Motion as Motivation: Using Repetitive Flexion Movements to Stimulate the Approach System

Gerald J. Haeffel
University of Notre Dame

Research suggests that having a healthy approach system is critical for adaptive emotional functioning. The goal of the current study ($n = 186$ undergraduates) was to determine the efficacy of an easy-to-disseminate and cost-efficient strategy for stimulating this system. The experiment tested the effects of repeated flexion movements (rFM) on approach system activation as measured by both self-report (BAS scales) and behavior. The results showed that rFM increased approach system motivation in men but not women. Men who completed the rFM task reported significantly greater levels of fun-seeking motivation than men in the control task. Moreover, the rFM task led to changes in actual behavior. Men who completed the rFM task exhibited significantly greater persistence on a difficult laboratory task than men in the control task. In contrast, women who completed the rFM task reported significantly lower levels of fun seeking and tended to exhibit less persistence on a difficult laboratory task than women in the control task. These results provide support for embodied theories of emotion as well as additional evidence for a gender difference in approach–avoidance tendencies.

Keywords: depression; approach; avoidance; emotion

Experimental psychologists have converged on the conclusion that there are at least two fundamental motivational systems that are critical in regulating emotions and behavior. One system regulates behavior to attain rewards and goals. It is typically referred to as the approach system (Davidson, 1994; see also Depue & Iacono, 1989; Fowles, 1980; Gray, 1994) and it is hypothesized to be implemented in the left prefrontal cortex (Davidson, 1994; Harmon-Jones & Gable, 2009). The other system regulates withdrawal and/or inhibition of behavior in response to threat and punishment and, accordingly, is referred to as the avoidance system. It is hypothesized to be implemented in the right prefrontal cortex. Individual differences in approach–avoidance activity emerge as early as 4 months of age (Hane, Fox, Henderson, & Marshall, 2008) and are relatively stable across the life span. Thus, these systems appear to be fundamental to human behavior and emotional reactivity.

Within this motivational perspective, high levels of approach system activity are associated with greater levels of psychological well-being. Research shows that high levels of approach motivation (as assessed by both self-report measures and neuro-imaging techniques) are correlated with a greater propensity for positive affect, more effective coping skills, increased numbers of positive life events, lower sympathetic nervous system reactivity, and enhanced immune functioning (e.g., Davidson, 1994; Davidson et al., 2003; Gable, Reis, & Elliot, 2000; Heponiemi, Keltikangas-Jarvinen, Kettunen, Puttonen, & Ravaja, 2004). In contrast, low levels of approach system activation are associated with poor emotional functioning (e.g., Shankman & Klein, 2003). Specifically, individuals with low levels of self-reported approach motivation are at increased risk for negative mood and depression (e.g., Gable et al., 2000; Hundt, Nelson-Gray, Kimbrel, Mitchell, & Kwapi, 2007). Low levels of approach motivation predict depression severity, recovery time, and recurrence (Kasch, Rottenber, Arnow, & Gotlib, 2002; McFarland, Shankman,
Tenki, Bruder, & Klein, 2006). Based on these and other findings, some researchers (e.g., Davidson, 1994; Davidson, Pizzagalli, & Nitschke, 2002; Gotlib, Ranganath, & Rosenfeld, 1998) have argued that an impaired approach system might represent a marker of depression risk.

Taken together, research indicates that having a healthy approach system is critical for adaptive emotional functioning. Thus, it may be important to create effective strategies for stimulating (or “exercising”) this system. To date, there are not any interventions specifically designed to activate the approach system; however, there is indirect support for the idea that this system’s activity can be altered. For example, transcranial magnetic stimulation (rTMS) is a noninvasive procedure that uses weak electric currents to stimulate nerve cells in cortical brain regions. Preliminary research shows that high-frequency rTMS (>1 Hz) stimulation of regions implicated in approach motivation (e.g., dorsolateral prefrontal cortex) may be effective in reducing depressive symptoms (e.g., Kozel, 2002). Similarly, it may be possible to influence the approach system via a psychosocial intervention. For example, behavioral activation therapy (a treatment derived from cognitive behavioral therapy) emphasizes the identification of goals and reward-related positive activities. Specifically, patients are taught to create daily activity schedules (with an emphasis on reinforcing activities), identify strategies to achieve long-term goals, and decrease avoidance behaviors. Preliminary clinical trials indicate that behavior activation therapy is an effective treatment for depression (e.g., Dimidjian et al., 2006).

It appears that a variety of strategies (ranging from direct cortical stimulation to psychosocial interventions) are capable of influencing approach system activity. The goal of the present research is to contribute to this small but important body of work. The current study builds on previous research by addressing two limitations. First, existing strategies for stimulating the approach system typically require a trained professional (e.g., clinical psychologist, physician) or specialized equipment (e.g., TMS machine). It would be useful to create an intervention that is more accessible and cost efficient. Second, the current strategies were not designed specifically to target the approach system, and thus, the mechanisms underlying their benefits remain largely unknown. It is important to determine whether stimulation of the approach system alone leads to beneficial effects. The present study attempted to address these limitations by testing a computer task that was specifically designed to manipulate approach system activation.

The computer task was based on theories of embodiment that emphasize the importance of motor movement in affective and cognitive processes. According to this account, “specific movements become so strongly associated with a cognitive or affective state that their mere initiation elicits the corresponding state” (Koch et al., 2009, p. 549). Two of the most widely studied motor movements are flexion and extension. Flexion movements (typically of the arm or fingers) are used to pull desirable stimuli toward one’s self, and are associated with activation of the approach system. In contrast, extension movements are used to push aversive or unwanted stimuli away from the person, and are associated with activation of the avoidance system. This does not mean that flexion movements are never associated with avoidance motivation (e.g., consuming or grabbing something noxious) or that extension movements are never associated with an approach motivation. However, these movement–motivation combinations are thought to occur less frequently, and thus, are not as strongly linked together. According to Cacioppo, Priester, and Berntson (1993), there are “countless repetitions” over an individual’s lifetime in which arm flexion is temporally linked with the attainment of something desirable, whereas arm extension is linked with the onset of something aversive. These repetitions have classically conditioned humans to associate flexion with approach associations and extension with avoidance associations.

Research provides convincing evidence that flexion and extension movements activate the approach and avoidance systems, respectively (e.g., Maxwell & Davidson, 2007). Flexion and extensor motor movements differentially predict attitudes toward novel stimuli (e.g., Cacioppo et al., 1993), the categorization of emotional words (e.g., Neumann & Strack, 2000), motivation to eat or drink (Fishbach & Shah, 2006; Forster, 2003; Wiers, Rinck, Kordts, Houben, & Stack, 2010), social preferences (e.g., Kawakami et al., 2007), and cognitive control (Koch et al., 2009). Taken together these studies support the distinct effects of arm and extension motor movements. However, it is important to note that controversy exists to whether motor movements alone are sufficient to elicit the effects. For example, there is some evidence (Maxwell & Davidson) that flexion and extension motor movements only activate approach and avoidance tendencies given an appropriate situational context (e.g., only in response to stimuli that promote movements toward or away from the self).

In this study, we exploited the connection between flexion movements and approach system activation. Specifically, we used a computer task to stimulate the approach system through repeated flexion movements. Thus, the task is similar to rTMS, but uses...
flexion movements instead of electrical currents to target the approach system. Using an experimental design, we tested the efficacy of repeated flexion movements (rFM) to manipulate the approach system relative to a control task. We hypothesized that participants who completed a brief rFM task would exhibit (a) greater increases in self-reported approach motivation than participants completing a control task, and (b) greater persistence in achieving a goal (as measured by behavior on a difficult laboratory task). We did not, however, predict that the two groups (rFM and control) would differ in their level of positive or negative affect following the computer task. The effects of flexion–extension movements do not appear to affect general affective states or participants’ enjoyment ratings of laboratory tasks (Cacioppo et al., 1993). Along these same lines, Carver and White (1994) explain that the affective consequences of individual differences in approach motivation are most likely to emerge in response to specific classes of situations (e.g., positive events) than in a resting baseline state.

We also examined the moderating effect of gender in all analyses. Prior studies have shown that men and women exhibit different patterns of approach and avoidance tendencies with women having greater levels of avoidance system activation (Mardaga & Hansenne, 2007). This work suggests that rFM might elicit different outcomes in men and women (Caseras, Avila, & Torrubia, 2003; Jorm et al., 1999). For example, in a recent study by Huijding and colleagues (2009), young adolescents were trained to approach or avoid novel animals by having them push or pull pictures of the animals. Results showed that it was possible to increase avoidance tendencies, but not approach tendencies, in girls (note that this training effect was absent in boys). This work suggests that it may be more difficult to activate the approach system than the avoidance system in females. Thus, we hypothesized that women would be less likely than men to benefit from rFM.

Method

Participants

Participants were 205 unselected undergraduates (ages 17–22) from the psychology participant pool at a mid-sized private university in the midwestern United States. Specific data regarding ethnicity was not collected; however, the sample is likely representative of the diversity of the university more generally (76% Caucasian, 11% Hispanic, 8% Asian, 5% African American). Participants were recruited through a volunteer sign-up procedure and were given extra credit points for their participation. All participants consented to participate in the study by reading and signing an informed consent form. Consistent with previous research on flexion and extension motor movements (Harmon-Jones, 2006), participants were excluded from the final sample if they self-identified as being left-handed (n = 19) because handedness is related to the lateralization of brain function (left-handed individuals may have approach and avoidance systems implemented in different hemispheres than right-handed individuals). Thus, a total of 186 participants (109 women, 77 men) were included in the analyses.

Materials

Repeated Flexion Movement Task

A modified version of Maxwell and Davidson’s (2007) continuous-performance emotion asymmetry spatial cuing task (rFM task) was used to manipulate the activation of the approach system. Maxwell and Davidson created this task to test whether flexion (i.e., approach) and extension (i.e., avoidance) movements were represented in the left and right hemispheres, respectively. In this task, visuospatial cues (arrows directed toward the self or away from the self) are used to elicit flexion and extension motor movements that engage the approach and avoidance systems, respectively. Specifically, participants are instructed to indicate the direction of arrows by pressing one of two buttons vertically aligned on a response pad with their right index finger. They press the top button if the arrow points up and away from them; this motor response is an extension movement that in this context is an avoidance behavior (i.e., movement directed away from the self). They press the bottom button if the arrow points down and toward them; this motor response is a flexion movement that in this context is an approach behavior (i.e., movement directed toward the self). A central button serves as the starting point for the finger movements. At the start of each trial, the participant releases the center button to either extend his or her finger to press the top button (for upward arrows) or to flex his or her finger to press the bottom button (for downward facing arrows). The arrows are randomly presented (100 ms) to either a right or left target zone (i.e., the right or left visual field). The two peripheral target zones are outlined by boxes that remain visible during the entire task. Each arrow

1 Interestingly, left-handed participants reported less approach motivation as measured by the reward responsivity subscale at the level of a trend, F(1, 202) = 3.58, p = .06, than right-handed participants. Left-handed participants did not differ from right-handed participants on any of the other baseline measures (fun-seeking scale, drive scale, BIS scale, negative PANAS scale, or positive PANAS scale).
is immediately preceded by a brief flickering (150 ms) of the peripheral target zone where the arrow will appear. The arrows are flanked by either two diamond distractors or two arrow distractors that fall outside the peripheral target zone. Participants are not given feedback about the accuracy of their response.

Maxwell and Davidson (2007) used this task to demonstrate that approach–avoidance movements were lateralized in the left and right hemispheres, respectively. Specifically, they showed that participants were faster to make flexion movements (approach) relative to extensor movements (avoidance) when the stimuli were presented to the left hemisphere (right visual field) rather than the right hemisphere (left visual field). It is important to note that this effect was only found when participants generated their motor movements in response to the upward and downward arrows. This finding did not hold when the same motor movements were generated in the absence of stimuli denoting movement toward and away from the self. Thus, Maxwell and Davidson concluded that given the appropriate context, flexion movements are intrinsically tied to activation of the left hemisphere-driven approach system.

We made four primary modifications to the Maxwell and Davidson (2007) task to create the rFM task used in this study: (a) In the Maxwell and Davidson task, participants are presented with an equal number of visuospatial flexor and extensor cues. However, our goal was to stimulate the approach system. Thus, we increased the number of flexor–approach trials to 90% to create the rFM condition. The original presentation (i.e., equal number of flexor and extensor cues) served as the control task in this study; (b) In the original task, Maxwell and Davidson included distractor stimuli. We omitted the distractors as they tended to reduce the reliability of the flexor–extensor movements for activating approach–avoidance systems; (c) In the original task, Maxwell and Davidson used 500 trials. To reduce the time burden on participants, we decreased the number of trials to 300 (two blocks of 150 with a 1-minute break); and (d) Maxwell and Davidson used E-Prime presentation software, whereas we used Super Lab presentation software.² Further, in both our study and the Maxwell and Davidson study, response accuracy was extremely high (96% Maxwell and Davidson; 95% in the current study) with many participants not making any errors. Due to the lack of variability, response accuracy was not used as a predictor variable.

Behavioral Inhibition System/Behavioral Activation System
The Behavioral Inhibition System/Behavioral Activation System (BIS/BAS; Carver & White, 1994) assesses self-reported sensitivity of the approach and avoidance motivational systems. The BAS scale, which assesses approach motivation, is composed of three subscales—reward responsiveness, fun seeking, and drive. The reward responsiveness subscale consists of 5 items that assess positive responses to reward; the fun-seeking subscale consist of 4 items that assess willingness to approach rewards; the drive subscale consists of 4 items that assess persistence in reward/goal pursuit. The BIS/BAS scale is a gold-standard measure of approach–avoidance motivation, and is correlated with other measures of approach–avoidance such as frontal brain asymmetry (r = .4; Coan & Allen, 2003; Harmon-Jones & Allen, 1997; Sutton & Davidson, 1997). However, it is important to note that the BIS/BAS scale is typically used as a trait measure of motivational tendencies. The current study is one of the first to use this scale as a state measure to assess changes in approach–avoidance over a short time interval. However, moderate test–retest reliabilities (which typically range from .59 to .69; Carver and White) suggest that the scale may be sensitive enough to capture changes in approach–avoidance motivation.

Positive and Negative Affect Scale
The Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988) is a widely used questionnaire that assesses positive and negative affect. Participants rate the degree to which they experience 20 positive and negative emotions on a 5-point Likert scale. Possible scores on each scale can range from 10 to 50 with higher scores indicating greater levels of the construct being measured. In the current study, participants were instructed to think about how they felt “right now” when rating the items.

Difficult Laboratory Task
Participants were given three unsolvable five-letter anagrams (selected from Tresselt & Mayzner, 1966). Participants first completed two example anagrams (that were solvable) and were told that “Being good at solving anagrams requires good vocabulary and good memory.” Participants were then instructed that they had unlimited time to solve a series of anagrams. They were told to hit the space bar once they solved the anagram, or if they could not solve the anagram, then they should hit the space bar to

² Dr. Jeff Maxwell graciously provided us with all of his task materials, and thus, all other aspects of our task were the same as that of the original Maxwell and Davidson task.
receive the next anagram. The time spent trying to solve the three anagrams (i.e., persistence in achieving a goal) was used as a behavioral measure of approach motivation.

**Procedure**

Participants completed a 45-minute experimental session. All measures and laboratory tasks were completed on the computer (an iMac with a 17-inch screen). Participants first completed measures of mood (PANAS) and approach system activation (BIS/BAS scales). They were then randomly assigned to complete either a repeated flexion movement computer task \(n = 93\) or a control computer task \(n = 93\). After completing the computer task, participants once again completed the PANAS and BIS/BAS scales. Participants then completed the difficult lab task (three unsolvable anagrams). Last, they were debriefed and given their extra-credit points.

**Data analytic strategy**

Analyses were designed to test three hypotheses: (a) participants completing the rFM task would exhibit greater increases in self-reported approach motivation than participants completing a control task, (b) participants completing the rFM task would exhibit greater persistence in completing a difficult laboratory task than participants completing a control task, and (c) participants in the rFM and control conditions would not differ in their level of positive or negative affect following the computer task. We tested these hypotheses using analysis of covariance (ANCOVA). In all analyses, condition (rFM vs. control) and gender (male vs. female) served as the independent variables. Baselines levels of the dependent variables were included in analyses as covariates to control for any initial individual differences in the outcomes of interest.

**Results**

Participants in the rFM task and control conditions did not differ significantly on any of the baseline (i.e., premanipulation) variables. Gender was included in all analyses because of the well-documented differences in patterns of approach–avoidance motivation in men and women as well as its association with approach-related negative moods (e.g., Nolen-Hoeksema, 1987). Corroborating prior research, descriptive analyses showed that women had significantly greater levels of avoidance, BIS scale; \(F(1, 184) = 19.91, p < .001\), and reward responsiveness, \(F(1, 184) = 4.65, p = .03\), than men (Caseras et al., 2003; Jorm et al., 1999; Mardaga & Hansenne, 2007). Men and women did not differ on any of the other baseline measures. Also, there were no differences in the ratio of men to women in the two intervention conditions (41% men, 59% women in each condition).

**Hypothesis 1. rFM’s Effects on Self-Reported Approach Motivation**

To examine the effects of repeated flexion movements on self-reported approach system activation, we performed an ANCOVA with condition (rFM vs. control) and gender (male vs. female) as the independent variables and BIS/BAS scales (reward responsivity, fun-seeking, drive, and BIS) as the dependent variables. BIS/BAS scale scores at baseline were included as covariates to control for any individual differences in initial levels of approach–avoidance tendencies.

Results showed a significant two-way interaction between condition and gender predicting differences in approach motivation as measured by the fun-seeking subscale of the BAS, \(F(1, 181) = 4.96, p = .03, \eta^2_p = .03\). The pattern of results (see Fig. 1) for the two-way interaction was consistent with the hypotheses. Men who completed the rFM task exhibited significantly greater levels of fun seeking than men who completed the control task, \(F(1, 181) = 21.93, p < .001\). However, the opposite pattern was found for women. Women who completed the rFM task exhibited significantly lower levels of fun seeking than women who completed the control task, \(F(1, 181) = 6.09, p = .01\). This same condition by gender interaction was also marginally significant for
the reward responsiveness subscale, $F(1, 181) = 3.76$, $p = .06$, $\eta^2_p = .02$. There were no main effects of condition and gender (or their interaction) for predicting changes in drive or BIS scale scores.

**Hypothesis 2.** rFM’s Effects on Persistence on a Difficult Laboratory Task

To examine the effects of repeated flexion movements on persistence during a difficult laboratory task, we performed an ANCOVA with condition (rFM vs. control) and gender (male vs. female) as the independent variables and amount of time spent trying to solve three unsolvable anagrams as the dependent variable. Results showed a significant two-way interaction between condition and gender, $F(1, 182) = 5.40$, $p = .02$, $\eta^2_p = .03$. The pattern of results (see Fig. 2) were consistent with those found for Hypothesis 1. Men who completed the rFM task exhibited significantly greater levels of persistence trying to solve the anagrams than men who completed the control task, $F(1, 181) = 3.98$, $p = .04$. In contrast, women who completed the rFM task exhibited a (nonsignificant) tendency to exhibit lower levels of persistence than women who completed the control task, $F(1, 181) = 2.10$, $p = .15$. The main effects of condition and gender did not significantly predict persistence on the laboratory task.

**Hypothesis 3.** rFM’s Effects on Mood

To examine the effects of repeated flexion movements on mood, we performed a multivariate ANCOVA with condition (rFM vs. control) and gender (male vs. female) as the independent variables and PANAS scores (postmanipulation) as the dependent variables. PANAS scores at baseline were used as covariates. Consistent with hypotheses, neither the main effects of condition, sex, nor their interaction, predicted either positive or negative mood ($p > .17$ in all cases).

**Discussion**

This study tested the effects of a brief (~20 minutes) repeated flexion movement task on approach system activation as measured by both self-report (BAS scales) and behavior. The results of the experiment showed that rFM increased approach system motivation in men but not women. Men who completed the rFM task reported greater levels of fun seeking and marginally greater levels of reward responsiveness than men in the control task. Impressively, the rFM task also led to changes in actual behavior. Men who completed the rFM task exhibited greater persistence on a difficult laboratory task than men in the control task. Taken together, these results have important implications for both theory and practice. They provide support for embodied theories of emotion as well as demonstrate the ability of repeated flexion movements to stimulate the approach system in men. These results represent the first step (i.e., establishing the effect in the lab) in the process of creating and employing an intervention that could be used in a clinical setting. The results also highlight potentially important gender differences in approach system functioning. In contrast to men, women who completed the rFM task actually exhibited decreases in approach motivation as measured by the fun-seeking scale as well as a tendency for lower levels of persistence on a difficult laboratory task compared to women who completed the control task. The rFM task had no effect on self-reported drive, avoidance, or mood in men or women. These null results predicting mood corroborate recent work indicating that individual differences in approach motivation are not strong predictors of general levels of affect or enjoyment of tasks (Cacioppo et al., 1993). Rather increased approach motivation sets up the conditions under which positive affect is most likely to occur. Thus, to detect changes in affect, we likely would have had to examine participants’ responses to some sort of positive stimuli (i.e., examine affective sensitivity; Harmon-Jones, Gable, & Peterson, 2010; Hundt et al., 2007).

The different pattern of results found in this study for men and women corroborate recent work (e.g., Huijding et al., 2009) indicating that approach motivation may operate differently depending on gender. We suspect that the gender difference might
be due to the higher levels of avoidance motivation (i.e., high BIS scores) in women. Avoidance tendencies are thought to be antagonistic to approach motivation, and thus, high levels should make it more difficult to stimulate the approach system (Corr, 2002; Gray, 1976). Thus, it may be necessary to increase the number of rFM trials in women. Another possible explanation for our results is gender differences in visuospatial processing. Research indicates that males tend to perform better on visuospatial tasks than females (Thilers, MacDonal, & Herlitz, 2007). Moreover, this difference in visuospatial processing might rise from differences in cerebral organization. Males tend to process visuospatial and verbal information asymmetrically whereas females tend to process it bilaterally (Godard & Fiori, 2010; Voyer, 1996). These gender differences are likely to affect reactions to the rFM task. Indeed, the rFM task relies on visuospatial cues to activate approach–avoidance systems that are lateralized in the brain. However, these hypotheses about mechanisms underlying our gender results are merely speculation at this point. As Jorm et al. (1999) note, the gender difference appears to be “complex” (p. 57). Indeed, although we predicted that women would not benefit as much from rFM as men, we did not predict that the task would actually exert an opposite effect on women. It will be important for future research to replicate this gender difference, as well as begin to determine the mechanisms underlying this difference.

It is important to note strengths and weaknesses of the current study. A significant strength of this study was the use of an experimental design with multiple outcome measures: self-report and actual behavior. The current study also had a large sample size that provided enough power to detect the desired effects as well as examine gender differences. There were also limitations to the current study. For example, the study used a college sample so it is possible that the results may not generalize to a community sample. Moreover, we did not collect ethnicity data, and thus, it is uncertain how this factor affects the efficacy of the rFM task. However, research suggests that the results of studies using college samples often do generalize to communities and different ethnic groups, particularly when basic processes (e.g., motivation) are being studied (e.g., Anderson, Lindsay, & Bushman, 1999). Also, it remains unclear whether rFM could be used as a treatment intervention for a clinical sample (e.g., those with major depressive disorder). The goal of the current study was to determine whether the approach system could be stimulated through repeated flexion movements (i.e., an initial well-controlled test of the rFM task). Although the results showed that this is possible, the small effect sizes bring into question the clinical usefulness of the task. Can rFM be useful as a treatment intervention for individuals with psychopathology as opposed to only a brief “exercise” for relatively healthy individuals? We contend that the current results likely underestimate the potential usefulness of the intervention for clinical samples. A growing body of research indicates that intervention effects tend to be stronger when using a targeted sample rather than an unselected sample (Gillham, Shatte, & Freres, 2002; Haefel & Grigorenko, 2007). This means that our results might have been stronger in a sample in which approach motivation was low (e.g., a depressed sample) rather than an unselected healthy sample in which some individuals’ approach motivation might already be at ceiling levels. However, at this time, we can only conclude that the rFM task is capable of causing relatively small changes in approach motivation in healthy participants. Although these increases were enough to influence both self-reported motivation and behavior, future research is still needed to translate this work to a clinical population (i.e., to go from bench to bedside).

In conclusion, the goal of the current study was to determine the efficacy of an easy-to-disseminate and cost-efficient strategy for stimulating the approach system. Specifically, we compared a computer task (based on theories of embodied emotion) that used rFM to a control task. Results showed that the rFM task increased willingness to approach reward (i.e., fun seeking) in men, but decreased this type of approach motivation in women. These findings provide some of the first evidence that rFM, even over a small period of time (~20 minutes), can manipulate approach system motivation. It will be important for future research to determine whether repeated use of this task (either daily or weekly) could have long-term beneficial effects.

References


