An Analysis of Exercising Behavior in Online Populations

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network dynamics

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Introduction and Motivation -

Exercise is an important component of health. Previous studies of exercise and health have been stymied by the lack of accurate records of exercising activities. In our study, we overcome this limitation by using data from Fitocracy, a gamified workout tracking site that precisely records users' workout histories using over 1,000 unique exercises and where users self-report their age, gender, and height. We analyze nearly half a million users' histories to identify exercising behavior trends and how those behaviors vary by age and gender.

Data[•]

All of a user's activities, profile, social data, and group memberships on Fitocracy were crawled over a six-month period to acquire the complete profiles and workout histories of 441,034 users. Ultimately, 188,265 users recorded at least one workout, with the total dataset comprising 3,130,276 workouts (14.3M activities) over nearly a four year span from February 2011 to January 2015.

How does exercising behavior vary with age and gender?

Methodology: The activities performed by different age groups provide a insightful view into how exercise behavior changes over time. We divided users by gender and into seven age ranges. Within each gender-age cohort, we computed the probability that a user in that cohort records each exercise and then sorted all exercises according to their average probability of being performed. Below, we show the ten exercises that are most likely to be performed by an individual from each cohort.

Ages 0-20 Walking Running Crunch (1) Plank Body Weight Squat Push-Up Elliptical Trainer Running (treadmill) Jumping Jacks

Overhead Press

Sit-Up Stretching Push-Up Push-Up Barbell Squat Running Barbell Bench Press Barbell Squat Running Barbell Deadlift Barbell Deadlift Pull-Up Pull-Up **Dumbbell Bicep Curl** Walking Walking Crunch

Ages 20-25 Walking Running Elliptical Trainer Crunch Running (treadmill) Push-Up Plank Body Weight Squat Cycling (stationary)

Barbell Bench Press Dumbbell Bicep Curl Crunch Sit-Up

Ages 25-30 Walking Running Elliptical Trainer Running (treadmill) Push-Up Plank Crunch **Body Weight Squat** Cycling (stationary)

Stretching

Running Push-Up Barbell Squat Barbell Bench Press Walking Barbell Deadlift Pull-Up Running (treadmill) Cycling Dumbbell Bicep Curl

Ages 30-35 Walking Running Elliptical Trainer Running (treadmill) Push-Up Plank Crunch Body Weight Squat

Cycling Running Push-Up Walking Barbell Squat Barbell Bench Press Running (treadmill) Cycling Elliptical Trainer Barbell Deadlift Pull-Up

Ages 35-40 Walking Running Elliptical Trainer Running (treadmill) Walking (treadmill) Push-Up

Walking (treadmill) Crunch Cycling (stationary) Running Walking Push-Up Cycling

Plank

Ages 40-50 Walking Running Elliptical Trainer Running (treadmill) Push-Up Body Weight Squat Plank

Running (treadmill) Barbell Bench Press Elliptical Trainer **Barbell Squat** Cycling (stationary) Pull-Up

Walking (treadmill)

Cycling (stationary) Crunch Stretching Running

Walking Push-Up Cycling Running (treadmill) Elliptical Trainer Cycling (stationary) Barbell Bench Press Barbell Squat Crunch

<u>Ages 50+</u> Walking Walking (treadmill)

Running Elliptical Trainer Cycling (stationary) Walked up the stairs Cycling Swimming Running (treadmill) Push-Up

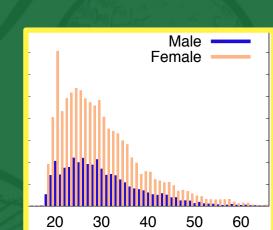
Walking Running Cycling Push-Up Elliptical Trainer Cycling (stationary) Running (treadmill) Walking (treadmill) Light Walking (secondary) Walked up the stairs

Women's exerce selection focuses on bodyweight movements and cardio and is remains largely similar across age cohorts.

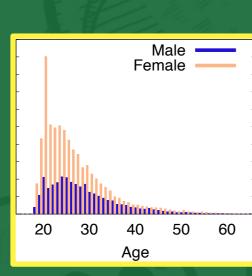
Men's exercise selection initially focuses on strength training but then converges with women's exercise choices.

-What exercising behaviors are practiced by subpopulations?-

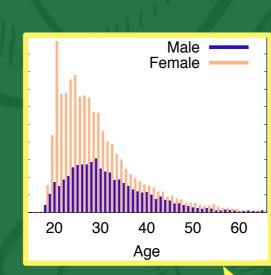
Methodology: To identify the underlying behaviors from people's activities, we train a Latent Dirichlet Allocation (LDA) model on users' exercising data. We model each individual's history as a reflection of that person engaging in just a few behaviors, where a behavior selects for certain exercises with higher frequency. Below, we show the demographics of the population engaging in the behaviors identified from a 20-behavior LDA-model.



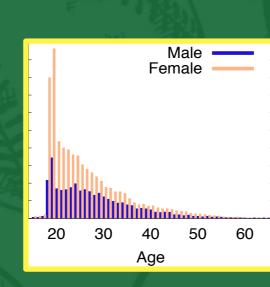
Top Exercises Boot Camp Spinning Arnold's 1% Circuit Zumba Kickboxing



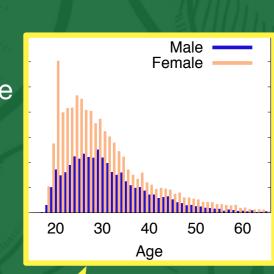
Top Exercises Bicycle Crunch **Reverse Crunch** Plank Russian Twist



Top Exercises Elliptical Trainer General Yoga **Pilates** Vinyasa Bikram / Hot Yoga



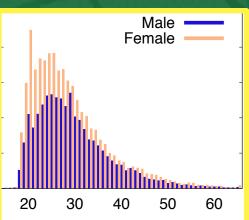
Top Exercises Standing Calf Raise Walking Abductor Machine **Adductor Machine** Glute Kickback



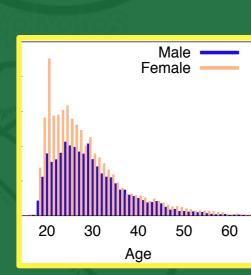
Top Exercises Walking Walked up the stairs Light Walking Yard Work Other Cardio

Our analysis found more behaviors that were practiced by more women than men, suggesting more nuance in female exercising habits. The behaviors here are ordered from mostly-female practiced to mostly-male practiced.

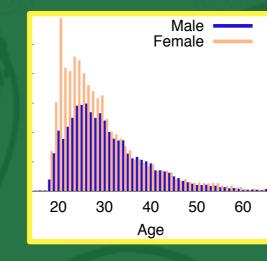
Age matters: These two behaviors were associated with the oldest individuals on average



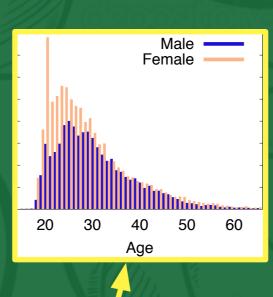
Top Exercises Plank Dumbbell Lunges Dumbbell Side Bend Exercise Ball Crunch Standing Dumbbell Shoulder Press



Top Exercises Stretching Foam Rolling Shoulder Dislocation Other Bodyweight Band Pull Aparts



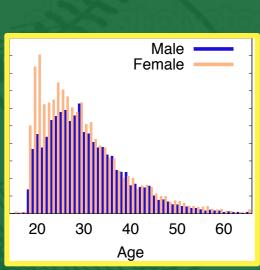
Top Exercises Cycling (stationary) General Insanity Rowing (machine) Stair Machine Walking (treadmill)



Top Exercises Running (treadmill) Walking (treadmill) Boxing Brazilian Jiu-Jitsu Muay Thai

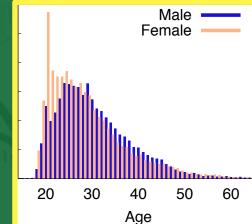
Some behaviors buck.

gendered expectations!

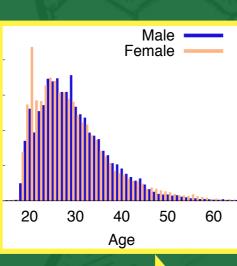


Top Exercises Two-Arm Kettlebell Swing Goblet Squat (kettlebell) One-Arm Kettlebell Swing Body Weight Inverted Row Push-Up

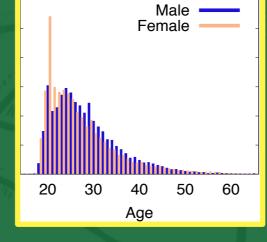
Height influences exercise selection: Men and women practicing the bottom behavior were 1.5in and 0.34in taller than those for the top behavior!



Top Exercises Running Trail Running Walking General P90X Running (Sprints)



Top Exercises Burpee Rowing (machine) Pull-Up Front Barbell Squat Box Jumps



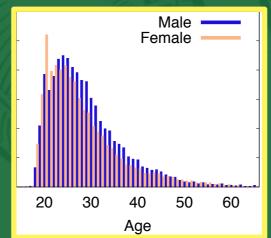
Top Exercises Push-Up **Body Weight Squat** Crunch Plank Sit-Up

Behavior adoption time changes

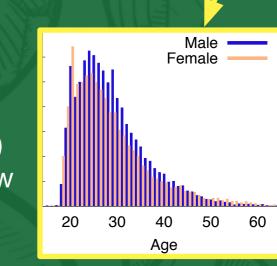
by gender: Women most adopt

this behavior in their early 20s,

while men adopt it near 30.



Top Exercises Leg Press Lat Pulldown Rowing (machine) Seated Cable Row Leg Extensions



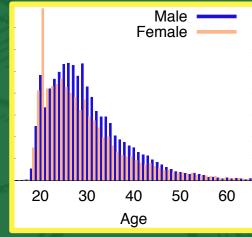
Surprisingly, we found that the proportion of behaviors did

not radically change between age cohorts, which suggests

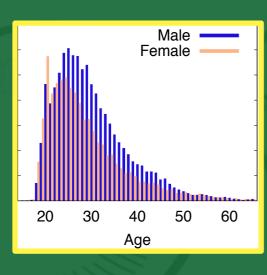
people find their preferred activities and stick with them as

Top Exercises Dumbbell Bicep Curl Standing Dumbbell Shoulder Press **Dumbbell Side Lateral Raise Dumbbell Bench Press** Dumbbell Flyes

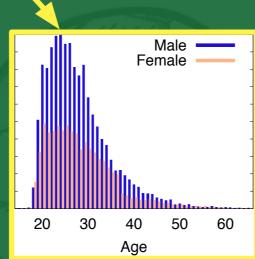
The behavior associated with CrossFit-like exercises had an even gender split.



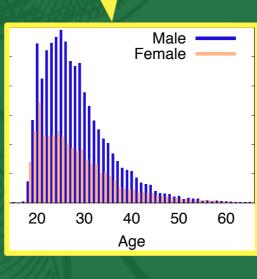
Top Exercises Cycling Swimming Football (US Soccer) Basketball Hiking



Top Exercises Machine Chest Fly Machine Ab Crunch Lat Pulldown Leg Press Machine Shoulder Press

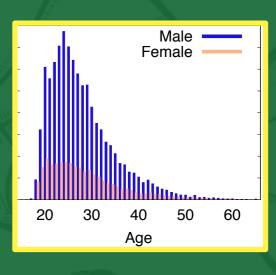


Top Exercises Barbell Squat Barbell Bench Press Barbell Deadlift Standing Barbell Shoulder Pres Bent Over Barbell Row



Top Exercises Pull-Up Chin-Up Push-Up Dips - Triceps Ver. Wide-Grip Pull-Up

they grow older.



Top Exercises Incline Dumbbell Bench Press Barbell Bench Press Barbell Incline Bench Press Dumbbell Side Lateral Raise Seated Cable Row