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The influence of success experience on self-efficacy when providing feedback through technology

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ABSTRACT

Background: as a high level of self-efficacy is associated with bigger behavioral changes as well as to higher levels of physical activity, the development and implementation of strategies that successfully improve self-efficacy are important to technological interventions. We performed an experiment to investigate whether self-efficacy regarding a specific task can be influenced by using feedback strategies that focus on success experience and are provided through technology. *Method:* subjects were asked to walk from A to B in exactly 14, 16 or 18 s, wearing scuba fins and a blindfold. The task guaranteed an equal level of task experience among all subjects at the start of the experiment and makes it difficult for subjects to estimate their performance accurately. This allowed us to manipulate feedback and success experience through technology-supported feedback. *Results:* subjects' self-efficacy regarding the task decreases when experiencing little success and that self-efficacy regarding the task increases when experiencing success. This effect did not transfer to level of self-efficacy regarding physical activity in general. Graphical inspection of the data shows a trend towards a positive effect of success experience on task performance. *Conclusion:* experiencing success is a promising strategy to use in technology-supported interventions that aim at changing behavior, like mobile physical activity applications.

1. Introduction

More and more people live a sedentary lifestyle, resulting in a decrease in health and posing a risk for various diseases (e.g. Bankoski et al., 2011; Warren et al., 2010). On the other hand, a physically active lifestyle has significant positive effects on prevention of chronic diseases, such as cardiovascular disease, diabetes and cancer (Warburton, Nicol, & Bredin, 2006). Also, a sufficient level of physical activity has positive effects on mental health condition through reduced perceived stress and lower levels of burnout, depression and anxiety (Jonsdottir, Rödjer, Hadzibajramovic, Börjesson, & Ahlborg, 2010). Numerous interventions have already been developed to improve the level of physical activity in the general population (e.g. Dishman & Buckworth, 1996; Marcus et al., 1998). They are usually delivered through public media, flyers, e-mails, or consist of face to face (group) consultations, and show moderate effect sizes (Dishman & Buckworth, 1996).

A recent development regarding physical activity interventions is using mobile, technology-supported applications to achieve the desired effect. Examples include UbiFit Garden (Consolvo et al., 2008), BeWell+ (Lin et al., 2012) and Move2Play (Bielik et al., 2012). A study by Op den Akker, Jones, and Hermens (2014) concluded that many interventions apply tailoring, i.e. personalization of information or feedback, which increases the effect of the intervention (Hawkins, Kreuter, Resnicow, Fishbein, & Dijkstra, 2008). The most common technique is to provide previously obtained information about the individual and some also include a tailored goal and tailored inter-human interaction. Although the effectiveness of tailoring based on constructs from behavioral science – or adaptation (Hawkins et al., 2008) – has been proven, Op den Akker et al. (2014) show that none of the interventions used adaptation as a tailoring strategy. Such lack of adaptation in technology-supported physical activity interventions was also noticed by Achterkamp et al. (submitted for publication), who developed specific feedback strategies for these types of intervention. Four of the six feedback strategies include a focus on increasing self-efficacy, making it an important aspect when designing mobile activity coaches (Achterkamp et al., submitted for publication).

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The concept op tailoring information or feedback enhances relevance for the individual and increases the impact of the message; guidelines for designing effective physical activity interventions strongly recommend tailoring feedback (Greaves et al., 2011). Traditional, non-technology-supported interventions that apply adaptation, e.g. by providing tailored information based on subjects' attitudes, stage of change, social support or processes of change, show significantly larger effect sizes than interventions that do not tailor on these constructs (Noar, Benac, & Harris, 2007). Additionally, self-efficacy seems of major importance (Hawkins et al., 2008); a construct that is common in models and theories that explain behavior and behavioral change. High self-efficacy not only increases intention to perform the target behavior, it also leads to actual performance of the target behavior (Gist & Mitchell, 1992). Additionally, Achterkamp et al. (submitted for publication) showed that the level of self-efficacy is related to (1) level of activity at baseline: the higher the subjects' level of self-efficacy, the higher their level of physical activity; and (2) the percentage of change as a result of a twelve week intervention: for subjects who are inactive at the start of the intervention, a higher level of self-efficacy is associated with a higher level of increase in physical activity. Bandura (1994) describes four sources of self-efficacy:

- Mastery experience: the subject successfully performs the target behavior.
- Vicarious experience: the subject observes a similar other perform the target behavior.
- Verbal (or social) persuasion: expressing faith in the subject's capabilities.
- Physiological/affective states: correcting misinterpretations of bodily states.

A systematic review with meta-analysis (Ashford, Edmunds, & French, 2010) shows that the most successful strategy to increase self-efficacy for physical activity is using enactive mastery experience, including feedback about previous performance/successes, followed by vicarious experience and feedback about similar others' performance.

So, traditional non-technology-supported interventions emphasize the importance of increasing self-efficacy to maximize the chance of positive results, but this knowledge is rarely applied in technology-supported interventions and it is not yet clear how this should be done. Therefore, the aim of the current study is to investigate whether experiencing success also leads to an increase in self-efficacy when using technology-supported feedback strategies. To our knowledge, no such experiment has been performed until now. Specifically, we aim to answer the following questions: what is the effect of a feedback strategy that focuses on success experience on (1) level of self-efficacy regarding a specific task, (2) level of self-efficacy regarding physical activity, and (3) task performance?

2. Method

2.1. Participants

The call for participation was distributed through e-mail, social media and the involved researchers personally. Subjects were included if they were Dutch-speaking and did not have walking disabilities. These criteria were necessary considering instructions were in Dutch and, as much as, possible rule out the influence of walking ability.

Fifteen subjects were included and participated in the study; nine women and six men. Age ranged from 22 to 36 years and averaged 27 years (SD = 4). All participants signed an informed consent. A local ethics committee reviewed and approved the study.

2.2. Procedure

The study used a repeated measures design. Subjects came to the lab of Roessingh Research and Development three times, with an interval of approximately seven days. During their first visit, subjects signed an informed consent, after which they completed a questionnaire assessing demographical variables and stage of change. Stage of change was assessed using the questionnaire by Prochaska and DiClemente (1983). A modified version of the Multidimensional self-efficacy for Exercise Scale was used to assess self-efficacy (Rodgers, Wilson, Hall, Fraser, & Murray, 2008). Next, subjects received information about the task they would have to perform. They were then asked to put on scuba fins and were allowed to practice walking in a straight line. Next, the subjects were asked to put on a blindfold and could again practice walking. Following this introduction, subjects completed a total of 15 trials of the task (see below). They were then asked to complete a self-efficacy questionnaire, after which the subject had to complete another six trials. The procedure during the second and third visit of the subject was equal to the first visit, except for signing the informed consent.

2.3. Task

Subjects were asked to walk from one side of the lab to the other (8 m), in exactly 14, 16, or 18 s (target time), wearing scuba fins and a blindfold. Subjects were told that the goal was to get as close to the target time as possible; the closer they were, the higher their reward would be. The reward was given after every trial, in the form of applause, ranging from 0 to 10 claps. Subjects started between a red light laser and reflector, which functioned as a starting gate on one side of the lab. A second laser and reflector combination functioned as a finishing gate and was placed at the other side of the lab. The distance from start to finish was approximately eight meters. The sensors were linked to the PC to measure the exact time subjects needed to reach the finishing gate. Subjects were reassured that the experimenter would correct their course if they deviated too much. Otherwise, the experimenter did not intervene during the task; the instructions for every trial and the feedback were provided automatically through speakers.

At the start of every trial, the subjects were asked the following automated question via the speakers: "To what extend do you think you can successfully accomplish this task on a scale of 0 to 100?" The experimenter entered the subject's answer in the PC. Next, the following automated message sounded: "After the countdown, walk to the other side of the lab in exactly X seconds". X corresponded to 14, 16 or 18 s. The PC randomly picked on of the three options, such that every target time was prompted five times. These times were chosen based on results of a pilot study that showed that they corresponded to fast, normal, and slow walking speeds respectively. Following the countdown, the subject walked from the starting gate to the finishing gate. Upon reaching the finishing gate, another automated message would sound: "stop, you have reached the destination." After this, the subject was given feedback about their performance; how close were they to the target time. The number of claps depended on the condition they were in.

In the positive feedback condition, subjects only received feedback as if they performed well, leading to the experience of success. Subjects always heard 6 to 9 claps, independent of their actual performance.