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# Usability of a user-centered virtual reality system for upper limb motor rehabilitation in chronic stroke patients



AG. Grosmaire, L. David, T. Koeppl, G. Bouyer, S. Otmane, O. Pila, C. Duret

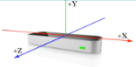
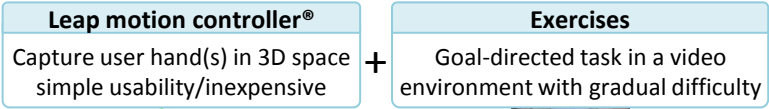
## CONTEXT

**Stroke** → 2/3 patients with persistent upper limb motor **impairment**  
**Nonlinear pattern of motor recovery** → >M6-M12: **decline**, especially post-discharge  
**Effect of community-based therapy at post-discharge** → **Ineffective** on motor impairment  
**Value of new technologies in self-rehabilitation** → Enhance **motivation**; Interactive with **feedback**; easily **transportable**; **suitable** at home; **intensive training** based on motor learning principles  
**Objective:** To assess the **usability of a Virtual Reality (VR)-based program** using a Leap Motion Controller® designed to train pronation-supination movements in chronic patients following stroke

## METHODS

**Demographics:** N=28 (10 F/18 I), Age: 53 ± 15y (Mean ± SD)  
 Time since stroke: 71 ± 51mo, FMA score: 49 ± 8pts

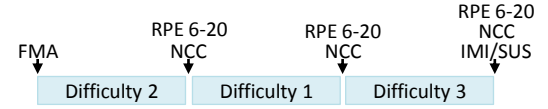
### VR-based program:



**Intervention:** 1-day session, forearm pronation/supination tasks with 3 randomized difficulty levels (1,2, 3)

### Evaluations:

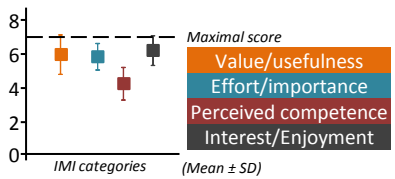
- Fugl-meyer assessment (FMA)
- Rating of perceived exertion (RPE 6-20)
- Number of coins collected (NCC)
- System usability scale (SUS)
- Intrinsic motivation inventory (IMI): Value/usefulness, interest and enjoyment, perceived competence and effort/importance



## RESULTS

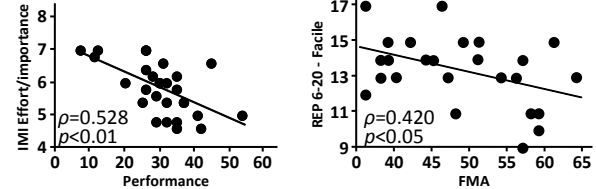
**System usability scale (/100): 79 ± 15** → **Excellent usability** using the VR-based program

### Intrinsic motivation inventory



→ **Good subjective experience** related to the VR-based program

### Correlations



→ The more the patients **succeeded** the task, the **lower** was the perceived effort. The more the patients are **disabled** the more the perceived exertion was **greater**

## CONCLUSION

- **Excellent usability** of the VR-based program / **user-centered** approach
- Intensive training (effort) related to the **difficulty**
- **Motivation ++** → long-term rehabilitation program and long-term participation
- **Close collaboration** between engineers and clinicians ++ in interface conception

**Perspectives** → Development of various therapeutic games/ to launch a RCT study