1 Introduction
Exoskeletons exist for i.a. reducing metabolic cost, but often the ankle joint is neglected. Our ankle-foot exoskeleton reduced metabolic cost via optimal bilateral push-off timing [1]. However, push-off work was not held constant, which influences metabolic cost [2]. Unilateral exoskeleton assistance could be useful for restoring symmetry in pathologies with unilateral impairments (e.g. hemiplegia). As a first step towards clinical use of unilateral assistance we wanted to study the effects of unilateral assistance and asymmetry in healthy subjects.

2 Methods
13 healthy adults (♂) walked with an ankle-foot exoskeleton that can assist plantarflexion [2]. The experiment consisted of unilateral or bilateral assistance in 9 conditions of various push-off timings (35, 43, 50 stride%) and work rates (maximal, half). Unpowered walking acted as control. Conditions were randomized. Metabolic cost was determined via indirect calorimetry. Trials were compared using RM ANOVA (α=0.05).

3 Results
Figure 1 shows net metabolic cost reduction in all conditions (p < 0.01), with larger bilateral (-11 till -15%) than unilateral (-6 till -9%) reductions. Power variations in the bilateral trials resulted in equal energetic demands. However, low power gave the highest reduction normalized versus work rate. Dominant and non-dominant unilateral leg assistance did not differ.

4 Discussion
Results concur with previous exoskeleton experiments, although the optimal timing was earlier than the existing guideline (~43%) [1]. Heavier subjects and a larger exoskeleton maybe led to different work profiles that could have altered the optimum.

5 Conclusions
Push-off timing and mechanical work rate seem crucial elements for a more efficient gait. Leg dominance does not seem to interact with metabolic consumption through unilateral ankle support in the abled-bodied.

6 Prospects
Further data analysis includes electromyography, kinematics and gait symmetry evaluation. Latter will respectively offer insights into possible lowered muscle activation, different joint angles and potential asymmetry accompanied by a metabolic penalty.

7 References