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## Text Messages Promoting Mental Imagery Increase Self-Reported Physical Activity in Older Adults: A Randomized Controlled Study

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1 Text Messages Promoting Mental Imagery Increase Self-Reported Physical Activity in Older  
2 Adults: A Randomized Controlled Study  
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11 ADULT

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## 1 Abstract

2 This study tested whether text messages prompting older adults to perform mental imagery  
3 would increase Aerobic Physical Activity (APA) duration using a randomized parallel trial  
4 design.

5 Method: Older adults were assigned to an Imagery 1, Imagery 2 or Placebo group. For 4  
6 weeks, each group was exposed to two conditions (morning text message vs. no morning text  
7 message). In the morning message condition, the Imagery groups received a text message  
8 with the instruction to mentally imagine performing an APA and the Placebo group received a  
9 placebo message. All participants received an evening text message: “Did you do your cardio  
10 today? If yes, what did you do?” 3 days per week.

11 Results: Participants of the Imagery groups reported significantly more weekly minutes of  
12 APA in the morning text message condition compared with the no morning message  
13 condition.

14 Conclusion: Electronic messages was effective at increasing minutes of APA in older adults.

15 *Keywords:* cell phone, mental imagery, older adult, physical activity

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1 Text Messages Promoting Mental Imagery Increase Self-Reported Physical Exercise in Older  
2 Adults: A Randomized Controlled Study

### 3 **Increasing Physical Activity for Health in Older Adults**

4 Physical inactivity has been estimated to cause 3.2 million deaths per year (WHO,  
5 2013<sup>i</sup>) and was the fourth leading risk factor for global mortality in 2011, accounting for more  
6 than 20% of the diabetes, cancer and ischemic heart disease cases (World Health  
7 Organization: WHO, 2011<sup>ii</sup>). Conversely, physical activity has a well-documented positive  
8 impact on aging (Albinet, Boucard, Bouquet, & Audiffren, 2010; Charansonney, 2011;  
9 McPhee et al., 2016; Stacey, Kozma, & Stones, 1985) and by consensus is today considered a  
10 medicine (Taylor, 2014). The WHO currently recommends a minimum of 150 minutes of  
11 physical activity per week. Nevertheless, despite the wide disparity across studies (Sun,  
12 Norman, & While, 2013), it seems that only 17% of the adults between 55 and 64 years old  
13 and less than 16% of those who are older are meeting this recommendation (Centers for  
14 Disease Control & Prevention, 2013; Myers & Gonda, 1986). The worldwide community of  
15 researchers on chronic diseases is consequently struggling to find the best strategies to  
16 encourage people to be more active (Denison, Vist, Underland, & Berg, 2014). The strategies  
17 of health promotion and physical activity campaigns are a major center of interest (Brawley &  
18 Latimer, 2007; Leavy, Bull, Rosenberg, & Bauman, 2011) as it is assumed that these  
19 campaigns can have a significant impact on behavior. From this perspective, several  
20 innovative strategies have been explored, such as using the internet (Duncan et al., 2014),  
21 personalized videos (Vandelanotte et al., 2015), video games (Studenski et al., 2010) and  
22 mobile devices (Fong et al., 2016; Johnston, Hoffman, & Thornton, 2014). The latter in fact  
23 led to the concept of mobile health (mHealth) (Fiordelli, Diviani, & Schulz, 2013; O'Reilly &  
24 Spruijt-Metz, 2013).

25 **Text Messaging as a Way to Increase Physical Activity in Older Adults**

1           Although the use of new technologies generally spreads quickly, fewer than 20% of  
2 UK adults older than 65 years and at risk of type 2 diabetes owned a smartphone in 2013<sup>iii</sup>,  
3 but 77% in the 64-74 age group owned a non-smart mobile phone in 2011<sup>iv</sup>. Texting as a tool  
4 for health promotion has therefore become a focus in mHealth research (Hall, Cole-Lewis, &  
5 Bernhardt, 2015; Morton et al., 2015) based on the idea that, like marketing strategies, it may  
6 be able to prompt people to change their behaviors in a desired way (Cole-Lewis & Kershaw,  
7 2010). The effectiveness of texting in promoting physical activity has in fact been  
8 documented (for a review, see Fanning, Mullen, & McAuley, 2012) and this strategy was  
9 found to generate positive feedback and attitudes (Gerber, Stolley, Thompson, Sharp, &  
10 Fitzgibbon, 2009). Given the observations that older adults are increasingly using cell phones  
11 (Selwyn, Gorard, Furlong, & Madden, 2003<sup>v</sup>) and that they have easier access to these phones  
12 than to other technologies (Gerber, Olazabal, Brown, & Pablos-Mendez, 2010), designing  
13 new ways to use them to promote health (Gell, Rosenberg, Demiris, LaCroix, & Patel, 2015)  
14 and physical activity (Morton et al., 2015; O'Reilly & Spruijt-Metz, 2013) has become an  
15 obvious research objective. Several studies (Antoine Parker & Ellis, 2016; Kim & Glanz,  
16 2013; Muller, Khoo, & Morris, 2016) have shown that text messaging increases certain  
17 domains of self-reported Aerobic Physical Activity (APA) and one study reported an  
18 objective increase in pedometer measurements (Kim & Glanz, 2013).

### 19 **Mental Imagery as an Innovative Way to Increase Physical Activity in Older Adults**

20           Mental Imagery (MI) refers to the mental simulation or re-creation of a perceptual  
21 experience (Kosslyn, Ganis, & Thompson, 2001). MI can be carried out in various ways,  
22 including auditory, olfactory, tactile, gustatory, kinesthetic, and visual modes (Cumming &  
23 Williams, 2014). In the physical activity sciences, MI has been widely explored as a strategy  
24 to enhance sports performance (Di Rienzo et al., 2015; Robin et al., 2007) or as a tool in  
25 physical therapy (Slimani, Tod, Chaabene, Miarka, & Chamari, 2016) mainly through its

1 visual and motor aspects. However, occasional practitioners and non-athletes generally report  
2 that visual imagery is the easiest to use (Lorant & Nicolas, 2004). A comprehensive yet  
3 inexpensive method of determining a person's abilities for visual and kinesthetic imagery is  
4 the self-report questionnaire (Hall, 2001). According to Williams et al. (2012), one of the  
5 most popular and commonly used questionnaires is the revised Movement Imagery  
6 Questionnaire (MIQ-R; Hall & Martin, 1997), which has proven valuable for controlling for  
7 individual differences in imagery interventions (Debarnot, Sahraoui, Champely, Collet, &  
8 Guillot, 2012; Robin et al., 2007).

9         Many years ago, Paivio (1985) proposed that MI in sports, or "sport imagery," has two  
10 main roles that can be broken down into five non-exclusive functions. Mentally rehearsing  
11 race plans and strategies of play (CG; cognitive general imagery) or skills (CS; cognitive  
12 specific imagery) are proposed to be the two cognitive functions of sport imagery. Imagining  
13 the arousal and anxiety associated with performing (MG-A; motivational general-arousal  
14 imagery), imagining being in control and feeling confident (MG-M; motivational  
15 general-mastery imagery) and imagining goal achievement and accomplishment (MS;  
16 motivational specific imagery) are proposed to be the three motivational functions. The Sport  
17 Imagery Questionnaire (SIQ) (Hall, Mack, Paivio, & Hausenblas, 1998) was designed to  
18 explore these five domains, respectively: SIQ CG, CS, M-GA, M-GM and MS.

19         The motivational functions of mental imagery and their ability to influence behaviors  
20 have been documented, especially in the field of eating disorders (Missbach, Florack, &  
21 Konig, 2015). In the field of physical activity promotion, very few works are available (Chan  
22 & Cameron, 2012; Martin & Hall, 1995). MI was found to increase the intrinsic motivation  
23 and quantity of practice of beginner golfers (Martin & Hall, 1995). It was also found to  
24 increase approach motivation, intentions post-session and action planning for physical activity  
25 in non-active adults (Chan & Cameron, 2012).



1 They all met the following inclusion criteria: (1) 50 years of age or older, (2) member of the  
2 fitness center for at least 6 consecutive months, (3) currently participating in group strength  
3 training with a professional fitness instructor at least twice a week but not meeting the WHO  
4 recommendation for weekly APA, and (4) able to send and receive e-mail and/or text  
5 messages from a cell phone over a 4-week period. Two participants (1 female and 1 male)  
6 were excluded because they reported having low imagery ability, and 87 volunteers (47  
7 females, 40 males;  $M_{\text{age}} = 62.87$  years, age range: 51–73 years) thus were retained for the  
8 entire experimental procedure (see Table 1 for demographic and clinical characteristics for  
9 each group). The experiment was approved by the local ethics committee and was conducted  
10 in accordance with the Declaration of Helsinki.

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11  
12 Table 1 near here  
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#### 14 **Procedure and Intervention**

15 All participants were successively and in random order exposed to two 2-week periods  
16 (session 1: weeks 1–2 / session 2: weeks 3–4) from 3 September to 1 October 2016. At the  
17 beginning of the study, all the participants met together, and the Principal Investigator (PI, the  
18 first author) presented the procedure, explained how to carry out the visual and kinesthetic  
19 imagery, and answered questions. The participants then signed an informed consent form,  
20 filled out a personal information questionnaire, and completed two questionnaires assessing  
21 imagery ability and use. They were then randomly assigned to the Imagery 1, Imagery 2 (with  
22 a similar but counterbalanced condition to control for the order effect) or Placebo group by  
23 drawing lots made by the PI, as illustrated on Figure 1.

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24  
25 Figure 1 near here



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2           The study lasted 4 weeks. The Imagery and Placebo groups received a morning text  
3 message (at 7:00 am) 3 days per week for 2 weeks. In the other 2 weeks, they received no  
4 morning messages. The morning message for the Imagery groups told them to “Visually  
5 imagine yourself performing a cardio activity,” whereas for the Placebo group, the message  
6 was the exchange rate for the euro from the day before: for example, “1 euro = 1.07 dollars.”  
7 After receiving the morning text message, the Imagery and Placebo groups simply had to send  
8 the message “received” to the PI.

9           All the participants also received an evening text message at 7:30 pm, 3 days a week  
10 for 4 weeks, asking “Did you do your cardio today?” Once the evening text messages were  
11 received, they completed the APA participation form by cell phone e-mail or text message  
12 and sent it to the PI. They had to respect a specified answer format, and when the response  
13 was “yes,” they were expected to report the type of APA, duration in minutes, and intensity  
14 (moderate or vigorous).

## 15 **Measures**

16           **Electronic Aerobic Physical Activity Participation Form.** The electronic APA  
17 participation form, previously used by Antoine Parker and Ellis (2016), asked two questions:  
18 “Did you do your cardio today? and “If yes, what did you do?”. As noted, when APA was  
19 reported, the participants specified the type of activity (e.g., bike, walk, swim, etc.), duration  
20 in minutes and intensity (moderate or vigorous). As bias can occur with self-report  
21 questionnaires, we used the French version of the Marlowe-Crowne Social Desirability  
22 Scale—short form C (MCSD) (Blais, Lachance, & Riddle, 1991; Verardi et al., 2010) and, as  
23 recommended by Crowne and Marlowe (1960), divided the participants into three groups: low  
24 scorers (0–3,  $n = 13$ ), average scorers (4–7,  $n = 57$ ) and high scorers (8–13,  $n = 17$ ).

1           **Imagery Ability.** We assessed individual imagery ability to ensure that the sample did  
2 not include anyone with extremely high or low mental imagery ability (see Robin et al., 2007;  
3 for a similar procedure) and especially ensured that none of the participants encountered  
4 difficulties in realizing visual imagery. Before the beginning of the experiment, all the  
5 participants completed the Movement Imagery Questionnaire–Revised (MIQ-R) (Hall &  
6 Martin, 1997). The MIQ-R measures movement imagery ability for basic and daily life  
7 movements. The MIQ-R is an 8-item self-report questionnaire in which participants rate the  
8 ease or difficulty of forming a mental representation using two 7-point Likert-type scales (1 =  
9 *very hard to see/feel* and 7 = *very easy to see/feel*) referring to visual and kinesthetic imagery,  
10 respectively. Psychometric properties of the MIQ-R have been consistently adequate, with a  
11 Cronbach (1951)  $\alpha$  of .82 for both visual and kinesthetic scales (Lorant & Nicolas, 2004).

12           **Imagery Use.** We used the Sport Imagery Questionnaire (SIQ; Hall et al., 1998),  
13 which is designed to assess the use of the five cognitive and motivational functions of  
14 imagery. The SIQ is composed of 30 questions, six questions per imagery function. Each item  
15 is rated on 7-point Likert-type scale (1 = *rarely use that function of imagery* and 7 = *often use*  
16 *that function of imagery*). An average frequency score for the participants' use of each of the  
17 five functions was then calculated. Internal consistency values range from  $\alpha = .70$  to  $\alpha = .88$ ,  
18 are satisfactory for the five SIQ subscales, and the scale possesses good validity (Hall et al.,  
19 1998). The sample was divided into three groups based on the SIQ MS scores (high, medium  
20 and low MS groups) to specifically evaluate the influence of the motivational specific  
21 function of imagery.

## 22 **Preliminary Data Analysis**

23           We first examined the MIQ-R scores and each of the five SIQ scores across the  
24 experimental conditions to confirm that there was no difference between groups. Data were

1 checked for MIQ-R and each of the SIQ scores outliers considering values more than 2 SD  
2 above or under the mean.

3 Second, to evaluate the eventual influence of social desirability, two one-way  
4 ANOVAs were performed. The first compared the low, average and high scorer groups with  
5 regard to the increase in minutes of APA. The second compared the MCDS scores between  
6 each group (Imagery 1 vs. Imagery 2 vs. Placebo).

## 7 **Preliminary Results**

8 **Imagery Use and Ability.** The MIQ-R visual and SIQ scores (mean, standard  
9 deviation and range) are presented in Table 2. Two of the participants had MIQ-R visual  
10 scores lower than 16 (corresponding to “hard to see/feel” for all the items of the  
11 questionnaire) and their data were excluded from the statistical analyses. The ANOVAs  
12 revealed no main group effect on the MIQ-R visual scores,  $F(2, 84) = 0.11, p > .05$ , or the  
13 five functions of the SIQ scores (CS, CG, MS, M-GM, M-GA),  $F(2, 84) = 0.03, p > .05, F(2,$   
14  $84) = 0.85, F(2, 84) = 0.58, F(2, 84) = 0.02, F(2, 84) = 1.01$ , respectively ( $ps > .05$ ).

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15  
16 Table 2 near here

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18 **Social Desirability.** The ANOVAs revealed no main effect of the MCSD group on  
19 minutes of APA,  $F(2,84) = 0.62, p = 0.53$  (Table 3), and comparable social desirability in the  
20 experimental groups,  $F(2,84) = 0.05, p = 0.95$  (Table 4).

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21  
22 Tables 3 and 4 near here

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## 24 **Data Analysis**

1 To determine whether the two Imagery groups could be combined, the order effect  
2 (Imagery 1: "Imagery morning message condition followed by no morning message  
3 condition" versus Imagery 2: "no morning message condition followed by Imagery morning  
4 message condition") on APA was then explored by a two-way ANOVA with a group factor  
5 and a session factor, APA being the dependent variable.

6 We then performed a two-way ANOVA to explore the effect of condition and session  
7 on the minutes of APA on the whole sample. To evaluate the influence of the MS function of  
8 imagery on the increase in minutes of APA (mean differences between morning message and  
9 no morning message conditions on minutes of APA) for the Imagery group participants, a  
10 one-way ANOVA compared the low, medium and high MS groups.

11 For all analyses, the significant main effects and interactions were broken down using  
12 the HSD Tukey test for the one-way ANOVA and the Newman-Keuls test for the ANOVA  
13 with session. Normality was checked (Kolmogorov-Smirnov test), effect sizes ( $\eta_p^2$ ) were  
14 indicated, and  $\alpha$  was set at .05 for all the analyses.

## 15 Results

### 16 Aerobic Physical Activity

17 The weekly minutes of APA according to experimental condition are presented as  
18 means and standard deviations (see Table 5). The first two-way ANOVA revealed that there  
19 was no order effect on minutes of APA in either of the two Imagery groups,  $F(1, 56) = 0.01, p$   
20  $< .01$ . We therefore combined the two groups into one.

21 We then performed another ANOVA to explore the effect of group (Imagery vs.  
22 Placebo) on minutes of APA with the type of morning message (imagery message vs. placebo  
23 message) as a between-subject factor and a repetition factor (morning message vs. no morning  
24 message) as a within-subject factor.

1           The ANOVA revealed a significant main effect of group,  $F(1,85) = 9.61, p = .002, \eta_p^2$   
2  $= 0.10$ , and a significant main effect of type of morning message,  $F(1,85) = 28.85, p = .000$ ,  
3  $\eta_p^2 = 0.25$ . Moreover, the ANOVA revealed a significant interaction between group and type  
4 of morning message,  $F(1,85) = 26.01, p = .000, \eta_p^2 = 0.24$ . The post-hoc Newman-Keuls test  
5 revealed that the participants of the Imagery group reported significantly more average  
6 weekly minutes of APA ( $M = 99.53$ ) in the morning imagery message condition compared  
7 with the no morning message condition ( $M = 72.73$ ). Moreover, as illustrated in Figure 2, the  
8 participants of the Placebo group showed no significant difference between the morning  
9 placebo message condition ( $M = 72.10$ ) and the no morning message condition ( $M = 71.41$ ).

10           None of the participants reported vigorous APA in their electronic responses.

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Table 5 and Figure 2 near here

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#### 14 **Influences of SIQ MS Scores on APA**

15           Since “4” was the most frequently reported SIQ MS score and represented more than  
16 half the sample, we divided the sample into three groups: the low MS group with scores lower  
17 than 4 ( $n = 15$ ), the medium MS group with scores equal to 4 ( $n = 32$ ), and the high MS group  
18 with scores higher than 4 ( $n = 11$ ). The ANOVA revealed a main effect of group,  $F(2,55) =$   
19  $3.65, \eta_p^2 = 0.06$ , on the increase in minutes of APA. The post-hoc HSD Tukey test revealed  
20 that participants in the high and medium SIQ MS groups had greater increases in minutes of  
21 APA than participants in the low SIQ MS group (Figure 3).

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Figure 3 near here

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## Discussion

### Limitations

The duration of the morning text message condition (2 weeks) could be considered short, despite its positive results. However, the study objective was to determine whether text messages to prompt mental imagery would increase minutes of APA in older adults, and we compared our findings with those of other studies using similar protocols to facilitate the interpretation of the results (i.e., Antoine Parker et al., 2016; Prestwich, Perugini, & Hurling, 2010). Our study should thus be viewed in the context of previous research with similar characteristics that also demonstrated the effectiveness of prompts for changing behavior (Antoine Parker et al. 2016; Fry & Neff, 2009). The results are promising, suggesting the positive effects of cell phone imagery prompts to promote short-term APA. Further research is needed to evaluate whether this strategy is effective for long-term APA participation. The self-reporting of APA minutes might be another limitation, although this was modulated by the absence of any group difference according to social desirability. We may assume that a few participants over- or underestimated their minutes of APA, and this may have been the case with the evaluation of the intensity of APA, as well (none of the participants reported vigorous activity). Further research is needed using objective measurements of APA, such as heart rate monitoring, pedometers or doubly-labeled water.

### Generalizability

The aim of this study was to determine whether cell phone prompts with imagery scripts would increase APA participation in adults aged 50 years and older. The results showed that, in the Imagery groups, the average weekly minutes of APA were significantly higher in the morning text message condition, during which participants had to visually imagine themselves doing an APA, than in the no morning message condition. The results of this original study are consistent with previous research showing that cell phone prompts

1 related to physical activity increased the physical activity of younger adults (Fanning et al.,  
2 2012; Fry & Neff, 2009) and older adults (Antoine Parker & Ellis, 2016; Kim & Glanz, 2013).  
3 Indeed, the latter authors showed a significantly greater weekly duration of APA in a group  
4 that received the electronic reminder in the morning than during the control condition when  
5 the morning reminder was not delivered. Moreover, our use of a Placebo group showed that a  
6 placebo morning message, which had no relation to physical activity but merely indicated the  
7 euro versus dollar exchange rate, had no influence on APA. This non-significant result is  
8 important because it suggests that the Imagery group participants benefited from the message  
9 content and not from the message itself. An MI message is therefore useful to improve APA  
10 duration in older adults and may also be beneficial for younger participants or pregnant  
11 women, for example. MI prompts can complete or replace other prompts that suggest or insist  
12 on APA. The act of imagining oneself engaged in physical activity could be considered a self-  
13 motivational technique and probably activates a specific neural network that incites this  
14 behavior.

### 15 **Interpretation**

16 The results of the current study extend the literature by providing evidence that  
17 imagery text delivered via cell phones can also be a successful strategy for increasing weekly  
18 minutes of APA among older adults. Indeed, the increase of APA was about 36.8% (with a  
19 quite small sample size  $\eta_p^2 = 0.24$ ) with morning imagery text. It seems that imagery text  
20 prompts are as effective as other prompts like “Don’t forget to do cardio today” used in  
21 Antoine Parker et al. (2016) study, for example, in which the increase was 35.2% (with a  
22 small sample size  $\eta_p^2 = 0.18$ ). Moreover, it seems important to note that in the morning text  
23 condition, participants of the Imagery groups averaged about 33 minutes of APA each  
24 message day versus 24 minutes of APA on the days without the morning text message or 23  
25 minutes of APA for the Placebo group participants who received a placebo morning message.

1 We can assume that if the MI messages had been delivered 4 to 5 days per week, the  
2 participants would have been on track to meet the WHO physical activity recommendation  
3 (150 weekly minutes of APA).

4 As hypothesized, the results suggest that imagery text messages are an effective  
5 intervention strategy for increasing APA in adults 50 years and older who regularly engage in  
6 physical activities. As Paivio (1985) observed, MI is frequently used to enhance sports  
7 performance. It has nevertheless been reported that the beneficial effects of MI on sports  
8 performance are modulated by numerous factors (Hall, 2001). For example, Short, Tenute,  
9 and Feltz (2005) suggested that individual differences in imagery ability influence the  
10 frequency of imagery use and how effective the imagery will be. Furthermore, the differences  
11 in imagery ability may be one reason why people choose not to use imagery even when it  
12 could be beneficial. In order to control for the influence of this factor, all the participants  
13 completed the MIQ-R and none of them were categorized as poor or good imagers (Robin et  
14 al., 2007). Another factor that can influence the beneficial effects of MI is the fitness level of  
15 the participants. Most of the sports imagery research has been conducted with adult athletes  
16 (Hall et al., 2009). According to Martin and Hall (1995), these athletes use imagery to modify  
17 cognitions and regulate arousal and anxiety, which are classed as serving motivational  
18 general-arousal and motivational general-mastery functions. When these athletes need to learn  
19 or improve movement performance, they use the cognitive specific function of imagery, and  
20 for strategies, game plans and routines, they use the cognitive general function. Moreover,  
21 Hall and collaborators (1998) suggested that athletes use all five functions of imagery to a  
22 greater extent than amateur or recreational athletes. Nordin and Cumming (2007), on the other  
23 hand, revealed that athletes show the lowest frequency scores for MS imagery, and athletes  
24 and non-athletes differ in their imagery use. Indeed, in the early stages of skill acquisition,  
25 novices attend to cognitive cues regarding the skill being learned and use imagery primarily



1 for its cognitive function to assist in organizing information (about the skill or strategy) at the  
2 central processing level (Murphy & Jowdy, 1992). However, it should be noted that the older  
3 adults in this study were not learning a new task or movement, which probably explains their  
4 higher scores on the MS imagery function than the other four functions. Indeed, the other  
5 functions are more oriented toward competition or learning, whereas MS imagery entails  
6 imagining goal achievement and accomplishment. Moreover, our results are consistent with  
7 those of Martin and Hall (1995) with beginner golfers, as these authors demonstrated that MS  
8 imagery is effective for modifying cognitions related to goals and motivation. In their study,  
9 the participants with six imagery sessions spent more time practicing a golf-putting task and  
10 adhered more closely to their training program than the participants in the no-imagery control  
11 group. A complementary analysis revealed that the participants who reported medium and  
12 high SIQ MS scores had greater increases in APA duration than those with low SIQ MS  
13 scores. These results confirm the literature and are consistent with the idea that MS imagery  
14 enhances motivation (Martin et al., 1999) to practice a physical activity.

15 Few studies have examined electronic prompts on cell phones to increase APA  
16 participation in older adults (Antoine Parker et al., 2016; Tabak, Op den Akker, & Hermens,  
17 2014) and none has tested mental imagery text messages. The results of our study confirm  
18 previous research results indicating that electronic prompts can increase APA in older adults  
19 and show the benefits of mental imagery messages. As suggested by Paivio (1985), mental  
20 imagery has a motivational role that can improve physical practice. The use of mental  
21 imagery text messages may be an easy-to-use, cost-effective and beneficial method to  
22 increase APA in older adults.

23 **Note**

1 <sup>i</sup> World Health Organization Diet and Physical Activity Factsheet. Secondary Diet and  
2 Physical Activity Factsheet 2013.

3 [http://www.who.int/dietphysicalactivity/factsheet\\_inactivity/en/index.html](http://www.who.int/dietphysicalactivity/factsheet_inactivity/en/index.html)

4 <sup>ii</sup> World Health Organization. Global status report on noncommunicable diseases 2010.  
5 Geneva: WHO Press; 2011.

6 <sup>iii</sup> Tech Tracker Quarterly Release: Q4 2013. Ipsos Media; 2013. [2015-08-03]. website  
7 [https://www.ipsosmori.com/DownloadPublication/1630\\_IpsosMediaCT\\_Techtracker\\_Q4\\_20](https://www.ipsosmori.com/DownloadPublication/1630_IpsosMediaCT_Techtracker_Q4_2013.pdf)  
8 [13.pdf](https://www.ipsosmori.com/DownloadPublication/1630_IpsosMediaCT_Techtracker_Q4_2013.pdf).

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Table 1

*Participants demographic and clinical characteristics*

Variables	Imagery 1 Group (n = 30)	Imagery 2 Group (n = 28)	Placebo Group (n = 29)
<b>Demographics</b>			
Sex	57% females	54% females	52% females
Age (years)	61.59 (7.35)	62.54 (6.54)	64.48 (5.23)
Marital Status	47% Married	43% Married	52% Married
Race/ethnicity	100% White	97% White	100% White
Education	50% College	46% College	52% College
Medium financial income	97%	100%	100%
<b>History of disease</b>			
Bone	13%	7%	3%
Cancer	10%	14%	17%
Cardiovascular	13%	10%	3%
Thyroid	7%	11%	3%
Spine	3%	0%	7%
Other	17%	14%	21%
No disease reported	40%	46%	38%

Table 2

*Descriptive statistics for imagery use and imagery ability.*

Measure	<i>M</i>	<i>SD</i>	Range
<b>SIQ</b>			
Cognitive Specific	1.62	0.57	1-3
Cognitive General	1.28	0.50	1-3
Motivational Specific	3.93	0.74	2-5
Motivational General-Arousal	1.85	0.63	1-4
Motivational General-Mastery	1.75	0.64	1-3
<b>MIQ-R</b>			
Visual	23.83	1.87	19-28
Kinaesthetic	21.35	1.84	18-28

Table 3

*Mean scores and increase of Aerobic Physical Activity (APA) of the groups (Low scorers, Average scorers, and High scorers) according to the French version of the Marlowe-Crowne measure of Social Desirability scale (MCSD).*

Groups	<i>M1</i> MCSD scores	<i>SD</i>	Range	<i>M2</i> increase of APA	<i>SD</i>
<b>Low scorers</b> (n = 13)	2,46	0,49	1-3	23,38	14,89
<b>Average scorers</b> (n = 57)	5,5	0,93	4-7	26,95	18,74
<b>High scorers</b> (n = 17)	9,17	1,07	8-11	21,97	15,46

Note: M1 = Mean MCSD scores, M2 = Mean increase of minutes of Aerobic Physical Activity (mean differences between morning text and no morning text conditions minutes of APA).

Table 4

*Mean Marlowe-Crowne measure of Social Desirability (MCSD) scale scores of the groups (Imagery 1, Imagery 2, and Placebo).*

Groups	<i>M (SD)</i>	Range
<b>Imagery 1</b> (n = 30)	5.63 (2.25)	2-11
<b>Imagery 2</b> (n = 28)	5.82 (2.35)	2-10
<b>Placebo</b> (n = 29)	5.69 (2.32)	1-11

Table 5

*Weekly minutes of aerobic physical activity, by conditions, for the Imagery and Placebo Groups*

<b>Groups</b> Conditions	Week 1		Week 2		Week 3		Week 4	
	<i>M</i>	<i>(SD)</i>	<i>M</i>	<i>(SD)</i>	<i>M</i>	<i>(SD)</i>	<i>M</i>	<i>(SD)</i>
<b>Imagery 1 (n = 30)</b>								
Imagery morning text	98.44	(29.31)	99.82	(28.01)	xxxx	xxxx	xxxx	xxxx
No morning text	xxxx	xxxx	xxxx	xxxx	72.55	(33.17)	73.03	(29.84)
<b>Imagery 2 (n = 28)</b>								
Imagery morning text	xxxx	xxxx	xxxx	xxxx	97.96	(26.60)	101.51	(26.73)
No morning text	73.27	(32.30)	72.03	(35.75)	xxxx	xxxx	xxxx	xxxx
<b>Placebo (n = 29)</b>								
Placebo morning text	72.75	(29.20)	71.44	(32.80)	xxxx	xxxx	xxxx	xxxx
No morning text	xxxx	xxxx	xxxx	xxxx	72.03	(26.97)	70.79	(30.50)

Note: M = Mean weekly minutes of aerobic physical activity, (SD) = standard deviation

Note: M = Mean MCSD scores, (SD) = standard deviation

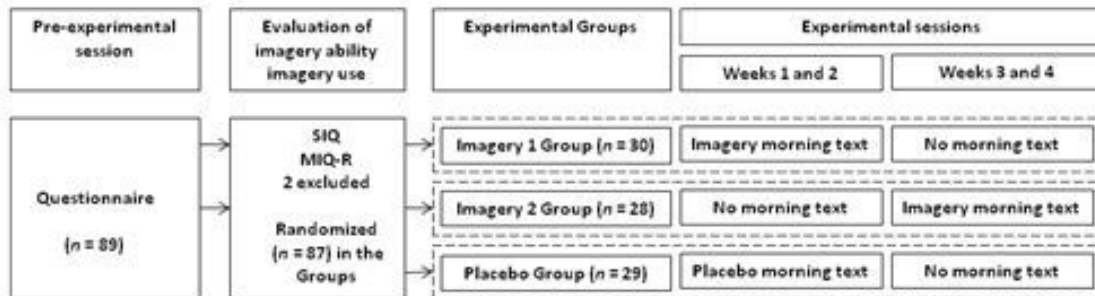


Figure 1. Time course of the experimental design

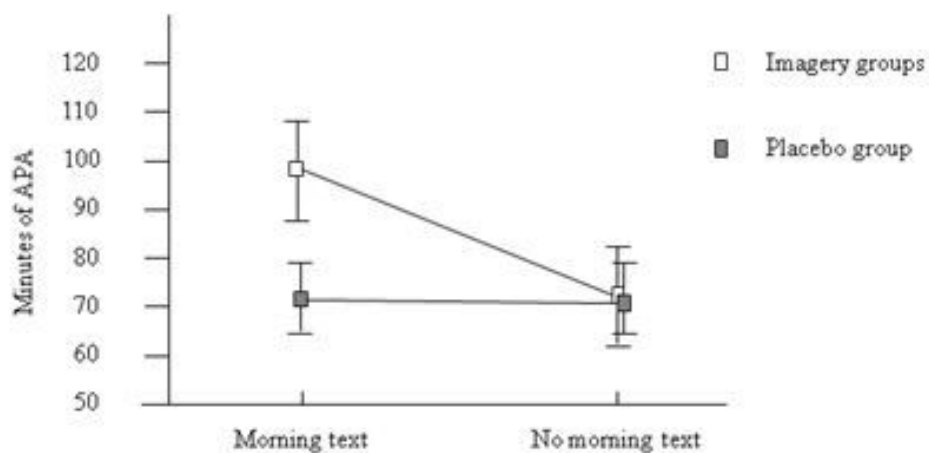
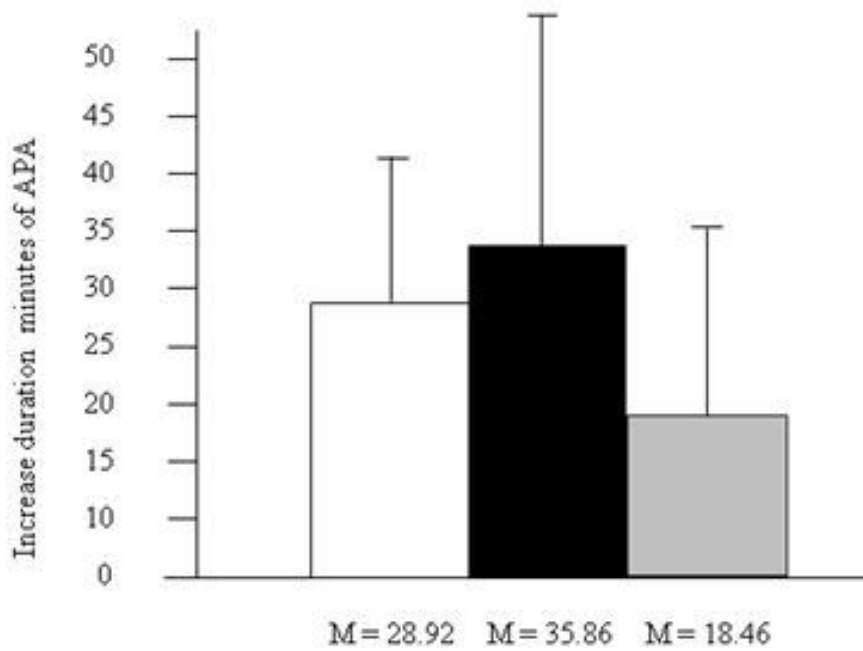


Figure 2. Significant interaction between condition (Morning text vs. No morning text) and groups (Imagery vs. Placebo) by ANOVA. I-beams indicates the 95% confidence intervals for the mean values.



*Figure 3.* Main effect of the High (white bars), Medium (black bars) and Low (grey bars) SIQ-MS groups on the increase of the duration of aerobic physical activity (APA). I-beams indicates the 95% confidence intervals for the mean values.