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# An external focus of attention enhances balance learning in older adults

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ABSTRACT

Studies with young adults have shown that an external focus of attention (i.e., on the movement effect) results in more effective motor learning and greater automaticity than an internal focus (i.e., on one's own body movements). The present study examined whether instructions inducing an external versus internal attentional focus would differentially affect the learning of a balance task in 32 older adults (24 females and 8 males, mean age: 69.4 years), divided equally, by number and gender, into two groups. The task required participants to stand on a balance platform (stabilometer) tilting to the left and right, and to try to keep the platform as close to horizontal as possible during each 30-s trial. The external focus group was instructed to concentrate on keeping markers on the platform horizontal, while the internal focus group was instructed to concentrate on keeping their feet horizontal. The dependent variable was time in balance (i.e., platform movements within ±5°). Participants performed 10 practice trials on day 1, with focus reminders given before each trial. Learning was assessed by a retention test, consisting of five trials without instructions, performed 1 day later. The external focus group outperformed the internal focus group in retention [$F(4, 120) = 3.46$, $p = .01$]. The results demonstrate that the learning benefits of an external attentional focus are generalizable to older learners.

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## 1. Introduction

With the proportion of older adults increasing in many industrialized nations [1], much research is being dedicated to understanding the changes that occur with aging. One area of decline seen in older people is the performance and learning of motor skills, including those requiring balance [2,3]. Loss of postural stability is a primary risk factor for falls [4]. Although most falls do not result in serious injuries, they will at least affect the individual's feelings of competence [5] and quality of life [6]. This illustrates the need for developing exercise or training strategies that can enhance balance in older people, and perhaps reduce their risk of falls.

One factor that has consistently been shown to enhance the performance and learning of motor skills, including balance skills, is the performer's focus of attention. Specifically, instructions or feedback that induce an external attentional focus – directing attention to the movement effects on the environment (e.g., support surface, implement) – have been found to result in more effective motor performance than those inducing an internal focus by directing attention to the body movements themselves, or no focus instructions [7]. This has also been shown for a variety of balance tasks [8,9]. For example, in studies in which participants were asked to learn to balance on a platform that tilts to the left and right (stabilometer), instructing them to concentrate on keeping markers attached to the platform horizontal (external focus) resulted in more effective learning than instructing them to concentrate on keeping their feet horizontal (internal focus) [10]. Importantly, external focus benefits have not only been shown relative to internal focus conditions, but also relative to control conditions [9,11]. This suggests that, left to their own devices, individuals tend to adopt less-than-optimal (possibly, internal) foci. A focus on the intended movement effect facilitates the utilization of unconscious or automatic processes, resulting in greater movement ease or fluidity [10,12]. Conversely, focusing on one's own movements leads to a more conscious type of control, thereby constraining the motor system and disrupting automatic control processes [10]. It has been shown that relative to an internal focus, an external focus reduces attentional demands and results in the utilization of fast reflexive (automatic) feedback loops [10].

Most studies have examined attentional focus effects in young, healthy adults. Given the apparent generalizability of the attentional focus effect across tasks and skill levels [7], we deemed it potentially fruitful and important to examine whether motor skill learning in older adults would also benefit from instructions inducing an external focus – particularly in light of balance issues facing many older people. To date, only a few studies examining attentional focus effects have used older adults (with Parkinson's

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disease or after stroke) as participants [9,13,14]. The results of those studies were in line with previous findings.

Nevertheless, it seemed important to further examine the generalizability of the benefits of an external focus to older adults without physical or mental impairments. Moreover, a limitation of previous studies with older (impaired) participants was that they examined only immediate effects of attentional focus on motor *performance*. That is, evidence that focus instructions have a more permanent effect on motor *learning* in older adults – as measured by delayed retention tests without instructions or reminders – is still lacking. The question whether older people would show differential learning as a function of instructions to focus externally rather than internally is not trivial. The learning of new (motor) skills is generally assumed to be "slower", that is, to require more practice time in older compared to young adults [15]. As a consequence, a state of automaticity in movement control is reached later. This slowing of learning has been attributed to various factors, including limitations in information processing [16], prolonged reaction and movement times [17], as well as the adoption of more conservative response strategies where accuracy is emphasized over speed [18].

Given the effectiveness and simplicity of directing learner's attention to the movement effect, the purpose of the present study was to determine whether older adults would show more effective learning after being provided external rather than internal focus instructions.

## 2. Method

### 2.1. Participants

Thirty-two older adults (24 females and 8 males, 60–85 years, average age: 69.4 years, SD: 6.57) participated in this study. They were recruited from a physical activity group for older adults from the university's extension program. All participants were volunteers, they had no prior experience with the task, and all gave their informed consent before participating in the study. The study was approved by the university's institutional review board.

### 2.2. Apparatus and task

The task required participants to balance on a stabilometer. The apparatus consisted of a wooden platform, 130 cm long × 140 cm wide, with a maximum deviation of 18° to the left or right side. The participant's task was to try to keep the platform as close to horizontal as possible during each 30-s trial. A safety harness that was suspended from the ceiling above the stabilometer was used to prevent participants from falling if they lost their balance (see Fig. 1). A millisecond timer measured time in balance (i.e., platform within ±5° of horizontal).

### 2.3. Procedure

Participants were assigned quasi-randomly to one of two groups, an internal and an external focus group (16 participants each), with the provision that an equal number of males and females be in each group. In the internal focus condition, participants were instructed to focus their attention on keeping their feet horizontal, while in the external focus condition they were asked to try to keep the markers in front of their feet horizontal. However, participants were asked to look straight ahead, while concentrating on their feet or markers, respectively. Attentional focus reminders were given before each practice trial. To prevent participants from falling, they were placed in a harness during each trial (Fig. 1). Each trial began with the platform touching the ground on its left side. Approximately 15 s before the beginning of each trial, the participant was instructed to step on

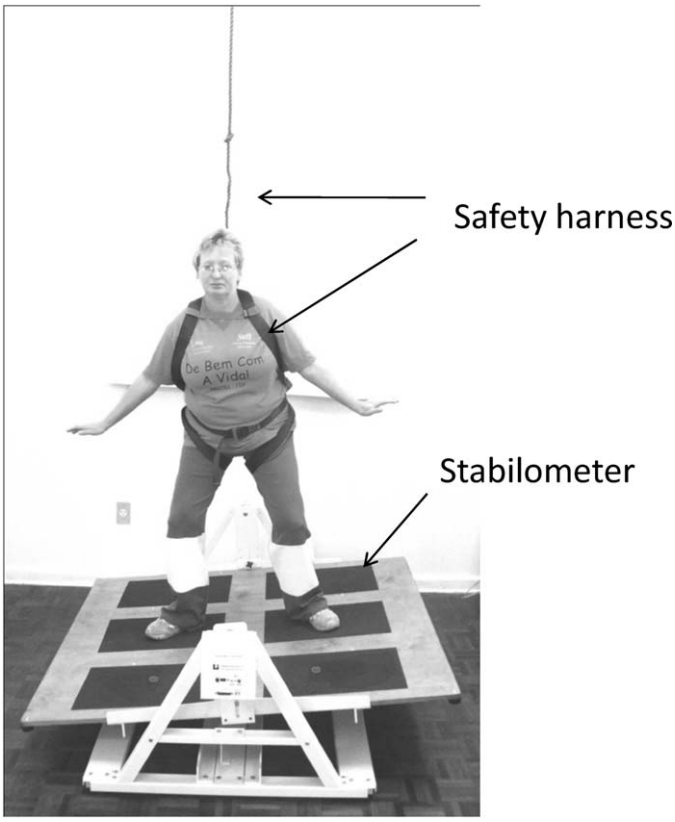


**Fig. 1.** Participant wearing a harness, balancing on the stabilometer.

the platform with both feet and to place one foot on each of two dots in the center of the platform. The participants' feet remained there for the duration of the trial. Two round orange markers (3 cm in diameter) were placed on the platform 22 cm from the front edge, 43 cm from the midline of the platform, and approximately 20 cm in front of the participant's feet. These were used as attentional cues in the external focus condition. Before the beginning of a trial, participants were instructed to keep the left side of the platform on the floor. Once a start signal was given, the participant began to move the platform and data collection began. After each trial, participants were given feedback about their time in balance on that trial. The practice phase consisted of 10 30-s trials, with a 90-s rest interval between trials. To assess learning effects as a function of attentional focus, a retention test without instructions, reminders, or feedback was conducted one day later. It consisted of five 30-s trials with 90-s breaks.

### 2.4. Data analysis

Time in balance on each 30-s trial was analyzed in a 2 (groups: internal versus external focus) × 10 (trials) analysis of variance (ANOVA) with repeated-measures on the last factor for the practice phase. Retention data were analyzed in a 2 (groups: internal versus external focus) × 5 (trials) repeated-measures ANOVA.

## 3. Results

### 3.1. Practice

Both groups increased their time in balance across practice trials, with the external focus group tending to show somewhat longer times (see Fig. 2, left). The main effect of trial was significant, $F(9, 270) = 7.29$, $p < .001$, $\eta^2 = .20$. The main effect of

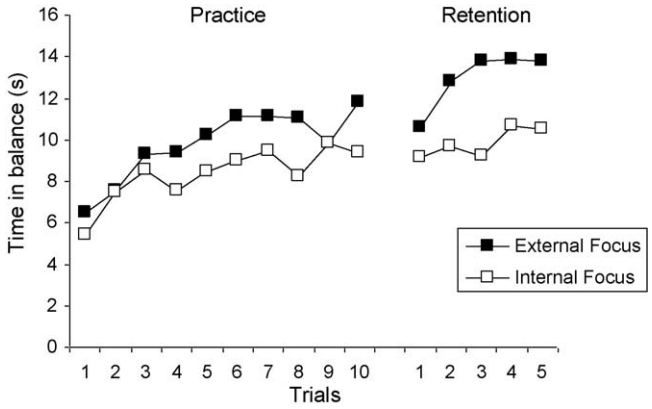


**Fig. 2.** Time in balance (s) for the external and internal focus groups during practice and retention.

group, $F(1, 30) = 1.70$, $p > .05$, and the interaction of group and trial, $F(9, 270) < 1$, were not significant.

### 3.2. Retention

Both the internal and external focus group continued to demonstrate increases in balance performance across retention trials (see Fig. 2, right). Yet, the external focus group was overall more effective than the internal focus group. Time in balance was significantly longer for the external focus group, $F(1, 30) = 4.54$, $p < .05$, $\eta^2 = .13$. Also, the main effect of trial was significant, $F(4, 120) = 3.46$, $p = .01$, $\eta^2 = .10$. The interaction of group and trial was not significant, $F(4, 120) = 1.12$, $p > .05$. Thus, the external focus instructions provided during practice resulted in more effective learning of the task than the internal focus instructions.

## 4. Discussion

In the present study, older adults were asked to learn a relatively challenging balance task requiring whole-body coordination. The results showed that participants generally increased their time in balance across practice trials. At the beginning of practice (trial 1), participants were in balance approximately 20% of the time (6 out of 30 s), but increased that time to almost one third of the time by the end of practice. Even though there were no significant group differences during practice, the external focus group clearly outperformed the internal focus group on the retention test. On average, the latter group was in balance 33% of the time on retention trials, whereas the external focus group was in balance 43% of thetime. Thus, the instructions directing participants' attention to the (external) markers, rather than their feet (internal), resulted in more effective learning. The benefits of external focus instructions are in line with previous studies, in which young adults served as participants [7]. The present findings appear to be the first ones demonstrating those benefits in older people.

The adoption of an external focus of attention has been shown to result in greater automaticity in motor control than a focus on the movements per se, resulting in greater movement ease or fluidity [10,12]. For balance tasks such as the one used in the present study, the frequency of movement adjustments (i.e., mean power frequency) has been found to be increased with an external relative to an internal focus [10,19] – suggesting that an external focus promotes the utilization of unconscious, fast, and reflexive control processes. It has been argued that an external focus speeds the learning process, such that higher performance levels are achieved sooner, and a state of automaticity is reached earlier [7]. The present findings suggest that appropriate instructions can promote a more automatic type of control not just in young participants, but also in older adults.

Several recent studies have provided evidence that movement efficiency, or the physical effort exerted to produce a given performance level or outcome, is also enhanced by an external focus. This is presumably due to a more efficient recruitment of motor units and minimization of co-contractions between agonist and antagonist muscle groups. As a consequence, greater maximum forces are produced [20,21], the same forces are produced with less muscular energy [20,22], and oxygen consumption for a given output is reduced [23]. Thus, an external focus seems to facilitate energy conservation. This can be particularly important when physical strength and endurance are declining as a function of age.

In practical settings that involve the (re-)learning of motor skills, including sports, music, or physical therapy, instructions that refer to the performer's body movements are common. It may therefore not be surprising that individuals spontaneously focus on their own movements when not given instructions [11,14]. Furthermore, older people are presumably inclined to be relatively cautious when confronted with novel and complex motor tasks, especially those involving balance. Higher anxiety and fear levels, and lower levels of self-efficacy, have been found to influence or correlate with the neuromuscular coordination or control of movement tasks and skills [24,25]. These findings are consistent with the idea that a focus on one's own movements (i.e., internal focus) is associated with more widespread, inefficient activation of the muscular system, disruption of automaticity, and the use of more conscious control over ongoing movement. The problem is that this does not result in optimal performance. Ironically, it even exacerbates postural instabilities and balance problems.

The findings of the present study have implications for practical settings that involve physical activities with older adults, including activity classes, exercise programs, or clinical rehabilitation settings. Instructors or physical therapists using optimal attentional focus instructions may contribute to enhancing their clients' actual competence as well as their feeling of competence. The result might be increased motivation to pursue or continue physical activities. Furthermore, and more specifically, a benefit of balance training with an external focus might be enhanced balance and perhaps a reduction in the risk of falls in older individuals.

## Conflict of interest statement

None declared.

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