



Technical Brief

The Coming Gamification of Fitness

Abstract

The advent of accelerometer- and GPS- equipped activity trackers has enabled millions of people to easily monitor their physical activity level. Despite the prevalence of these devices, to date, no wearable manufacturer or fitness-app studio has succeeded in motivating the general population to adopt the sort of habitual exercise that is required to make lasting changes in fitness and health. We believe that in the coming years, one or more parties will succeed in leveraging the intrinsic social motivation of collaborative and competitive games to fundamentally change fitness. This gamification will make exercise more fun, more accessible, and more rewarding for people who are most in need of help achieving their own fitness goals.

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[Introduction and Hypothesis](#)

[The Weight and Fitness Crisis in America](#)

[The Evolution of Fitness](#)

[Existing Approaches -- Fitness Tech and Tracking Today](#)

[Wearables](#)

[FitBit](#)

[Jawbone](#)

[Nike Fuel](#)

[Fitness Apps](#)

[Strava](#)

[MapMyFitness](#)

[Gamification of Fitness: Engaging Consumers Any Time, Any Place](#)

[Some Early Starts](#)

[Zombies, Run!](#)

[Run An Empire](#)

[Market Summary / Analysis](#)

[Leveraging the Opportunity](#)

[Conclusion](#)

[Appendix A: Hardware Devices that Enable Fitness Tracking](#)

[Appendix B: Smartphone Fitness Applications](#)

[Appendix C: Business Model Canvas for Fitness Gamification](#)

[Appendix D: Minimum Fitness Activity Recommendations by the American Heart Association](#)

[Appendix E: Baseline Criteria Essential for Adoption and Short-Term Use of Wearable Products and Services](#)

[References](#)

Introduction and Hypothesis

There is a substantial segment of our society that wishes they were more physically fit. The vast majority of these people have been unable to find a form of exercise that is sufficiently motivating to drive a long-term change in their fitness. We believe that there is a huge opportunity to create such a motivational environment, and moreover that customers are eager to pay to have access to these extrinsic motivators.

In particular, our hypothesis is of an impending revolution in the social gamification of physical activity. We believe that mobile devices running games that are interactive, entertaining, social, and competitive will offer users the persistent motivation to do the exercise they crave. These games might leverage accelerometers, global position satellites (GPS), or even on-device cameras to create a dynamic and compelling experience for users. The social and competitive aspect of these experiences will motivate people to enduring cardiovascular activity, and far outstrip the success of the current cadre of fitness products and services.

The Weight and Fitness Crisis in America

Over a third of children and over two-thirds of adults in the United States are overweight or obese, a problem that is both serious and costly [\[11\]](#)[\[17\]](#). Conditions such as heart disease, stroke, type-2 diabetes and certain types of cancer are related to obesity, and the risks these diseases can be reduced through exercise and better weight management. Average medical costs for those who are obese are \$1,429 higher than those of normal weight. Obesity costs businesses \$4.3 billion annually in absenteeism, and it costs the nation \$147 billion annually in additional healthcare costs.

Over half of all Americans say that they want to lose weight, but only quarter of us are actually doing anything about it [\[15\]](#). Worse yet, less than a fifth of Americans are getting the recommended amount weekly exercise recommend by the American Heart Association for the prevention of cardiovascular disease [\[16\]](#). (See Appendix D for a detailed description of the AHA recommendations.)

There is a crisis of fitness in America today. Regular exercise seems the obvious solution, but people by and large have not successfully been able to alter their own behavior. In the sections below we will argue that social games mediated by smartphones or wearable activity trackers may offer an opportunity to completely disrupt the status quo.

The Evolution of Fitness

Figure 1 presents the evolution of fitness incorporating our hypothesis. In the past, fitness was focused on going to the gym and working out. Gyms are still quite popular, with 45+ million members in the United States and \$27 billion in revenue last year alone. One of the problems with working out is that it involves work and discipline -- making it challenging for less active consumers to stick with it. Today, the present trend in fitness is all about using fitness trackers. According to a report by Endeavour Partners in 2014, 10% of US adults own an activity tracker [13]. Nike's fitness tracker, the Nike+ Fuelband records 1 billion "fuel" points earned by Fuelband users each day. Fitbit activity tracker users average 43% more steps per day. As stated in our hypothesis above and discussed in the sections below, we believe that the future of fitness involves "play," or the proliferation of fitness games to better engage consumers in their fitness goals.



Figure 1. Evolution of Fitness

Figure 2 highlights some of the issues of long-term engagement to past and current approaches to fitness. Despite the large number of gym members and revenue presented in Figure 1, Figure 2 shows that an estimated 67% of people with gym memberships never use them [18]. Furthermore, although fitness trackers of today seem to be helping some consumers be more active, more than 50% of consumers who own fitness trackers no longer use them [13]. This is not to say that gyms or fitness trackers are bad. On the contrary, we believe that future fitness activities involving the gamification of fitness could leverage fitness trackers and even gyms to enable or support fitness games.



Figure 2. Issues of Long-Term Engagement

Existing Approaches -- Fitness Tech and Tracking Today

Wearables

Recent years have seen a proliferation of physical activity tracking devices (e.g. FitBit, Nike Fuel, etc.). These devices offer users an unobtrusive mechanism to track mechanical activity levels, such steps-per-day measurements. As we argue below, on its own, activity-level tracking via a wearable device is an insufficient motivator drive continued (habitual) use. This is perhaps not surprising; tracking your steps with an accelerometer is about as much fun as tracking your weight with a bathroom scale.

FitBit

In 2007, the founders, Eric and James, realized that sensors and wireless technology had advanced to a point where they could bring amazing experiences to fitness and health. They embarked on a journey to create a wearable product that would change the way we move. Their mission is to empower and inspire you to live a healthier, more active life. They design products and experiences that fit seamlessly into your life so you can achieve your health and fitness goals, whatever they may be.

Jawbone

Jawbone is a world-leader in consumer technology and wearable devices, building hardware products and software platforms powered by data science.

Jawbone's UP system helps people live better by providing personalized insight into how they sleep, move and eat. Its open API – the UP Platform – includes an ecosystem of apps and services that integrate with UP to offer new, customized experiences. The company's approach to lifestyle tracking is unique, with over 600 patents granted or pending related to its ecosystem and wearable technology manufacturing processes. Headquartered in San Francisco with offices globally, Jawbone products are available in over 40 countries around the world.

Nike Fuel

Nike is an example of a sports shoes and clothing manufacturer offering apps, online community and supporting hardware to 1) engage with their customers more often and 2) provide a platform and community where their customers can engage with each other. Nike has developed a proprietary unit of measuring fitness activity, which they refer to as NikeFuel points. All Nike apps and fitness products allow users to earn NikeFuel points. This includes the Nike+ FuelBand (wrist-worn fitness tracker), Nike+ SportWatch GPS, Nike+ SportBand, Nike+ for iPod, Nike+ Running app, Nike+ Basketball app, Nike+ Kinect Training for Xbox. By tracking all of a user's physical activity through a common points system, Nike enables gamification of fitness for customers using their products.

One of the best, and perhaps most popular, examples of Nike supporting gamification of fitness is Nike+ Challenges, which are available on the Nike+ Running App. Using Nike+ Challenges, customers can set up a race with Nike+ friends. The first person to reach the target distance within the specified period of time is the winner. Nike+ mileage can be recorded on different devices – mobile phone, Nike Fuelband, Nike+ Sportwatch GPS, etc. Users can easily set up a “Rematch” for follow-on challenges with the same group of Nike+ friends. The Nike+ running challenges are focused more on distance within a fixed period of time (e.g., over a week) rather than competitions of speed, based on who can run a fixed distance in the fastest time. In general, Nike's notion of gamification of fitness focuses on competition vs. fun.

Fitness Apps

Rather than focus on wearable devices as their product, others have developed cross-platform mobile fitness apps. Many of these offerings follow a leaderboard model (e.g. Strava). This model allows users to track personal-bests and compete (against themselves and/or others) for global records on crowd-sourced running/biking routes. These products are minimally interactive, offering little more than time splits and position tracking during the physical activity itself. Nonetheless, this model is very successful among those already interested in running and biking. This is however a vastly smaller audience than the available market. Our target is those who do **not** enjoy running or biking as a stand alone activity, but wish to exercise more if exercise could be made more fun.

Below we review some of the currently available fitness apps, and their limitations.

Strava

Strava is a privately-held, venture capital backed company that aids users in tracking and optimizing their exercise routines. Strava develops mobile applications geared specifically toward runners and cyclists, allowing them to share, analyze and compare their performance with other users of the service. Strava also sells its top-level analytics data to urban planners, marketed as Strava Metro. Strava is headquartered in San Francisco, California and was founded in 2009.

The most popular activities tracked using the software are cycling and running. The site has aspects similar to other sites like mapmyride or ridewithgps. The basic service is free but there is an optional pay component (Premium Membership - \$5 per month) which allows members to gain access to additional statistical detail. Both amateur and professional athletes can be found as members although the offering appears to be aimed more at the serious athlete. Strava refer to their offering as a “Social Fitness Experience” rather than any mention of gamification. Strava estimate that there is a potential market of over 300M endurance athletes globally who would benefit from their social fitness experience.

Interestingly, Strava’s business model extends beyond just the “Social Fitness Experience”. The data gathered by Strava is available to other services; aggregated GPS logs of Strava users are used to design bike traffic solutions in cities through the Strava Metro initiative. Strava Slide is a fork of iD editor for Open Street Map, which allows map editors draw roads and trails more accurately using the same aggregated and anonymized GPS data. Cycling and running traffic may be monitored by everyone on the Strava Heatmap page. It is unclear how or when these services will be monetized.

MapMyFitness

MapMyFitness offers a suite of fitness-based websites and mobile apps, including MapMyRUN.com, MapMyRIDE.com, MapMyWALK.com, MapMyHIKE.com, MapMyFITNESS.com, MapMyMOUNTAIN.com, and MapMyTRI.com. MapMyFitness was founded in 2007 and on November 14, 2013, MapMyFitness was acquired by Under Armour. Through this acquisition, Under Armour has basically purchased a 3 million+ global community of athletes who use an alternative platform to Nike.

MapMyFitness differentiates itself through its geo-mapping smartphone apps that allow them to track and store users' daily running, cycling, walking, or hiking routes in an online database. Their complementary websites enable users to search for global fitness routes, join local or brand-related fitness groups, find event listings, join competitions for prizes, and access other health- and fitness-related content such as a nutrition center and training tools. Similar to Nike, MapMyFitness focuses on supporting a social community of avid athletes for serious competitions vs. offering game-like fun to encourage everyday users to be more active and fit.

Gamification of Fitness: Engaging Consumers Any Time, Any Place

We believe that the combination of social interaction, objective-driven play, and simple fun are the key to an explosive growth in fitness. Real-life team sports are a prime example of the power of this combination. In addition to being objective-driven and fun, real-life team sports are simultaneously social collaborations and social competitions. The collaborative+competitive combination is a powerful intrinsic motivator, and it is this mix that we feel is absent in the current fitness products. The failing of real-life team sports in modern life is that they demand the co-location of players in both time and physical space. Social gamification offers the opportunity to greatly expand the application of collaborative+competitive social motivation to fitness by allowing participants to play in different locations, at different times, or both.

An additional advantage social gamification offers over real-life team sports is seamless player-handicapping. Real-life sports generally require all members of a team to play at roughly the same level of ability in order to participate without disadvantaging their team. Gamification apps may be able to offer data driven player-handicapping to facilitate the formation of teams of players with disparate levels of fitness. Imagine for example, an ad showing a retirement-age father on the phone with his twenty-something son across the country; the father's doctor has told him he needs to get more exercise, to which the son responds by describing our product, and offering that he and his dad play as a team.

Some Early Starts

A few companies have sought to bring fun to exercise with direct gamification (e.g. GenericGymGame). To date, most offerings have focused on gym activities or simple accelerometer games. These games are predominantly single-player, and generally miss the opportunity to leverage social motivators. Some of them, however, do have a compelling entertainment element (e.g. *Zombies, Run!*), which succeeds in making an available but monotonous activity - e.g. jogging or walking - truly fun. Figure 3 shows a Venn diagram of health-, location- and games- based mobile apps, including interesting / iconic apps and fitness game examples for each area of the diagram. *Zombies, Run!* and *Run an Empire* are especially interesting for fitness gamification and we provide more details about them below.



Figure 3: Venn diagram showing current apps and fitness games and the “sweet spot” for the fitness app ecosystem.

Zombies, Run!

“Zombies, Run!” is a mobile game title from the publisher Six to Start, available for both Android and iOS. This app, which is gaining popularity with 800K downloads, is perhaps the most well-executed and well-produced examples of compelling entertaining content for exercise.

In game play, the player runs (or walks) while listening to a dramatic narrative, reminiscent an 1940s radio serial. Periodically during the narrative, zombies chase the protagonist, and the player is instructed pick up their exercise pace outrun the zombies to survive. Players also accrue in-game resources and currency during their workout, which can be used later in the non-workout phase of play. In this non-workout phase, users can use the items they acquired to build a “base” in a Farmville like game mechanic.

“Zombies, Run!” is principally passive entertainment while exercising, and only scratches the surface of how interactive fitness games may become. The social competitive aspect of the game is minimal, resting on the base construction elements, which seem like an afterthought. There is no actual social collaboration in game play, though the dramatic narrative does create an imagined urgency of others depending on the player.

Run An Empire

Run An Empire was founded by Ben Barker and Sam Hill and based in Shoreditch, London. The founders have been working together since 2010 on similar projects and have spoken internationally about the value of play, narrative, experience and memory in the urban environment and as part of every-day living.

Details on the the company and this unreleased game (as of 23rd February 2015) are scarce. The game was successfully funded as a Kickstarter Campaign on 14th April 2014. The target was just 15,000 GBP (~\$23,200 USD) they raised just over 23,000 GBP (~\$35,500 USD). The ETA for the game’s launch is Early 2015 for private beta for certain Kickstarter backers and March 2015 public launch. There are no details yet on the business model although it is likely to be a subscription model with possible in-app purchases. They are clearly trying to build something that has mass-market appeal with low barrier to entry for the casual user.

The strategy element is a unique twist on the gamified fitness app which blends current health app’s fitness tracking with territory ownership of Foursquare/Swarm. (see fig.1) The founders have stated that the intention is to create a “full-blown” game rather than a fitness app. They have used the example of Soccer to describe how the game will differ from the current fitness app paradigm; “Take football. Football is a game, played for fun. The objective is to score goals – not to “be healthy”. If someone were to take the components of football and “gamify” them to improve health then the end product would likely more closely resemble football training than the game itself”

Some more details on the game itself are found on game’s website:

The [Run An Empire] game will use GPS to record the paths players take - local neighbourhoods will become new arenas for strategic play. To control a territory, a player simply has to sprint, jog or saunter around it. For a competing player to capture it from them they need to do the same – either faster or more often. Territory can be better protected from invasion by encircling it multiple times. [see fig. 2]

The key to success is dedication. The game is designed for people like us, not naturally gifted athletes – a slow player can beat a faster opponent if they show more determination.

Rather than a gamified fitness app, we see Run Your Empire as a strategy game with sports-like real world elements. While there's certainly a potential health benefit (which we'll enrich as best we can with player analytics) what we're really excited about seeing are the strategies players enlist to achieve victory.

Market Summary / Analysis

Modern day smartphones, smart watches and fitness trackers have made it easy for consumers to set goals and track their daily and weekly fitness activities – and thus see how they are doing with respect to the amount of weekly activity recommended by AHA. Although fitness trackers in particular are becoming more commonplace, unfortunately, many consumers stop wearing such devices within a short period of time. In an internet survey of thousands of Americans (Sept 2013), Endeavour Partners found that “more than half of U.S. consumers who have owned a modern activity tracker no longer use it. A third of U.S. consumers who have owned one stopped using the device within six months of receiving it.” [13] They claim that an activity tracker that provides data, but does not inspire action (e.g., for users to be more active, if they are not being active enough), ends up failing in the market. They also posit that devices that help users change their habits also promote sustained behavior change and can lead to long-term health.

In their report, Endeavour Partners suggests nine baseline criteria that are essential for adoption and short-term use of wearable products and services [13]: *Selectability / Adoptability* (device's advantage over competitors), *Design / Aesthetics* (how the wearable looks), easy *Out-of-Box / Setup Experience*, *Fit / Comfort / Form Factor* for fitness and everyday activities, *Quality / Robustness* (wearable durability), seamless *User Experience*, *API / Integratability* (added value to use fitness data with other services), *Lifestyle Compatibility* (limited overhead for using device, including ease of charging), and *Overall Utility* (obvious benefits). Without a clear understanding of the value proposition, users will eventually stop using the device. For more details on these nine baseline criteria, see Appendix E.

While these baseline criteria are important for initial adoption and short-term use, they are not enough for long-term use. Endeavour Partners also suggests three behavioral factors for long-term engagement (of an activity tracking device or service) [13]:

- **Habit Formation:** how well does the device / service help users form and stick with new habits? (I.e., to form automatic behaviors or routines, triggered by situational cues and followed by some form of reward.)
- **Social Motivation:** share goals to improve commitment to achieve goals – including receiving social support and accountability, competing or collaborating with others; learn from vicariously observing others (e.g., if Suzy can lose 10 pounds with an activity tracker, so can I); improved health through connecting socially with others.
- **Goal Reinforcement:** users need to feel like they are making progress towards higher level goals; “baby steps” or smaller goals can provide the positive momentum needed to achieve bigger goals and can give users a sense of continuous progress.

These three behavioral factors for long-term engagement can be well supported through the gamification of fitness. By nature, multi-player games include social motivation and goal reinforcement – players compete in teams or against each other and goal reinforcement is provided through leaderboards or “leveling up.” Furthermore, becoming addicted to a fitness game means that users are actually forming fitness habits. Thus, fitness gamification can be a means by which fitness device manufacturers can engage users in a more long-term basis. Being engaged longer term can lead to better fitness, which can in turn lead to reduced risk of diseases related to sedentary lifestyles, as well as lower healthcare costs for both healthcare providers and individuals. In fact, forward-looking healthcare providers such as Humana Inc., already offer an activity tracker rewards program and an app that integrates fitness and eating behaviors [14]. Since fitness gamification brings added value to both fitness tracker manufacturers and healthcare providers, both of them can be key partners and revenue opportunities for fitness game makers.

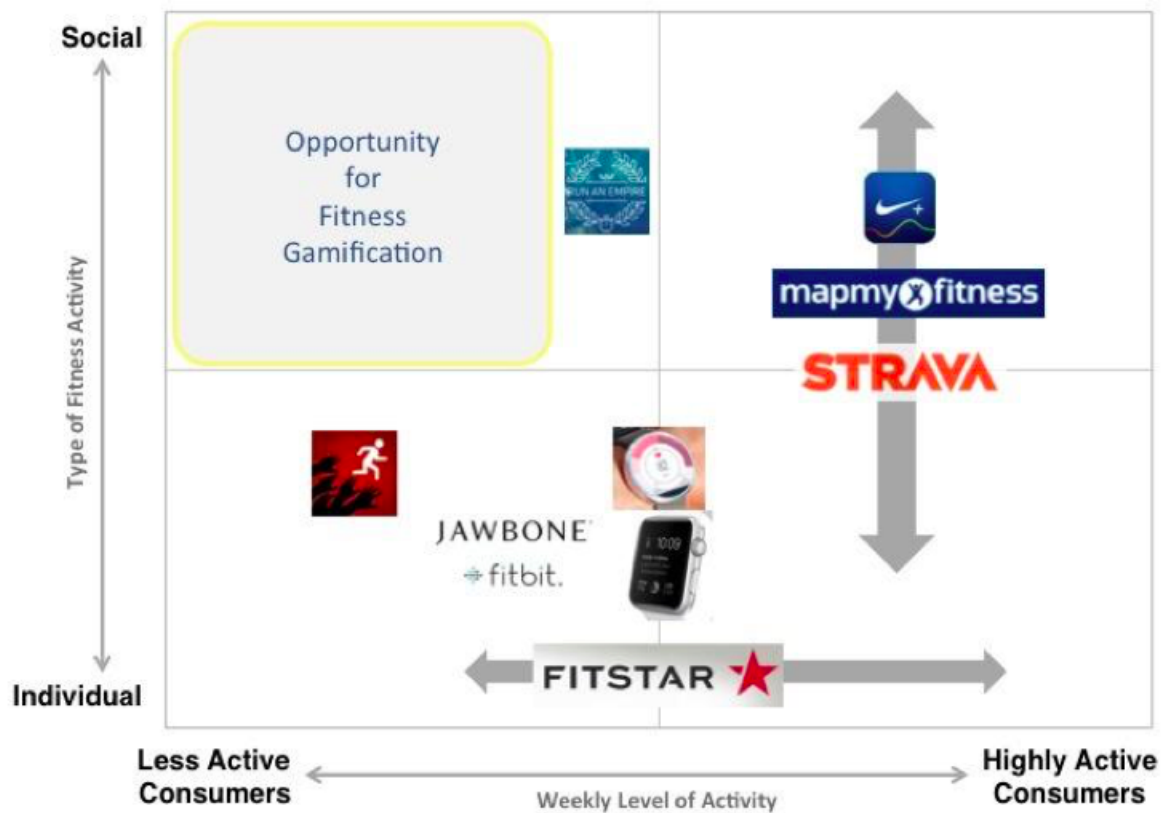


Figure 4. Opportunity for Fitness Gamification, based on current weekly level of consumer fitness activity and type of fitness activity (individual vs. social).

Although fitness games may be appealing to both consumers who are less active and those who are highly active from a fitness perspective, we believe that the true opportunity lies on focusing on those who are less active and whom could be socially motivated to be more active (see Figure 4). Consumers who are already avid about their fitness (those in the right-hand quadrants of Figure 4), tend to be intrinsically motivated, and products tailored for them already exist in the marketplace. Fitness wearables and apps for *individual* users (bottom quadrants of Figure 4) exist for both less active and highly active consumers. As indicated above, however, the trouble with apps / hardware / services for individuals, is that they tend to lack long-term engagement / sustainability -- especially for the not-so-intrinsically-motivated casual / less active consumers. Details about the products and services mapped in Figure 4 can be found in the Appendix.

Leveraging the Opportunity

From the analysis we have conducted, it is clear that as the appetite for tracking personal fitness using wearable devices and smart phones increases, an ecosystem is being created which could be leveraged to deliver habit-forming and motivating fitness games with a potential for helping more Americans be more successful in meeting their fitness goals.

We think this could be done in one of three ways:

1. A game studio launches a blockbuster fit-game title
2. A cross device fit-game platform is created, seeded with a few game titles
3. A wearable company invests seriously in fit-game development for their products

Even if the opportunity of fitness gamification is clear, the mode of execution is not. In particular, it remains unclear whether the successful social gamification of fitness will be driven by a device provider (like FitBit or Jawbone), by a blockbuster game title (the "Candy Crush Saga" equivalent of "Zombies, Run!"), or by a gaming platform provider (like Android or Facebook). The strong lock-in network effects for the device and platform solutions seem to endow those with a potentially greater long-term value, but a blockbuster game title may be required to drive their adoption in the first place.

Regardless of the details of the business model, game mechanics, or device sensors, it seems clear that the social gamification of fitness presents a large market opportunity for the party that perfects it, and a profoundly disruptive development for current fitness device manufacturers as well as brick and mortar fitness clubs.

Conclusion

Americans are in a fitness crisis, where nearly 4 out of 5 of us do not get the minimum exercise recommended by the American Heart Association. Long-term fitness engagement can be especially challenging to less active consumers, who would greatly benefit from extrinsic motivation to be more active. We have shown that fitness gamification offers a flexible solution for fitness activity at any time and any place. Finally, fitness gamification has business value for app developers, fitness device makers and healthcare providers.

Appendix A: Hardware Devices that Enable Fitness Tracking

Apple Watch Platform (<https://www.apple.com/watch/>) - This is Apple's long awaited entry into the wearables market and is focussed heavily on fitness tracking, able to measure heart rate as well as motion.

Android Wearable Platform (<http://www.android.com/wear/>)- There are multiple devices on the market from companies such as LG, Motorola and Samsung that leverage the Android Wear platform and are all capable of providing fitness tracking data.

Microsoft Band (<http://www.microsoft.com/microsoft-band/en-us>) - Microsoft's advanced fitness band that, like the Apple device is capable of monitoring heart rate as well as motion.

Nike Fuel Band (http://www.nike.com/us/en_us/c/nikeplus-fuel) - Nike was an early entrant into the fitness device market. However, this device has now been discontinued, seemingly in favor of their Nike+ FuelApp

Jawbone UP (<https://jawbone.com/store/buy/up3>) - The original Jawbone UP! was launched in November 2011[3] as a basic movement tracker. The latest iteration of this device (UP3) is also capable of tracking heart rate among other things.

Fitbit (<http://www.fitbit.com/>) - Fitbit were also an early entrant into the fitness tracker market. They now have a range of wearable fitness trackers with various capabilities.

A wearable device (activity tracker) is a device or application for monitoring and tracking fitness-related metrics such as distance walked or run, calorie consumption, and in some cases heartbeat and quality of sleep. The term is now primarily used for dedicated electronic monitoring devices that are synced, in many cases wirelessly, to a computer or smartphone for long-term data tracking, an example of wearable technology. [4] Gamification is the use of game thinking and game mechanics in non-game contexts to engage users in solving problems and increase users' self contributions. The intersection of these two technologies is where we are evaluating the technical opportunity. [5]

The rapid technology change in the wearable device industry can be a challenge to all the competitors and force business to change their business models to solve newer, more complex problems in order to maintain a competitive advantage and generate revenue. We have already seen major changes to the technology in a short period of time from simple step counters to gyroscopic motion detectors that have the capabilities of tracking several activities.

The wearables market has continued to evolve at a heroic pace as has the data to be collected and new ways in which the data from these devices are used. [6] We see Jawbone licensing its technology to companies like Whistle, where owners can track their dogs' activity and we see companies like Strava using the data to create a competitive culture of fitness. Overall, the technology is gaining ground in two specific areas, new uses for the devices are being identified and the data being generated is being leveraged in new and creative ways.

There is an anticipation that the gamification and wearable device industry will collide. When evaluating the five competitive forces in this scenario, we can evaluate the technical from several angles regarding the supplier power, new market entrants, buying power, technology development and competitive rivalry. Each of these variables had a bit of mystique, given the general lack maturity of this industry, but it's remarkable the amount of technology that exists in such a new area.

While evaluating the supplier power regarding the gamification of wearable devices in , there was a clear indication that brand, geographical coverage and relationships with customers were important. We are seeing devices, such as the Jawbone Up, being sold in over 40 countries, which, when tied with their open API, means that developers will have fairly open access to the data being generated across the globe. [7] There is, in general, a flood of devices entering the market, which can also be seen in the Gartner data, indicating the proliferation of wearable devices in the market. [8] We are also seeing an explosion in the application market. There are dozens of applications that are leveraging the data and open API's to track activities from data produced by wearable devices. What is lacking, are the types of applications that leverage this data in a gamification manner. During our research we were able to only identify two applications Run an Empire and Zombie's Run. Given this environments, we see an opportunity to engage wearable device customers at a global scale in a way that doesn't currently exist. The company that can get this right and build a strong relationship with it's customers will do very well.

This is a relatively new market. There is an anticipation that the gamification and wearable device industry will collide. There is relatively no resistance to entering this market. Our research indicates that there are two companies that have interesting strategies to expand in this market. Given that device manufacturers have fairly open APIs's [10], there is virtually no technical obstacle or foreseen resistance to entering such a market. In fact, we are expecting increase in demand new, fun applications that do more than track and report activity.

We are seeing rapid technology development in both the application and wearable device areas. We have already seen major changes to the technology in a short period of time form simple step counters to gyroscopic motion detectors that have the capabilities of tracking several activities.

There are also several new technologies in the market that have yet to hit mainstream. For example, The Nike Lunar Hyperdunk+ sports shoes help serious basketball player's track performance stats and their NikeFuel score. The iPhone app is slickly designed and engagingly presented. [9] The wearable environment has exploded with data to be collected and new ways in which the data from these devices are used. As an example, we see Jawbone licensing its technology to companies like Whistle, where owners can track their dogs' activity and we see companies like Strava using the data to create a competitive culture of fitness. We are also seeing high fashion join enter the technology market with Tory Burch partnering with Fitbit to release a high fashion version of their wearable devices. Overall, the technology is gaining ground in two specific areas, new uses for the devices are being identified and the data being generated is being leveraged in new and creative ways.

The customers in the foreseen scenario would be individuals that have purchased a wearable device that are looking for more fun and creative uses. It's expected that their behaviors will mimic the behavior seen with other wearable technology. We are seeing device loyalty, but not application loyalty. We are attributing the device loyalty to the initial investment. Costs of these devices can be over \$200. Customers seem to migrate from hot app to hot app, seeking higher levels of engagement. This can be a challenge when changing applications can cost only a few dollars. Although abandonment rates continue to be high despite increased adoption [6], and the industry continues to struggle to deliver products and services that provide sustained benefit to the mass market.

The industry of gamification of wearable devices is a brand new. There are only a few companies trying to bridge wearable devices and games. There are completion driven apps like Strava, but they are focused on a fitness first model. New apps in this field are having the fitness first aspect take a back seat to gaming. In essence they are saying 'have fun and if you get some exercise having fun, great, but it's not required'. This approach is what will differentiate gamification from activity tracking.

Appendix B: Smartphone Fitness Applications

Map My Fitness (<http://www.mapmyfitness.com/>) - MapMyFitness offers a suite of fitness-based websites and mobile apps, including MapMyRUN.com, MapMyRIDE.com, MapMyWALK.com, MapMyHIKE.com, MapMyFITNESS.com, MapMyMOUNTAIN.com, and MapMyTRI.com. MapMyFitness was founded in 2007 and on November 14, 2013, MapMyFitness was acquired by Under Armour. Through this acquisition, Under Armour has basically purchased a 3 million+ global community of athletes who use an alternative platform to Nike.

MapMyFitness differentiates itself through its geo-mapping smartphone apps that allow them to track and store users' daily running, cycling, walking, or hiking routes in an online database. Their complementary websites enable users to search for global fitness routes, join local or brand-related fitness groups, find event listings, join competitions for prizes, and access other health- and fitness-related content such as a nutrition center and training tools. Similar to Nike, MapMyFitness focuses on supporting a social community of avid athletes for serious competitions vs. offering game-like fun to encourage everyday users to be more active and fit.

Fitstar (<http://fitstar.com/>) - Fitstar is available on mobile and Web and takes a personal trainer approach to fitness tracking by providing personalized workouts. It was acquired by Fitbit in early 2015.

Strava (<http://strava.com>) - Strava is a privately-held, venture capital backed company that aids users in tracking and optimizing their exercise routines. Strava develops mobile applications geared specifically toward runners and cyclists, allowing them to share, analyze and compare their performance with other users of the service. Strava also sells its top-level analytics data to urban planners, marketed as Strava Metro. Strava is headquartered in San Francisco, California and was founded in 2009.

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Strava estimate that there is a potential market of over 300M endurance athletes globally who would benefit from their social fitness experience.

The company is Backed by Madrone Partners and Sigma Partners and led by a founding team who has been through three generations of successful startups. They recently received a round of venture funding of 18M (after two previous rounds) and are expanding their operation rapidly.

Interestingly, Strava's business model extends beyond just the "Social Fitness Experience". The data gathered by Strava is available to other services; aggregated GPS logs of Strava users are used to design bike traffic solutions in cities through the Strava Metro initiative. Strava Slide is a fork of iD editor for [Open Street Map](#), which allows map editors draw roads and trails more accurately using the same aggregated and anonymized GPS data. Cycling and running traffic may be monitored by everyone on the Strava Heatmap page which shows a global [heatmap](#). It is unclear how or when these services will be monetized.

The following are examples of fully gamified applications:

Zombies, Run! (<http://zombiesrungame.com>) - "Zombies, Run!" is a mobile game title from the publisher Six to Start, available for both Android and iOS. The app is perhaps the most well-executed and well-produced examples of compelling entertaining content for exercise. In game play, the player runs (or walks) while listening to a dramatic narrative, reminiscent an 1940s radio serial. Periodically during the narrative, zombies chase the protagonist, and the player is instructed pick up their exercise pace outrun the zombies to survive. Players also accrue in-game resources and currency during their workout, which can be used later in the non-workout phase of play. In this non-workout phase, use the items they acquired to build a "base" in a Farmville like game mechanic.

"Zombies, Run!" is principally passive entertainment while exercising, and only scratches the surface of how interactive fitness games may become. The social competitive aspect of the game is minimal, resting on the base construction elements, which seem like an afterthought. There is no actual social collaboration in game play, though the dramatic narrative does create an imagined urgency of others depending on the player.

Run An Empire (<http://runanempire.com>) - Run An Empire was founded by Ben Barker and Sam Hill and based in Shoreditch, London. The founders have been working together since 2010 on similar projects and have spoken internationally about the value of play, narrative, experience and memory in the urban environment and as part of every-day living.

Details on the the company and this unreleased game (as of 23rd March 2015) are scarce. The game was successfully funded as a Kickstarter Campaign on 14th April 2014. The target was just 15,000 GBP (~23,200 USD) they raised just over 23,000 GBP (~35,500 USD). The ETA for the game's launch is Early 2015 for private beta for certain Kickstarter backers and March 2015 public launch. There are no details yet on the business model although it is likely to be a

subscription model with possible in-app purchases. They are clearly trying to build something that has mass-market appeal with low barrier to entry for the casual user.

The strategy element is a unique twist on the gamified fitness app which blends current health app's fitness tracking with territory ownership of Foursquare/Swarm. [see Figure 2] The founders have stated that the intention is to create a "full-blown" game rather than a fitness app. They have used the example of Soccer to describe how the game will differ from the current fitness app paradigm; *"Take football. Football is a game, played for fun. The objective is to score goals – not to "be healthy". If someone were to take the components of football and "gamify" them to improve health then the end product would likely more closely resemble football training than the game itself"*

Some more details on the game itself are found on game's website:

"The [Run An Empire] game will use GPS to record the paths players take - local neighbourhoods will become new arenas for strategic play. To control a territory, a player simply has to sprint, jog or saunter around it. For a competing player to capture it from them they need to do the same – either faster or more often. Territory can be better protected from invasion by encircling it multiple times. [see Figure 3]

The key to success is dedication. The game is designed for people like us, not naturally gifted athletes – a slow player can beat a faster opponent if they show more determination.

Rather than a gamified fitness app, we see Run Your Empire as a strategy game with sports-like real world elements. While there's certainly a potential health benefit (which we'll enrich as best we can with player analytics) what we're really excited about seeing are the strategies players enlist to achieve victory."

"Run An Empire is not what we'd call a gamified health app. It's more like a strategy game blended with a sport - requiring both cunning and action. The primary objective is to beat other people at building and controlling the most successful empire.

However, we know that Run An Empire has the potential to encourage regular exercise and we're excited that the game can also be used this way - we'll make sure to provide health metrics alongside the game's strategic data and we'll include integration for existing health and running platforms' APIs."

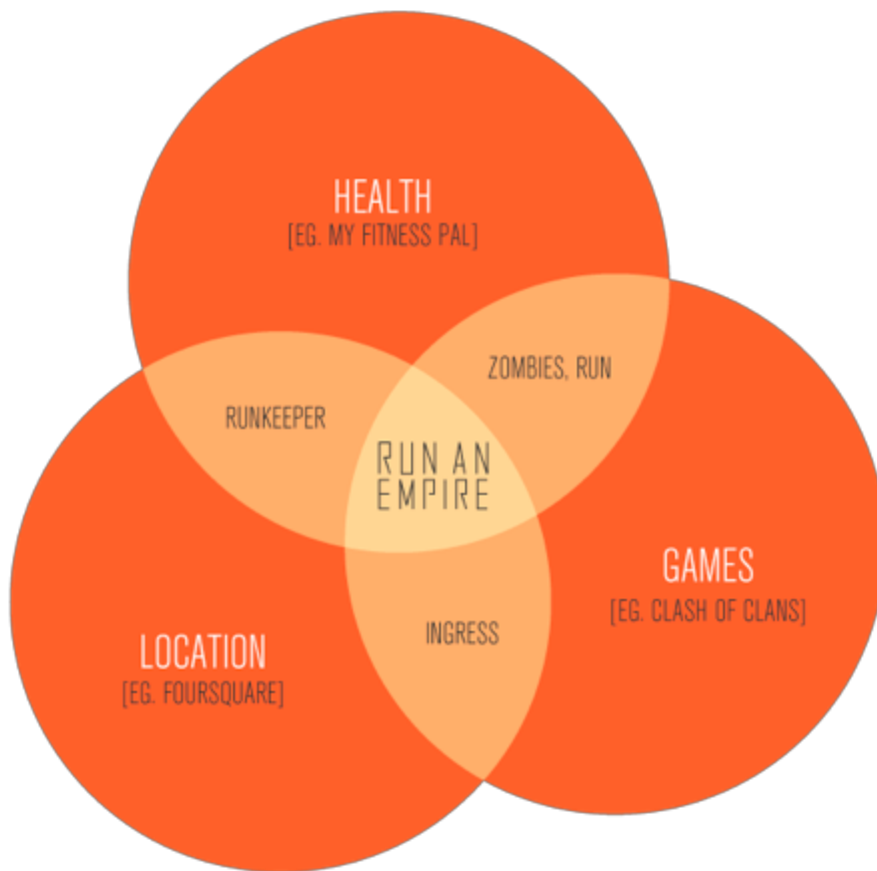


Figure 2: Venn diagram showing where the game fits into the fitness app ecosystem.

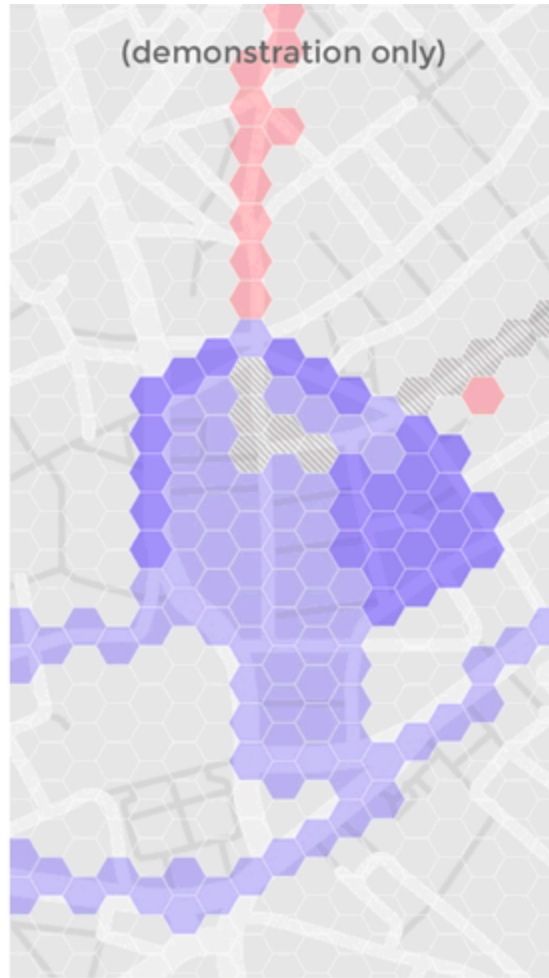


Figure 3. Prototype visual of how territory is divided and gained.

Name	Monthly Web Page visits	Facebook likes	Twitter followers	iOS app ratings
Strava	6 million	230 k	730 k	14 k
Run an Empire	7.5 k	400	747	N/A
Map My Fitness	3.5 million	50 k	53 k	28 k
Nike Fuel	NA	307 k	273 k	27 k
Fitocracy	1.5 million	60 k	33 k	120
Zombies Run	250 k	44 k	25 k	N/A

Figure 4. Current success indications of smartphone fitness apps

Appendix C: Business Model Canvas for Fitness Gamification

The Business Model Canvas		Designed for: ELPP class (3/2015)	Designed by: Fitness Gamification ELPP team	On: 03/22/2015 Iteration # 1
Key Partners <small>Who are our Key Partners? Who are our key suppliers? Which Key Resources are we acquiring from partners? Which Key Activities do partners perform?</small> Fitness tracker manufacturers Healthcare providers	Key Activities <small>What Key Activities do our Value Propositions require? Our Distribution Channels? Customer Relationships? Revenue streams?</small> Software development (app) → initial game + updates Analytics / reports Website development?	Value Propositions <small>What value do we deliver to the customer? Which one of our customer's problems are we helping to solve? What bundles of products and services are we offering to each Customer Segment? Which customer needs are we satisfying?</small> - healthier lifestyle - reduced risk of heart disease - credit / lower health insurance	Customer Relationships <small>What type of relationship does each of our Customer Segments expect us to establish and maintain with them? Which ones have we established? How are they integrated with the rest of our business model? How costly are they?</small> Communities: → Facebook, twitter, or internal? Reporting to healthcare providers	Customer Segments <small>For whom are we creating value? Who are our most important customers?</small> low to moderately fitness active users especially those pre-disposed to risk of heart disease
Key Resources <small>What Key Resources do our Value Propositions require? Our Distribution Channels? Customer Relationships? Revenue Streams?</small> Software developers Cloud storage Website?		Channels <small>Through which Channels do our Customer Segments want to be reached? How are we reaching them now? How are our Channels integrated? Which ones work best? Which ones are most cost-efficient? How are we integrating them with customer routines?</small> healthcare providers workplace campaign hardware manufacturers (of activity trackers)		
Cost Structure <small>What are the most important costs inherent in our business model? Which Key Resources are most expensive? Which Key Activities are most expensive?</small> Fixed cost: software development Ongoing costs: data storage (& reporting engine?)		Revenue Streams <small>For what value are our customers really willing to pay? For what do they currently pay? How are they currently paying? How would they prefer to pay? How much does each Revenue Stream contribute to overall revenues?</small> Revenue from healthcare providers based on customer use? Revenue share from fitness tracker manufacturer?		

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Figure 4. Business Model Canvas for Fitness Gamification.

Appendix D: Minimum Fitness Activity Recommendations by the American Heart Association

For overall cardiovascular health, the American Heart Association (AHA) recommends the following [12]:

- At least **30 minutes of moderate-intensity** aerobic activity at least **5 days per week for a total of 150 minutes per week**

OR

- At least **25 minutes of vigorous** aerobic activity at least **3 days per week for a total of 75 minutes**; or a combination of moderate- and vigorous-intensity aerobic activity

AND

- **Moderate- to high-intensity muscle-strengthening activity** at least **2 days per week** for additional health benefits.

In addition, the AHA recommends the following for lowering blood pressure and cholesterol:

- An average **40 minutes of moderate- to vigorous-intensity** aerobic activity **3 or 4 times per week**

Appendix E: Baseline Criteria Essential for Adoption and Short-Term Use of Wearable Products and Services

Endeavor Partners identified nine baseline criteria that are essential for adoption and short-term use of wearable products and services [13]:

- **Selectability / Adoptability** – Users must understand the relevance and uniqueness of the value proposition for a given device, in order to select that device over competitors.
- **Design / Aesthetics** – Because most wearables can be seen, aesthetics is a factor in deciding which wearable to purchase.
- **Out-of-Box / Setup Experience** – Should be quick and easy.
- **Fit / Comfort / Form Factor** – Fit and overall comfort of a device are critical for adoption and sustained utilization. This includes fit and comfort during all types of daily activity, not just when worn for fitness workouts.
- **Quality / Robustness** – A device designed to be worn throughout all daily activities must be capable of enduring the high degree of wear and tear that come with those activities.
- **User Experience** – The user experience must be immediately intuitive, familiar and seamless.
- **API / Integratability** – Users can gain more value from their device by being able to leverage the device's data from additional services, thereby receiving an overall improved experience or greater value from that device.
- **Lifestyle Compatibility** – Wearing the device should require low overhead. The more times per week the user is required to take the device off (to charge or sync the device, or to take a shower), the more likely they are to abandon it.
- **Overall Utility** – Users need to understand how wearing the device will benefit them. Without a clear understanding of the value proposition, users will eventually stop using the device.

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