environmental health

Most of the research in environmental health focuses on the impact of pollutants and chemicals on the body. The near future will see interest move to the redesign of physical spaces to promote healthier behaviors and choices. Over the next decade, a better understanding of how environments shape human information processing and health-related behavior will aid us in the design and building of environments that promote well-being. (Long-term capacity-building response)

Develop tools for blended network support

The use of ambient signals, such as lights or beeps, can provide less invasive ways to communicate timely information and context-sensitive suggestions to people. Over time, ambient messages will become a primary form of social feedback and support—allowing people in human networks to signal when they need help or motivation. (Short-term capacity building response)

Use choice reduction to create capacities for mental and physical health

The high level of complexity in our personal lives has been shown to decrease happiness and raise emotional regret, while in medical settings, excessive information has been linked to medical errors. Research also has revealed a relationship between information overflow and the loss of self control. By reducing information flow and the number of decision points to more manageable levels, we can improve emotional satisfaction and increase capacities for physical health. (Short-term capacity building response)

Curating information vs. denying choice

Finding ways to filter and shape information and feedback without restricting individual access to options and information will require observation and regular adjustments.

Collective health vs. individual control

As collective agreements become an increasingly important tool for shaping local health environments, it's likely that some individuals will become frustrated by restrictions on their lifestyles.

Embedded technologies vs. second thoughts

Self-imposed restrictions won't necessarily reduce desires for forbidden items. A key design question will involve the extent to which individuals should be allowed to have rethink—and suspend—these restrictions.

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