

# CAN EXERGAMING REDUCE THE DUAL TASK COSTS OF PERSONS WITH AND WITHOUT A FALL HISTORY?

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# Background

- ❖ Increased fall risk by reduced balance and slow walking speed (AGS & BGS, 2011)
- ❖ Decreased performance under dual task conditions (Yogev-Seligmann et al., 2008)
- ❖ Gait speed under single and dual task conditions predicts falls (Menant et al., 2014)
- ❖ Interventions (Plummer et al., 2015)
  - reduce fall risk
  - improve cognitive function,
  - single task gait,
  - dual task gait speed, and
  - DTC on gait speed



# Hypothesizes

- ❖ Fallers have a slower gait speed and poorer cognitive function under single and dual task condition
- ❖ Video-based physical training improve gait speed and cognitive function under single and dual task condition
- ❖ Fallers profit more from training than non-fallers

# Gaps

- ❖ Effects on cognitive task
- ❖ Effects of video-based exercises

# iStoppFalls - ICT based System to Predict & Prevent Falls

## ❖ Funding



## ❖ Consortium



Deutsche  
Sporthochschule Köln  
German Sport University Cologne



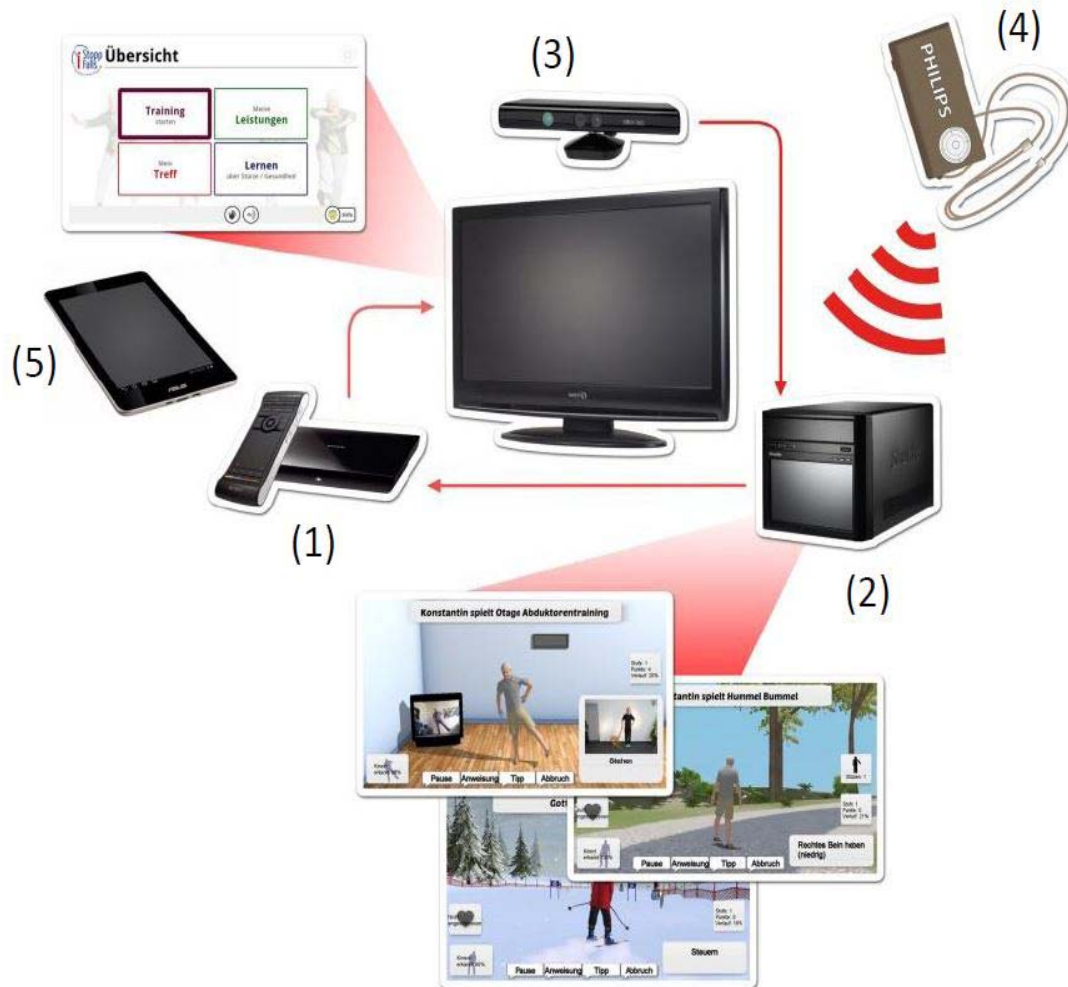
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# Methods



System Components:

- 1) Set-Top-Box (iTV)
- 2) Mini-PC (Exergame)
- 3) Kinect Gesture/Voice)
- 4) Senior Mobility Monitor (SMM)
- 5) Tablet (Diary, Control)

# Methods - Intervention

## ❖ Video-based iStoppFalls program

- Balance and strength exergames (criteria Otago, WEBB)
- Ankle weights, dual task
- 3 hours/week, 4 months



# Methods - Assessment

- ❖ 10 m walk at habitual speed [sec.] [m/s]
- ❖ Counting backwards by 3 [numbers] within 30 sec. and gait time
- ❖ Gait speed while counting backwards [sec.] [m/s]
- ❖ Counting backwards while walking [numbers]
- ❖ dual task costs (DTC)=  
[100 \* (single task score – dual task score)/single task score]
- ❖ mDTC: (DTC 1 + DTC 2) / 2

## Methods - Sample

- ❖ 153 persons randomly assigned to intervention (IG) or control group (CG)
- ❖ 15 dropouts (IG): health/medical, system-related, going away, moving furniture, no more time, not motivated, family
- ❖ 135 persons with complete data sets
- ❖ 33 % (n=44) fallers (IG: 52 %; CG: 48 %), 1-2 times: n=35



# Methods - Sample

	Faller	Non-Faller	p
Age (mean, SE)	73,5 (5,9)	74,6 (6,1)	.313
Female (% , n)	77 (34)	51 (46)	<b>.005</b>
BMI	25,9 (4,1)	26,5 (3,8)	.424
Years of education (mean, SE)	11,3 (4,1)	11,0 (5,2)	.640
Hearing impairment	30 (13)	31 (28)	1
Comorbidities	3,2 (1,4)	2,9 (1,3)	.199
Drugs per day	4,1 (3,3)	2,7 (2,5)	.020
Pain feet (% , n)	25 (11)	20 (18)	.508
Pain knee/leg (% , n)	49 (21)	40 (36)	.352
Concerns falling (mean, SE) [Icon-FES]	17,0 (6,3)	14,7 (3,6)	<b>.038</b>
Physical activity (mean, SE)[PAQ; h/w	37,3 (12,9)	47,2 (25,3)	.107
IPEQ; h/w]	25,5 (18,4)	26,9 (17,2)	.747
Fall risk (PPA score)	0,7 (0,8)	0,5 (1,0)	.220

# Results – T1

	Faller	Non-Faller	p
10 m Gait time [s]	9.02 (2.21)	8.52 (1.65)	.147
10 m Gait speed [m/s]	1,16 (0,23)	1,21 (0,23)	.220
Gait time (under dt 3-back) [s]	11.60 (4.05)	11.75 (3.91)	.843
Gait speed (under dt 3-back) [m/s]	0.95 (0.29)	0.93 (0.28)	.761
3-back (within gait time) [#]	3.84 (2.11) <sup>1</sup>	3.45 (2.17) <sup>2</sup>	.325
3-back (under dt gait) [#]	4.45 (2.49) <sup>3</sup>	4.20 (2.20) <sup>4</sup>	.544
DTC Gait [%]	27,99 (28,94)	36,77 (33,16)	.136
DTC 3-back [%]	19,09 (59,78)	41,79 (104,54)	.206
mDTC [%]	22,22 (31,65)	38,47 (55,80)	<b>.044</b>

<sup>1</sup> n=4 not able to count backwards

<sup>2</sup> n=10 not able to count backwards

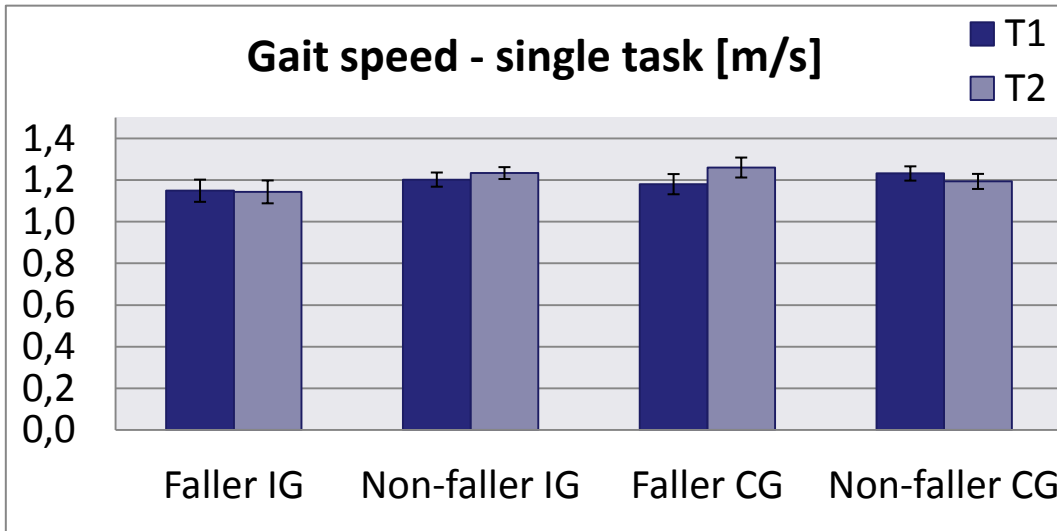
<sup>3</sup> n=1 not able to count backwards

<sup>4</sup> n=1 not able to count backwards

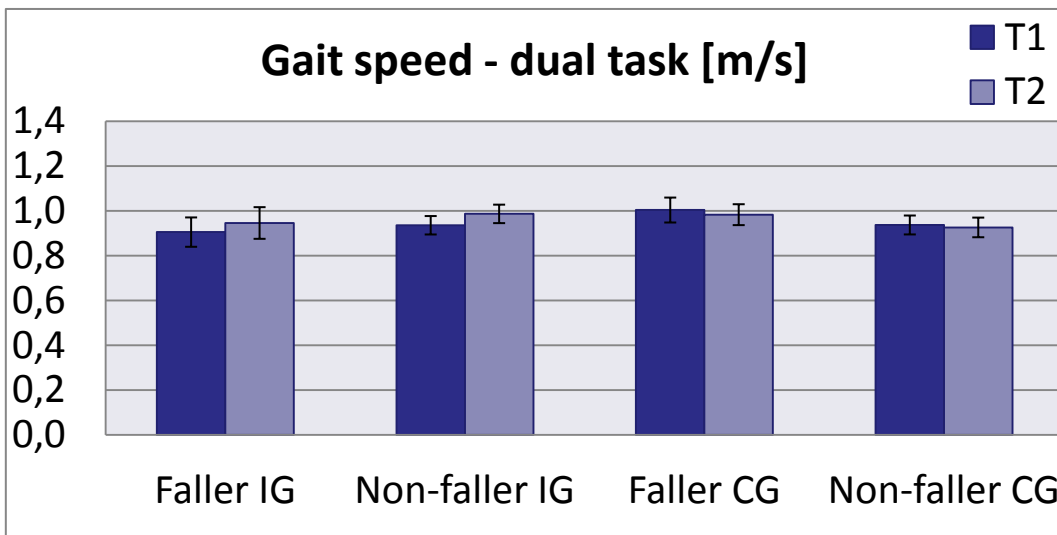
# Results – changes

	Intervention group		Control group	
	Faller (n=23)	Non-Faller (n=47)	Faller (n=21)	Non-Faller (n=44)
10 m Gait time [s]	0,35 (0,74)	-0,34 (1,40)	-0,53 (1,16)	0,35 (1,21)
10 m Gait speed [m/s]	-0,52 (2,38)	0,03 (0,18)	0,07 (0,13)	-0,04 (0,15)
Gait time (under dt 3-back) [s]	-0,01 (0,09)	-0,68 (2,36)	0,08 (2,88)	0,32 (3,16)
Gait speed (under dt 3-back) [m/s]	0,04 (0,24)	0,05 (0,17)	-0,04 (0,21)	-0,02 (0,20)
3-back (within gait time) [#]	0,78 (1,88)	0,74 (2,35)	0,80 (1,91)	0,39 (1,78)
3-back (under dt gait) [#]	0,22 (2,84)	0,81 (2,60)	0,75 (2,29)	-0,20 (1,98)
DTC Gait [%]	-5,9 (31,7)	-3,5 (26,3)	9,6 (31,5)	-1,9 (34,2)
DTC 3-back [%]	-8,2 (94,1)	9,2 (118,8)	-10,3 (82,8)	-26,3 (173,4)
DTC [%]	-9,8 (41,5)	-3,1 (44,5)	7,7 (53,4)	-21,0 (77,1)

# Results – Gait speed

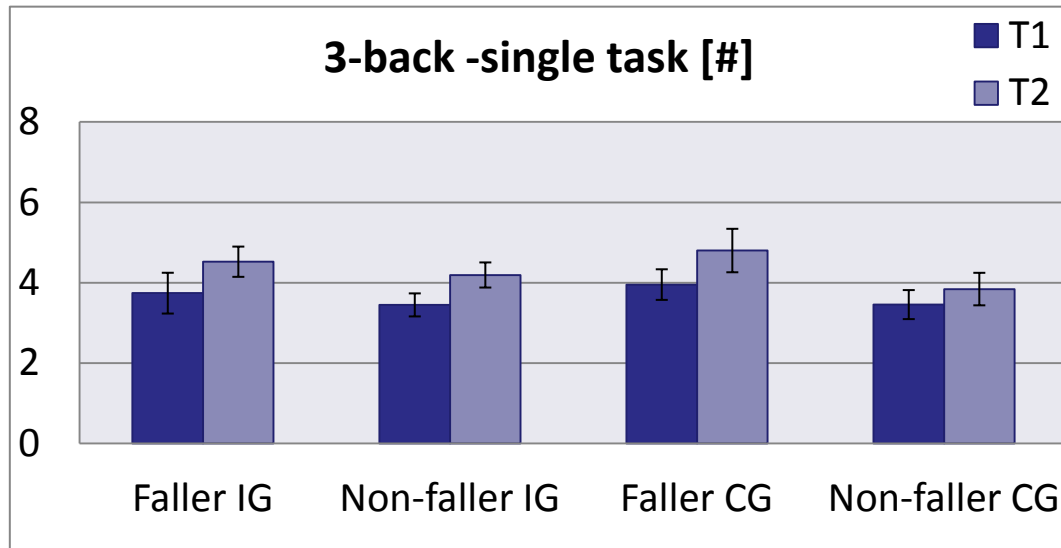


Time:  $F=0,968$ ;  $p=.327$   
time\*Fall:  $F=1,505$ ;  $p=.222$   
time\*IG:  $F=0,004$ ;  $p=.948$   
time\*Fall\*IG:  $F=6,454$ ;  $p=.012$

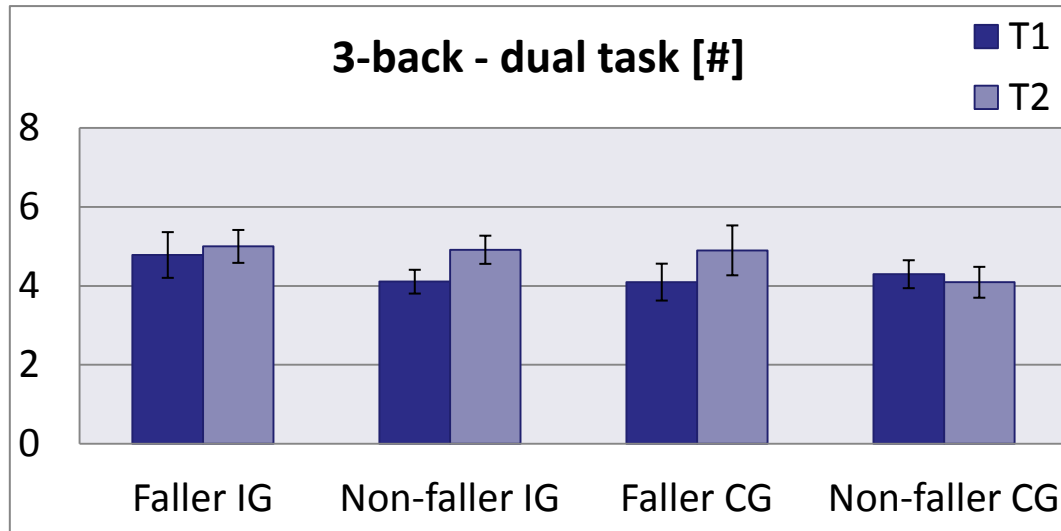


Time:  $F=0,303$ ;  $p=.583$   
time\*Fall:  $F=0,166$ ;  $p=.684$   
time\*IG:  $F=3,664$ ;  $p=.058$   
time\*Fall\*IG:  $F=0,019$ ;  $p=.892$

# Results - count

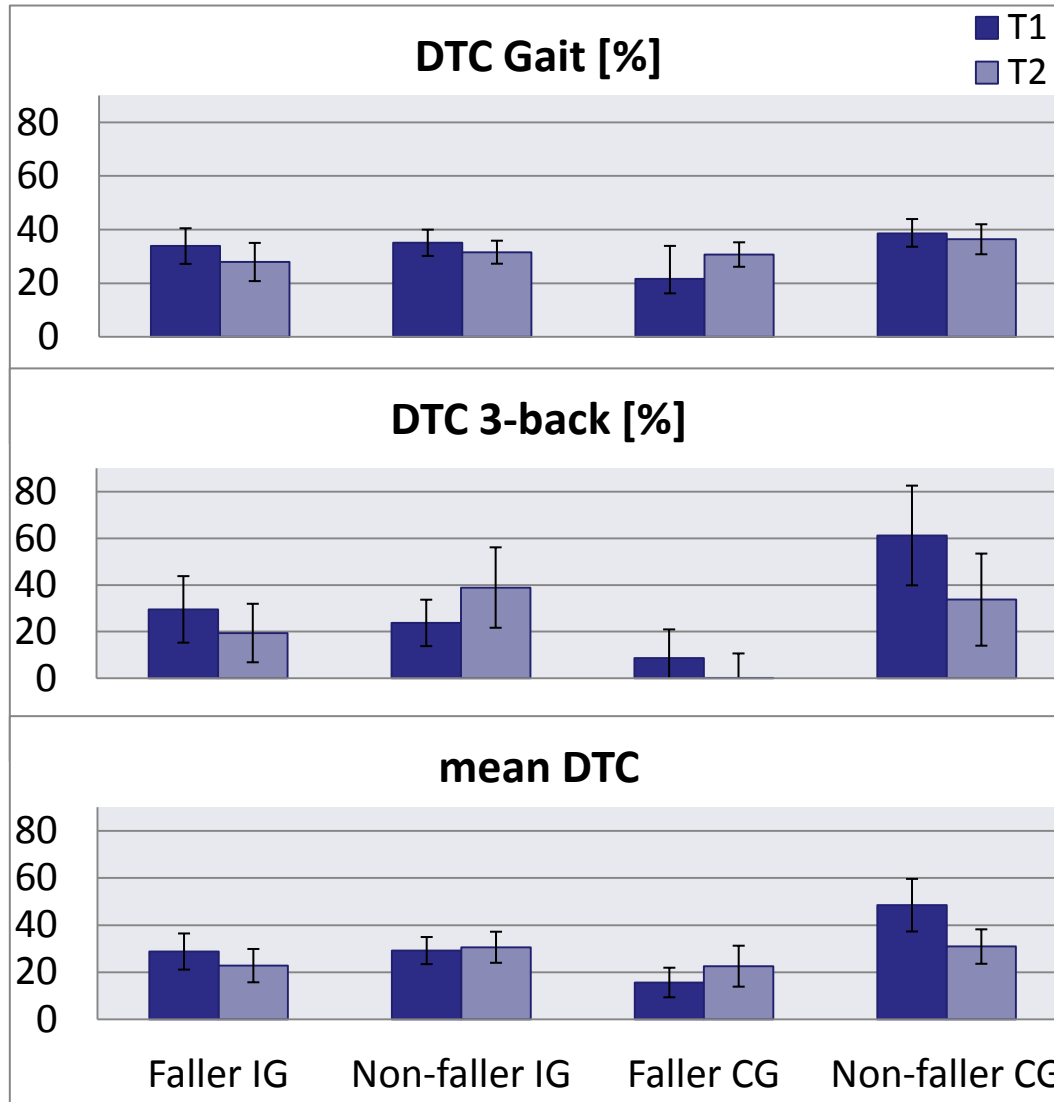


Time:  $F=12,931$ ;  $p=.000$   
time\*Fall:  $F=0,358$ ;  $p=.551$   
time\*IG:  $F=0,204$ ;  $p=.652$   
time\*Fall\*IG:  $F=0,248$ ;  $p=.619$



Time:  $F=3,080$ ;  $p=.082$   
time\*Fall:  $F=0,165$ ;  $p=.685$   
time\*IG:  $F=0,288$ ;  $p=.592$   
time\*Fall\*IG:  $F=2,980$ ;  $p=.087$

# Results - DTC



Time:  $F=0,022$ ;  $p=.881$   
 time\*Fall:  $F=0,631$ ;  $p=.428$   
 time\*IG:  $F=2,267$ ;  $p=.135$   
 time\*Fall\*IG:  $F=1,490$ ;  $p=.224$

Time:  $F=0,466$ ;  $p=.496$   
 time\*Fall:  $F=0,001$ ;  $p=.979$   
 time\*IG:  $F=0,522$ ;  $p=.472$   
 time\*Fall\*IG:  $F=0,412$ ;  $p=.522$

Time:  $F=1,345$ ;  $p=.249$   
 time\*Fall:  $F=0,950$ ;  $p=.332$   
 time\*IG:  $F=0,000$ ;  $p=.985$   
 time\*Fall\*IG:  $F=2,449$ ;  $p=.120$

# Training adherence (4-month period)

	Faller	Non-Faller	p
Raw data (with instructions)			
Frequency balance games	29	24	.326
Frequency strength games	22	18	.879
Duration balance [sum, hours]	4,6	4,0	.349
Duration strength [sum, hours]	7,3	8,0	.989
Intensity balance [mean, levels]	4,6	2,5	.347
Intensity strength [mean, levels]	1,6	1,4	1.0

## Possible explanations

- ❖ Fallers have a slower gait speed and poorer cognitive function under single and dual task condition
  - High fitness in both groups
  - Higher fear of falling doesn't (yet) affect gait speed
- ❖ Video-based physical training improve gait speed and cognitive function under single and dual task condition
  - Low training stimuli (frequency, duration, intensity, level of difficulty)
- ❖ Fallers profit more from training than non-fallers
  - See above



# Further research

- ❖ Additional subgroup analyses
  - Adherence
  - Level of initial performance
  - Persons at higher risk of falls
- ❖ How to increase motivation?
- ❖ How to increase affordance?



*Thanks to  
our participants  
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*... and for your attention*