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Gamification Use and Design in Popular Health and Fitness Mobile Applications

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Abstract

Purpose: To evaluate the presence of gamification in popular mobile applications and if principles from behavioral economics were incorporated in the design.

Design: The top 50 ranked free health and fitness applications were downloaded. Gamification elements were pre-determined through literature review and applications were evaluated for their presence.

Setting: App Store by Apple Inc.

Measures: Presence of gamification, type of game element, and use of behavioral economic principles.

Analysis: We classified the types and frequencies of targeted behaviors and features of gamification. Use of behavioral economic principles focused on designing rewards or points by using loss aversion (allocated upfront and could be lost), variable reinforcement (not allocated constantly), and probability inflation (using drawings or lottery designs).

Results: Gamification was used by 64% of mobile applications. Most applications that included gamification (97%) targeted behaviors related to physical activity and weight loss. Applications focused on other areas such as reproductive health, meditation, and sleep used gamification less often (11%). Game elements used most commonly included goal-setting (78%), social influences (78%), and challenges (63%), while less common elements included points (6%) and levels (3%). No applications incorporated behavioral economics principles specified in the study.

Conclusions: Gamification was commonly used by popular health and fitness mobile applications, but none used the specified behavioral economic principles to design rewards or points. Mobile applications could potentially improve their use if their design better leveraged principles from behavioral economics.

Declaration of Conflicts of Interest
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Purpose

Gamification is the use of game design elements such as points, levels, and badges and is increasingly being used in mobile applications focused on helping individuals improve their health and fitness.[1,2] However, evidence on their use and effectiveness is limited. A prior study of smartphone applications conducted in 2015 found that only 4% used gamification and that many of these applications did not appropriately incorporate principles from theories of health behavior.[3] However, there has not been a recent examination of these applications to understand if these rates have changed.

In prior work, we have demonstrated how insights from behavioral economics can be used to design gamification interventions to address predictable barriers to behavior change.[4] Since mobile applications that use gamification commonly offer incentives through rewards or points, these elements may be well-suited to leverage the following behavioral economic principles: loss aversion, variable reinforcement, and probability inflation.[5–7] In this study, we evaluated the proportion of popular health and fitness smartphone applications that use gamification, the targeted health behaviors, and whether the specified behavioral economic principles were incorporated within their design.

Methods

Design

In August 2017, the top 50 most popular (based on download rankings) free health and fitness smartphone applications from the App Store (Apple Inc.) were downloaded and evaluated.

Measures

Applications were evaluated for the presence of gamification, the types of design elements, and targeted behaviors. Gamification elements were pre-determined based on a review of existing literature on gamification.[2,3] If gamification existed, we evaluated whether the design incorporated principles from behavioral economics that have been demonstrated to leverage predictably irrational tendencies to motivate behavior change through incentive mechanism including loss aversion, variable reinforcement, and probability inflation.[5–7] For example, rewarding points after a behavior was accomplished would be classified as using standard economic theory. An application that endowed users with points upfront and then took them away when the behavior was not accomplished would be classified as using the behavioral economic principle of loss aversion.[6,8] These criteria were developed based on prior work conducted by one of the authors.[4–7]

Analysis

Applications were classified by the type of behavior targeted. The proportions of applications that used gamification both overall and by each targeted behavior, as well as the frequency of different gamification design elements, were tabulated. Data were publicly available and deemed exempt from review by the University of Pennsylvania Institutional Review Board.

Results

Among the 50 applications, 64.0% used gamification but none were designed leveraging principles from behavioral economics. Gamification was used in 100.0% of the 22 applications that primarily targeted either physical activity or weight loss, but much lower for other behaviors such as tracking reproductive health and sleep (Table 1).

Among the 32 applications that used gamification, we found no evidence that the design of rewards or points used the specified behavioral economic principles. The most frequently identified gamification design elements were goal-setting (78.1%), social influences (78.1%), and challenges (62.5%) (Table 2). The use of points and levels was infrequent (6.3% and 3.1%, respectively).

Discussion

This study has 4 main findings. First, among the top most downloaded health and fitness smartphone applications, gamification was used by nearly two-thirds of them. This is significantly higher than 4% found in a prior study of smartphone applications in 2015.[3]

Second, gamification was used predominantly among applications focused on physical activity and weight loss. There may be an opportunity to use them in apps that focus on other behaviors such as tracking sleep and water consumption.

Third, none of the applications that used gamification designed rewards or points using the specified behavioral economics principles. This is consistent with a prior study that found many gamification interventions did not appropriately leverage insights from behavior change theories.[3] Our recent work found that insights from behavioral economics such as loss aversion could address predictable barriers to behavior change.[4,6] Therefore, there is an opportunity to test whether mobile applications could use behavioral economic principles to better promote healthy behaviors. For example, rather than awarding points after a behavior is achieved, points could be allocated upfront and taken away if the goal is not met.[6] Points could be allocated in variable reinforcement schedule to maintain engagement and reducing motivation fatigue from constant reinforcement mechanisms.[9] These applications could also leverage insights from work in financial incentives into the design of gamification by offering rewards through lotteries or drawing.[7]

Fourth, the most commonly used gamification features focused on setting and achieving goals including ways to leverage social influences such as support, collaboration and competition. Gamification is often described as using points and levels,[2,3] however, we did not find that this was used often. This information can help to better tailor future research in this field by better focusing the evaluation on features that are deployed within these applications.

This study has limitations. Data were from a single time point and only a small sample of the hundreds of iOS applications focused on health and fitness were evaluated. However, these were the top 50 most downloaded and likely represent a high proportion of utilization

by individuals with iPhones. Our evaluation focused only on the use of three behavioral economic principles and did not assess their effectiveness.

More than two-thirds of adults in the United States (US) use mobile devices[10] and many wellness programs are now also using these technologies to deliver gamification interventions.[1] Our findings suggest that there is an opportunity to improve the design of these applications and this could have an important impact on health promotion efforts.

So What?

What is already known on this topic?

Gamification is increasingly being used in mobile applications but little data exists on how often it is used and whether or not design incorporates principles from behavioral economics.

What does this article add?

This is one of the first studies to demonstrate the significant presence of gamification in popular mobile applications but it also found that no applications used behavioral economic in principles in their design of rewards or points.

What are the implications for health promotion practice or research?

There is an opportunity to test whether mobile applications could use behavioral economic principles to better promote healthy behaviors.

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References

1. Patel MS, Foschini L, Kurtzman GW, et al. Using Wearable Devices and Smartphones to Track Physical Activity: Initial Activation, Sustained Use, and Step Counts Across Sociodemographic Characteristics in a National Sample. Ann Intern Med. 2017;167(10):755–757. [PubMed: 28973116]
2. Lister C, West JH, Cannon B, Sax T, Brodegard D. Just a fad? Gamification in health and fitness apps. JMIR Serious Games. 2014;2(2):e9. [PubMed: 25654660]
3. Edwards EA, Lumsden J, Rivas C, et al. Gamification for health promotion: systematic review of behaviour change techniques in smartphone apps. BMJ Open. 2016;6(10):e012447.
4. Patel MS, Benjamin EJ, Volpp KG, et al. Effect of a Game-Based Intervention Designed to Enhance Social Incentives to Increase Physical Activity Among Families: The BE FIT Randomized Clinical Trial. JAMA Intern Med. 2017;177(11):1586–1593. [PubMed: 28973115]
5. Haff N, Patel MS, Lim R, et al. The role of behavioral economic incentive design and demographic characteristics in financial incentive-based approaches to changing health behaviors: a meta-analysis. Am J Health Promot. 2015;29(5):314–323. [PubMed: 25928816]

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6. Patel MS, Asch DA, Rosin R, et al. Framing Financial Incentives to Increase Physical Activity Among Overweight and Obese Adults: A Randomized, Controlled Trial. Ann Intern Med. 2016;164(6):385–394. [PubMed: 26881417]

7. Patel MS, Volpp KG, Rosin R, et al. A Randomized, Controlled Trial of Lottery-Based Financial Incentives to Increase Physical Activity Among Overweight and Obese Adults. Am J Health Promot. 2018:890117118758932.

8. Kahneman D, Tversky A. Prospect Theory: An Analysis of Decision under Risk. Econometrica. 1979;47(2):263.

9. Skinner BF. The behavior of organisms; an experimental analysis. New York, London,: D. Appleton-Century Company; 1938.

10. The US digital consumer report. 2014; http://www.nielsen.com/us/en/insights/reports/2014/the-us-digital-consumer-report.html.

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Table 1:

Smartphone Applications by Targeted Behavior and the Use of Gamification

Primary Behavior	Physical Activity	Weight Loss	Workouts	Tracking Reproductive Health	Meditation/Relaxation	Tracking Sleep	Tracking Water Consumption	Tracking Heart Rate
Use of Gamification	15/15 (100)	7/7 (100)	6/7 (85.7)	0/8 (12.5)	2/7 (28.6)	0/3 (0)	1/2 (50)	0/1 (0)
Apps	Fitbit *	My Fitness Pal *	RedRock * Fitness *	Flo period tracker	Calm *	Good Morning	Waterlogged	HeartRate
	Achievement *	8Fit *	Aaptiv *	Clue	Headspace *	Sleep Cycle	My Water *	
	MapMyRun *	Lose It! *	Wakeout *	Period Tracker	Relax Melodies	Pillow		
	RedRock Running *	My Plate *	Sworkit *	Baby Center	Relaxing Sounds			
	Nike Run Club *	Fitness Buddy *	Work Out *	What to Expect	Mindbody			
	Runkeeper *	Lifesum *	Nike Training *	Life	White Noise			
	RedRock Walking *	Fitstar *	Interval Timer	Period Counter	Beru Beru iMassage			
	Sweatcoin *			Eve period tracker				
	Pacer *							
	Strava *							
	Garmin Connect *							
	Runtastic							
	Steps *							
	Pedometer *							
	Runtastic Results *							

* Indications applications that used gamification

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Table 2:

Gamification Design Elements and their Frequency of Use

Gamification Feature	Description	Frequency of use, N (%)
Goals	Performance-based measures and targets	25/32 (78.1)
Social influences	Performance is publicly displayed or ability to communicate directly with another member	25/32 (78.1)
Challenges	Time-limited goals or competitions	20/32 (62.5)
Collaboration	Work together with other members to achieve a goal	15/32 (46.9)
Competition	Compete with other members either head-to-head or through leaderboards	13/32 (40.6)
High Scores	Tracking of best attempts at goals or challenges	7/32 (21.9)
Badges	Recognition earned for completing specific milestones	6/32 (18.8)
Narrative	A story is used to provide context for targeting a goal	4/32 (12.53)
Streaks	Recognition for consecutive goal achievement	3/32 (9.4)
Points	Accumulate points that help progress through game and/or can be redeemed for rewards	2/32 (6.3)
Levels	Progress through parts of the game (e.g. level 1 to level 2) or gradients of status (e.g. bronze level to silver level)	1/32 (3.1)
Unlockable content	Access to enhanced functionality or content for accumulating experience or achieving a specific goal	1/32 (3.1)
Lifelines	Ability to obtain help or gain a second chance at completing a goal	0/32 (0)