Influence of visual illusion and attentional focusing instruction in novice motor performance

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To examine attentional focusing (AF) instruction mechanisms, the present study observed their novel interaction with a visual illusion environment. Wood et al. (2013) demonstrated longer quiet-eye durations and greater putting accuracy towards perceptually larger targets induced through Ebbinghaus illusion. Importantly, vision is proposed to mediate external focus benefits (e.g., Al-Abood, et al., 2002). De Fockert and Wu (2009) demonstrated that Ebbinghaus illusion effects are greater under high working memory load: greater resource availability supports selective attention efficiency. In line with this, recent AF explanations cite cognitive resources as potential mechanism: an internal focus uses greater working memory processing resources than an external focus (e.g., Poolton, et al., 2006). **Would the visual environment interact with the instructional context?**

Method

Participants: Twenty-six novice golfers volunteered to participate. Investigation approved by institutional ethics committee, written informed consent obtained.

Design and Task: In a 2 (Illusion type: perceptually smaller [PST] vs larger [PLT] target) X 3 (Attentional Focus Instruction: Control [C], Internal [In] and External [Ex]) within-subjects design participants completed 6 putts from a distance of 1.75m in each condition.

All control condition (C) putts were completed first to each target type. Order of In and Ex instruction was counterbalanced. Within each AF condition, order of target type was counterbalanced. Ebbinghaus illusion were projected onto an artificial putting green (Fig 1), participants putt towards center target.

Measures: Mean radial accuracy (cm) calculated for putts. In C, participants estimated target size by drawing the target from the putting position.

Instructions: Golf verbal instructions adapted from those used previously (e.g., Wulf & Su, 2007): Table 1.

Table 1: Attentional Focusing Instructions

Attentional Focus Instruction	
Control	"Putt to the best of your ability"
Internal	"Focus on the swing of your arms"
External	"Focus on the swing of the club"

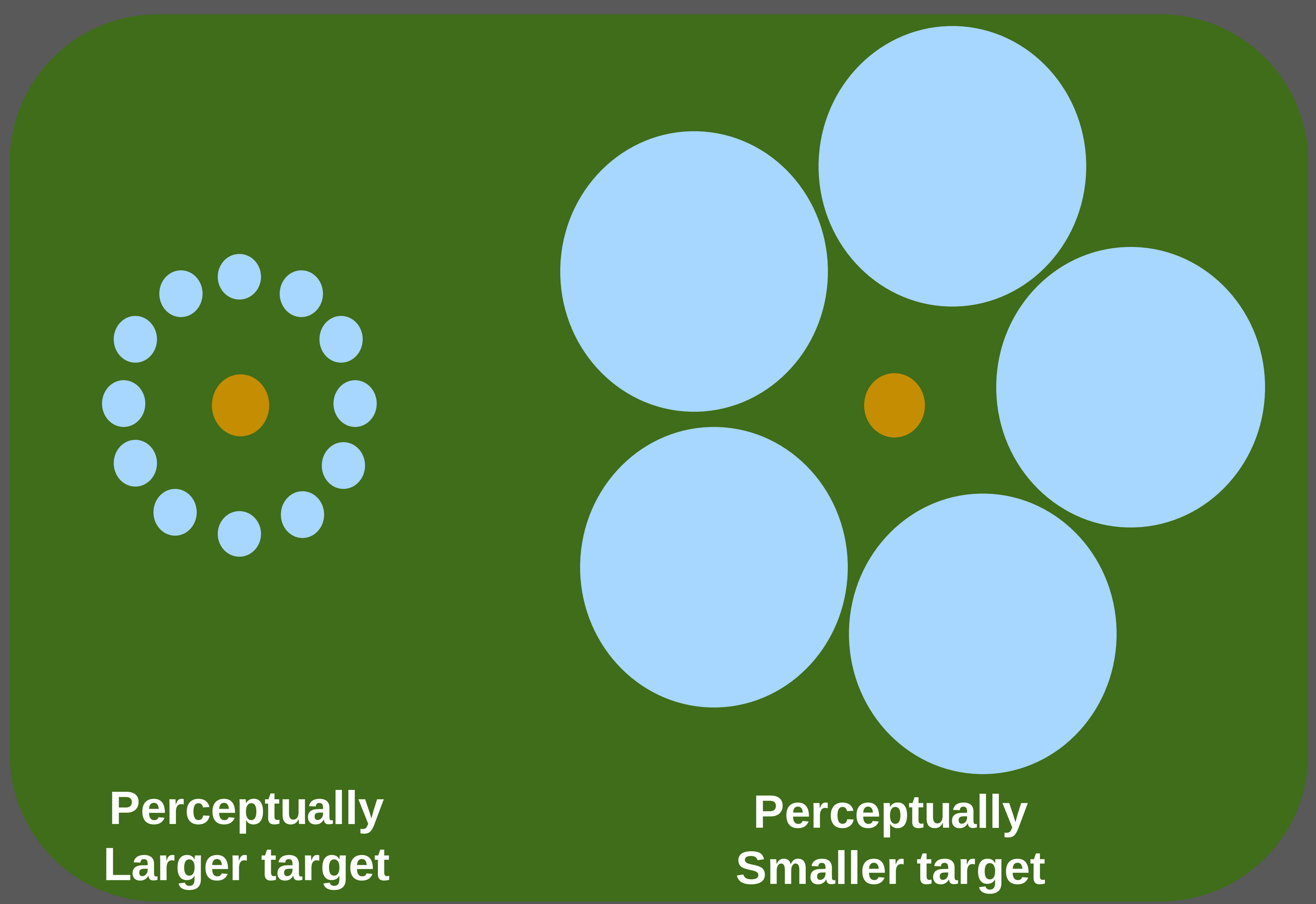

Fig 1: Ebbinghaus illusion targets. Participants putt towards center target.

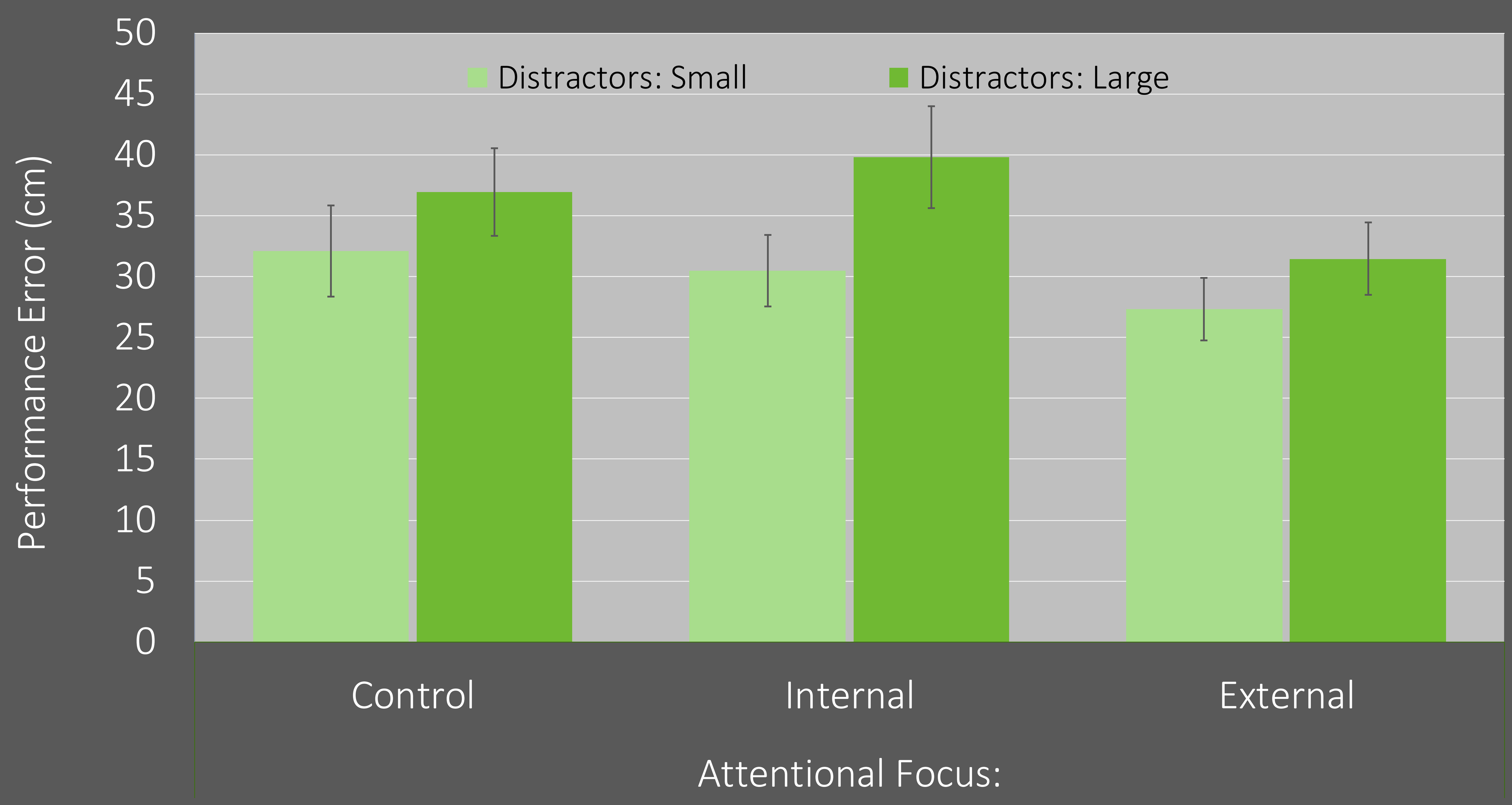

Fig 2: Mean (±SE) performance error for each focus and illusion condition.

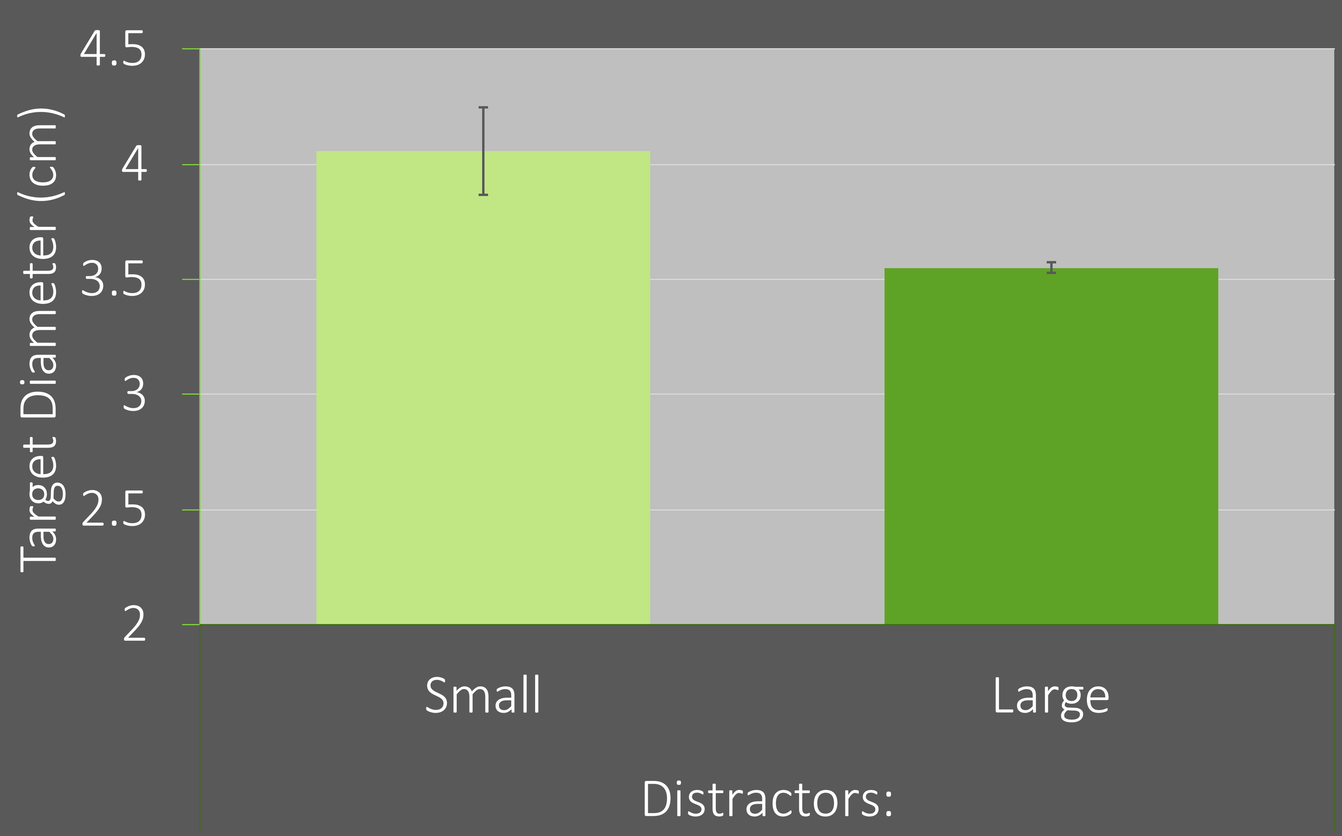

Fig 3: Mean (±SE) target size estimation for each distractor size.

Results

- **Putting Accuracy**: 3 (Attentional Focusing Instruction) X 2 (Illusion Type) repeated measures ANOVA: Significant main effect of AF on putting accuracy ($F_{(2, 42)} = 3.65$, $p = 0.04$, $\eta p^2 = 0.15$), Contrasts: accuracy in C ($F_{(1, 21)} = 4.87$, $p = 0.04$, $\eta p^2 = 0.19$) and IF ($F_{(1, 21)} = 6.48$, p = 0.02, $\eta p^2 = 0.24$) was significantly poorer than EF. C and IF not significantly different ($p = 0.80$). Significant main effect for Illusion condition on accuracy ($F_{(2, 42)} = 14.92$, $p = 0.001$, $\eta p^2 = 0.42$). No significant AF and Illusion interaction. Greater effect sizes suggest a greater influence of visual illusion during IN. (Fig 2)

- **Perceived Target Size**: participants perceived the target with smaller distractors to be significantly larger (M = 4.06cm, SE = 0.19) than the target with larger distractors (M = 3.55cm, SE = 0.023) (t(21) = -2.58, p = 0.02, medium effect size, 0.48. (Fig 3)

Discussion

- Performance was independently affected by AF instruction (i.e., External vs Internal) during novice performance (consistent with Wulf & Su, 2007) and whether the visual context of the target induced different perceptions of target size (consistent with Wood et al. 2013). AF instruction and perception impact different mechanisms in motor execution: instructions appear to influence the online control of movement whereas the target perception informs motor planning.
- A potentially greater influence of visual distractors during IN conditions suggests a greater load on working memory when internally focused.
- **Changing the instructed attentional focus and perceptual environment in combination impacts motor performance, with potential benefits to learning to be explored.**

References

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