A Data Story about a Bike that Goes Nowhere

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Domain/Introduction

The earliest form of at home workouts began with VHS tapes in 1979 and exploded with Jane Fonda's workout series in the 1980's. [4] As technology evolved, the workout video format moved to DVDs, then streaming from computers and tablets. [4] The home fitness equipment industry was booming in the 1990s with sales of traditional workout equipment like weights and treadmills as well as novelty items like the Thighmaster. [6] In current times, we have seen a combination of digital fitness and equipment with gear like the Peloton®, Tread, and Mirror. These are high-tech pieces of exercise equipment that include an instructor component to guide you through your workout. In 2020, the home workout industry experienced a boom due to gyms being closed to prevent the spread of coronavirus. From January to March of 2020, sales of fitness equipment shot up 55% during lockdown. [6] Even though having the equipment at home can reduce the amount of time needed to fit a workout into a routine, a 2016 study found that motivation to exercise comes from incentives and rewards to sustain the habit long enough for health to be a motivator. [9] For some people, data can be a motivating factor.

Peloton® was founded in 2012 with a mission to "use technology and design to connect the world through fitness, empowering people to be the best version of themselves anywhere, anytime." [8] Founder John Foley wanted to provide an in-home high end boutique workout experience for people with busy schedules. [5] By 2019, they sold over 400,000 indoor spinning bikes and had introduced their treadmill in 2018. [5] After viewing the success of Peloton®, competitors such as NordicTrak, Echelon, and Flywheel released their own bikes accompanied with streaming content at different price points enabling more households the privilege of getting a studio workout at home.

Literature Review

Besides bringing the instructor led coaching experience into the comfort of your home, the connected apps generate data points about the exerciser and their workout. In 1985, the effect of percentile-based feedback on intrinsic motivation was evaluated on seventh and eighth grade children. Perceived interest-enjoyment, competence, effort, and pressure-tension were evaluated on the subjects after they were given positive-biased feedback, negative-biased feedback, or no biased feedback. The positive feedback group received scores above the 80^{th} percentile and the negative feedback group received scores below the 20^{th} percentile. The intrinsic motivators increased for the group that were told they were in the 80^{th} percentile, indicating that data point had a positive effect on their performance. [11]

Along with home workout equipment, wearable trackers have become more popular to record steps, activity, and calories burned. These devices not only collect the data but offer insights to users on how to improve the numbers. Some also incrementally increase goals as the user achieves different fitness levels. A questionnaire based 4-week study of 34 users of the fitness trackers JawBone and FitBit observed three key areas of the user interface that affected performance: data, gamification, and content. The most impactful data refers to statistics on movement and sleep, goals, and visualizations. Gamification motivates users by offering challenges or competitions for which the user can earn badges. Content refers to the tracker and apps ability to support the wearer's goals. [1]

Objective

I learned that data can be a motivator firsthand through the Peloton® Power Zone training program. A ride called the FTP test can be completed by the user to establish their base level of fitness to guide their effort in each class. Each ride is cued to various levels between 1-7 with 1 being easy and 7 being max effort. The rider adjusts their cadence and resistance so their output falls within the cued level. As the effort becomes easier, the rider retakes the FTP test and gets new, more difficult levels. As my zones became easier and I increased my average FTP score, I was more motivated to get on the bike for a workout. [7]

After being sidetracked by health issues over the last few years, I am finally well and able to refocus my efforts on regaining my strength. Even though I have resumed my post illness power zone routine, my body has not responded in the same way. Medication and age are likely to be a factor, but are there controllable factors that I can identify by using the data from my Peloton® and Apple Health Apps? Some questions I can explore are:

- What are the biggest factors that affect the output during my ride? Resistance, Cadence, Time of Day, Day of Week
- What are my favorite workouts according to the data? What am I best at?
- When my weight is going down, what workouts am I doing? Strength, Power Zone, Endurance, HIIT, Short or Long rides
- What is my average heart rate when I am losing weight? Does the "fat burning zone" myth ring true? Do I burn more fat at lower intensities?
- Can I predict my weight based on workouts during the previous two weeks?

This project will explore the information that is generated by one of these tools to improve the workout experience and motivate me to continue doing the work.

Data

Peloton® has an unofficial API that I will use to download my history of workouts containing the following datapoints [10]:

- Workout type
- Personal Record – is this a personal record for that time/type of workout?
- Start Time
- Total Output
- Difficulty rating
- Difficulty level
- Duration
- Instructor
- Rating Count – number of users who rated the ride.
- Total Workouts – number of users who did this workout.
- Leaderboard Rank
- Leaderboard Users – number of users on the leaderboard.
- Intensity
- Average Output
- Average Cadence
- Average Resistance

- Average Speed
- Total Output
- Total Distance
- Total Calories

In addition to my workout data, I will be attempting to connect to the Apple Health Kit to download my weight history. For the last few years, I have used a Renpho Bluetooth scale that connects to an app on my phone and syncs to the Apple Health app.

Methods

The Peloton® world is filled with data junkies so even though Peloton® has not released official documentation on their API, the outline for connecting to the API is well documented. I followed the process provided by A. Chen to load my personal workout details, general stats for the workout, performance metrics, and instructor names. [3] I will be working with a dataset rather than loading the data to Coda Doc.

Many have also already downloaded their health data from the Apple Health Kit. I am still exploring different methods get this information. My ideal approach would be to follow the steps provided in a Better Programming blog post by Guido Casiraghi on loading the health data using XML. [2]

When reviewing my weight with workout data, I would like to plot a time series graph with various workout statistics to observe any patterns with the workouts that happen directly before my weight drops. Pearson's coefficient can be used to explore correlation between most of the variables because they are primarily numeric. Linear regression will be used to perform predictions for output based on workout features or for predicting weight based on workouts. It may be a fun experiment to use a classification model to predict the instructor based on the ride stats.

Challenges

Even though downloading health information from the Apple Health information is documented, I haven't attempted it yet. To gain insights on how the bike affects my weight, I will need this to work. I have had the Peloton® for a few years longer than the Bluetooth scale so any modeling based on weight will need to exclude workouts before the scale data starts. This could create a situation where there is not enough data for reliable predictions.

Conclusion

Motivation is a requirement for sticking to any routine. Knowing your motivating factors and using them strategically can lead to success in achieving your goals. The online fitness community provides many avenues of motivation including community, convenience, competition, and data. Developing a reproducible method to identify the factors that can improve performance and results can allow users to benefit even more from their investment.

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