The Art and Science of Behavioral Economics for Digital Health Design

Abstract

Behavioral economics provides a toolkit of tactics to influence people's decisions and behaviors. People who design digital health interventions dip into that toolkit can maximize their efficacy if they have a nuanced understanding of why behavioral economics works. We offer a targeted review of the psychology behind behavioral economics, coupled with a consideration of how individual user data and longitudinal user experience might affect how behavioral economics is applied in an intervention setting. We also offer examples from health behavior change and beyond to illustrate how behavioral economics have been used effectively to change behavior, and where gaps continue to exist.

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People who design interventions intended to improve health outcomes have come to explicitly recognize the essential importance of behavior change technology in producing favorable outcomes.

Any behavior change design would be incomplete without considerations of such topics as incentives structures, program participation campaigns, and long-term intervention engagement strategies, all of which are increasingly employing principles and concepts taken from psychology and behavioral economics. The good news is that an evidence base exists from these disciplines to support their well-considered use in programmatic design. However, at present there is considerable variability in how accurately and effectively these concepts and principles have been applied to the design and development of digital *(including mobile)* health interventions.

We believe this stems from an inconsistent or incomplete understanding of the behavior change concepts, their evidence, the context in which they should be used, and their implications for programmatic design. We would argue that improving the knowledge about these concepts will lead to more appropriate design application, better appreciation for their limitations, and the creative generation of interventions that wisely employ not only behavioral economics but other principles of behavior change within a behavior change and design rubric. Finally, we believe that considering the toolkit of behavioral economics and behavior change principles in tandem with information about the individual user and the longitudinal user experience is critical to maximize intervention engagement and outcomes.

The intent of this article is twofold. First, we aim to provide a succinct tutorial on the implications behavioral economic principles have for better understanding how people make choices, including about their health and health risks. Second, we outline the design implications of these principles in terms of best practices as well as limitations and constraints. We focus on loss aversion, discounting, and anchoring as specific principles commonly used in health program design. Through recapping the evidence and unpacking several real-world examples to illustrate best practices and common misapplications, we aim to equip readers with enough knowledge to more effectively use these concepts in their own health intervention design and application work. We believe that effective use of behavioral economics in digital health interventions can create better, more valuable user experiences that motivate effective behavior change and in turn lead to lower health care costs and improved outcomes, by enticing people to enroll in the interventions and helping them make the initial *(and often most difficult)* steps to healthier living.

It all starts with a deeper understanding of why behavioral economics principles can influence people's behavior.

Why Behavioral Economics?

In recent years, the success of books such as Thaler and Sunstein's <u>Nudge</u>, Thaler's <u>Misbehaving</u>, and Kahneman's <u>Thinking Fast and Slow</u> have fueled a specific interest in behavioral economics as a way to foster health behavior change in people and populations. Behavioral economics is a relatively new field that emerged in the 1970s and 1980s as economists realized that the rational model of consumer decision-making was a poor predictor of real-world behavior, especially among non-experts.

Human Nature:
How We Think And Decide

The traditional economic model of consumer behavior makes predictions about how people evaluate options and arrive at decisions "to buy" or take action based on a set of *(often erroneous)* assumptions about human nature.

Consumers...

- Have rational *(logical)* preferences among options

- Make decisions that will result in the highest value outcomes

- Operate autonomously with complete information and decisional choice relative to the option.

Even economists realize these assumptions are extreme. Nevertheless, they often rely on them to help simplify complex processes for modeling and studying consumer behavior. However, there are numerous examples where these traditional economic models simply fail to explain real-world consumer choices.

For example:

- People who consistently choose one option over another in a choice problem when the two options are identical in meaning or value.

- Someone whose investment is doing poorly, so he puts more money into it.

- People who acknowledge that a possession is not useful, but refuse to part with it.

A clear and different perspective about why people do what they do was both needed and substantiated by study. Enter behavioral economics. Specifically, behavioral economics draws from two major classes of findings about human cognition:

- **Dual Processing.** Decisions are the product of both the logical mind and the emotional mind; in many circumstances, the latter has a more significant and common role in driving the ultimate decision.

- **Hedonistic Bias.** The human brain is biased in how it perceives and processes information, leading to a reliable set of errors when presented with information and decisions. It favors easy, efficient, and pleasurable in the now.

The Hot and Cold Brain

Research suggests the people operate with two neurologically distinct sets of processes or systems when making decisions *(Goel, Buchel, Frith, & Dolan, 2000; Kahneman, 2011; Stanovich & West, 2002)*. The first is the emotional "fast" or "hot" brain which is based on individual shortcuts, rules of thumb or other heuristics that create efficiencies but can also undercut the objectivity or rationality of the more well-considered and accurate workings of the second, methodical, "slow" or "cold" brain. In recent years, the behavioral sciences have been able to demonstrate that the rational decision-making instances invoked by the cold brain are in the minority of our actual day-to-day choices, which therefore cannot explain the majority consumer choices via traditional economic models. Behavioral economics rests on this duality and holds that people evaluate their circumstances via a dual processing approach to situational evaluation. Behavioral economics offers an alternative perspective that layers an understanding of cognitive and emotional biases into the decision-making process. More often than not, these decisions arising from dual processing are not in favor of our health.

Hedonistic cognitive biases

If we truly took the time to consider all of the information available to us in any given situation, we would likely be overwhelmed by sheer volume of inputs. In order to allow us to behave quickly and efficiently, we use heuristics *(rules of thumb)* to filter, parse, and prioritize the available information. Often times, these heuristics are "good enough" solutions, allowing us to arrive at a satisfactory solution that, while not always optimal, does the job most of the time.

Here are four hot brain short cuts that often lead to unhealthy behaviors and habits.

- Since cognitive biases exist to simplify choice and decision-making, it should come as no surprise that a major source of bias is a preference for simplicity over complexity. Make it easy. People gravitate toward problems with fewer variables rather than more. Even though simplifying a decision results in the loss of some information, often it doesn't significantly degrade the quality of the choice and the outcome (Johnson & Fowler, 2013). In fact, with some decision areas such as investing, novices are more successful when they simplify than when they try to account for a complex set of variables *(Hsu & West, 2016)*. The key for designers is to create meaningful choice options.

- Another set of cognitive habits that can result in biases comes from our tendency to weigh information in context, even if that context is not directly relevant. Rather than considering an idea in isolation, our perception is colored by our physical surroundings, the ideas and words we've most recently heard, how a question was phrased or even our present mood. Although this environmental data may be logically irrelevant, our hot brains assume otherwise and use it in our decision algorithms. I fill a bigger plate with more and eat more food than I do a small plate, even with the same level of hunger. The result? A biased outcome in favor of eating more.

- Willpower has its limits. Bounded willpower then is our innate tendency to favorably weigh choices that bring about more immediate value and discount choices whose value is realized sometime in the future. It is in our nature to do what feels good now and put off those things that we know will produce a long-term benefit, particularly when there is a short-term cost. Note that most health-compromising behaviors produce that immediate gratification while most health-promoting behaviors have an initial cost with vague future returns *(e.g. exercise)*.

- Another commonly referenced cognitive bias that finds its way into many behavioral economics-based intervention features has to do with our sensitivity to losses. This loss aversion means that people are more motivated to avoid losing something they have, than working to gain something they don't. A bird in the hand . . .

Behavioral Economics In Digital Health Design

We started with a broader review of behavior economics to circumvent an issue that we see in the application of behavioral economics tactics. Without understanding why these tactics work, it is easy to assume they will work in a broader set of circumstances than is actually true. By considering the larger pattern of emotional and cognitive interplay that can bias decisions, and overlaying them on to an understanding of your individual user's psychological needs and situational context, it becomes more likely that you will design the right behavioral economics features into your intervention architecture and thereby achieve your goals for your end user.

Each of these "central tendencies" of human behavior can and do have implications for how health risks and related behaviors become ingrained habits. More importantly, however, they can also be used to favorably modify risk and establish new, healthier habits with equal potency. We would like to break down three commonly used behavioral economic principles as they relate to and are used in digital health applications and their underlying design:

• Loss aversion: We are more likely to take action to avoid losing something we have than to gain something we don't.

• Discounting effect: We value what we have more than we would value the same item if we did not have it. The fear of losing the item causes us to assign it a higher value than we would be willing to pay to acquire it.

• Anchoring bias: We judge information based on available anchors, which may lead to over- or under-estimation of base rates and incorrect judgments.

Opportunities for behavioral economics in digital health: The good and the bad

If loss aversion is our tendency to be more motivated to avoid losses than to make gains and our reluctance of give up something we "own," even if we don't objectively assign a lot of value to it, then digital health interventions have attempted to leverage this tendency in a couple of common ways:
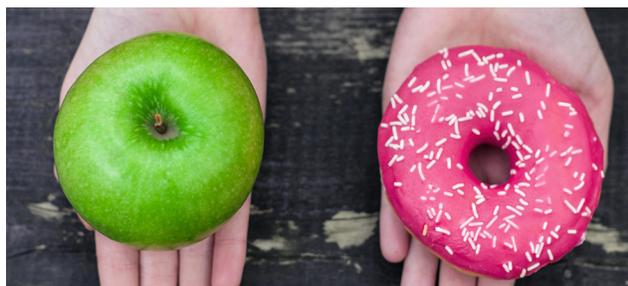
Awarding badges or status

Many digital programs offer "badges" or other iconographic indicators of status to acknowledge user performance as feedback within the program. The appeal of badges for companies is that they are completely scalable. From the user side, badges would theoretically have value because they are a marker or cue for accomplishment *(i.e. mastery)*. Badges also offer flexibility in how they are awarded (i.e. the contingencies for garnering the award), the timing to permit recognition of both short-term *(e.g. enrolling in a health risk assessment)* and long-term *(e.g. keeping smoke-free for six weeks)* outcomes, and rate of exchange *(real world value redeemable based on status)*.

Fitbit acknowledges the first time a user reaches milestones such as 5000 or 10000 steps in a day with a digital badge that the user can view in his profile. Other apps, like MapMyFitness, offer corporate-sponsored challenges such as UnderArmour's You vs. the Year that offer social comparison of miles logged in physical activity over the course of a year, with incremental badges to mark milestone achievements.

We know from research on behavioral economics that people place irrationally high values on objects they possess versus those they don't (Kahneman, Knetsch, & Thaler, 1990). There are two concepts where such a feature could be enhanced by well-placed loss aversion principles. The first is the concept of endowed progress. In such a case the user would not begin at the beginning but by virtue of signing up would have some value, points, etc. they could lose if they do not take the next call to action. The second is the concept of withering whereby non-action allows badges *(and value)* to expire.

Digital health intervention designers could learn from airline loyalty programs to apply loss aversion to the badge or status feature for improved engagement. For example, what if Fitbit rescinded the 5000 step badge if a user didn't repeat that accomplishment at least once within a 30 day period and returned all badges if they met their goals for 4 consecutive weeks? That would help drive ongoing, rather than one-time, behavior. And what if the badges were socially visible, for example to the user's Fitbit friends and inside any social challenges? Finally, for the more difficult-to-achieve badges *(e.g. 50,000 steps in one day),* Fitbit could permit access to buy swag such as t-shirts proclaiming the accomplishment that would offer real-world testament to the user's achievement.

Using behavioral economics to structure the timing and criteria for badges can also help enhance their efficacy. The UnderArmour challenge via MapMyFitness does some of this well. It offers badges based on milestone accomplishments throughout the year, with a greater frequency at the beginning of the challenge. By fostering self-efficacy *(e.g. Bandura, 1982),* this helps to encourage repeated fitness behaviors early to help form a habit, and also extends the challenge associated with badges as time progresses and user ability ostensibly grows. Altering the "density" of rewards then becomes a strategic tool for moving the user along in their journey.

We are not aware of any digital health programs that successfully apply loss aversion to this gamification practice to enhance user participation. Some health plans, however, have built elements of loss aversion into health plan design with varying degrees of success.

Penalizing non-participation

Borrowing again from the concept of loss aversion, a participation tactic often used to drive enrollment in digital health interventions is a penalty for non-participation. This happens frequently when an employer or health plan offers programs to its employees or members, and has a goal of enrolling as many people as possible. A common structure for this may be reducing health plan deductibles by $250 or $500 for people who complete an online health risk assessment prior to the beginning of the plan year.

This strategy has proven to work well for getting people to participate in an intervention, especially when measured at a discrete point in time *(Mattke et al., 2014).* However, financial incentives for behavior can reduce the amount of intrinsic pleasure someone takes in the behavior through the undermining effect *(Murayama, Matsumoto, Izuma, & Matsumoto, 2010).* This motivational shift is counterproductive for an intervention designed to instill a lifelong exercise habit or new way of eating.

The long-term view matters in designing reward structures. Consider that the purpose of most health interventions is to produce a return on investment either directly by reducing health care costs, or indirectly by improving productivity and reducing absenteeism. In order for those outcomes to occur, so must health behavior change be maintained and improved upon over time. An incentive structure that prompts sign-up to an intervention but not continued engagement with health-related behaviors may not ultimately achieve the cost reductions that drove the health plan or employer to install the program in the first place *(see Volpp et al., 2008).*

There are several ways to make extrinsic reward structures more effective. One more effective implementation would tie incentives to behavioral milestones, rather than participation per se. Another is to have people make refundable deposits into an account which are lost if they don't follow through on behavior change commitments. This scheme, which has been used successfully for people working on quitting smoking *(Halpern et al., 2016)*, takes advantage of loss aversion. Yet another successful reward scheme is called "temptation bundling," and allows people to indulge in a pleasure at the same time as they complete a required behavior *(e.g. reading gossip magazines only while on the elliptical machine; Milkman, Minson, & Volpp, 2013)*. These and other alternative reward structures may be more effective than the non-participation penalty.

For digital *(and analog)* health interventions that operate under a B2C business model, monthly *(or other time-based)* billing is a standard structure. This setup is often used with gym memberships or with online programs that have a monthly subscription fee, such as Weight Watchers. Customers provide their credit card information and are automatically charged each month unless they explicitly cancel *(opt out)* in advance. This is sometimes also called negative option marketing, since the consumer's failure to act is presumed as consent. The monthly billing model is advantageous for businesses because customers often fail to cancel promptly after ceasing to use the service; they may even forget about the recurring charge altogether if it's not particularly large, or if the cancellation process is too onerous *(see Stancil, 2015)*. This is what behavioral economics would predict because of the status quo bias *(Schweitzer, 1994)*.

For people who do remember that they have the monthly subscription, canceling may also be difficult. Both the discounting effect and the sunk cost fallacy prompt the person to remain a member. The discounting effect makes people overvalue what they already own, while the sunk cost fallacy results from people being reluctant to walk away from an investment even when logic suggests further investment is futile. In the case of an unused membership, these cognitive biases manifest as a persistent belief that this month will be different, and that there is more value in holding on to the membership than rescinding

it. Businesses encourage these biases in various ways: Regular promotional communications to inactive members reiterating the value of membership, joiner fees that make renewing a canceled membership seem more expensive, and offering special deals when members do attempt to quit to entice them to remain on board. Rather than underscoring that payments toward an unused service are a waste, these communications emphasize membership as a benefit to protect.

For health behaviors, time-based billing may in some cases prevent people from taking action. Consider someone with an unused gym membership. Perhaps the gym is inconveniently located, doesn't offer classes at a convenient time, or is simply unpalatable to the member. However, as long as the person is paying a fee to that gym and manifesting suboptimal attendance at best, the likelihood of paying for exercise at a more suitable facility they might actually use is low.

> **Example**
>
> Consider how reframing the investment in a gym membership could look. Rather than using "I already paid for this gym membership" as an excuse not to try other options, someone might be encouraged to think "My gym membership shows that I value health and fitness. Making this investment in a place where I'm not getting the benefit of using it doesn't make sense. The next step is finding a regimen that's right for me." The question changes from one of sunk cost to one of maximizing investments.
>
> Loss aversion can also be repurposed toward non-financial investments to promote continued engagement. Consider again the person with the seldom-used gym membership. An intervention could offer feedback on fitness participation and progress *(e.g. "You checked in at the gym three times this week—a new record!" or "You logged 4 miles on the treadmill—great job!")* and encourage building "streaks," or continuous patterns of behavior. To skip a planned workout jeopardizes the streak, triggering loss aversion.

We suggest that the fixed interval billing paradigm could be successfully adapted for digital health interventions by focusing users not on their financial investments, but on their behavioral investments. Orienting people toward the progress they've made and encouraging continued movement toward a goal can leverage the discounting effect and sunk cost fallacy for good. Having a single cigarette at a moment of weakness does not negate months or years smoke free. This is the essence of lapse versus relapse prevention.

Same as it ever was.

A common tactic in digital health interventions and health coaching generally is to learn what a person already does frequently and enjoys, and then tie *(or make contingent)* new behaviors to those. This habit laddering can increase the odds that a person actually completes new behaviors. Leveraging existing habits helps people fit change into their schedule and pairs it with an already established habit. It thereby improves then user's ability to remember to do something new, and takes advantage of preferences and personal style to maximize the chance that new behaviors will be liked.

So, what does this have to do with behavioral economics? The discounting effect refers to people's tendency to value what they have over what they don't. By consistently reinforcing a particular identity *(a runner, a yogi, someone who prefers not to sweat),* personalization tactics based on past behavior may inadvertently discourage people from trying new activities. This is problematic if historical patterns are no longer effective for someone—if their aging knees no longer tolerate running, their schedule no longer accommodates yoga, or their health no longer permits chronic inactivity. Here, what a person fears losing is an outdated identity, one that worked well in the past, in pursuit of a new version of self.

We suggest that one way to take advantage of the benefits of personalization while avoiding the negatives of the discounting effect is to deliberately test the limits of what a person might be willing to do. Pandora for example uses its algorithm, part of the Music Genome Project, to fairly accurately predict tastes, but will include songs that don't fit the blueprint intermittently to test how the blueprint should be expanded or altered *(see Dror, Koenigstein, & Koren, 2012; Titlow, 2013).* Whether the user doesn't like the song and chooses to skip it, or does like it and lets it play on, the algorithm learns something that allows it to strengthen its predictive abilities. Similarly, in developing health behavior change interventions, we recommend taking calculated risks to introduce new ideas and activities into a user's plan with a feedback mechanism to enhance data driven learning. If these risks are unsuccessful, offer the user an apology and an opportunity to correct your data. Acknowledging that a digital health program is learning—and therefore makes mistakes—can help overcome negative feelings and actually add to overall credibility in the eyes of a person who's received advice that doesn't fit their preferences.

Misplaced anchors

Great negotiators know they can quickly gain ground by being the first to establish an anchor point in a debate. The first example used to illustrate a point of debate skews subsequent conversation. In a study by Ariely, Loewenstein, & Prelec *(2003),* if people are asked to think of the last two digits of their social security number, those with a higher number are subsequently more willing to pay a higher price for a digital keyboard. Even though the social security number is unrelated to keyboard prices, its proximity influences what people consider a fair price. It is a misplaced anchor.

In daily life, we see anchors presented in a "sale" context *(e.g. "manufacturer's suggested price" vs. "our price"),* salary negotiations, and yes, health interventions. Anchors in health interventions often appear in one of two forms:

- Guidelines. If a scientific body has made recommendations about a measurable quantity such as blood pressure, cholesterol, or minutes of exercise one should get per week, these numbers may be presented to users and serve as anchors.

- Normative information. When a health intervention offers information about what "most," "average," or "typical" people within a certain group do based on group data, this serves as a social comparison anchor.

These types of anchors serve a positive function by educating people about scientifically agreed-upon standards for health, and establishing functional norms based on a larger population. The hope is that this information will motivate people to move their own behavior to meet or exceed guidelines, but that is not always the case. Many times, these types of anchors in health interventions may not serve their intended function of becoming a goal or benchmark for participants.

This is an example where behavioral economics must be considered in light of other psychological research to understand its effect. A pure behavioral economics approach would assume that providing an anchor, say for the recommended number of minutes of moderate-intensity aerobic activity per week for adults *(150, according to the 2008 Physical Activity Guidelines for Americans),* would establish that number as a normal benchmark to work toward. However, social psychology suggests that for someone significantly over- or under-performing that guideline, the anchor would be ignored or even serve to demotivate *(see Dijksterhuis & van Knippenberg, 1998;*

Dijksterhuis, Spears, Postmes, Stapel, & Koomen, 1998; Garcia, Tor, & Schiff, 2013). Overachievers and people in the most need of change are two groups we clearly do not want to demotivate.

Consider someone who is a complete couch potato, engaged in minimal exercise in a typical week. To that person, 150 minutes probably seems like an unreachable and unrealistic goal. Putting it forth might lead to disengagement, particularly if the emotional System 1 has a quick reaction to the goal. Better would be to offer incremental milestones *(subgoals)* that gradually help the person work from 0 up to 150 minutes of movement per week, while offering positive feedback and support for hitting milestone and building confidence. In this way, you can build the person's self-efficacy and self-confidence *(Bandura, 1982)* and engage the more logical System 2 while approaching clinical guidelines over time.

On the other hand, someone who is an endurance athlete probably sees 150 minutes as barely worth mentioning. Research has in fact found that when someone outperforms the average and is simply informed of it rather than being congratulated for their achievement, they are more likely to let their performance degrade toward the average *(Abrahamse, Steg, Vlek, & Rothengatter, 2005).* In the case of someone who is outperforming norms or recommendations, it may either be more helpful to acknowledge and encourage their high-level performance, or compare them only to that sub-set of people who are also in the top percentiles.

Normative feedback can similarly be leveraged to provide a more motivating anchor for people at different stages of accomplishment. Let's continue with the physical activity example. The non-exerciser could learn about what a typical person accomplishes each week in their very first exercise attempts, and perhaps hear stories from more seasoned athletes about their humble beginnings. An already active person, on the other hand, could be offered normative feedback about overcoming barriers to get to the next level of fitness or how others have broken into new sports.

How Can We Apply Behavioral Economics More Effectively?

In each of the examples above, we've described why a particular feature might be expected to work based on behavioral economics, and offered a few suggestions to improve their efficacy. But how can a designer, coach, or anyone else working on developing a health behavior change intervention improve their own odds of creating an efficacious program?

Given the complexity of human behavior and its malleability in the face of different social and instrumental environments, the successful application of behavioral economics relies on a nuanced understanding of an individual's challenges and abilities at a given point in time. This does not necessarily require 1:1 conversation, but it does require an understanding of the likely journey a person is on, including key milestones and challenges, and some basic psychometric information to help predict skills, interests, and motivations. By layering a longitudinal journey map and a psychological profile into the development process, it is possible to improve the likelihood that your program achieves its desired results.

Behavior change needs over time

How people react to stimuli, cues or triggers depends in large part on the context in which they encounter them. It stands to reason that food elicits a different reaction from a person before and after a meal. Similarly, a user of a digital health intervention will respond differently to behavioral economic-based prompts depending on whether they are newly attempting to change behavior,

actively implementing change, or working to maintain a successful outcome. People's needs change depending on their circumstances, and since behavioral economics works by satisfying needs, understanding those circumstances is key.

That's why a critical early step in designing any behavior change intervention is to map out the likely experience for each type of target user, including any key milestones, barriers, or decision points. Creating such a "journey map" or an "experience map" will help your team to identify where behavioral economics can most effectively influence behavior, and where a user's needs might significantly transition.

One framework that can be used to sketch out the user's longitudinal experience comes from research on gamification and considers the following four stages of experience with a digital game or tool (see Chou, 2016):

- **Discovery** is when a user first learns about an intervention. It's the marketing campaign, if you will. At this stage, the user is trying to understand the benefits and requirements of engaging with the intervention. What type of time commitment and effort is needed? What type of positive output can be expected?

- **Onboarding** is the time period in which a user first begins using an intervention, and includes sign up and the first set of experiences to learn the necessary behaviors to participate. Depending on the complexity of the intervention, onboarding may happen very quickly in a matter of minutes, or it may take weeks or months to complete. In the digital world, onboarding is usually on the shorter side.

- **Scaffolding** refers to a structured and staggered unveiling of the activities that comprise the bulk of an intervention or experience. Typically, scaffolding will be the longest stage in the user's experience and will continue until the user has completed all of the components, learned all of the skills, or earned all of the points the intervention has to offer.

- **The endgame** is the final stage of the experience and comes once the user has experienced all of the growth components of the intervention. While the endgame may serve as a graduation from the intervention, it could also serve as a maintenance phase *(such as ongoing monitoring of food and activity once a weight loss goal has been reached, or continuing to play a game after having beaten all of its levels).*

The motivational and decision-making needs a user has will vary depending on where in the process they are. During discovery and onboarding, there is a need to make an explicit case for participation as well as structure the motivational dynamics to engage people in action. At scaffolding, ideally there will be an established rhythm to follow, also called a core loop. This rhythm should include some call to action that precedes the user's activity, and feedback that provides some combination of information about progress and what to do next. And during the endgame, users may be most in need of ongoing access to tools and feedback that permit the continuation of the behavior change they established in earlier stages.

In terms of behavioral economics specifically, we suggest that tactics based on this work are particularly critical in the recruitment and onboarding stages. The first return visit is particularly critical for sustained engagement in a digital experience—users are not likely to return if they find the first visit frustrating or not useful. That's why there's an opportunity for designers to build a compelling hook to drive the return visit. For example, while an initial visit may be focused on orientation and establishing preferences, the first return visit is a prime opportunity to offer a user an opportunity to notch a success. Knowing how critical self-efficacy is to continued engagement *(Bandura, 1982)*, are there ways to offer first time returnees a fairly simple task that can be successfully completed and added to their accomplishments? A newbie exerciser will feel more motivated to return a second time after acing the first physical activity challenge of a walk around the block at a comfortable pace.

We believe that a digital health intervention that considers a user's journey and uses behavioral economics to establish a pattern of engagement early in that journey will ultimately show better outcomes. This is because an intervention's efficacy can only be manifested through use; therefore, any improvements in engagement should amplify outcomes. This is particularly true if the behavioral economics tactics not only improve engagement in the digital health intervention itself, but also support offline healthful habit formation.

Behavior change needs based on the between and within individual and situational differences

Individual differences are those unique aspect of selves. Between differences are those that represent how we differ from one another. Within differences represent how each of us is different in different situations. These individual difference also affect how people react to behavioral economics tactics.

These personality variables, as well as past experiences, behaviors, and accomplishments, are one cause of differential responses to behavioral economics tactics. For example, research has shown that the cool set of logical and deliberate processes is enhanced by individual differences such as increased need for cognition *(Shafir & LeBoeuf, 2002, Smith & Levin, 1996),* higher intelligence *(Stanovich & West, 2002),* and exposure to statistical concepts *(Agnoli & Krantz, 1989).* To return to the example of using anchors with exercisers, whether a person has a history and current day habit of physical activity will greatly affect how any specific anchor is interpreted and influences behavior. Understanding more about who a person is can help people who design digital health interventions select the behavior change tools most likely to work for that user.

Situational differences can also affect whether a behavioral economics concept plays out as expected. Take loss aversion, which predicts that people will be reluctant to part with an item once they own it. Loss aversion can be greatly mitigated if the person relinquishing the item is doing so as part of an expected exchange *(Novemsky & Kahneman, 2005).* This suggests that providing participants in a health behavior change intervention with adequate information about the benefits associated with sacrifices such as fewer dinners out may reduce barriers related to loss aversion.

To the extent that a designer of a digital health intervention can either tailor the behavioral economics principles used for the most likely users—or, better yet, get to know the individual user during the onboarding process and then tailor the intervention for that specific person—the more likely that the selected tactics will elicit the desired outcomes.

A Vision Forward: Blending Behavioral Economics And Design
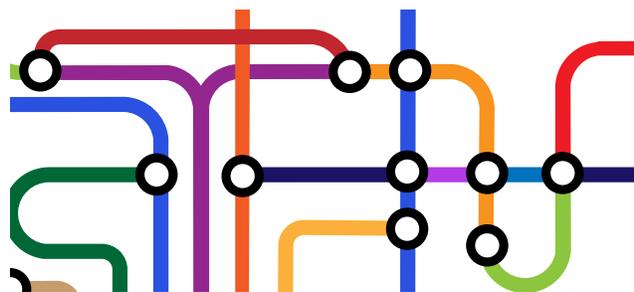
Moving forward, how can the cross-functional teams involved in the creation of digital health interventions do a better job of embedding behavioral economics into their products? We recommend as a first best practice that designers who wish to operationalize behavioral economics in their products take the time to learn not just the heuristics that can change behavior, but the underlying cognitive phenomena that enable them. Consider dual processing and our hedonistic bias before leaping to the specific tactics that those suggest. Going back to the foundations of the science in design will help correct assumptions about what will work and why.

We also make an argument that behavioral economics is most effective when it's applied with a nuanced consideration of a person's circumstances and psychological makeup. People's needs change over time as their experiences with health change. Recognizing the milestones and demands of a person's experience helps optimize the delivery of research-based techniques. Similarly, we know from research that individual differences impact how a person responds to interventions. Therefore, we encourage evaluating key psychographic qualities of the end user, the application of experience mapping early in the process, and using data to make more accurate predictions about individual needs.

An important precursor to successfully determining which behavioral economics principles will result in the desired user behavior, and when and how to implement them, is to consider three concepts in tandem: The principle itself, the user's journey or longitudinal experience, and key

psychological characteristics of the target user or user groups. While it may complicate the health intervention development process, it will ultimately result in more targeted and efficacious solutions.

For teams who design digital health behavior change interventions, we recommend the following high-level process when beginning the concepting phase:

1. Identify the behaviors to be changed and the outcomes to be achieved, in as much specific detail as possible. Being able to answer the questions about what will happen and how it will be measured will enable precision in design choices and improve the likelihood of designing an effective intervention.

2. Document who will use the intervention and when. Many interventions have a defined target audience (e.g. people with type 1 diabetes, people who want to run a 5k) that has a great deal of variability within it. To help parse the variables within the target audience, detail the key characteristics that may influence how any individual user responds to the intervention. Similarly, think about where your intervention will be used in a person's experience with a specific area of health. Is it for newly diagnosed people with diabetes, who may have a stronger educational need and fewer existing diabetes management habits? Is it for someone who's struggled for years with managing an illness and is frustrated and looking for change?

3. Determine whether and how you can learn where your specific users fall on the key characteristics you've identified. Is there an opportunity to use existing data to segment your users into meaningful groups? Can you collect data on the individual to help tailor the intervention in meaningful ways? Likewise, you may have users who are at different points in their longitudinal experience with health behavior change. If the intervention may be used by people at more than one stage of their journey, how can you identify them and offer an appropriate experience for their likely needs?

4. Create some kind of visual artifact to help your team consider the key factors *(person, situation, outcome)* in tandem. Depending on the skill sets and information processing styles on your team, this might be a journey map/persona combination, a set of strategy slides, or a conceptual diagram. The format is less important than the exercise of looking at the factors that will influence success as a holistic system.

5. Identify the behavioral economics tactics that are most likely to prompt the desired behavior from the specific user at the identified milestone in their journey. You may find that you have a menu of options depending on characteristics of the users. This exercise might prompt design decisions such as personalization of the intervention, so that different users experience the intervention differently, breaking one intervention into multiple products, or narrowing the target user group.

By mapping out who will be using the intervention when to do what, design teams will improve their odds of successfully leveraging behavioral economics to engage users and produce meaningful real-world outcomes.

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Table 1 – Glossary of Terms

Term	Definition	Best Practice Application
Anchoring	Our tendency to judge information based on available anchors, which may lead to over- or under-estimation of base rates and incorrect judgments.	Personalize anchors so they are marginally better than a user's current status; offer sub-anchors that ladder up to the main goal, as in the case of target minutes of physical activity.
Between differences	The variables that make individual people different from each other	Identify target user groups and key variables of difference as part of the design process. This may take the form of personas, behavioral archetypes, or psychographic profiles.
Bounded Willpower	Our innate tendency to favor choices that bring about more immediate value and discount choices whose value is realized sometime in the future.	Provide guidance on noticing and appreciating immediate positive effects of healthy behaviors (e.g. boosts in energy from exercise) and structure long-term behavior change with many incremental goals to feed an ongoing sense of self-efficacy.
Core Loop	A well-designed set of cues, calls to action, action steps and feedback the promote a return to the loop and habit formation.	Ensure that for every action that you want users to take in the system, there is some call to action and a response that provides the user with feedback and information about what to do next.
Discounting	We value what we have more than we would value the same item if we did not have it. The fear of losing the item causes us to assign it a higher value than we would be willing to pay to acquire it.	Orient people to rewards and positive characteristics that they already possess and how they can guard them through action, e.g. maintaining physical ability by regular exercise. Endowed progress in the form of points or status can be used if the design permits.
Dual Processing	Decisions are the product of both the logical, rational (cold) mind and the emotional (hot) intuitive mind.	Design should focus not just on logical mapping of actions (cold brain) but also emotional appeal and likely cognitive biases (hot brain).

Term	Definition	Best Practice Application
Endowed Progress	A design element in which users start with an accumulation of points or status that can be lost if the next call to action is not taken.	Provide some level of status at the beginning of an intervention and emphasize its vulnerability to inaction to take advantage of loss aversion.
Habit Laddering	A tactic in health interventions and coaching that pairs (or make contingent) what a person already does frequently and enjoys, with a new behavior.	Pair new behaviors with existing ones to increase the odds that people remember to perform the new behavior regularly.
Hedonistic Bias	Human nature is biased in favor of decisions that are easy, efficient, and pleasurable in the now.	Emphasize any immediate positive returns that exist for healthy behaviors (e.g. energy boosts from exercising, improvements in sense of smell after quitting smoking, the taste of a well-prepared low-fat meal).
Journey Map	An understanding of the likely journey a person is on, including key milestones and challenges, and some basic psychometric information to help predict skills, interests, and motivations.	Incorporate some form of a journey map into the design process to document and address any predictable situational influences on users' behaviors.
Loss Aversion	The tendency for people to be more motivated to avoid losing something they have, than working to gain something they do not have.	Consider incentives schemes whereby users provide funds up front that can be lost if behavior change does not occur; if appropriate, frame behavior change in terms of what might be lost through inaction rather than what might be gained through action.
Negative Option Marketing	The application of a charge or cost that requires the consumer to subsequently actively opt out to terminate the service.	This tactic may maintain subscribers but does not guarantee active users. We recommend using this technique sparingly to maximize effective behavior change.

Term	Definition	Best Practice Application
Status Quo Bias	The tendency for people to want to maintain the current state and resist change.	Emphasize ways in which the status quo is no longer serving the user to increase the odds that the cold brain will decide in favor of action; frame inaction in terms of potential loss or degradation of the status quo.
Subgoal	A subordinate (typically more attainable) goal that builds towards and leads to an ultimate goal.	Break major goals, particularly ones that have a distant time target or will require significant progress to achieve, into smaller subgoals that can be reached more quickly and move the user closer to the ultimate goal.
Sunk Cost Fallacy	The tendency for people to be reluctant to walk away from an investment even when logic suggests further investment is futile.	Focus users on their time and energy investments rather than their financial ones to counter inaction; reframe investments in terms of waste.
Undermining Effect	The impact financial incentives for behavior can have in reducing the amount of intrinsic pleasure someone takes in the behavior.	Avoid financial incentives for participation if possible in favor of behavior-promoting incentives (e.g. a discounted gym membership as a reward for fitness participation); tie incentives to behavioral milestones rather than participation per se; combine effortful activities with rewards via "temptation bundling."
Withering	The design feature in which earned value deteriorates over time as a consequence of non-engagement.	To prompt ongoing behavior, expire earned benefits after a time period has passed without action.
Within differences	The variables that make a same person think, act, and react differently across different situations	As part of your design process, identify common situations that a target user might encounter with your product, and how situational variables might influence behavior. This may take the form of a journey map or other process document.

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