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# Exploring visual feedback modalities in Augmented Reality to control the walking speed. Feasibility study

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## 1. Introduction

Serious games (SG) can improve gait rehabilitation. [1] In an augmented reality environment, the real time visual feedback modalities can be multiple [2]. This study aims to test the feasibility of the protocol to compare the effect of three visual feedback modalities on reaching and exceeding a target walking speed.

## 2. Research Question

Is the study design adapted to test if there is a feedback modality that optimize the control of gait speed?

## 3. Methods

The SG has been developed for Microsoft Hololens Augmented





Mini Game	Focus of attention		Frame of reference		Challenging	
	Knowledge of Performance <i>(relative to the quality of movement)</i>	Knowledge of Result <i>(relative to the aim -reach or not-)</i>	Body-locked <i>(Content attached to the gamer)</i>	World-locked <i>(Content attached to the world)</i>	Yes <i>(Game)</i>	No <i>(No Game)</i>
	Current speed		3 m in front of the gamer			No
	Current speed		3 m in front of the gamer		Yes	
		Succeed/Failure relative to the target speed	3 m in front of the gamer			No
		Succeed/Failure relative to the target speed		Speed of the content is the target speed		No

Fig. 1. Description of tested Mini Game with conceptual framework of feedback modalities for AR display.

Reality (AR) headset. The target speed (mean maximum walking velocity on 20 meters) of fifteen participants was recorded during a calibration trial. Each participant then tested randomly four mini games plus the control on 30 meters (Fig. 1). Displacement of the participant was recorded (100 Hz) with the Hololens. [3] Time spent above the target speed and mean speed were compared between feedback modalities.

#### 4. Results

There was a significant difference between feedback modalities for the difference between mean speed and target speed ( $p < 0.001$ ). The combination of Knowledge of Result, World-locked content, and challenging game seemed to be the best way to exceed the target speed (percent of time spent above target speed of  $78\% \pm 18\%$ ). The distance difference between the calibration trial and the test trials is not enough, all the participants succeed in reaching their target speed with the control condition (without feedback).

#### 5. Discussion

Visual feedback modalities in AR have a real time effect on the controllability of the walking speed. The future study should include a harder task of walking speed. It should be interested to calibrate the target speed using the Muscle-Power-Sprint-Test [4] and to test the feedback modalities on 30 meters.

#### References

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