



CENTRE NATIONAL
DE LA RECHERCHE
SCIENTIFIQUE



Fear of falling in multiple sclerosis

A sequential treatment with Virtual Reality and
Interactive Games

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Fear of falling in neurological diseases as a paradigm (combined anxiety)

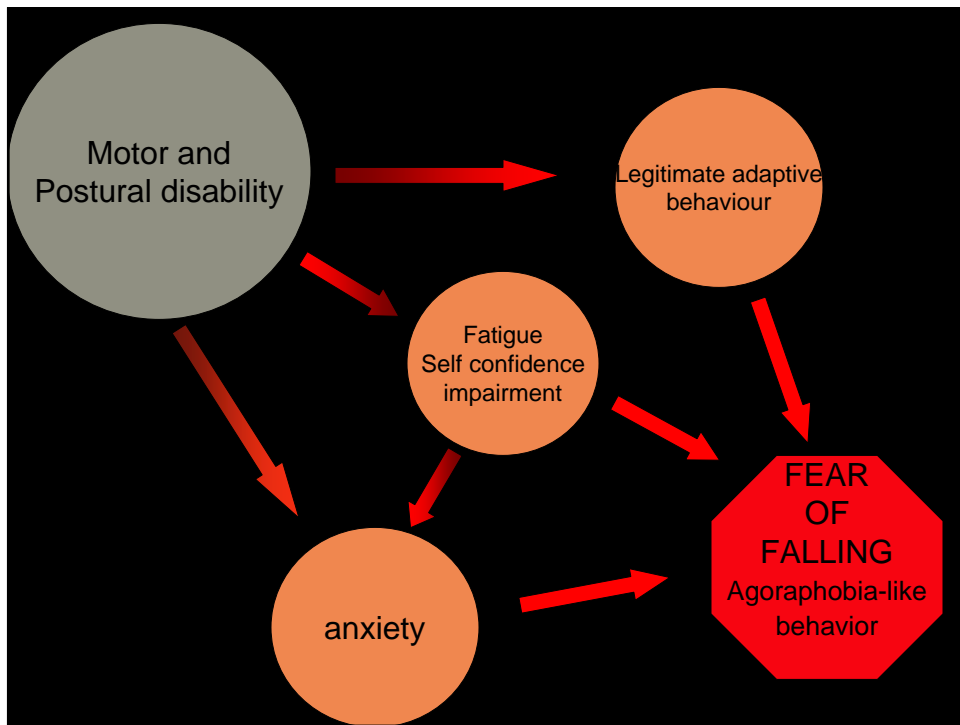
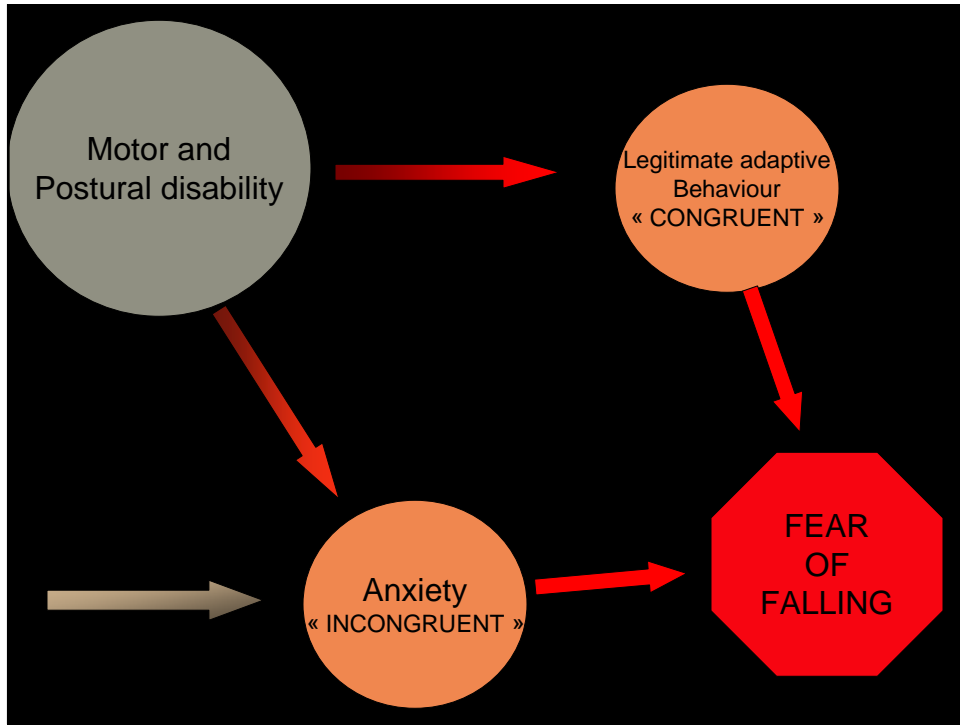
Fear of falling (FOF) is a frequent phobia

- older adults
- patients with neurological impairments

multiple sclerosis (MS)

FOF in MS is

- a “rational” emotion (congruent with imbalance and motor symptoms)
- and sometimes a pathological fear (uncongruent with neurological symptoms)



The hierarchical integration

Perception and regulation of gait

- low levels of integration
 - vestibular (balance, ...)
 - proprioceptive
 - visual ++ (sensorial conflicts,..)
- high levels
 - cognitive
 - emotional

Design

FOF and associated agoraphobia must be addressed
For treatment, combined patterns have to be disentangled.

Planning two sequential mechanisms of action in treatment

- Top-down high level of integration
 - Non related with motor symptoms (beliefs)
- Bottom up level
 - Related with postural imbalance

PILOT OPEN STUDY

Population

- To be eligible for the study patients have to be
- able to walk independently or with assistance
 - without relevant cognitive impairments
 - Mild to moderate MS

11 patients are recruited so far

Population

<i>Patients</i>	<i>Age</i>	<i>Sex</i>	<i>EDSS</i>
OS	27	M	6.0
HR	32	M	3.5
CA	38	M	6.0
NB	40	F	2.5
GM	40	F	6.5
IT	41	F	4.0
GA	44	M	5.0
JM	44	M	4.0
DG	56	F	6.0
BS	58	M	6.0
LL	67	F	5.0

Design of the study

One session per week during 10 weeks:
For each session, a sequential treatment

- 1 "Pure Mental recalibration ": *Virtual navigation (15-20min) without real exposition to imbalance deficit .*

(5 different environments)

- 2 Transfert: virtual and real/ exposition
Interactive multimedia exercises (25-30min)
(Eye Toy & Dance mat)

RATINGS

before & after intervention

Fear of falling (Velzo & Peterson, 2001)

Quality of life (Marks, 1993)

Handicap linked to the phobia (Sheehan, 1983)

Expanded Disability Status Scale (EDSS) (Kurtzke, 1983)

Clinical Global Impression (CGI)

Video films

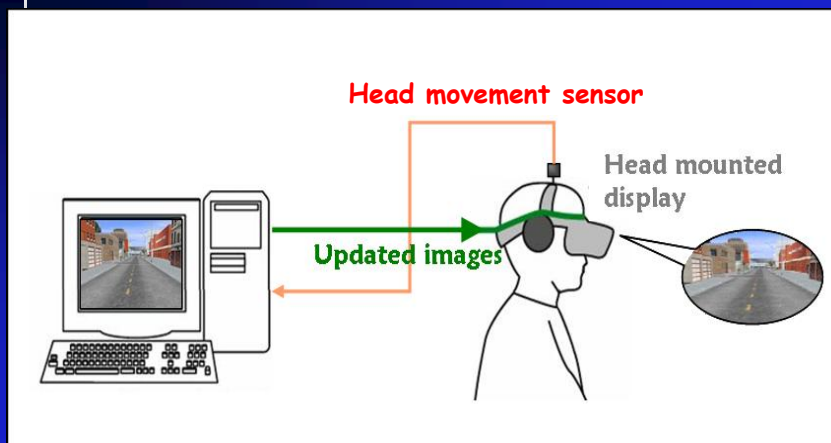
VR navigation: phase 1

Pure Mental simulation of walking:
patients seated during navigation (to avoid
“bottom-up reinforcement factors “ of fear)

Visual Training of the perception of fluid walk

Possibility to practice *virtually* complex motor
exercises (go up/down stairs)

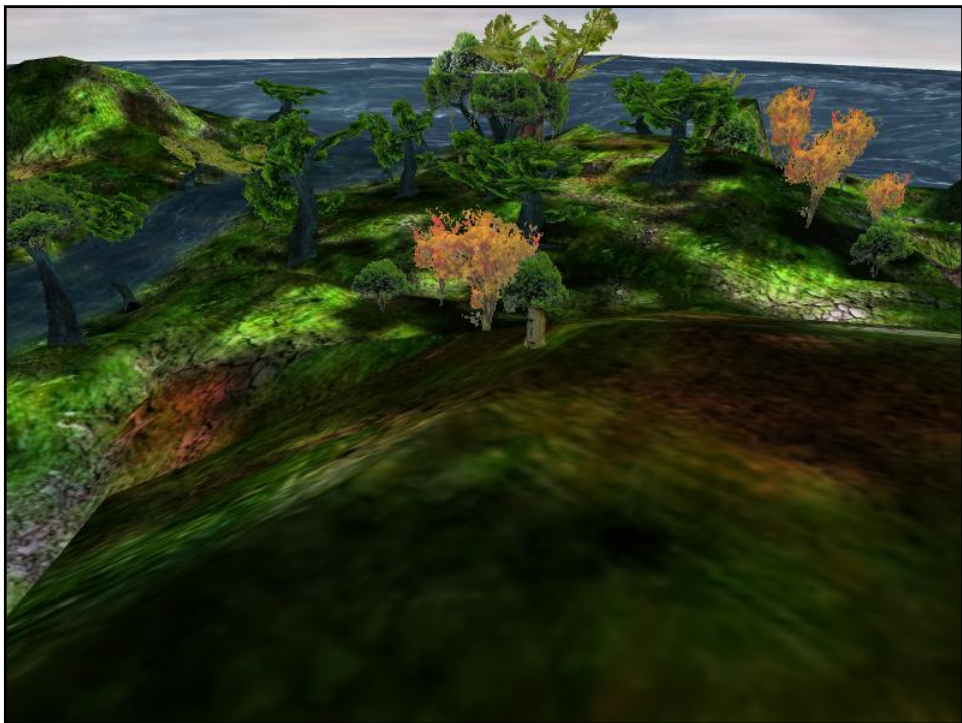
Virtual reality display

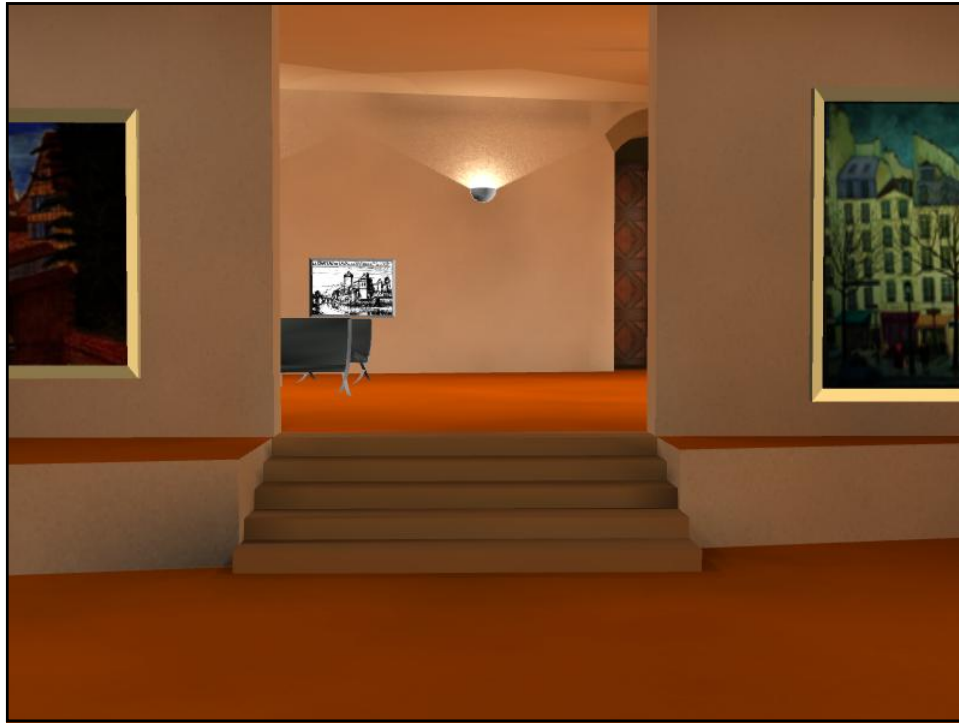




During this first step, patients seated in order to optimize pure mental recalibration, without postural implication.





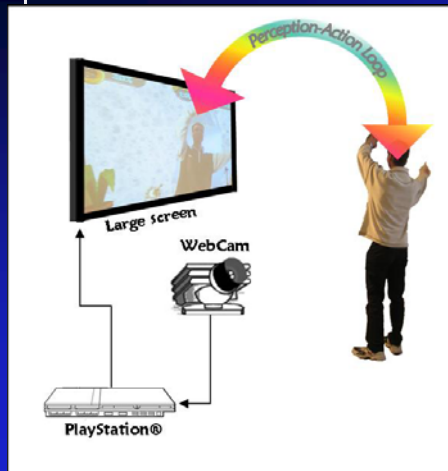


Phase 2A: The perception-action recalibration

Dance mat (gait and balance)

- Lower limbs movements according to the task visually suggested on the screen
- Visual-motor coordination reinforcement
- First **Ecological reintegration** of previous virtual recalibration

Phase 2B: The perception-action recalibration: mirror play, self and agency integration



- Upper & lower limbs movements according to the auditory-visual context presented in the exercise
- Visual representation of the body of the patient allows a real-time monitoring of action
- Self-seing (movements and translations) increases agency integration (knowing of self attribution of action)

Results (1)

Measures	Number of patient improved /10
FOF (FFM)	9/10
Global state CGI	7/10
Quality of life	8/10
Handicap linked to phobia	8/10
EDSS (motor)	4/10

Results (2)

- ⇒ MS Patients are more frequently improved on FOF than on motor impairment
- ⇒ Both effects are not closely related (except for 3 of 10)

Conclusion & Perspectives I

It is a pilot open study, unable to strongly establish the interest of this design
VR + IME allow the management of
Cognitive & Emotional component in MS patients with FOF through the involvement of the body
However, several patients described a global, large cognitive as well as emotional effect

After treatment

Patient's comments:

"when I felt I was afraid to move, I mentally visualized the arrows and it helped me to make the first step, then I could continue my way"

"When walking became difficult, I remember the virtual walking and all what I was able to do..."

"...now I can cross roads without panic"

Conclusion & Perspectives II

Need for theories ...

- physiopathology
 - sharing of neural mechanisms between sensorimotor processes and higher level cognitive processes
 - early processes of reactivation of fear
- implicit mechanisms of therapeutic effect
 - "de-embodiment of fear"?