

**This is an electronic reprint of the original article.
This reprint *may differ* from the original in pagination and typographic detail.**

Author(s): Kettunen, Eeva; Kari, Tuomas; Hassandra, Mary; Critchley, Will; Doğan, Umut

Title: Activity Trackers Influencing Motivation and Awareness: Study Among Fitness Centre Members

Year: 2017

Version:

Please cite the original version:

Kettunen, E., Kari, T., Hassandra, M., Critchley, W., & Doğan, U. (2017). Activity Trackers Influencing Motivation and Awareness: Study Among Fitness Centre Members. In A. Pucihar, M. K. Borštnar, C. Kittl, P. Ravesteijn, R. Clarke, & R. Bons (Eds.), *Bled 2017 : Proceedings of the 30th Bled eConference. Digital Transformation : From Connecting Things to Transforming Our Lives* (pp. 295-311). University of Maribor Press. <https://doi.org/10.18690/978-961-286-043-1.21>

All material supplied via JYX is protected by copyright and other intellectual property rights, and duplication or sale of all or part of any of the repository collections is not permitted, except that material may be duplicated by you for your research use or educational purposes in electronic or print form. You must obtain permission for any other use. Electronic or print copies may not be offered, whether for sale or otherwise to anyone who is not an authorised user.



30TH Bled eConference

Digital Transformation – From Connecting Things to Transforming Our Lives

(June 18 – 21, 2017, Bled, Slovenia)

(Conference Proceedings)

Editors:

dr. Andreja Pucihar
dr. Mirjana Kljajić Borštnar
dr. Christian Kittl
dr. Pascal Ravesteijn
dr. Roger Clarke
dr. Roger Bons



University of Maribor Press

Activity Trackers Influencing Motivation and Awareness: Study Among Fitness Centre Members

EEVA KETTUNEN, TUOMAS KARI, MARIA CHASANDRA,
WILL CRITCHLEY & UMUT DOĞAN

Abstract Consumer fitness technology products are becoming increasingly popular. This leads to interesting questions about the influence of activity trackers on a person's motivation to exercise. This study explored the role of activity trackers in motivating fitness centre members towards exercising and in increasing their awareness regarding their own health and physical activity. The study included 100 fitness centre members divided into a test group and a control group and three sub-groups: OLD, NEW, and personal trainer (PT) members. The focus was on gym visit frequency during a 10-week test period and on tracking the consistency of activity levels. Participants also completed a pre and post study questionnaire assessing changes in their health and physical activity awareness. The results suggest that an activity tracker does not significantly influence fitness centre members' gym attendance or overall physical activity levels. Group comparisons reveal no statistically significant differences between groups, but observations of the descriptive statistics indicated that an activity tracker can bring some inspiration and other benefits, especially for PT clients and people who are just starting their new more physically active lifestyle. Using an activity tracker increased participants' perceived awareness of their own wellbeing, daily sitting time, and amount of sleep.

Keywords: • Activity Tracker • Motivation • Goal Setting • Fitness Centre
• Health Awareness • Physical Activity •

CORRESPONDENCE ADDRESS: Eeva Kettunen, University of Jyväskylä, Seminaarinkatu 15, 40014 Jyväskylän yliopisto, Finland, e-mail: eeva.k.kettunen@jyu.fi. Tuomas Kari, University of Jyväskylä, Seminaarinkatu 15, 40014 Jyväskylän yliopisto, Finland, e-mail: tuomas.t.kari@jyu.fi. Maria Chasandra, University of Jyväskylä, Seminaarinkatu 15, 40014 Jyväskylän yliopisto, Finland, e-mail: maria.m.chasandra@jyu.fi. Will Critchley, University of Jyväskylä, Seminaarinkatu 15, 40014 Jyväskylän yliopisto, Finland, e-mail: wcritchley@gmail.com. Umut Doğan, University of Jyväskylä, Seminaarinkatu 15, 40014 Jyväskylän yliopisto, Finland, e-mail: doganumut89@gmail.com.

1 Introduction

The health benefits of physical activity are widely known, yet still the participation rates in regular physical activity are below recommendations (Middelweerd et al., 2014). Commercially available physical activity monitors are becoming increasingly popular for personal use and the entire field of wellness technologies is expected to grow significantly (Grand View Research, 2016). There has also been a substantial interest in scientific research to objectively study individual and group level physical activity and in the role of wellness technology to increase adherence to physical activity guidelines or to be physically more active (see e.g. Marcus, Ciccolo & Sciamanna, 2008). Wearable activity monitors have the potential to help people reach their fitness and health goals by constantly monitoring and giving feedback on activities and bodily responses. Wearable devices may have various applications in other areas, such as in medical safety settings, or leisure and entertainment.

Activity trackers and other wearable devices have been found to bring a variety of benefits for their users. For example, Hagströmer, Oja and Sjöström (2007) found that objectively obtained estimates of physical activity yielded different activity patterns and lower values compared to those that were obtained by self-reports. This shows that wearable devices often provide more accurate data compared to self-perception and, therefore, serve as more reliable information source when planning and executing health behaviour change programs. Kari et al. (2016a) found that using a mobile exercise application can enhance the awareness of personal physical activity and motivate towards being more physically active. Moreover, activity trackers could have even more potential in increasing the amount of physical activity, as suggested by Kari et al. (2016b). Yet, it seems that the perceived increase in wellbeing would require a long enough use period for the user to notably perceive any changes (Kari et al., 2016b). A mere tracking of wellness related data may result in increased awareness of daily activity, but may not be sufficient to maintain the use of wellness technologies (Miyamoto et al., 2016). The use of wellness related technology is also more effective the more frequently it is used (Wang et al., 2016). The intention to use such devices is mostly based on utilitarian reasons but also hedonic perceptions play a role (Makkonen et al., 2012a; Makkonen et al., 2012b). O'Brien et al. (2015) evaluated the utility and feasibility of activity trackers among older adults, and found that most users experienced positive outcomes. They also suggested that activity trackers could be useful in improving older adults' health by monitoring and promoting physical activity (O'Brien et al., 2015).

As the popularity of activity trackers is growing tremendously, there is an increasing need to conduct more research on their use. These kinds of investigations enable a deeper understanding of the influences activity trackers have on people's behaviour. Much of the prior research has concentrated on the feasibility of individual solutions rather than the human aspects, such as psychological and social variables. For companies producing wearable devices or using the devices with their clients, sustained consumer engagement has been named as one of the key challenges. To achieve sustained consumer

engagement, the companies must understand behavioural science and study motivation, habit formation, and progress toward goals (Endeavour Partners, 2014).

The aim of the study was to investigate how using an activity tracker can influence participants' physical activity behaviour and motivation. It was not the aim of the study to encourage participants to increase or change their exercise behaviour in some way, rather, it was to investigate how the activity tracker influences their exercise behaviour. The main research questions of the study are:

1. Do activity trackers influence fitness centre members' gym attendance and overall physical activity level?
2. Do activity trackers influence the fitness centre members' awareness of their physical activity and health related issues?
3. Do activity trackers have a different influence on members with different lengths of membership history or personal trainer members?

The activity tracker used in this study was the Polar Loop by Polar Electro Finland (see Polar, 2016). The group using an activity tracker is referred to as the Loop group. The study includes 100 fitness centre members divided into a test group (Loop group) and a control group. Both groups were also divided into three sub-groups: OLD, NEW, and personal trainer (PT) members.

Considering the claimed benefits and the rising popularity of wearable activity trackers, the results of this study can benefit several stakeholders. The new knowledge it provides can have theoretical implications for scholars as it increases our understanding on the usage of these devices. The study can also provide practical implications for exercisers, manufacturers, fitness centres, and those working with physical activity promotion.

2 Theoretical Framework

2.1 Motivation and Physical Activity

Motivation can be divided into intrinsic and extrinsic motivation (Ryan & Deci, 2000). Self-determination theory is a major component in the discussion of intrinsic and extrinsic motivation and physical activity. Self-determination consists of three psychological needs: autonomy, competence and relatedness. Autonomy refers to the need to be self-initiating in the regulation of personal behaviour, competence represents a person's need to interact effectively within their environment, and relatedness reflects the person's need to feel connected to other people. The feeling of these needs can separate or together facilitate intrinsic motivation (Carron, Hausenblas, & Estabrooks, 2003).

The most common motives for getting involved with physical activity and exercise are extrinsic factors, such as improved health, improved fitness, or weight loss. However,

although extrinsic motives act as catalysts, the focus can often change between initial adaptation and subsequent adherence. This change also applies to the change in the level of self-determination: from non-self-determination to limited, to moderate and finally to full self-determination (Carron, Hausenblas, & Estabrooks, 2003).

This study included participants who had different membership periods. “OLD” members were defined of having been going to the gym for more than 9 months, and “NEW” members had been going to the gym for less than 2 weeks. Therefore, it can be assumed that OLD and NEW participant groups might have different levels of self-determination and differences in their types of motivation.

Goal setting techniques have been used extensively to enhance motivation and adherence and to improve performance. Studies conducted in exercise settings showed that 99% of participants set multiple personally motivating goals for their exercise participation. These goals were perceived as influencing actual exercise behaviour and helped people acknowledge what exercise behaviour is needed in order to meet their goals. Goal setting also helps people maintain their exercise program and keep up motivation to maintain their level of activity. Goal setting can therefore be seen as a way to maximize effectiveness in reaching exercise and physical activity objectives. The most effective goals in exercise settings tend to be flexible goals that people have set for themselves. (Berger, Pargman, & Weinberg, 2007).

According to Abraham and Michie (2008) there are various behaviour change techniques, all of which have different positive aspects. The key is to find the right technique to apply in the correct setting and with the target group. Techniques promoting specific goal setting, self-monitoring of behaviour, review of goals, and performance feedback are considered to be effective (Abraham & Michie, 2008). Health behaviour change interventions tend to be more effective if they are firmly connected with a health behaviour change theory (Middelweerd et al., 2014).

Participants were not asked to set any specific goals for themselves. However, Polar Loop users were asked to set their activity tracker to a setting (activity level on 1–3 scale) that best fit their everyday life. This affected the daily activity goal provided by the tracker. Even though Loop group members were not asked to try to meet the daily activity goals, the activity tracker can still be seen as a goal setter by giving people a target for how physically active they should be according to their set activity level.

2.2 Transtheoretical Model of Health Behaviour Change

Most health related behaviour change programs have concentrated on negative behaviours, such as alcohol consumption, smoking, or obesity, rather than focusing on increasing positive behaviour such as physical activity and exercise. It is extremely hard to change long-term habits. Behaviour change is a process that occurs over a long time period. The transtheoretical model divides this process into different stages that occur in

a cyclic model. The stages are precontemplation, contemplation, preparation, action, and maintenance. (Prochaska & Velicer, 1997).

The transtheoretical model has been applied to many health behaviour programs (Spencer et al., 2006). In this study, the transtheoretical model was used as a theoretical background for designing the questionnaire. Participants self-evaluated their current stage in becoming more physically active before and after the 10-week test period. However, it is important to remember that 10-weeks is a short time to make any real changes between the stages and therefore the results concerning behavioural change should be interpreted with caution.

According to Bandura's (1997) social cognitive theory there are different reasons why people might need outside help (proxy agent) in order to better reach their set goal. Firstly, people might have lost their means to reach their desired outcome. Secondly, they might think that a third person is more capable of facilitating the achievement toward the desired outcome. Finally, people may want to give control over to somebody else because they want to shift the responsibility of the direct control (Bandura, 1997). In an exercise and physical activity setting the use of proxy agent, often a personal trainer, helps a person to manage environment and task demands as well as gives extra help in regulating and controlling exercise behaviour, developing new skills and helping in lifestyle management (Beauchamp & Eys, 2007). Having a proxy agent also provides a person social support which increases positive outcomes. This can lead to greater likelihood of experiencing full involvement, focus, and enjoyment (Jowett & Lavallee, 2007).

3 Methodology

3.1 Study Design and Data Collection

The study follows a quantitative experimental design. The study was carried out among members of a fitness centre located in Finland. The study consisted of two main groups: the test group (Loop group) and the control group. The Loop group members were given Polar Loop activity trackers and H7 heart rate sensors in the beginning of the test period, whereas the control group did not receive these devices. After the study, the Loop group got to keep their devices, and the control group were also given Loops as a reward for participating. The two main groups were further divided into three sub-groups: OLD members (members for at least 9 months), NEW members (members for under 2 weeks) and personal trainer (PT) members (having at least six PT sessions during the study). Participants were recruited via the fitness centre's e-mail newsletter. All club members were allowed to apply for the study and the first 100 suitable candidates were selected and randomly split into the Loop Group or control group. Both groups had the same number of male and female participants. From the 50 participants in the Loop group, 25 were OLD, 13 were NEW, and 12 were PT. Table 1 shows the number of participants in each group.

Table 1: Description of the participants

Group	Sub-group	N	Female	Male	Average age
Loop	OLD	25	14	11	42.52
	PT	12	10	2	41.67
	NEW	13	8	5	33.08
	Loop total	50	32	18	38.09
Control	OLD	25	14	11	38.04
	PT	12	10	2	40.42
	NEW	13	8	5	28.54
	Control total	50	32	18	36.32
Total		100	64	36	37.91

The Loop group was asked to create a Polar Flow account, which made the training observable for research purposes. Data was also collected from the fitness centre's visitor database, which recorded all the fitness centre visits participants did during the 10-week test period. In addition, a questionnaire concerning the members' perceptions regarding their own health and fitness and the possible changes the 10-week test period had on them was collected from the participants before and after the test period. The questions were identical both times. The questionnaire included questions regarding current physical activity, sleeping time, daily sitting time, and awareness regarding their own overall wellbeing. The participants could also give feedback regarding their experiences during the study period after the study ended. In the results section, the experiences concerning Loop are reported. The full questionnaire is available from the authors by request.

In total, three different data sets were used: 1) One obtained from Polar Flow service, which showed weekly activity goals based on the activity level set on the device, and how well these goals were achieved. 2) One obtained from the fitness centre's visitor database, which was used to compare the Loop group and the control group as well as their sub-groups to see whether there were differences in physical activity measured by gym visits. 3) One obtained by the pre- and post-study questionnaires, which was used to investigate the changes in the perceptions of the participants.

3.2 Data Analysis

The quantitative data from Polar Flow and the visitor database was analysed with IBM SPSS Statistics 21. The data from the questionnaires was transformed into numeric data and also entered to SPSS for further analysis. Means, age range and frequencies were computed in order to obtain the basic information of the test group. This was followed by

the test of normality, which was done by using the Kolmogorov-Smirnov test for the main groups and Shapiro-Wilk test for different sized sub-groups.

Next, the analyses concentrated on the first measurement, which related to gym visit activity. An independent sample T-test was done in order to test differences between the Loop group and control group. Here, the independent variable was the group and the dependant variable was the number of average weekly fitness centre visits within the 10-week period. The same test was also done to compare the sub-groups between the Loop and control group. When testing differences within the Loop group or control group the test method was oneway ANOVA. The same method, oneway ANOVA, was also used in measurements concentrated on Loop group weekly activity percentages and their development. Here the independent variable was the sub-group and the dependent variable was the weekly average activity percentage within the 10-week test period. The last phase of the SPSS analyses was done by using repeated measures MANOVA to test for differences before and after the 10-week period among groups.

4 Results

The tests of normality were conducted to investigate normality for the main variables; average gym visits and average activity percentages (only Loop group). The normality tests were done after dividing the data into different sub-groups. Results for the Kolmogorov-Smirnov test for normality indicated that average gym visits were normally distributed within OLD sub-group ($D = .110, p = .185$). Due to the smaller sample sizes (< 50) for other sub-groups, the results from the Shapiro-Wilk test were more appropriate. These tests indicated normal distribution in all sub-groups.

4.1 Gym Visits and Activity Percentages

Regarding the amount of gym visits, T-test was done in order to investigate differences between the Loop group and control group. No statistically significant difference was found, but it can be seen (Table 2) that the average visit amount for the 10-week test period was higher with the Loop group (16.5) compared to the control group (14.8).

Table 2: Gym visits – group comparison

Group	N	Gym visits Mean	Std. Deviation	Std. Error Mean
Loop	50	16.5	11.7	1.7
Control	50	14.8	10.2	1.4

A similar comparison was made between Loop group sub-groups and control group sub-groups. No statistically significant differences were found. OLD members in the control group had a higher average compared to the OLD in the Loop group. With the PT and

NEW members' gym visits, it was the opposite. Within both PT and NEW, the Loop group average gym visits were higher than in the control group (see Table 3).

Table 3: Gym visits – sub-group comparison

Sub-group OLD	N	Gym Visits Mean	Std. Deviation	Std. Error Mean
Loop	25	13.7	9.8	2.0
Control	25	14.2	11.3	2.3
Sub-group PT	N	Mean	Std. Deviation	Std. Error Mean
Loop	12	21.8	14.5	4.2
Control	12	17.4	9.2	2.7
Sub-group NEW	N	Mean	Std. Deviation	Std. Error Mean
Loop	13	17.1	11.5	3.2
Control	13	13.9	9.2	2.5

Figure 1 shows the development of the average gym visits compared by sub-groups. All groups experienced a slight decrease in weekly gym visits.

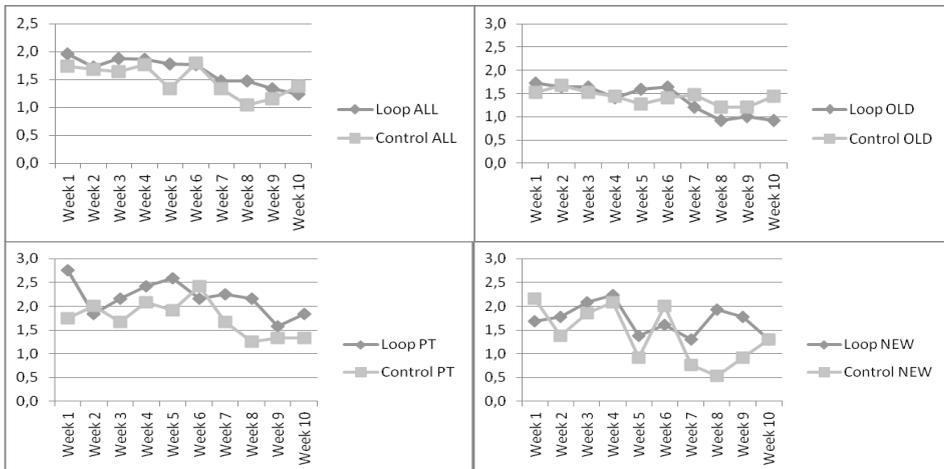


Figure 1: Loop group and control group gym visit development comparison

Regarding how well the Loop sub-groups achieved the weekly activity goals provided by the tracker, the Loop's weekly activity percentage measurements were used. The Loop activity tracker measures the accumulated activity as a percentage of the weekly goal. A

100% measurement means a user has achieved that goal. It is also possible to exceed the weekly goal and have a measurement higher than 100%. No statistically significant differences were found between Loop sub-groups in weekly activity percentages. Similar to gym visits, all Loop groups experienced a slight decrease in weekly activity percentages during the test period. However, the decrease was larger with gym visits (see Figure 2). When comparing different Loop sub-groups, the decrease in activity percentages was strongest within OLD, whereas within PT and NEW groups, the decrease was almost non-existent.

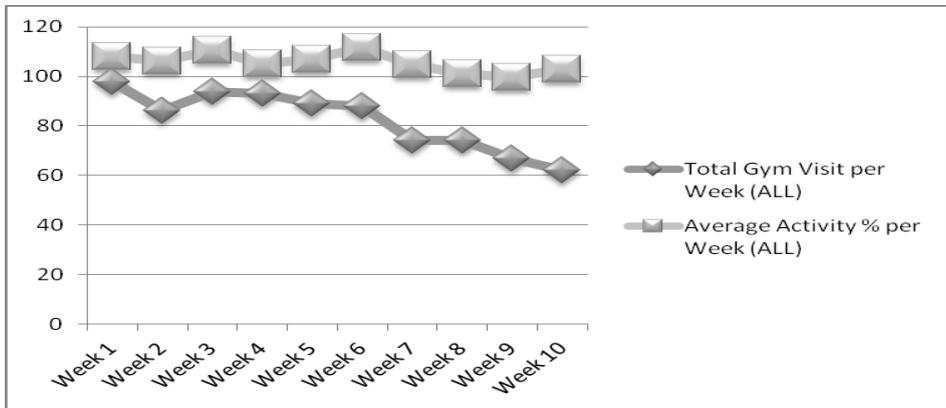


Figure 2: Loop group activity percentage and gym visit trends

Pearson correlation test revealed that gym visits and activity percentages were positively correlated (see Table 4).

Table 4: Correlation between gym visits and weekly activity percentages

		Weekly gym visits	Weekly activity %
Gym visits week	Pearson Correlation	1	.524
	Sig. (2-tailed)		.000
	N	50	50
Average weekly activity	Pearson Correlation	.524	1
	Sig. (2-tailed)	.000	
	N	50	50

4.2 Questionnaire Results

All participants received a questionnaire at the beginning and end of the test period. The questionnaire included seven different health, exercise, and gym satisfaction related

questions that participants answered based on their own subjective feelings. There were no statistically significant differences in the results of the questionnaires, but some trends were seen.

Participants were asked how active they perceived being before and after the 10-week test period. The overall trend was that participants felt they were more physically active after the test period. The only sub-group that perceived a decrease was the Loop group OLD (see Figure 3).

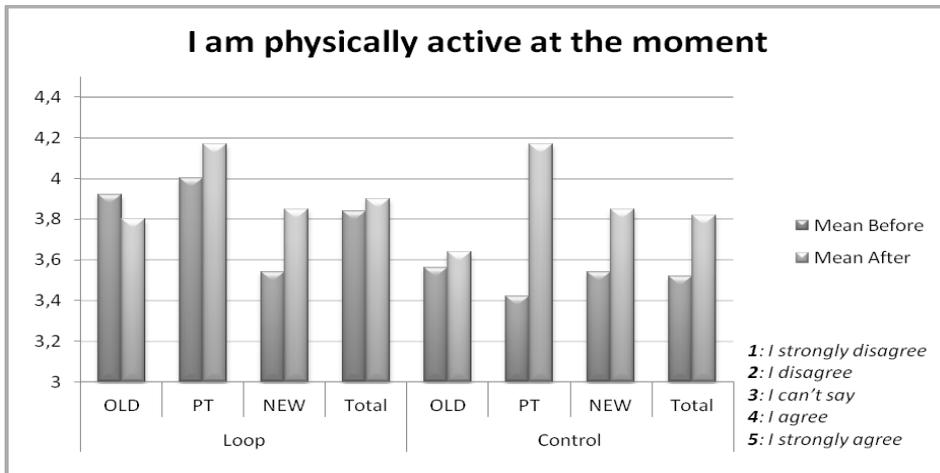


Figure 3: Perceived current physical activity level

After subjectively estimating their own physical activity level, the participants rated their own satisfaction related to their activity level. Satisfaction levels of all groups increased after the test period, with the exception of the Loop OLD group, which experienced a decrease in their level of satisfaction (see Figure 4).

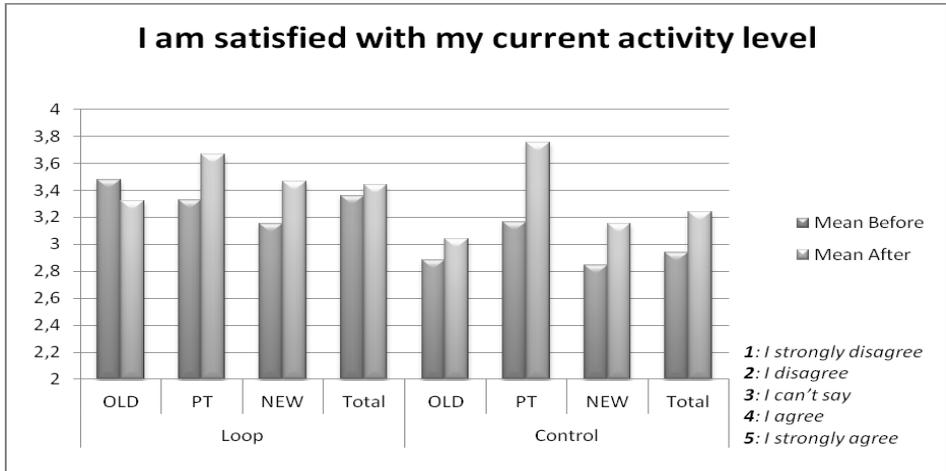


Figure 4: Physical activity level satisfaction

One question measured how satisfied the participants were with their sleeping time and whether they thought it was sufficient. Results showed that all Loop group sub-groups experienced an increase. The result was opposite in the control group. This indicates that Loop usage increased the Loop group participants' awareness of their own sleeping, and perhaps also persuaded them to sleep more (see Figure 5).

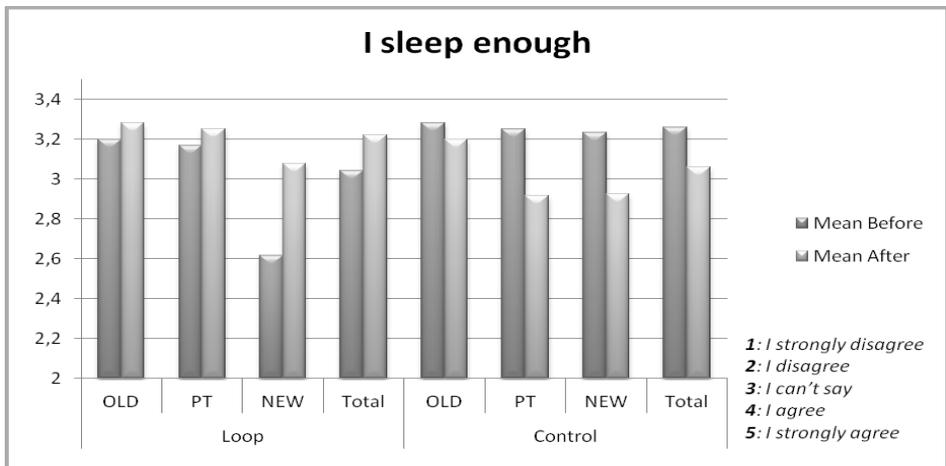


Figure 5: Perceived sleep amount

One question concerned the daily sitting time and whether participants thought they sit too much during the day. The Loop group experienced small increases in all sub-groups except the NEW group. In the control group participants were more certain after the test period that they do not sit too much during the day (see Figure 6).

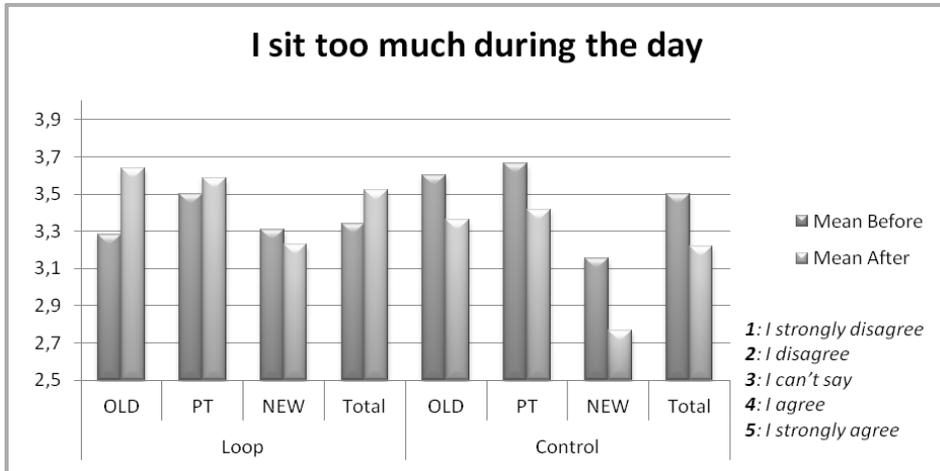


Figure 6: Perceived daily sitting time

One of the questions concerned participant's awareness of own state of wellbeing. The results show Loop group participants had an increase in their perceived awareness during the test period. The results of the control group show a small decrease in their perceived awareness (see Figure 7).

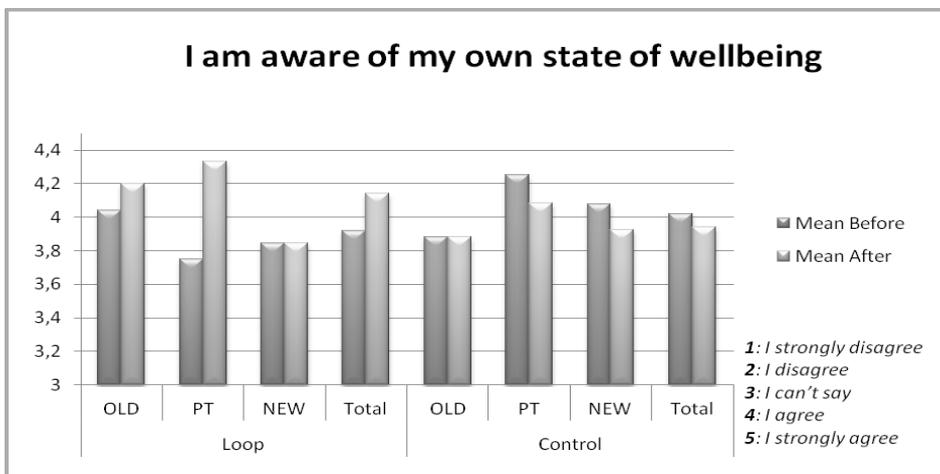


Figure 7: Perceived awareness of personal wellbeing

One question was based on the transtheoretical model measuring the participants' progress toward a more physically active lifestyle during the test period. The Loop group experienced a small positive increase, and after the test period they perceived to have a more physically active lifestyle than before (see Figure 8). The results were the same with the control group OLD sub-group, but otherwise the control group experienced a

marginal decrease. The biggest difference between matching sub-groups of Loop and control was in the NEW sub-group. The Loop NEW group perceived a greater increase than control NEW group, which suggests that the Loop can be a useful tool to encourage a more physically active lifestyle for those (new members), who perhaps are more novice with physical activity in general. It should be noted that ten weeks is a relatively short time period to make significant changes or even take a step between levels, so these findings should be considered with caution.

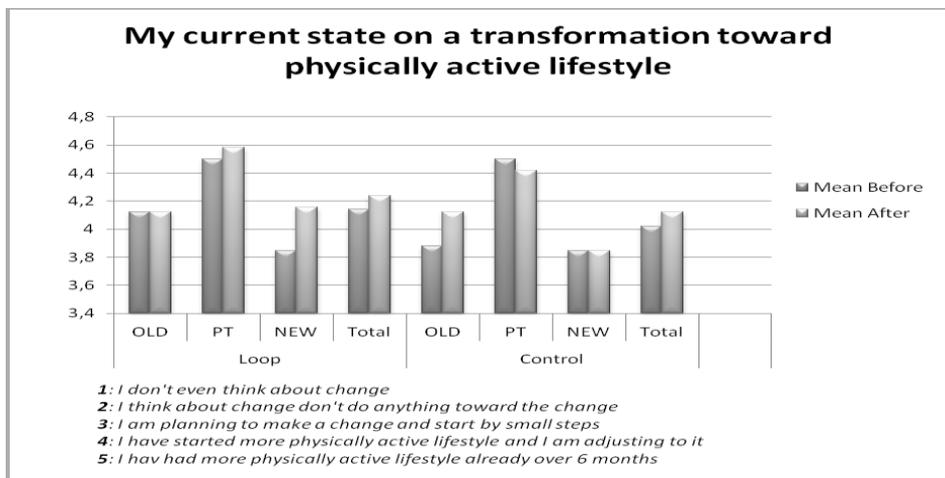


Figure 8: Perceived state of transformation

4.3 Feedback

Most of the feedback related to the Polar Loop was that participants had learned more about their own wellbeing no matter what their initial starting point was. Some participants mentioned that Loop had changed their awareness and perceptions of their sleeping time, sitting time, and overall physical activity. Some critical comments were related to Polar Loop functions and how the activity tracker was not suitable with the participants own existing devices. A few comments were also related to the pressure that the Loop and goal setting had created; whereas some people felt it was positive and motivating, others first experienced it negatively but eventually learned to cope with it. Only one participant quit using Loop in the beginning of the test period because they felt too much pressure to reach the set goal every day.

5 Conclusion

The purpose of this research was to study the role of an activity tracker (Polar Loop) in influencing fitness centre members' motivation and awareness regarding their own health and physical activity. The study followed a quantitative experimental design and included 100 fitness centre members divided into test and control groups.

Although the investigation revealed no statistically significant differences between different groups, some interesting findings can be reported. On average, participants with a Polar Loop visited the gym more often than those without, though the difference was not statistically significant. There was a small decrease in gym visits and activity trends during the 10-week test period in both main groups and in all sub groups. Thus, it can be assumed that an activity tracker alone might not be enough to sustain motivation to visit the gym or to be physically active, but can bring some benefits. Regarding the transformation towards a more physically active lifestyle the difference between Loop and control groups was not statistically significant. On a sub group level, the differences were also not statistically significant, but the results suggest that for new fitness centre members, an activity tracker could provide some tools for achieving intrinsic motivation, which is important when trying to maintain a more physically active lifestyle in the long-term. The results also suggest that there might be a reciprocal benefit where a personal trainer can use the extra information provided by the device to plan the training, while the user can utilize the personal trainer's knowledge to better understand the data. Overall, it can be concluded that an activity tracker may not significantly influence fitness centre members' gym attendance and overall physical activity levels but might make them more aware of their health and physical activity which is needed in building long lasting motivation.

Considering the high number of fitness centre members who volunteered for the study, it is probable that the Polar Loop worked as an extrinsic source of motivation. Previous studies have shown that exercise applications may increase exercise level and health outcomes leading to increased level of self-efficacy (Litman et al., 2015). Based on some of the participants' feedback, it was appreciated that Polar Loop offered a tool for personalized goal setting and also provided the participants with personalized information. Providing personalized feedback and increasing awareness about health related issues, the activity tracker may have increased the participants' level of perceived competence, which is one element in enhancing intrinsic motivation. Thus, in order to help turn the motivation more intrinsic, an activity tracker should provide personalized information and offer a tool for personalized goal setting.

Regarding the awareness of personal health and physical activity, on average, both main groups claimed to be more physically active at the end of the study period. This subjective feeling does not match the fitness centre data, which showed that participants in all groups went to the gym less often in the latter part of the study period. Loop group members also seemed to be less active at the end of 10-week period based on the Loop activity percentages. The satisfaction towards one's own physical activity level followed the development of perceived activity level. These findings support the ones by Adams et. al. (2005), that there can be some biases in self-reports of physical activity.

The finding that the Loop group were more concerned about their daily sitting time at the end of the test period, suggests that the information the Loop provided made them more aware and more concerned about their daily sitting time. Thus, activity trackers could be

used to educate users about their sitting or other inactivity habits. The results also suggest that an activity tracker might increase a person's perceived awareness of their own state of wellbeing. Whereas the Loop group perceived an increase in their awareness, the control group perceived a decrease. A similar result was found regarding the perceived sleep amount, as the Loop group reported being more satisfied with their amount of sleep, while the control group reported a decrease in satisfaction. Overall, it can be concluded that there are several influences an activity tracker has on one's awareness of personal physical activity and wellness related behaviour. However, given the contradiction between perceived and measured physical activity levels, the influence can be both positive and negative.

Electronic monitoring of daily physical activity can offer tremendous opportunities for people to independently improve their health and wellbeing. However, it is important for the stakeholders working in related fields to acknowledge that the key is not to just implement a device but to find out how the electronic devices are able to deliver useful information that is also motivating and easy to understand for diverse populations.

6 Limitations and Future Research

This study has some limitations. The first limitation concerns the sample size, which could have been higher. Even though the sample size is large enough for conducting the statistical analyses and can present the situation among the members of the particular fitness centre, it somewhat limits the generalizability to activity tracker users in general. The second limitation concerns the length of the study. A 10-week period is not necessarily long enough to facilitate changes in awareness or gym visit habits. Particularly, as according to the transtheoretical model of change, it might take several months to generate changes in habit formation.

One potentially interesting avenue of future research would be to do a similar study with a larger number of participants, which would provide better statistical representation of the target population. This study could also be done by having a longer study period which would give more reliable results and allow to the transtheoretical model assessment tools to track changes. A follow up questionnaire and measurements could also be done in order to see how the training motivation has developed after end of the study period. Similar study could also be conducted in different fitness centres. Future studies could also include gamification as a motivation driver as well, and examine it more deeply, as it seems that its relevance in this domain will continue increasing (Kari et al., 2016c).

Acknowledgement

We would also like to show our gratitude to Dr. Taru Lintunen from the university of Jyväskylä for sharing her advice and supporting us during the course of this research. We would also like to thank Polar Electro and SATSELIXIA for providing the possibility and resources for this research.

Special thanks to Polar representatives Dr. Raija Laukkanen and Janne Ukkonen for their support and co-operation.

References

- Abraham, C. & Michie, S. (2008). A taxonomy of behaviour change techniques used in interventions. *Health Psychology*, 27 (3), 379-387.
- Adams, S. A., Matthews, C. E., Ebbeling, C. B., Moore, C. G., Cunningham, J.E., Fulton, J. & Hebert, J. R. (2005). The effect of social desirability and social approval on self-reports on physical activity. *American Journal of Epidemiology*, 161 (4), 389-398.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: Freeman.
- Beauchamp, M. R. & Eys, M. A. (2007). *Group dynamics in exercise and sport psychology – Contemporary themes*. New York, NY: Routledge.
- Berger, B. G., Pargman, D. & Weinberg, R. S. (2007). *Foundations of exercise psychology*. Morgantown, WV: Sheridan Books.
- Carron, A. V., Hausenblas, H. A. & Estabrooks, P. A. (2003). *The Psychology of physical activity*. New York, NY: McGraw-Hill Companies.
- Endeavour partners (2014 January). The future of activity trackers (Part 3): The secret to long-term engagement. Retrieved 15.2.2017, from <http://endeavourpartners.net/the-future-of-activity-trackers-part-3-the-secret-to-long-term-engagement/>.
- Grand View Research, Inc. (2016 August). Connected health and wellness devices market worth \$612 billion by 2024. Retrieved 15.2.2017, from: www.grandviewresearch.com/press-release/global-connected-health-wellness-devices-market.
- Hagströmer, M., Oja, P. & Sjörström, M. (2007). Physical activity and inactivity in an adult population assessed by accelerometry. *Medicine & Science in Sport & Exercise*, 39 (9), 1502-1508. DOI:10.1249/mss.0b013e3180a76de5.
- Jowett, S. & Lavalley, D. (2007). *Social psychology in sport*. Champaign, IL: Human Kinetics.
- Kari, T., Piippo, J., Frank, L., Makkonen, M. & Moilanen, P. (2016a). To gamify or not to gamify?: Gamification in exercise applications and its role in impacting exercise motivation. In The 29th Bled eConference "Digital economy" Research Volume, 19.–22.6.2016 (pp. 393-405). Bled: University of Maribor.
- Kari, T., Koivunen, S., Frank, L., Makkonen, M. & Moilanen, P. (2016b). Perceived wellbeing effects during the implementation of a self-tracking technology. In The 29th Bled eConference "Digital economy" Research Volume, 19.–22.6.2016 (pp. 382-392). Bled: University of Maribor.
- Kari, T., Frank, L., Makkonen, M. & Moilanen, P. (2016c). How is gamification perceived in health and wellness technology companies: Views from four companies of different size. In The 10th Mediterranean Conference on Information Systems (MCIS) 2016, 4.–6.9.2016 (pp. 1-13). Paphos: University of Nicosia.
- Litman, L., Rosen, Z., Spierer, D., Weinberger-Litman, S., Holdschein, A. & Robinson, J. (2015). Mobile exercise apps and increased leisure time exercise activity: A moderate mediation analysis of the role of self-efficacy and barriers. *Journal of Medical Internet Research*, 17 (8), e195. doi:10.2196/jmir.4142.
- Makkonen, M., Frank, L., Kari, T., & Moilanen, P. (2012a). Explaining the usage intentions of exercise monitoring devices: The usage of heart rate monitors in Finland. In the 18th Americas Conference on Information Systems (AMCIS) 2012, 9.–11.8.2012 (Paper 13). Seattle: AIS.
- Makkonen, M., Frank, L., Kari, T., & Moilanen, P. (2012b). Examining the usage intentions of exercise monitoring devices: The usage of pedometers and route trackers in Finland. In The 25th Bled eConference "eDependability: Reliable and Trustworthy eStructures, eProcesses,

- eOperations and eServices for the Future” Research Volume, 17.–20.6.2012 (pp. 439–453). Bled: University of Maribor.
- Marcus, B. H., Ciccolo, J. T. & Sciamanna, C. N. (2008). Using electronic/computer interventions to promote physical activity. *British Journal of Sports Medicine*, 43 (2), 102-105. doi:10.1136/bjism.2008.053744.
- Middelweerd, A., Mollee, J. S., van der Wal, C. N., Brug, J. & te Velde, S. J. (2014). Apps to promote physical activity among adults: A review and content analysis. *International Journal of Behavioral Nutrition and Physical Activity*, 11 (1), 97. DOI:10.1186/s12966-014-0097-9.
- Miyamoto, S. W., Henderson, S., Young, H. M., Pande, A. & Han, J. J. (2016). Tracking health data is not enough: a qualitative exploration of the role of healthcare partnerships and mhealth technology to promote physical activity and to sustain behavior change. *JMIR mHealth and uHealth*, 4 (1), e5.
- O’Brien, T., Troutman-Jordan, M., Hathaway, D., Armstrong, S. & Moore, M. (2015). Acceptability of wristband activity trackers among community dwelling older adults. *Geriatric Nursing*, 36 (2), 21-25. DOI:10.1016/j.gerinurse.2015.02.019.
- Polar. (2016). Polar Loop Activity Band | Polar Global. Retrieved 15.02.2017, from <https://www.polar.com/en/products/lifestyle/loop>.
- Prochaska, J. O., Velicer, W. F. (1997). The transtheoretical model of health behavior change. *American Journal of Health Promotion*. 12 (1), 38-48. DOI:10.4278/0890-1171-12.1.38.
- Ryan, R. M. & Deci, E. L. (2000). Intrinsic and extrinsic motivations: classic definitions and new directions. *Contemporary Educational Psychology*, 25 (1), 54-67. doi:10.1006/ceps.1999.1020.
- Spencer, L., Adams, T. B., Malone, S., Roy, L. & Yost, E. (2006). Applying the transtheoretical model to exercise: A systematic and comprehensive review of the literature. *Health Promotion Practice*. 7 (4), 428-443. DOI:10.1177/15248399 05278900.
- Wang, Q., Egelanddal, B., Amdam, G. V., Almli, V. L. & Oostindjer, M. (2016). Diet and physical activity apps: perceived effectiveness by app users. *JMIR mHealth and uHealth*, 4 (2), e33.

