

Sustaining exercise behavior: An analysis through user-centered approach

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Physical health has received increased attention and exercise regularly is proved to provide many benefits to our physical and mental wellbeing. However, making exercise part of one's lifestyle is difficult for most people, and to sustain exercise behavior for a longer period of time requires sustained motivation. Researches in using persuasive technologies to promote exercise have addressed how modern technologies can be used to facilitate exercise activities to accomplish desired goals, but little have been done to observe from users' real life context nor to find out their true intention through user-centered approach. Designing to motivate people for sustainable behavior requires understanding of user behavior, and instead of only focuses on the behaviors happened during the moment of exercise, this study aimed to understand people's exercise processes include before, during and after exercise. The objective was to identify the key determinants of what motivate and impede people from sustaining their exercise behaviors. Contextual inquiry and in-depth interview were adopted to collect user data and understand user needs. This study provided preliminary user study that contribute to the designing of persuasive technologies and strategies tailored to people pursuing healthy lifestyle, but are reluctant to maintain and sustain their exercise behavior for a longer period of time. The findings in this study presented several key concepts and core notions within five themes: self-assessment, social support, multi-tasking, technology and artifact and emotion. Those themes addresses exercise behavior in aspects of user context, social and emotion that are crucial to take into consideration while designing for sustainable behavior.

Key words: *Persuasive technology, exercise behavior, user-centered design*

1. Introduction

Our relationship with modern technology has become tighter for the past decade. The role of technology in human's lives has transformed from dominating, facilitating, and influencing to the extent of changing the perception and cognition aspects of human. For example, technology can be designed to persuade people to reduce energy consumption through social facilitation [11], promote healthy eating by tracking and managing dietary intake [13], enhance user engagement through game setting [2], and increase purchasing and assist decision making in the field of marketing [8]. B.J Fogg called this kind of technology as "persuasive technology [6]" and proposed that technology can be designed with intent to motivate, trigger or fulfill human efficacy for the purpose of reinforcing, changing or shaping the desired behavior or attitude.

Exercise is important for health, but how to make exercise part of one's lifestyle is the difficult part for most people. In physical health, technologies can be used to facilitate people through helping them track calorie intake,

raise awareness in self-health or provide guidance for them to reach desired goals. According to ABI research, the numbers of people using fitness technology and gadgets for exercise are increasing [1]. People tend to use them to increase efficiency and effectiveness of exercise. Generally persuasive design can be categorized into two approaches based on the intentions of the persuader or the persuadee (user). Persuading people to sign up for paid membership is one kind of design strategy from the intention of the persuader. Designing from the intent of the users usually have to conform to personal desired goals in selecting appropriate goal, designing persuasive strategies, as well as setting up motivation and contextual trigger that both the users' original status (emotion, self-efficacy, intention) and context (environment, social group, social norm) are considered during design process.

This paper aims to focus on the later approach in persuading people with the desire to pursue a healthy lifestyle, through maintaining regular exercise and gradually incorporating exercise into their daily routine. There are few strategies used in behavior science to optimize behavior development, such as delayed reinforcement, intermittent reinforcement and desatiation behavior that were examined through many experiments and proved to be the effective solutions for sustaining certain behavior. Also, many of the researches in persuasive technology focused on designing and evaluating the persuasive tools or testing the effectiveness of the persuasive strategies. Of the above researches, user studies were often extracted from designer's perspective or through rough observation [12]. Little have been done to observe from users' real context nor to find out their original behavior and thoughts from a user-centered approach. The lack of preliminary user study would cause disconnection between the behavior desired to be changed and the real thoughts of the users, especially the emotional and social context that are important yet often neglected in persuasive design. In order to facilitate people to cross the threshold of sustainable behavior, there is a need to find out people's current exercise behaviors including the intention and motivation factors of each action, their belief and attitude towards exercise, the desired supported functions, and how technology foster behavior formation for those who have not yet adopt. Therefore, preliminary user study was conducted using contextual inquiry and in-depth interview to address the needs and requirements from users' perspective.

2. Method

The study adopted two kinds of investigations: contextual inquiry observation and interview. These two user-centered methodologies were used to gain a holistic understanding from participants' point of view. The first method aimed to understand the context of exercise including preliminary preparation, actual workout session and follow-up tasks, while also attempting to identify participants' intention and trigger in exercise process. The inquiries were carried out both in the gym when participants were performing a workout or if the location of the exercise was at home, participants were asked to perform the exact exercise steps during interview. Follow-up interviews were conducted to confirm observation validity and to elicit additional user needs and behavior causalities based on their current exercise status. Four participants (three males and one female; average age 29) were invited to participate in this study. Among the participants, two of them have athletic background in badminton and volleyball, and their intentions were to improve their sport performances, while the other two participants were trying to loss weight and stay healthy. The primary goal for them was to pursue a healthy lifestyle by having a regular exercise routine. All participants have already been active in doing workout in the gym, but were reluctant to maintain and sustain their exercise behavior for a longer period of time. Each

participant was individually observed in real-world settings by applying the principles of contextual inquiry [3] and follow-up by an interview for approximately 1.5 hour. Qualitative data were collected and interpreted through work models, then aggregated to create significant implication on designing for sustainable exercise behavior.

3. Result

The data from contextual observation and interview were consolidated into two work models: sequence and artifact models. Sequence model represented the step by step procedure of how participants accomplished their workout activity in the gym and identified what motivated and triggered their action as well as discovered major obstacles. The behaviors observed from four participants were as followed: Social interaction is essential during exercise, and exercise companion was a trigger for both starting and ending of such activity. Even though there was no direct interaction with friends while doing exercise, participants mentioned the sense of togetherness still provide social facilitation and acted as encouragement. In terms of motivation, participants wanted to know if they were making exercise progress, such as the amount of calorie consumed or the number of sub-goals accomplished, but participants also found it troublesome to remember all the achievements they made for later reference. Some emotional reaction were found among participants, such as listening to a favorite song or watch a favorite TV show during exercise helped them remain positive mood, and weighting in public caused embarrassment for most people. We also found the different belief between people with diverse background, participant with athletic background tended to evaluate based on coaches' recommendation and self-feeling, of which they think the information is reliable and effective. While those without athletic background tended to rely on evaluation from tracked physical information or online website and APP. The other work model we consolidated was the artifact model, which helped this study in understanding the kind of personal tools adopted and how the artifacts in the gym influenced participants' physical and emotional states. We categorized artifact into digital and physical artifacts: digital artifacts here include smartphone, TV, iPod and the physical artifacts include fitness equipment and personal objects such as membership card, water bottle, training sheet and so on. Most participants mentioned the lack of information synchronization between their personal artifacts and the artifacts in the gym, in terms of personal information like physical data, guidance and entertainment. The results described here would be extended into several themes discussed in the next section.

4. Findings

The results were summarized from consolidated work models and interview into five themes for understanding the workout behavior: self-assessment, social support, multi-tasking, artifact and technology, and emotion.

4.1 Self-assessment

Previous researches have identified self-assessment as a stepping point into self-evaluation and self-enhancement [10]. Self-assessment during exercise could help in keeping exercise progress, monitoring personal goal and discovering behavior pattern. The behaviors associate with assessment includes self-tracking, recording, reviewing and reminding. Through observation and interview, we discovered participants' belief, intention and some of the negative impacts towards self-assessment. The result showed that all participants believed self-assessment brought them sense of encouragement and motivation in continuing exercise behavior, especially when the outcomes are close to self-expectation, and this believe is even stronger among participants with athletic

background. When asked about the intention of doing self-assessment, and noticed two different perceived values among participants, both psychologically and physically. The intention of self-assessment associate with self-fulfillment provides psychological encouragement such as the feeling of increased self-image. Participants A said *“I feel good when every time after workout, I stood in front of the mirror and found out my body shape and contour are getting fitter and stronger”*. While the other intention of self-assessment is for the purpose of self-awareness and reminding, *“I know I eat too many calories yesterday, I need to exercise more to reduce it today”*. Even though self-assessment seemed positive, but it could have negative side effect as two participants in the interview mentioned the similar statement, *“I am glad to see that little progress I made, then I start slacking off and never reach my target goal”*. The lack of constant motivation can happen after achieving every little goal and also if the results are not as expected, people will get emotionally affected and their motivation could be influenced. Therefore, self-assessment plays an important role in keeping people motivated throughout the exercise process, so this raise the question in what kind of information do people want to know during exercise. Few main points were generated from participants for the information they seek to know during exercise, including calorie burnt, caloric balance between food intake and exercise, and progress forecast towards target goal. Despite of those information calculated and presented from the fitness equipment or personal devices, participants mentioned that information also came in the forms of other people’s comment or by whether or not they fit into their pair of jeans, of which are more direct and meaningful to them.

4.2 Social Support

Several researches have proved the supportive benefit of social interaction in physical activities [4]. It is evident that participants showed less motivation and often failed to exercise while workout alone. Participant B said, *“I tend to find excuses to quit workout at home such as I have more important things to do or I am tired!”* It was found that exercise buddies are the main trigger point for the workout activity to happen, and it is even more obvious among people with unclear goals and see workout as leisure activity. Participants described the importance of exercise buddies and how social support meant to them, *“If my exercise buddies are not going, I am not going as well because workout requires extra strength and I need that extra push from them”*, *“Chatting with friend after workout is the extra incentive that motivate me to exercise”*. Therefore, social support acts as trigger and motivation in different context, and it also appears in various form and content during workout process. We found that social interactions appeared explicitly before and after workout, for instance chatting or having meal together after workout. However, social interaction remained implicit during workout. Participant C said, *“I need to concentrate on my respiratory rate, and so did my exercise buddy. We usually won’t interrupt each other during exercise”* and participant A said, *“Each of us has different workout goals and routines, so there’s hardly any interaction when we begin to workout”*. During workout, social support transformed into an emotional form, participants mentioned “the sense of togetherness” and the presence of other exercisers in the gym kept them encouraged, *“I feel encouraged when someone click “like” on my check in status at the gym on foursquare (location-based social networking APP)”*. While designing for behavior sustaining in user-centered approach, social support should consider people’s current context and emotional state for better persuasion.

4.3 Multi-tasking

The multi-tasking behavior was criticized in researches as to decrease concentration and foster bad learning habit, but it might be beneficial to exercise in terms of motivation. Workout requires repetitive physical and emotional commitment and multi-tasking might distract attention and create ease in mind. It was found that during exercise all participants were either listening to music, watching TV, using their mobile phones or showed a great degree of temptation in doing something else. Some used smartphone to play games while also monitored calorie consumption on the fitness equipment; others watched TV show or read RSS feed on their smartphone. *“Watching TV makes me less bored”* and the other participant also mentioned, *“Watch my favorite basketball show while running keep my mind off how much time I have left”*. When asked about whether multi-tasking influences their emotion and performance. We found that when people exercise in conjunction with doing some of their favorite things like listening to a favorite song, watching a favorite TV show, their positive emotion tend to influence their physical activity in continuing doing exercise without giving up. Participants said psychologically they were more willing to keep on exercising and forgot about the exercise induced symptoms such as sore muscle or tiredness.

4.4 Artifact & Technology

The function and characteristics of artifacts may influence participants' emotional and usage experiences in sustaining exercise behavior. During observation we found participants spent quite some time setting up their personal data, exercise duration and desired goal on the fitness equipment. The same steps have to be repeated every time while switch to another equipment or change goals. Participants reported to be annoyed because of the repetitive action and the button clicking sound makes them feel embarrassed as well. Therefore, participants emphasized the importance of identity recognition with information such as personal physical data (weight, height, heart rate, etc.) and exercise history for fitness equipment to recognize user data and facilitate meaningful use. In terms of the information related to workout, participants mentioned some obstacles that were in-efficient to them, *“I cannot remember how much weight did I lift last time. Am I making progress?”*. *“Counting the number of repetitions during cardio workout is important, but also troublesome since you have to concentrate on your posture and breath at the same time”*. People want to know if they are making progress as well as if they are doing it in effective ways, so guidance would be helpful during exercise. Personal feedback or exercise technologies like body composition analyzer which facilitate participant to be more aware of their body condition, are considered to be useful for guidance and motivation, as all participants addressed their concern in doing exercises with “correct posture” regarding what area of the body to focus on in order to avoid exercise injury and promote efficiency.

People reflect on self record, movement or goals using different personal informatic tools for the purpose of self-assessment, and technology seems to be a useful tool for it. The degree of self-tracking in exercising seemed prominent and influential, and there are other terms with similar concept such as lifelogging, quantified self and living by numbers. A recent survey by Pew research center showed that 69% of U.S. adults track their weight, diet, exercise routine and other health related symptoms [14]. The number of people doing self-tracking is increasing and this also reflects in our study as participants also tracked their workout progress and personal goals. The information they track includes workout duration, the kind of fitness equipment used, weight lifted, calorie intake, calorie expenditure and number of repetition. Participants believed that tracking exercise data could help them improve and reach target goals in systematic and strategical ways.

Two participants adopted formal tracking tool like website and mobile applications, and the other two track data in their head. Interestingly, we have found out those tracked in their head were people with athletic background, and they tended not to assess using any personal informatics tool but based on evaluating from self-feeling or the recommendation from their coaches and online expert, while the other two participants tracked their data using mobile phone and follow information and goals recommended from mobile APP and websites. It is worth look into when designing for informatics tools for which they must adapt to the user's background and the kind of method they used to follow. However, even though people who track their physical information with technology are able to organize exercise record and be aware of the level of goal achieved, tracking itself requires persistent behavior and reliable record needs attention to every detail. The technology with real-time synchronization between the fitness equipment and the personal devices is required among participants. *"I have to memorize the number in my head, and then manually key in the data on my mobile application immediately in case I forget"*. We also noticed participants tend not to refer only to their physical information before and after exercise, but also during exercise, as they wanted to make sure whether they have followed and achieved their sub-goals like burn 500 calorie on cardio exercises. Some researches have pointed out the benefit of using technology for self monitoring in behavioral change [13], but identifying the best combination of tool and tracking method according to different context of use still need research attention.

4.5 Emotion

Emotion influences how we behave, and identify the factors that cause negative and positive emotion during exercise could help to understand what actually encouraged or impeded exercisers from sustaining a regular exercise routine. Participants mentioned positive emotion often occurred while listening to a favorite song during exercise, knowing that they have achieved their goal or socialize with friends after exercise. On the contrary, negative feeling occurred in situations like, *"I feel emotionally depressed and anxious after being inactive for a period of time, I tend to give up at this moment."* The decreases in self-efficacy demotivate participants both physically and emotionally and make it harder for people to start exercise again. Emotion could also be influenced from the context within. For example, participants experienced pressure when other people line up beside them waiting to take turns on fitness machine, and weighting on public scale in the gym make them embarrassed. In this situation, participants said they would finish up exercise quickly due to the discomfort of people looking at them and avoid weighting themselves in the gym.

5. Discussion & Future research

This paper is a preliminary study aimed to observe from the users' real world context of how people do their exercise and to find reasons behind what motivate or impede them from sustaining their behavior and therefore provide suggestion based on their needs. The collected data was analyzed in a way that could help to design user-centric strategies, or to optimize existing persuasive strategies and services tailored to user's behavior for sustainable effect. The findings presented several user requirements that address users' belief, intention, social and emotional aspects through subjects in self-assessment, social support, multi-tasking, artifact and technology and emotion. We found that self-assessment increases exercise related self-image and self-awareness. The psychological benefits gained from exercise should be equally valued with physical benefits. Self-image could be

strengthened through visual demonstration in each phase for personal recall and reflection during self-assessment process. Also, social support is vital in triggering and motivating users for sustainable behavior, but should be designed according to different phases since persuasion is most effective when “stage-matched” [5]. In addition, the study showed that people with or without athletic background have diverse beliefs and goal-reaching methods, so different design philosophies should be executed for more effective and personalized touch. This study also discovered a great amount of multi-tasking behaviors among exercisers in the gym while participants reported the benefits of multi-tasking as to fighting off boredom and keeping ease of mind. Technology is better than human persuader [6], technologies can be utilized in the way to bridge the gaps through information synchronization; cross-platform experience, social facilitation, just-in-time facilitation etc. Technology can have an added value to persuade people in changing into their desired goals. Therefore, improving how people use their digital and physical artifacts such as combining self-tracking record with social sharing, creating personalized identity recognition, having real-time posture correction and other supportive functions as to strengthen motivation and accomplish goal reaching in both emotional and physical levels, are some of the possibilities for technology to investigated upon. Positive emotion such as happiness, contentment and liking could increase the effectiveness in persuasive design [9]. To a certain extent, emotion is a determinant point for people to start or stop their exercise action, and it emerged not only from the influences of another people but also the self-esteem issues such as weighing in public which can be embarrassing for most people. The goal of this empirical study is to discuss the key points designers need to keep in mind when designing persuasive technology as well as the strategies to motivate exercisers in fostering a long-lasting exercise behavior. We also hope to contribute to the understanding of users’ exercise behavior from different perspectives that perhaps are neglected in other researches. The concepts raised in this study will have further development and research while more empirical studies will be conducted.

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