

Enhancing physical activity on the dance floor through a mobile phone application

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Abstract

Research indicates that there is a potential for persuasive technologies to be used as a means for increasing physical activity. In this exploratory work, we developed a mobile web application to gather movement data to explore the potential of a health tool in the context of a dance floor to promote physical activity. We wanted to explore if the mobile application in combination with the context and mechanisms seen in other health applications could drive physical activity. In total, 208 participants generated 20 279 data points through the mobile application on the dance floor. The result from this work points out that the concept should be further investigated in more studies.

Background

Research indicates that there is a potential for persuasive technologies to be used as a means for increasing physical activity ¹. Especially the use of mobile phones to target physical activity has emerged during the last years. The recent advent of smartphones has greatly increased both the reach and realm for this purpose by providing a platform for developers to design third-party applications, which expand the functionality and utility of these mobile devices ². Mobile applications allow users to track their fitness activities via GPS and/or accelerometer from their smartphones. According to a report issued by Mobihealthnews, more than 13.000 health and

fitness mobile applications, such as Runkeeper and Endomondo, were available via iTunes by August 2012³. The use of smartphones in supporting physical behavior change has also been explored⁴.

In this exploratory work, we developed a mobile web application to gather movement data to explore the potential of a health tool in the context of a dance floor to promote physical activity. Firstly, this work was a way to gather movement data in a different context. Secondly, we wanted to explore if the mobile application in combination with the context and mechanisms seen in other health applications could drive physical activity. The application was built on principles that have been investigated in earlier research in this field, such as visual performance feedback, rewards and social sharing⁵. Hence, the aim was test a mobile application, which was built on the same principles as health and fitness applications, and gather movement data. To our knowledge, no study has been published on enhancing physical activity on the dance floor through a mobile phone application.

Methods

Sample

Participants were the audience listening to Yamarill, an electronic music group consisting of two disc jockeys (DJ's) and a singer, on the 4th of May 2013 at a concert venue in Stockholm, Sweden. The concert was an open event with three other acts. The concert was mainly advertised among psychology students as it was held in conjunction with a nationwide conference for psychology students. Participants had to be at least 18 years of age - as well as have access to a smartphone to be able to participate.

Procedure

The participants were informed and enrolled to use the mobile application upon arrival at the venue by the research group. The participants were informed that the mobile application would measure their physical activity on the dance floor during Yamarill's concert. If agreed on participating and providing informed consent, a web link was given to the participant where he/she was automatically and directly randomized to one of three groups: the yellow group, the green group, or the pink group. A total of 515 participants were randomized. The participants were allocated to one of the three groups in a 1:1:1 ratio using simple randomization. A total of 208 out of the 515 participants (40 %) generated usable movement data during the concert.

Movement data

Movement data was collected through the participants' mobile phones. This was made possible due to the fact that modern smartphones are now equipped with accelerometers that are able to measure the acceleration of the phone, and because this sensor data is made accessible to mobile application developers.

It was not necessary to know the specific direction the participant was dancing in, but rather the amount of acceleration. As such, only the magnitude of the acceleration was needed. Since the accelerometer splits its readings into X, Y, and Z components, finding the magnitude was done using the following formula, and was labeled as the “movement score”:

$$\text{movement score} = \sqrt{(\text{accelerationX}^2 + \text{accelerationY}^2 + \text{accelerationZ}^2)}$$

Every second, the application calculated the movement score using the above formula, and then sent the data to a server that logged it along with which participant created it, and what time it was measured at. The acceleration due to gravity was not included in the calculation. The application could only measure data if it was running on the mobile phone.

The movement score was seen to fluctuate between 0 and 1000 depending on the amount of dancing done by the participant during a given second. This scale could roughly be divided into three categories; 0-300=normal dancing, 300-700=dancing somewhat excited, and 700-1000=dancing fervently. Values above 1000 were capped at 1000, to keep a consistent scale from 0 to 1000.

The mobile application

The mobile web application was developed for the current work. Feedback on performance, which reflected the aggregated movement from each group, was visualized as bars in real time on a large screen (approximately 4m x 3m meters) during the concert. The participants' individual movement was also given as visual feedback but on the screens of their phones instead. The more a participant moved, the quicker the color on the screen started to flash. See figure 1 and 2 for screenshots of the mobile application, and figure 3, 4 and 5 for screenshots of the visual feedback that was projected on the large screen.

Context

The concert, which was one hour long, was built around a competition where the three groups competed against each other. The aim of the competition was to win as many battles as possible with no other incentives. In total there were five battles, with each battle lasting one minute. The battles were initiated randomly, but the participants did get information one minute and 30 seconds before a dance battle would start. The aggregated data on the large screen and the individual feedback data were given only during these battles. Thus, although participants' smartphones were collecting data during the whole concert, these functions were enabled only during the five battles. Once a battle was on, the mobile application switched to the color of the team the participant was assigned (yellow, green or pink). The colors made it possible for people to recognize others in their family, so they could feel connected, even though being strangers to each other.

Data analyses

All analyses were performed using SPSS 20 (SPSS, Inc., Chicago, IL). Independent samples *t*-test was used to calculate the difference between the normal phases (A) and the battle phases (B). This was done for both the movement data, and for the number of cases. Between-group effect sizes (Cohen's *d*) were calculated by dividing the differences in means by the pooled standard deviations⁶.

Results

The raw data on the movement score (.xls) for each individual, sorted by time can be found in the additional file (Raw data 1). Figure 6 and 7 visualizes this data. The mean score for all participants' movement score (.xls) allocated on each minute can be found in the additional file (Raw data 2). Figure 8 visualizes this data.

In total, the 208 participants generated 20 279 data points ($M = 97.50$, $SD = 86.58$). Figure 6 and 7 show the frequency rate of data points during the concert.

Movement data

An independent T-test revealed a significant difference between the normal phases (A) and the dance battle phases (B): $t(59) = -9.21$, $p < .01$. Between group effect sizes were large ($d = 3.20$; CI [-19.65, 26.06]) in favor for the B phases.

Discussion

The aim for this work was to test a mobile application in the context of a dance floor together with mechanisms seen in other health applications to explore if this combination could drive physical activity. To our knowledge, no study has been published on this topic before. The results indicated a significance difference between the normal phases (A) and the dance battle phases (B).

Limitations

There are a number of limitations that need to be mentioned. First, the study is limited by a lack of a control group, which makes it difficult to draw the conclusion that the intervention itself was the factor that caused the difference in movement data between the phases; it is for example difficult to exclude the variation in music as a confounding variable. Second, there was a big dropout of participants during the whole event, as well as during the specific concert. Furthermore, it is difficult to evaluate if the findings are attributable to the mobile web application itself, to the visualization and the concept of a competition, or to the whole intervention. However, the current work was an exploratory study with the aim to examine a health tool in a different context and generate hypotheses, rather than to be a traditional RCT study to determine the effects of the intervention.

Conclusions

A review of research on the relationship between music and exercise gives an unambiguous picture - it is not evident that performance is enhanced by the addition of music to a physical activity⁷. However, subjects regularly report that they feel their performance is better with the music accompaniment. Therefore, music may directly improve a person's enjoyment and fulfillment of the physical activity, leading to greater exercise compliance⁷. Following this, the context of a dance floor might be a suitable platform for promoting physical activity.

Finding new ways to develop interventions to promote physical health is important, as it is unlikely that current methods will be able to fit all people. As mobile devices are becoming more persuasive behavior change tools, allowing for the facilitation of ongoing collection of data and the opportune timing of feedback to elicit a change in behavior⁸, mobile phones could be included to develop more innovative interventions within this field. The use of the dance floor and a mobile application to drive physical activity is a new and innovative way to promote physical activity that have potential to work for a broad range of people, as dance music is getting bigger and bigger. The result from this work points out that the concept should be further investigated in more studies.

Competing interests

KHL is member of the music group Yamarill.

Author's contributions

KHL was the project manager and has, together with DD developed the concept and the mobile web application. KHL made the conception of the study and its design, as well as conducted the analysis and interpretation of data. GA participated in the conception of the study and its design. GA also participated in the analysis and interpretation of data. KHL, DD and GA drafted the current manuscript. All authors read and approved the final manuscript.

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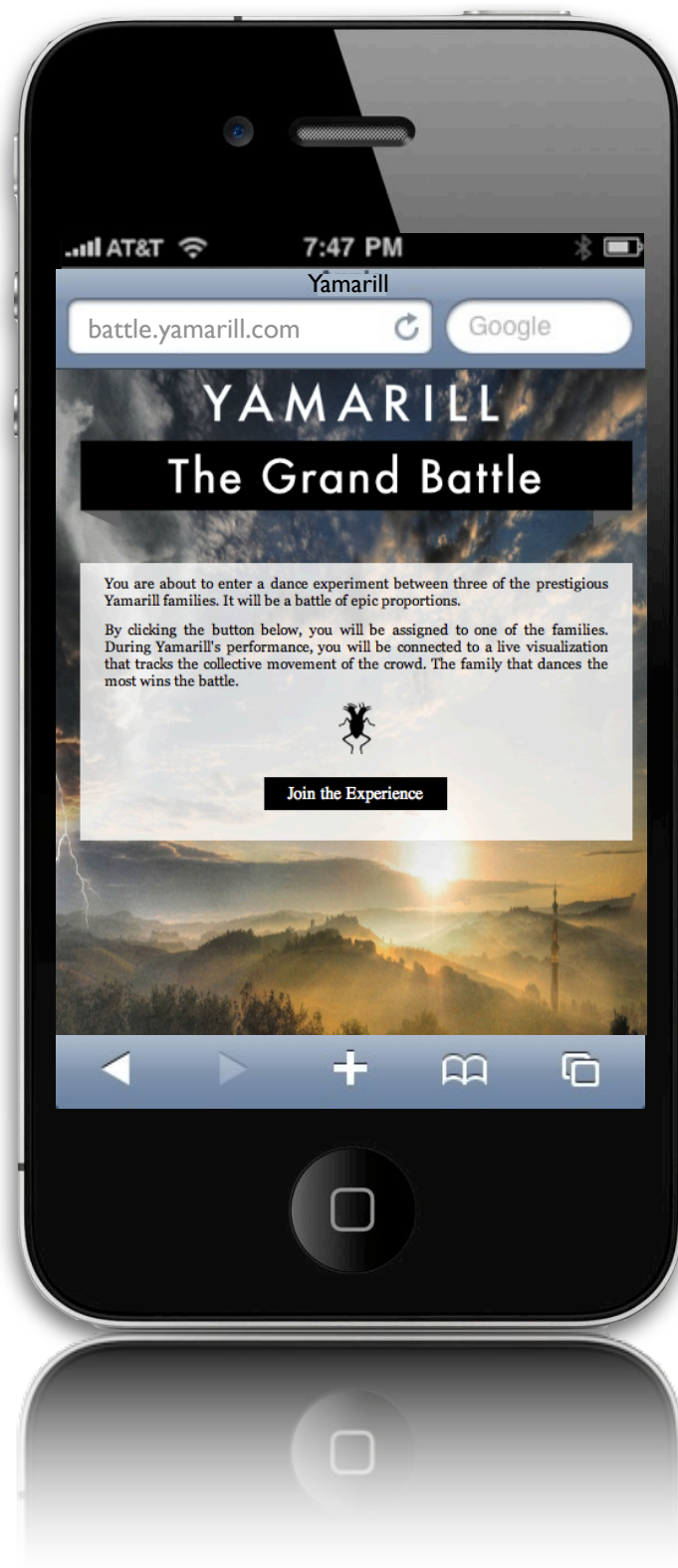


Figure 1. Screenshot of the mobile application

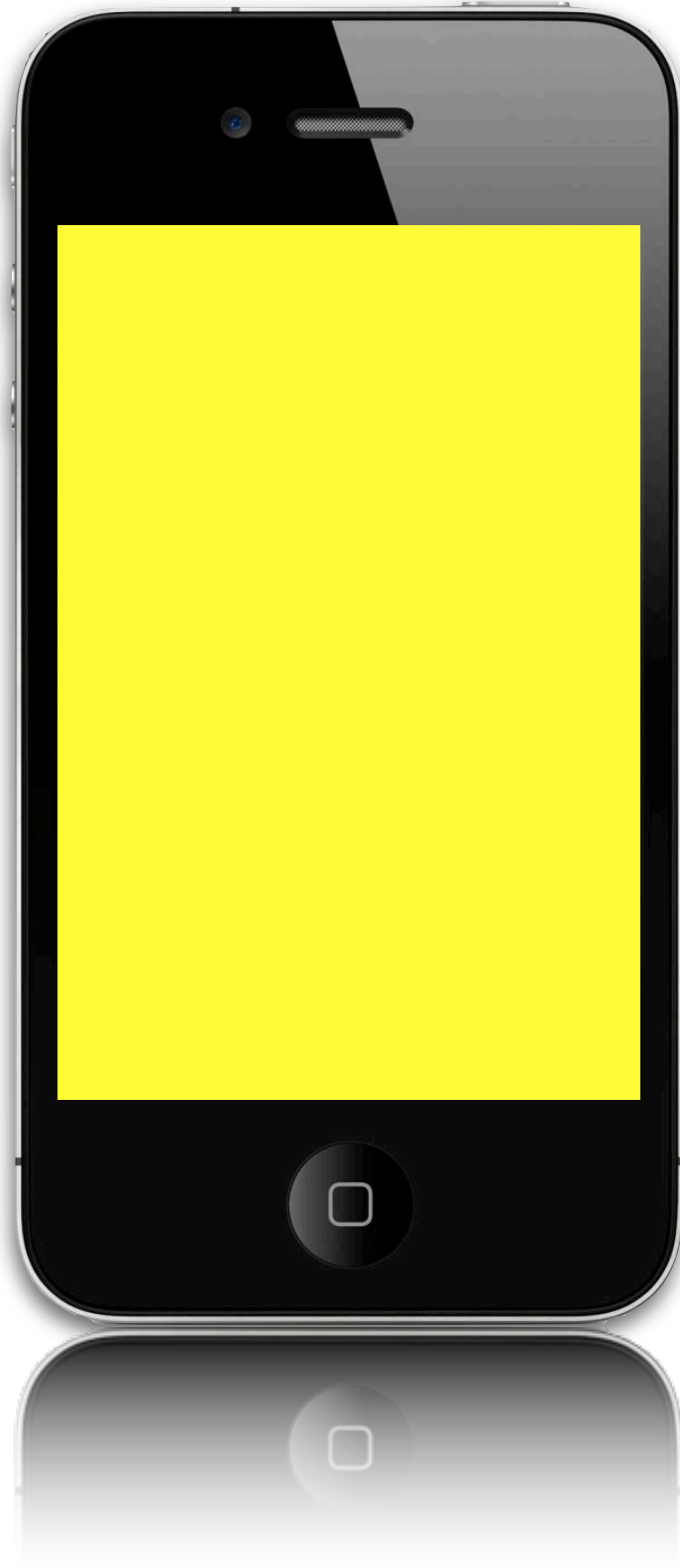


Figure 2. Screenshot of the mobile application

The Grand Battle

The next battle starts soon

00:19

battle.yamarill.com

Open the link on your phone to join

THE NATION OF
YAMARILL

ROUND WINNER

5

4

3

2

1

VOYNICH

TIESTA

CABRERA

CABRERA

VOYNICH

The screenshot shows a promotional interface for 'The Grand Battle' on 'THE NATION OF YAMARILL'. It features a central white box with a countdown timer at 00:19 and the website 'battle.yamarill.com'. Below this are three team logos: a yellow shield for 'VOYNICH', a green shield for 'TIESTA', and a pink shield for 'CABRERA'. On the right, a vertical ladder indicates the current round (1) and winner (CABRERA), with a silver insect icon at the top of the ladder. The background is a scenic landscape with a sunset and a lightning bolt.

Figure 3. Screenshot of the visual feedback

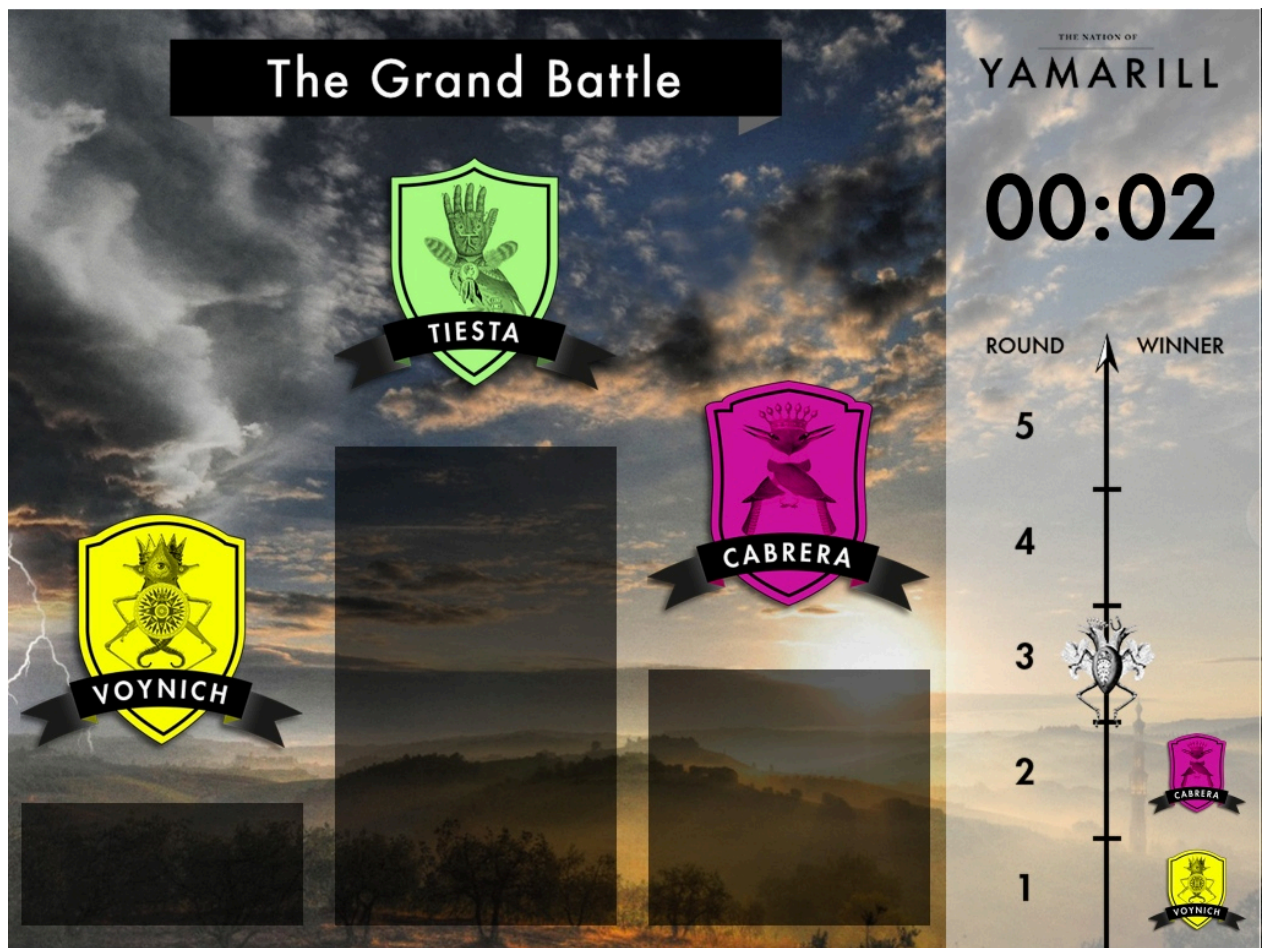


Figure 4. Screenshot of the visual feedback



Figure 5. Screenshot of the visual feedback

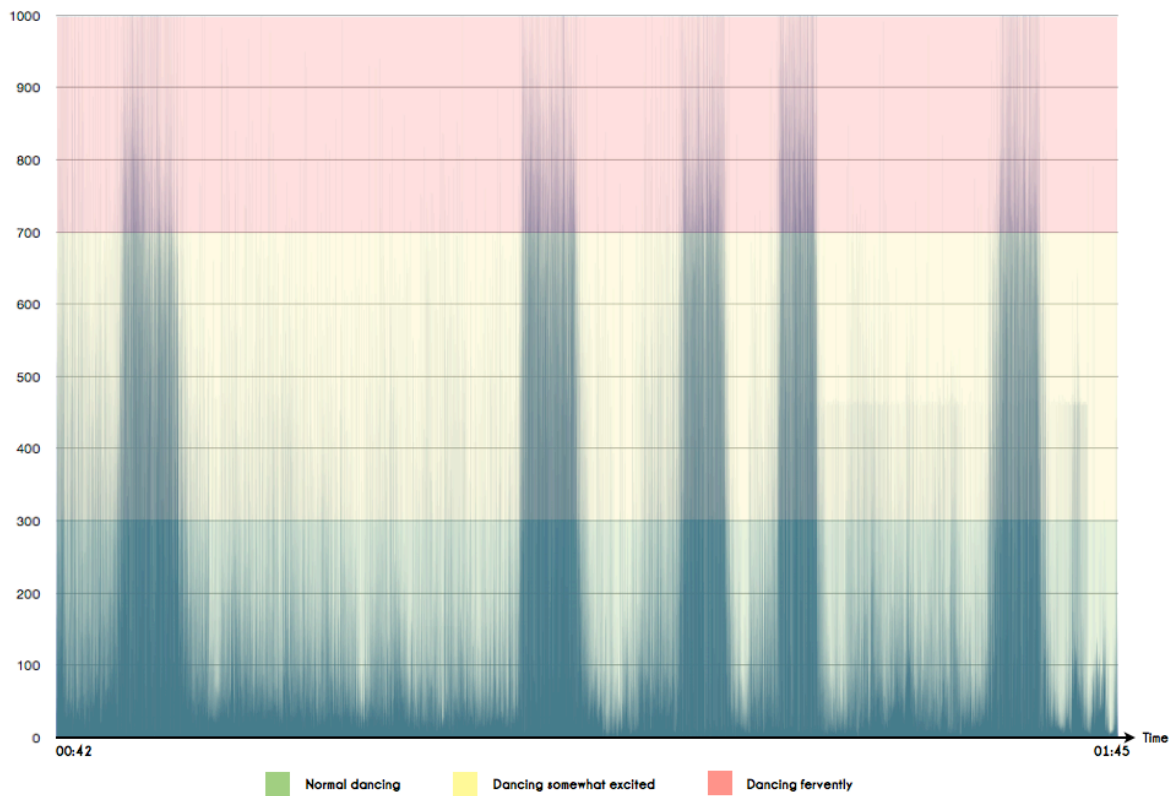


Figure 6. Data on the movement score for each individual, sorted by time

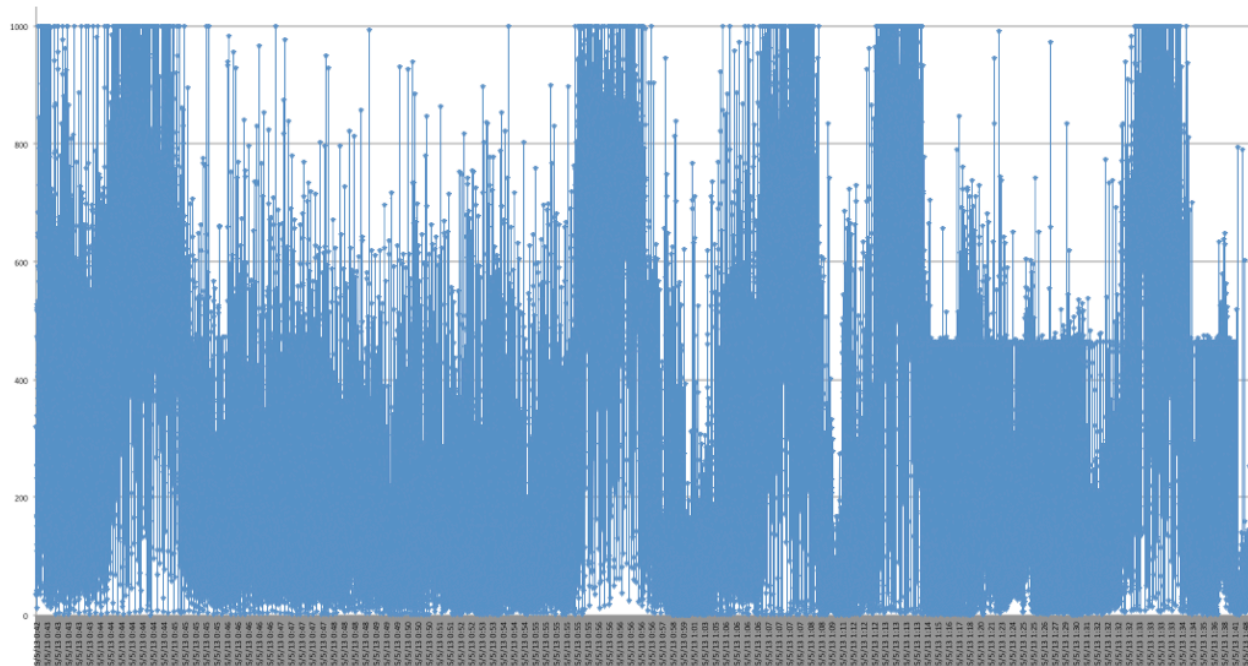


Figure 7. Data on the movement score for each individual, sorted by time

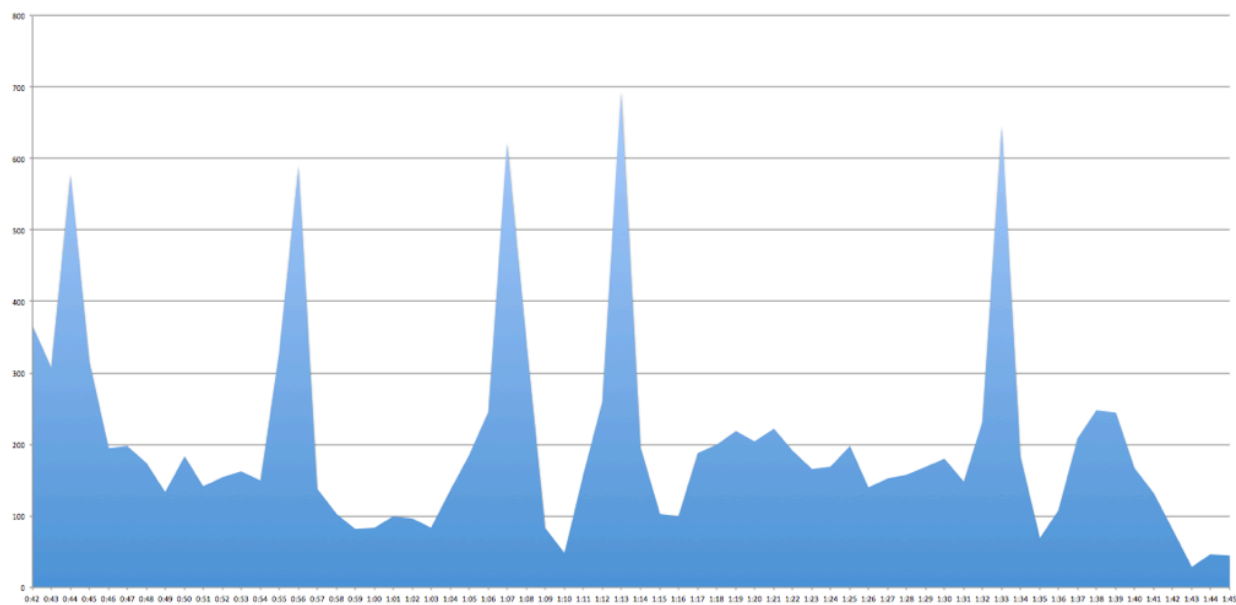


Figure 8. The mean score for all participants' movement score allocated on each minute