

# DECOUPLING OF SYNERGISTIC MOVEMENT PATTERNS WITH GRAVITY COMPENSATION AND VIRTUAL REALITY IN CHRONIC STROKE PATIENTS

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## INTRODUCTION

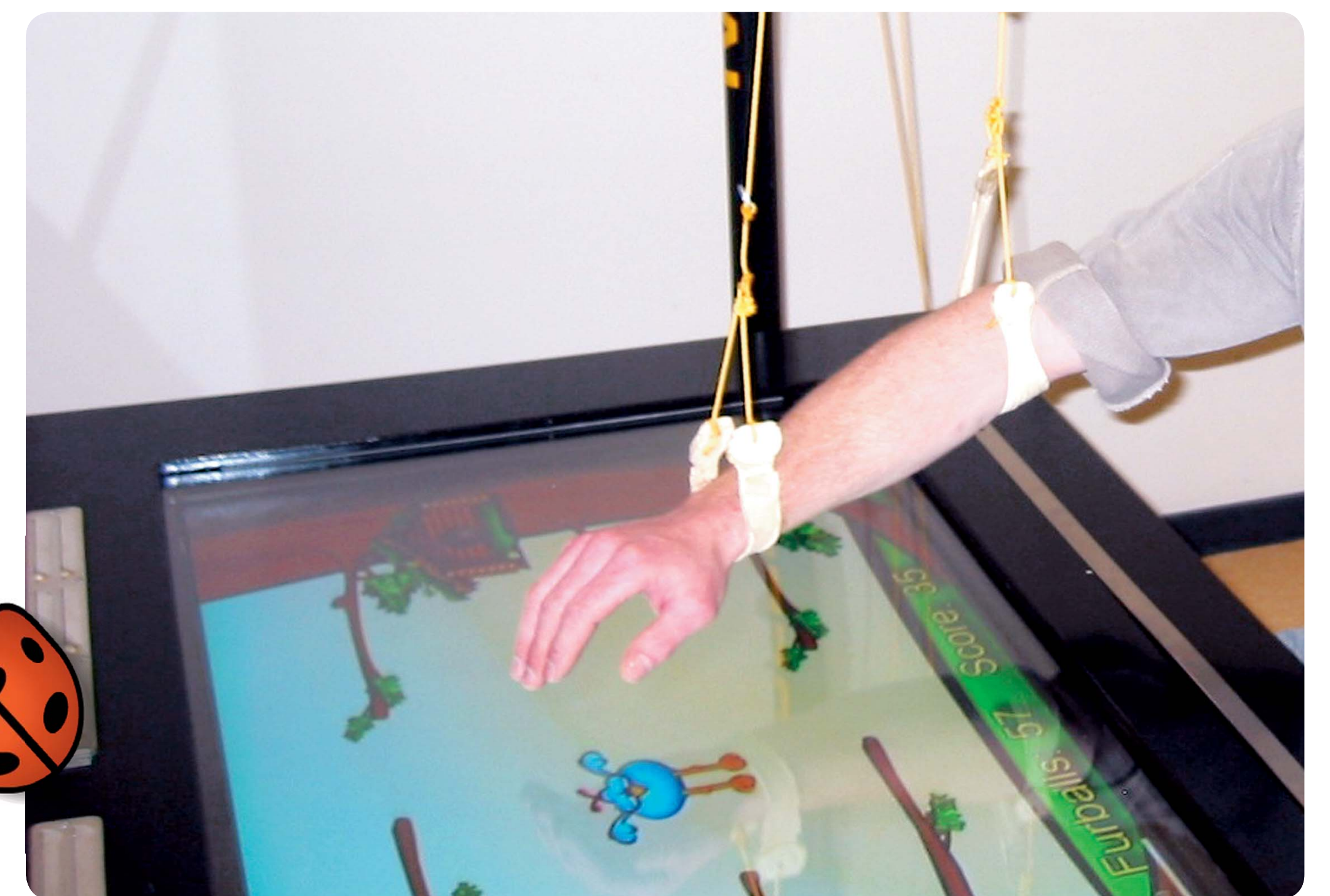
Stroke is one of the main causes of disability in Europe. Damaged brain tissue often results in synergistic instead of selective activation of muscles which limits the ability to perform isolated movements. As a result, many stroke patients have limited functional use in their affected arm. Recent studies showed instantaneous decoupling of synergies during maximal forward reaching when gravity compensation was applied. This decoupling was indicated by an increased range of motion while muscle activation decreased, compared to the unsupported condition.

## GOAL

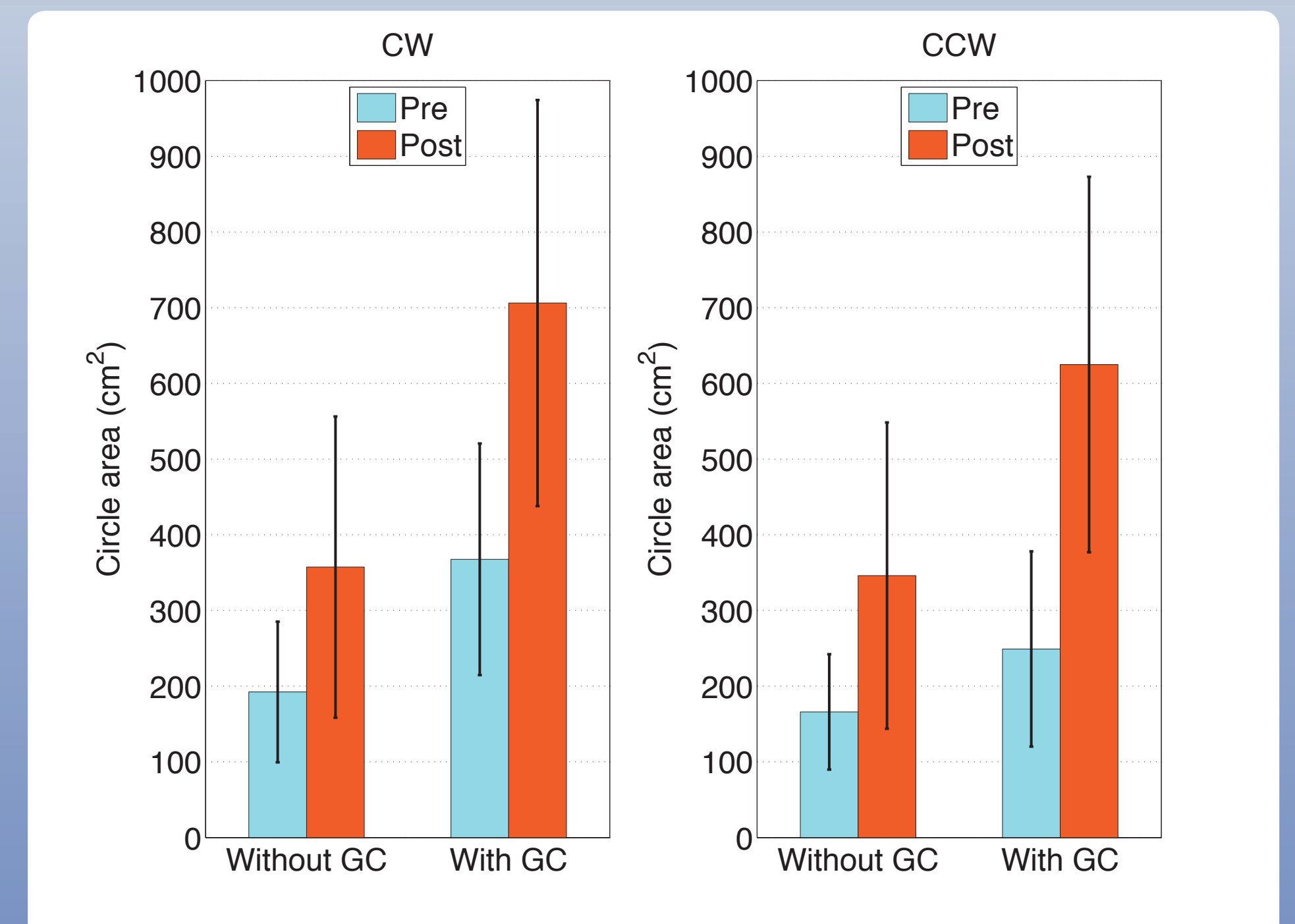
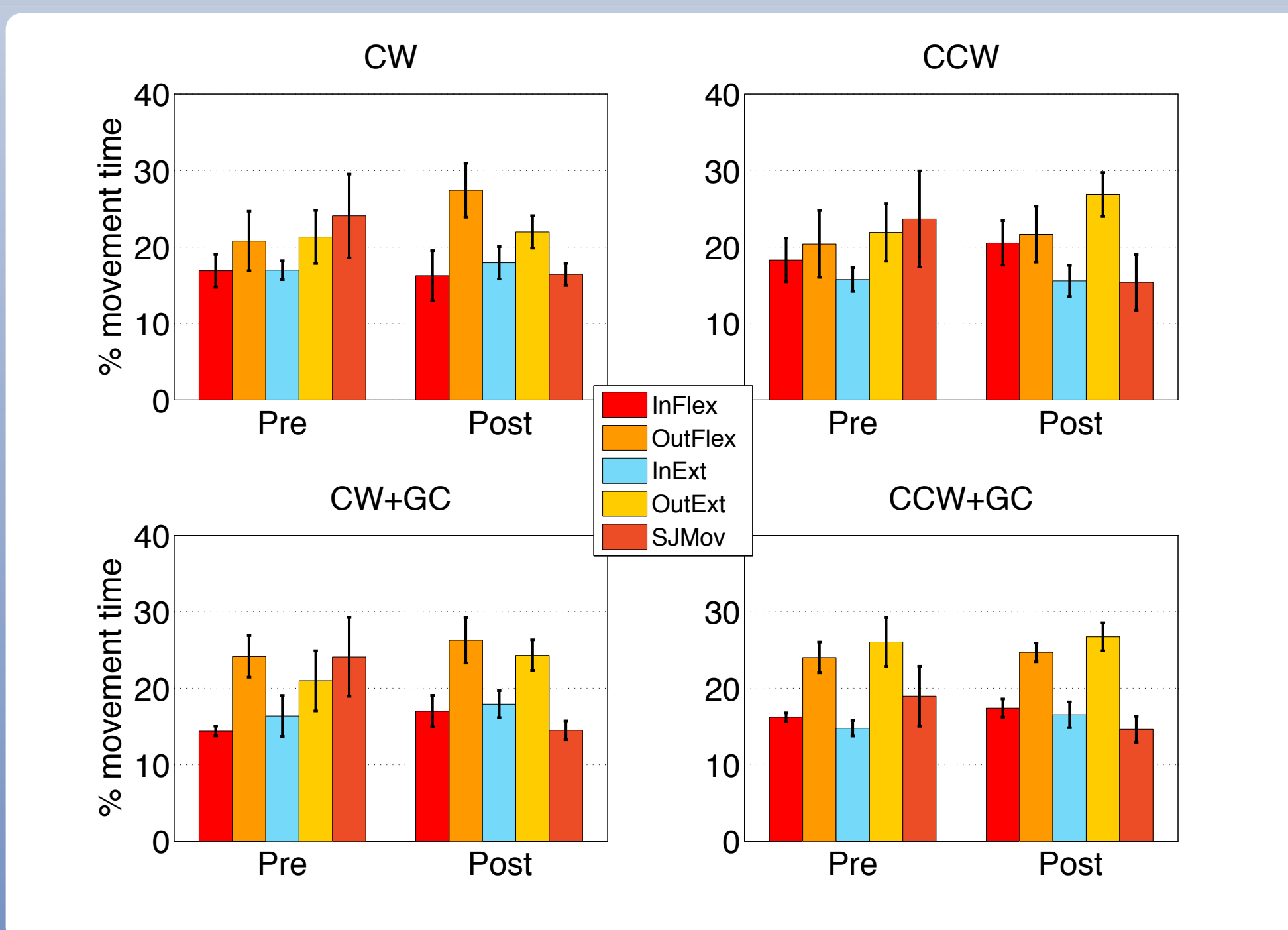
The goal of this explorative research project is to study whether training in a gravity compensated, virtual reality augmented environment can lead to decoupling of concurrent shoulder and elbow movements.

## METHODS

Four chronic stroke patients with moderate to severe hemiparesis were recruited at rehabilitation centre 'Het Roessingh' and received 18 sessions of 30 minutes arm training during a period of six weeks. During training a game named 'FurballHunt' was played, in which the user performed goal-directed reaching movements in the horizontal plane. During the game the arm was supported by a device named 'Freebal'. During pre and post training evaluation sessions, subjects drew clockwise (CW) and counter clockwise (CCW) circles in the horizontal plane, both with and without gravity compensation. Concurrent shoulder abduction/adduction and elbow flexion/extension characterizes movement within and out of synergistic patterns.



Gravity compensation and virtual reality



## RESULTS

- Increased active range of motion
- Increased ability to move out of flexion synergy during CW circle drawing
- Increased ability to move out of extension synergy during CCW circle drawing
- Decrease of single joint movements after training.

## CONCLUSIONS

Instantaneous decoupling of synergistic movement patterns by gravity compensation  
Training in a gravity compensated environment may also induce decoupling of synergistic movement patterns.

The use of virtual reality and gravity compensation in upper extremity post stroke rehabilitation is promising. Training in a gravity compensated environment can lead to decoupling of synergies during unsupported movements. As a result the active range of motion is increased, which can lead to functional improvement of the affected arm.



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