

Pilot Trial with Senso at AVEO

Results presentation, 29th June 2020



Intro

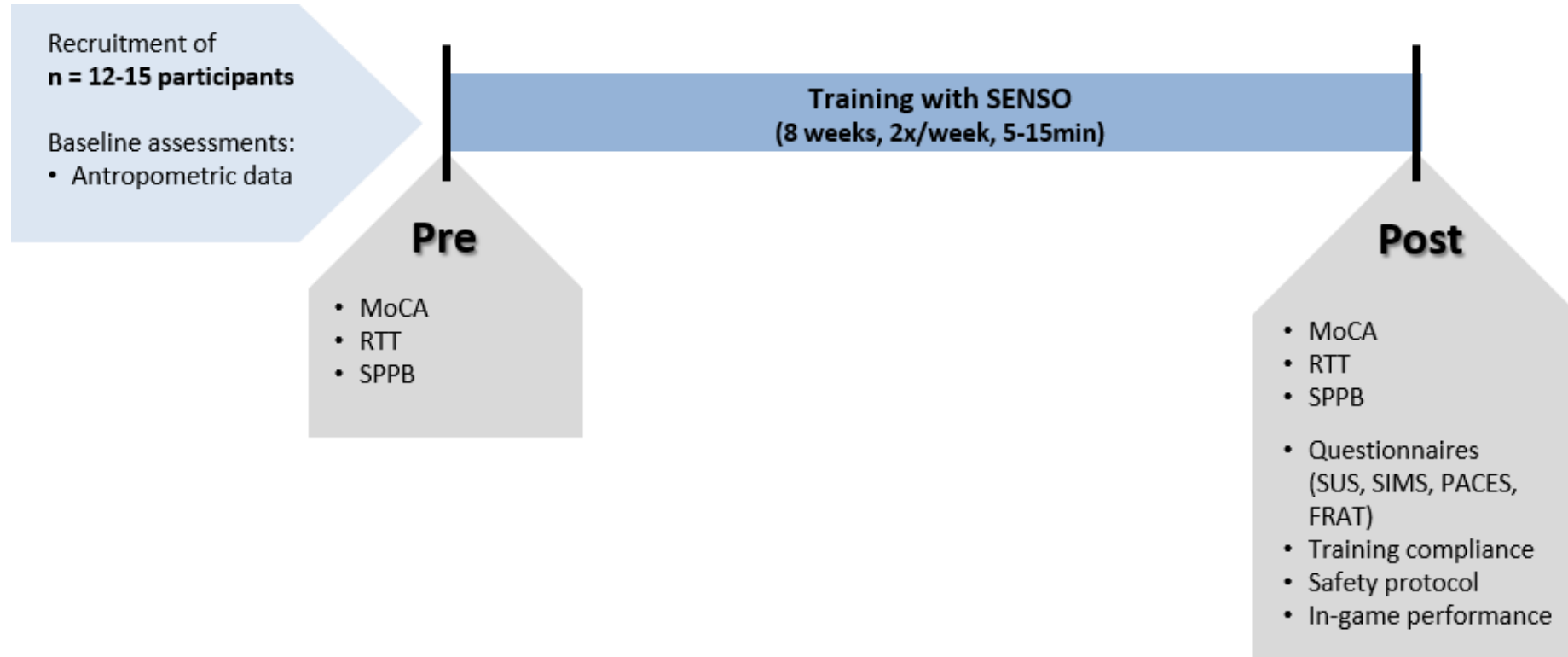
- Senso as a training system for combined cognitive-motor training
- 12 training games targeting different functions
- First opportunity in Australia to test the Senso in a retirement environment
- (Commercial) recommendation for future use in AVEO villages



Goals

- **Primary goal:**
To assess usability, motivation, enjoyment, compliance, safety
- **Secondary goal:**
To assess training progress and impact on functionality

Method: Trial design



Method: Inclusion and exclusion

- **Inclusion criteria:**

- Resident at Aveo Durack village
- Aged 65 years and older

- **Exclusion criteria:**

- Not able to stand for about 2min
- Acute, severe or uncontrolled illness/diseases/injuries which prevent from exercising on the Senso
- Residents undertaking NHMRC trial with HUR equipment and University of QLD

Method: Outcomes

- **Primary goal:**
To assess usability, motivation, enjoyment, compliance, safety

→ Primary outcomes:

Usability	System Usability Scale (SUS)
Motivation	Situation Motivation Scale (SIMS)
Enjoyment	Physical Activity Enjoyment Scale (PACES)
Complicance	Adherence rate and attrition
Safety	Safety protocol

Method: Outcomes

- **Secondary goal:**
To assess training progress and impact on functionality

→ Secondary outcomes:

Training progress	In-game performance data
Impact on cognitive functions	Montreal Cognitive Assessment (MoCA) Reaction Time Test (RTT)
Impact on physical functions	Short Physical Performance Battery (SPPB)

Results: Primary outcomes

Usability	System Usability Scale (SUS)
Motivation	Situation Motivation Scale (SIMS)
Enjoyment	Physical Activity Enjoyment Scale (PACES)
Complicance	Adherence rate and attrition
Safety	Safety protocol

Participants characteristics

N	Age	Sex
22	85.9 ± 6.5	73% female, 27% male
18 (remaining)	85.8 ± 7.1	72% female, 28% male
4 (drop-outs)	86.0 ± 2.7	75% female, 25% male

Results: Training compliance

- **Attrition: 4 drop-outs (18%)**
 - one drop-out: in week 1
 - two drop-outs: in week 3
 - one drop-out: «out of village»

→ Drop-out reasons?

Results: Training compliance

- **Attrition: 4 drop-outs (18%)**
 - one drop-out: in week 1
 - two drop-outs: in week 3
 - one drop-out: «out of village»
- **Adherence rate:**
on average 81.8% of all training sessions (100% = 16 sessions)

Results: Motivation

Situation Motivation Scale (SIMS)

Situation Motivation Scale (SIMS)							
Please specify for each of the following sentences on a scale from 1 to 7, why you're participating in this training?	Strongly disagree	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Strongly agree
	1. Because I think that this activity is interesting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
2. Because I am doing it for my own good	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
3. Because I am supposed to do it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. There may be good reasons to do this activity, but personally I don't see any	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Because I think that this activity is pleasant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
6. Because I think that this activity is good for me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
7. Because it is something that I have to do	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. I do this activity but I am not sure if it is worth it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

Situation Motivation Scale (SIMS)							
Please specify for each of the following sentences on a scale from 1 to 7, why you're participating in this training?	Strongly disagree	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Strongly agree
	9. Because this activity is fun	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
10. By personal decisions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
11. Because I don't have any choice	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. I don't know how, I don't see what this activity brings me	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. Because I feel good when doing this activity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
14. Because I believe that this activity is important for me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
15. Because I feel that I have to do it	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. I do this activity, but I am not sure it is a good thing to pursue it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

Situation Motivation Scale (SIMS)

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3. Because I am supposed to do it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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5. Because I think that this activity is pleasant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
6. Because I think that this activity is good for me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
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Situation Motivation Scale (SIMS)

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16. I do this activity, but I am not sure it is a good thing to pursue it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

Results: Enjoyment

Physical Activity Enjoyment Scale (PACES)

Physical activity enjoyment scale (PACES) - long version

Please rate the following statements on this scale regarding the accomplished training.

	1	2	3	4	5	6	7	
I hated it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	I enjoyed it
It was boring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	It was interesting
I didn't like it at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	I liked it very much
It found it unpleasurable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	I found it pleasurable
I wasn't absorbed at all in the training activity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I was very absorbed in the training activity
It was no fun at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	It was a lot of fun
I found it tiring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	I found it energizing
It made me depressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	It made me happy
It was very unpleasant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	It was very pleasant
I felt physically bad while doing it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	I felt physically good while doing it
It was not invigorating at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	It was very invigorating
I was very frustrated by it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I was not at all frustrated by it
It was not gratifying at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	It was very gratifying
It was not exhilarating	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	It was very exhilarating
It was not stimulating at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	It was very stimulating
It didn't give me any sense of accomplishment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	It gave me a strong sense of accomplishment
It wasn't refreshing at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	It was very refreshing
I felt as though I would rather be doing something else	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I felt as though there was nothing else I would rather be doing



Physical activity enjoyment scale (PACES) - long version

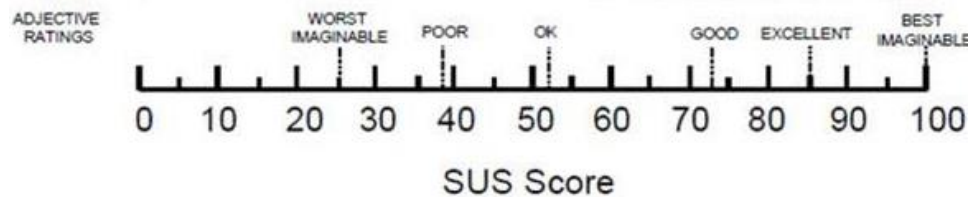
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It was boring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	It was interesting
I didn't like it at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	I liked it very much
It found it unpleasurable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	I found it pleasurable
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I felt physically bad while doing it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	I felt physically good while doing it
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I was very frustrated by it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I was not at all frustrated by it
It was not gratifying at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	It was very gratifying
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I felt as though I would rather be doing something else	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I felt as though there was nothing else I would rather be doing

Results: Usability

System Usability Scale (SUS)

SUS Score = 51 ± 9



System Usability Scale (SUS)

Please specify your agreement/disagreement with all of the following sentences on a scale from 1 to 5. (system = training system)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1. I think I would like to use this system frequently.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. I found the system unnecessarily complex.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. I thought the system was easy to use.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. I think that I would need the support of a technical person to be able to use the system.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. I found the various functions in this system were well integrated.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. I thought there was too much inconsistency in this system.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. I would imagine that most people would learn to use this system very quickly.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. I found the system very cumbersome to use.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. I felt very confident using the system.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. I needed to learn a lot of things before I could get going with the system.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Further feedback:

This questionnaire is based on the „System Usability Scale“ which was developed by John Brooke when he was working at Digital Equipment Corporation. © Digital Equipment Corporation, 1986.

→ Why? What could be improved?

Results: Safety

Safety protocol

→ Your experiences and observations?

Safety Protocol

1. **Were you feeling dizzy during the training?**
 no dizziness mild dizziness severe dizziness

If yes, do you also feel dizziness in general in your everyday life (known problem)?
 no yes

2. **Did you experience any sort of pain during the training?**
 no pain mild pain severe pain

If yes, where?

If yes, do you feel the same pain in your everyday life (e.g. due to a known problem)?
 no yes

3. **Were there any "critical moments" during the training in which you almost fell (e.g. stumbling, slipping, swaying)?**
 no yes

If yes, what do you think was the reason?

4. **Were you afraid of falling during the training?**
 no yes

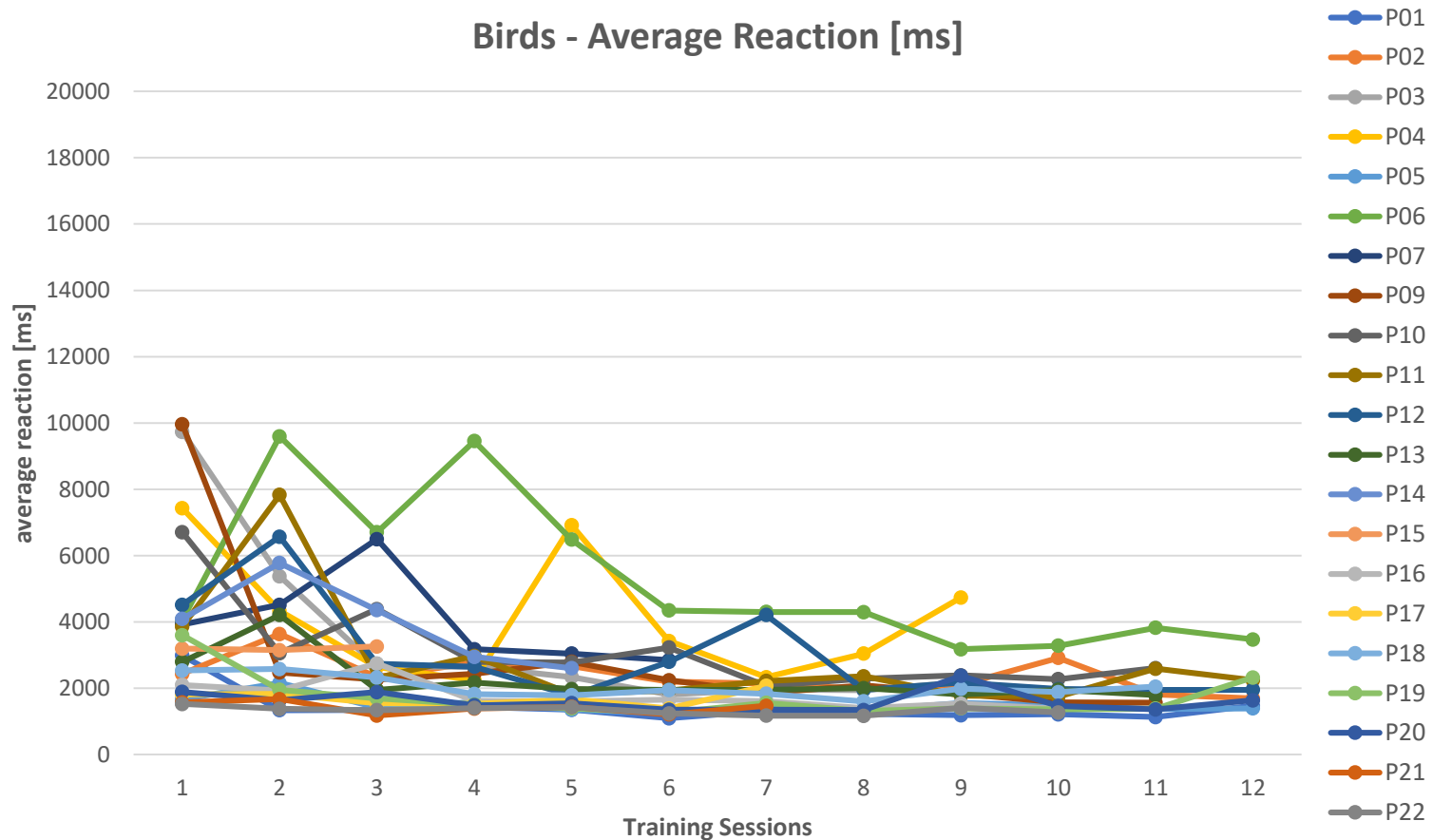
5. **Did you fall during the training?**
 no yes

If yes, what do you think was the reason?

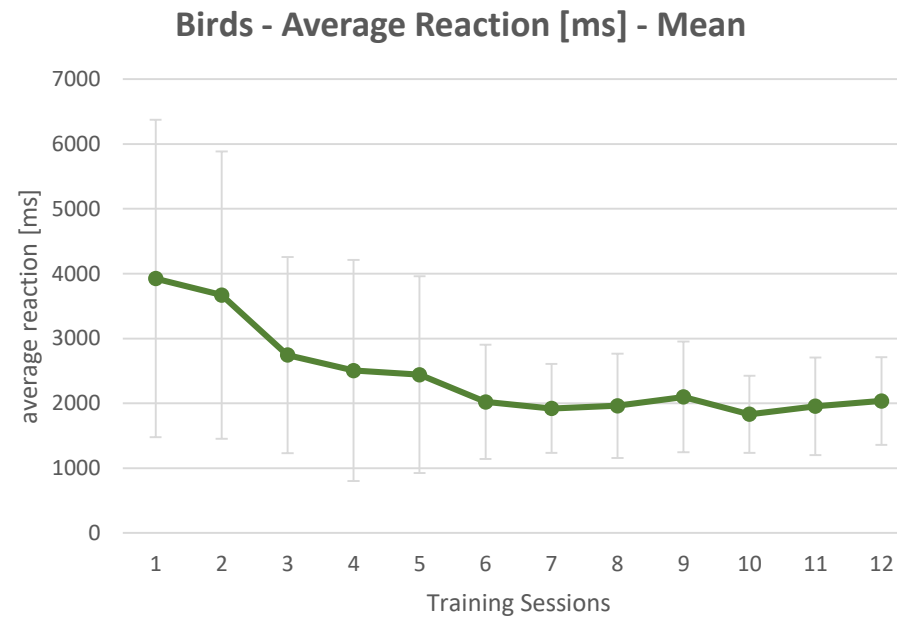
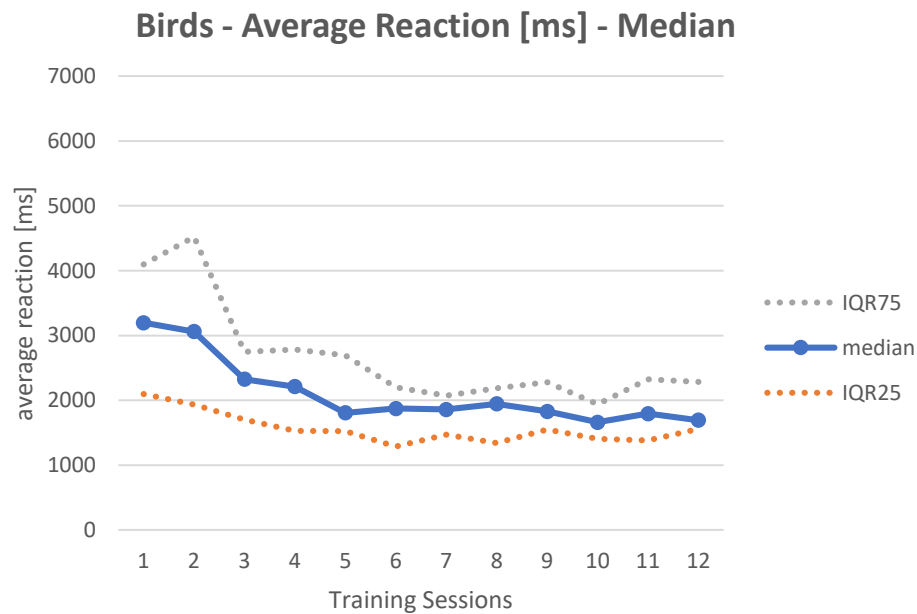
Results: Secondary outcomes

Training progress	In-game performance data
Impact on cognitive functions	Mini Mental State Examination (MMSE) Reaction Time Test (RTT)
Impact on physical functions	Short Physical Performance Battery (SPPB)

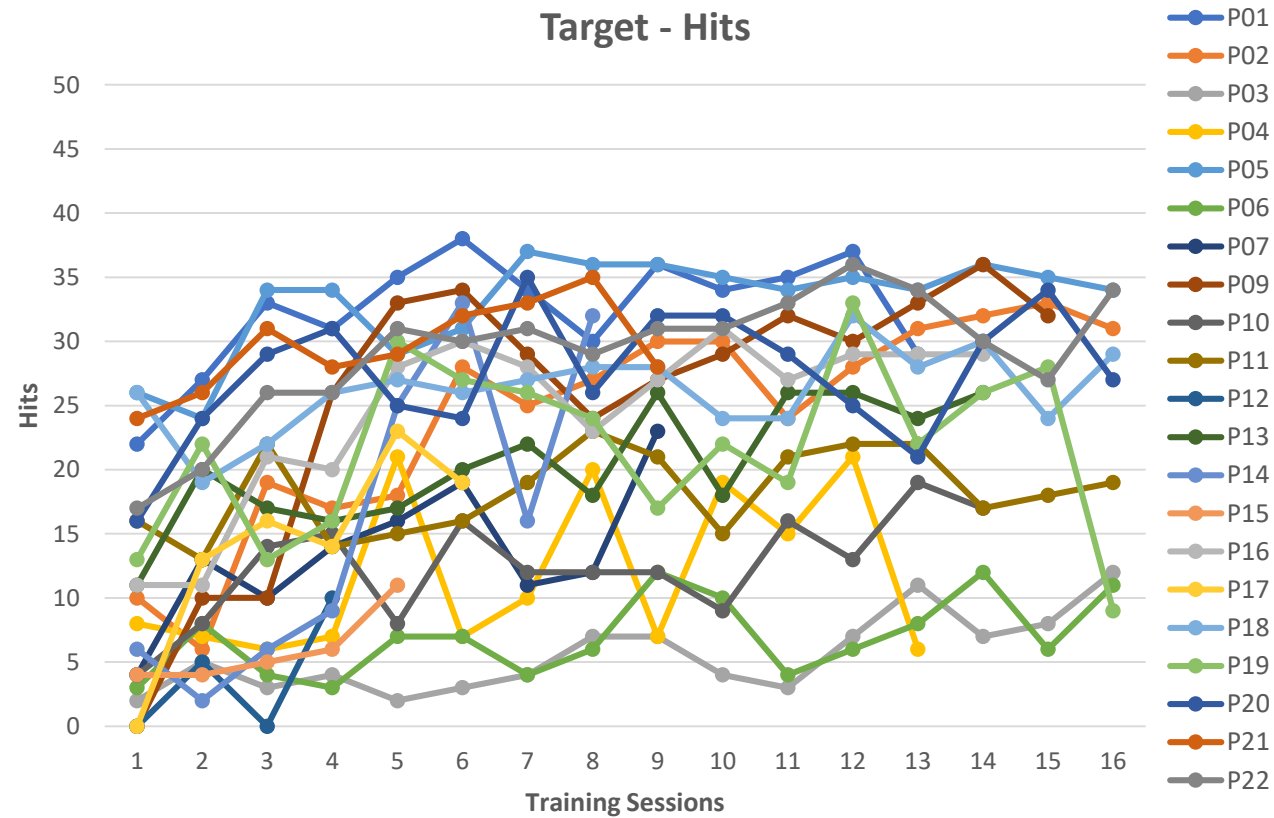
Results: In-game performance data



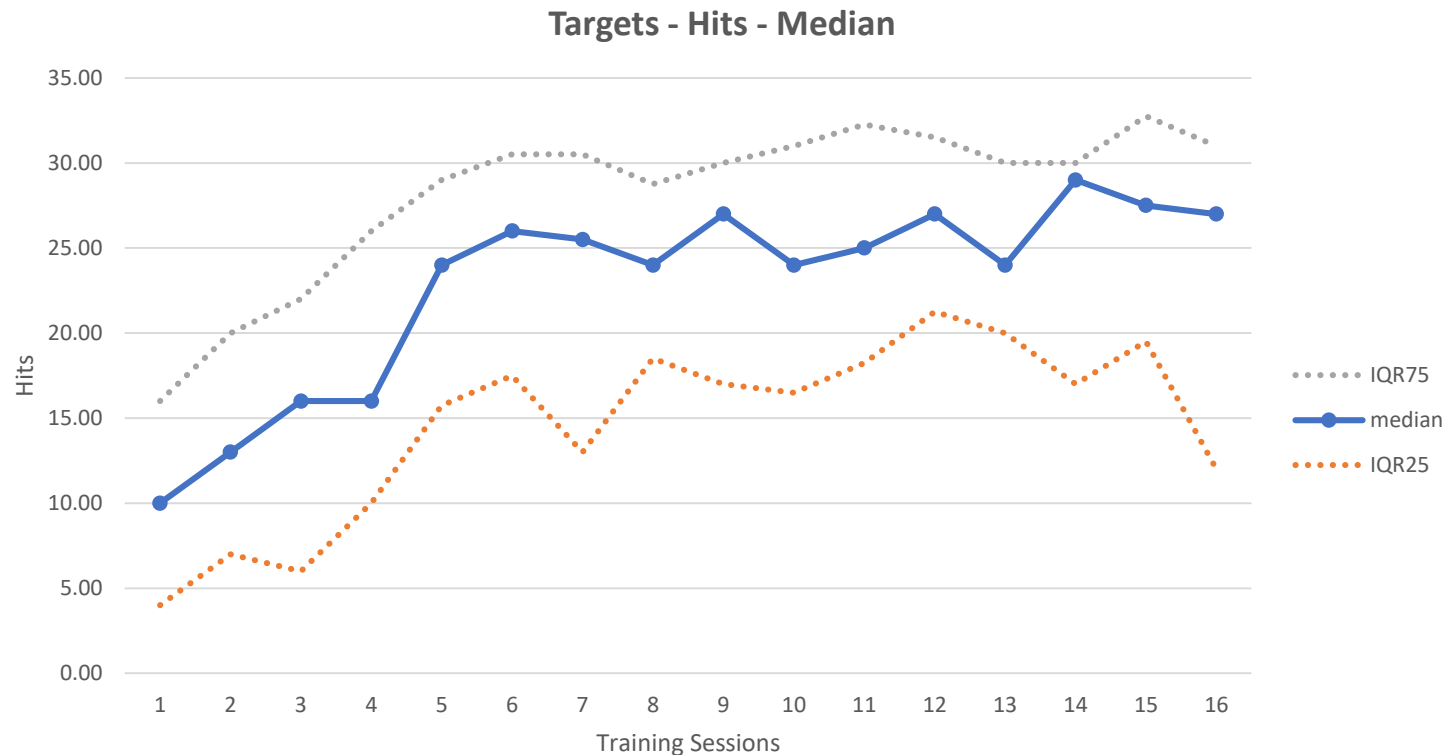
Results: In-game performance data



Results: In-game performance data



Results: In-game performance data



Results: In-game performance data

- **Clear improvements in:**

- Simple
- Birds
- Targets
- Flexi

→ Your experiences and observations?

- **No/less improvements in:**

- Simon
- Ski
- Snake

Results: Impact on functionality

Test	N	Mean \pm SD		T-Test			Wilcoxon signed-rank Test		
		Pre	Post	T	p (2-sided)	r	Z	p (2-sided)	r
MoCA	13	21.5 \pm 6.4	22.9 \pm 5.5	-1.330	0.208	0.36	-1.188	0.235	0.23
RTT [ms]	13	1743 \pm 972	1229 \pm 441	2.280	0.042*	0.63	-2.481	0.013*	0.49
Balance	13	2.69 \pm 1.03	2.77 \pm 1.09	-0.322	0.753	0.09	-0.333	0.739	0.07
Gait Speed	13	2.92 \pm 0.95	3.00 \pm 0.91	-0.322	0.753	0.09	-0.333	0.739	0.07
Chair Stand	13	1.54 \pm 1.39	1.54 \pm 1.56	0.000	1.000	0.00	-0.137	0.891	0.03
SPPB_total score	13	7.15 \pm 2.61	7.31 \pm 3.12	-0.262	0.798	0.08	-0.494	0.621	0.10

N = 13 due to "13 participants performed at least 15 training sessions"

→ Your experiences and observations?
Feedback of participants?

Summary:

- **Very high adherence, normal drop-out rate**
- **On average high motivation and enjoyment (SIMS, PACES)**
- **Medium usability (SUS)**
- **No safety issues**
- **Improvements in training performance in most of the games**
- **Significant improvement in cognition (reaction time)**
- **No significant improvement in physical functioning (SPPB)**