


# Development of computer-based methods for the study of individual factors in spatial thinking

Datorizētu metožu izstrāde individuālo faktoru izpētei  
telpiskajā domāšanā



Santa Bartušēvica  
Supervisor: Dr.phil. Jurgis Šķilters

# About me

## Education

**Bachelor's Degree** - University of Latvia

Computer Science (Specialization-Software Engineering)

**Master's Degree** - University of Latvia

Computer Science (Specialization-Bioinformatics)

**Third year of PhD** - University of Latvia

Computer Science and Mathematics (subprogramme Computer Science)

## Work experience

Programmer, SIA "DIVI grupa", Rīga (until 2022)

**Laboratory for Perceptual and Cognitive Systems at UL**

**Lecturer - University of Latvia**

**SIA "Cēsu Skaņa", Cēsis**

# Objectives

1

To conduct in-depth research on the impact of individual factors on spatial thinking.

2

Conduct research on digital tools and medical systems and comparisons of existing solutions.

3

Development of digital tools for tracking spatial perception and cognitive processes.

# PhD plans

Two projects investigating spatial abilities in various age groups (VPP and FLPP)

2023/2024

2024/2025

2025/2026

2026/2027

Dissertation,

Data collection and first analysis on FLPP,

Internship at University of Surrey,

Design and development of test sets for VPP,

Conferences/publications

Dissertation,

Data collection on VPP,

Data collection and analysis on FLPP,

Conferences/publications

Dissertation,

Final analysis on VPP,

Final analysis on FLPP,

Conferences/publications

Dissertation,

Conferences/publications



Development of an integrative approach to the assessment of cognitive abilities in patients with neurodegenerative diseases of the central nervous system

# Aim of the project

The aim of the project is to develop a set of cognitive and perception measurement tools that would allow early identification of neurodegenerative diseases based on the comparison of different experimental cognitive and perception measurements with patient clinical condition (which would be investigated by standard validated clinical neurological tests) and magnetic resonance imaging (MRI) measurements.

Fundamental and Applied Research project (FLPP)

**Project agreement No.** Izp-2022/1-0100

**Project realization:** 01.01.2023 → 31.12.2025

**University of Latvia, Riga Stradiņš University**



RĪGA STRADIŅŠ  
UNIVERSITY



UNIVERSITY OF LATVIA  
**FACULTY OF  
COMPUTING**

a) to develop a set of non-invasive methods (i.e. cognitive tests) for diagnosing early symptoms of neurodegenerative diseases, and

b) to understand and identify neural correlations of visual spatial and verbal processing disorders that could be diagnostically informative in the case of neurodegenerative diseases.



# The main research tasks

## Visual spatial cognition in neurodegenerative disease

Katherine L. Possin

Department of Neurology, University of California, San Francisco, CA, USA

**TABLE 1**

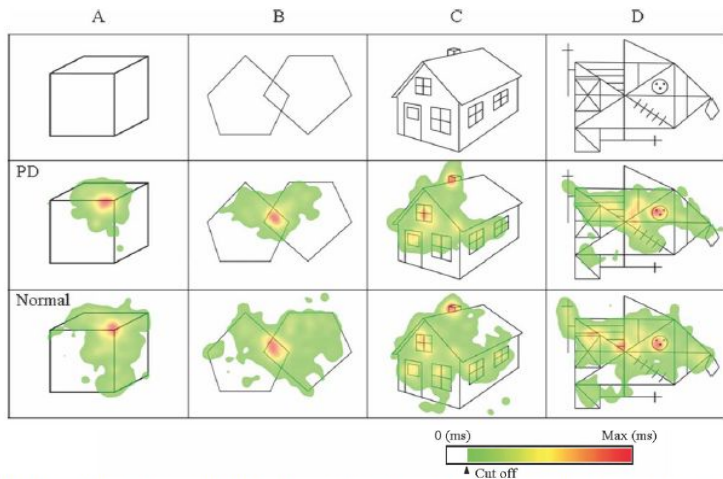
Typical constellation of visual spatial impairments in the early stages of neurodegenerative diseases

	<i>Bottom-up/Top-down</i>	<i>Dorsal/Ventral</i>	<i>Allocentric/Egocentric</i>
Alzheimer's disease	Bottom-up most patients, although some patients show top-down	Both are often affected	Allocentric
Posterior cortical atrophy	Bottom-up, all patients	Dorsal more than ventral, although both are affected with disease progression	Patients cannot use either frame of reference well due to severe bottom-up impairments
Parkinson's disease	Top-down	Dorsal	Egocentric
Lewy body dementias	Both, nearly all patients	Both, nearly all patients	Unknown, likely both in most patients
Corticobasal syndrome	Variable, top-down likely more common but in some patients bottom-up can be prominent, as discussed in text	When visual spatial processing is affected, dorsal impairments are usually more severe	Unknown, likely egocentric
Progressive supranuclear palsy	Top-down attentional impairment is common	Patients have difficulty orienting spatial attention, but cortical dorsal/ventral streams are usually intact	Unknown, likely egocentric
Behavioral variant frontotemporal dementia	Top-down, most patients, although in early stages no visual spatial impairment may be evident	Not impaired	Unknown, may vary with pathologic subtypes
Semantic dementia and Progressive nonfluent aphasia	Not impaired	Neither impaired early, although SD may affect ventral stream processing with disease progression	Not impaired

# Background

E E E E	H H H H H H H H
E E E E	H H H H H H H H
E E E E	H H
E E E E E E E E	H H H H H H H H
E E E E E E E E	H H H H H H H H
E E E E	H H
E E E E	H H H H H H H H
E E E E	H H H H H H H H

**Figure 3.** Navon figures. Patients with impaired global processing will identify the smaller letters but will fail to identify the global letters (i.e., in this example, they would report seeing only an E in the first figure and an H in the second figure).



**FIG. 2.** Presented images and heat maps. A: Image 1—a cube. B: Image 2—2 overlapping pentagons. C: Image 3—a house. D: Image 4—the Rey-Oslerith complex figure. The upper panels show the images presented to subjects, the middle panels show the heat maps of the PD patients, and the lower panels show those of the normal subjects. In all images, the distribution of eye-fixation positions (green area) in PD patients was narrower than that in normal subjects.

## RESEARCH ARTICLE

### Small Saccades Restrict Visual Scanning Area in Parkinson's Disease

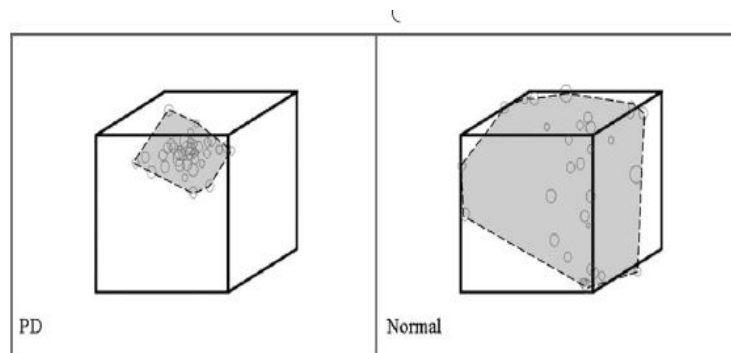
Hideyuki Matsumoto, MD, PhD,<sup>1\*</sup> Yasuo Terao, MD, PhD,<sup>1</sup> Toshiaki Furubayashi,<sup>1</sup> Akihiro Yugeta, MD, PhD,<sup>1</sup> Hideki Fukuda, PhD,<sup>2</sup> Masaki Emoto, PhD,<sup>3</sup> Ritsuko Hanajima, MD, PhD,<sup>1</sup> and Yoshikazu Ugawa, MD, PhD<sup>4</sup>

<sup>1</sup>Department of Neurology, University of Tokyo, Tokyo, Japan

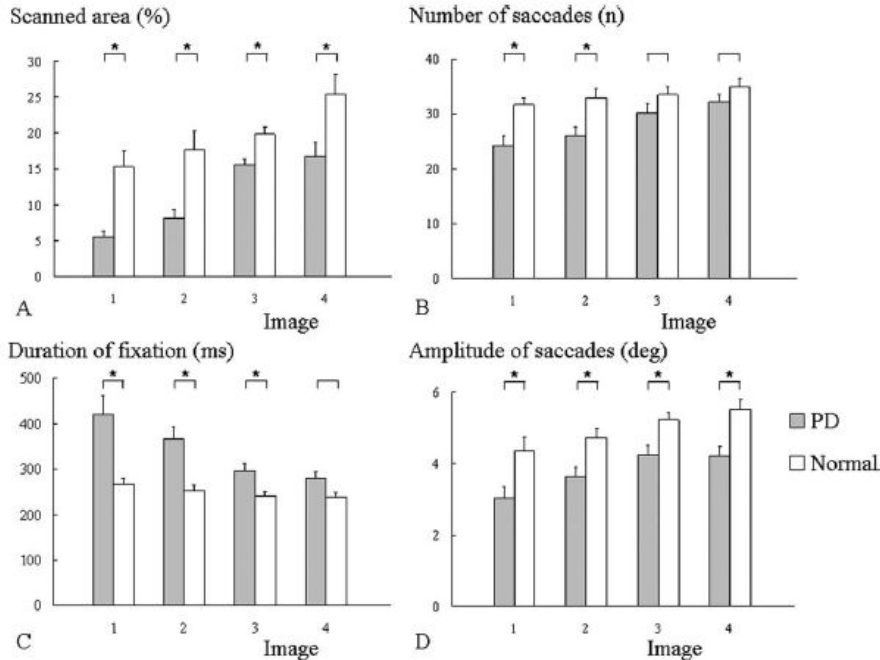
<sup>2</sup>Segawa Neurological Clinic for Children, Tokyo, Japan

<sup>3</sup>Interfaculty Initiative in Information Studies, University of Tokyo, Tokyo, Japan

<sup>4</sup>Department of Neurology, School of Medicine, Fukushima Medical University, Fukushima, Japan



**FIG. 1.** Examples of scanned area analysis. These are the results of an eye-fixation analysis for a PD patient and a normal subject scanning image 1. The scanned area is defined as the ratio of the area enclosed by the outline of the eye-fixation positions (gray shaded area) to the area of the whole image.



**Saccade** - a quick, simultaneous movement of both eyes between two or more phases of fixation in the same direction.

**Fixation** - A fixation is a period of time during which a specific part of the text on the screen is looked at and thereby projected to a relatively constant location on the retina.

Although the impacts differ depending on the particular disease, gaze patterns are sensitive to a variety of neurological diseases – Alzheimer’s disease, Parkinson’s disease, epilepsy, osteoarthritis, and rheumatoid arthritis, to mention just a few.

## Primary neurological examination (MoCA, PHQ9, MDS UPDRS)

MRI data collection  
/ analysis

Task driven /  
Top-down  
processes

Stimulus driven /  
bottom-up  
processes

Higher cognitive processes

Language

Object perception / recognition

Higher perceptual  
processes

Spatial Cognition

Primary perceptual processes  
(perceptual organization) / midlevel  
vision

Visual segmentation

Directionality effects

Visual grouping

# Inclusion criteria for the clinical group

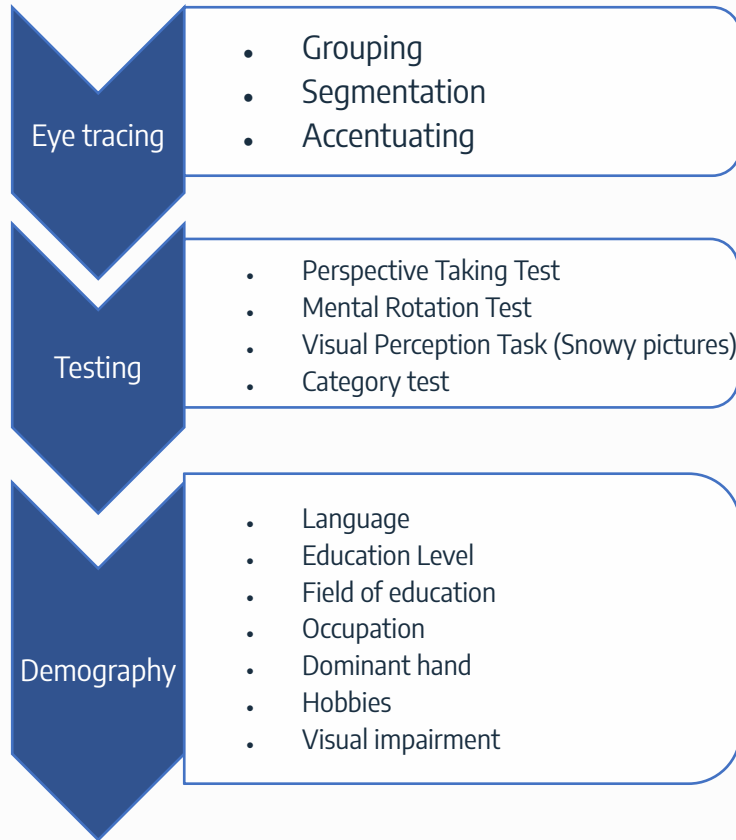
## Central nervous system diseases

- Parkinson's disease
- Huntington's disease

# Exclusion criteria

- Diagnosed CNS tumors or metastases, cerebrovascular event, encephalitis
- Any brain injury other than concussion
- Decompensated arterial hypertension
- Diabetes (type 1, 2)
- Metabolic syndrome
- Neurodegenerative disease other than Parkinson's disease or Alzheimer's disease
- Any thyroid disease (CA, hypothyroidism, autoimmune diseases - Hashimoto's thyroiditis, atrophic thyroiditis, partial or complete removal of thyroid tissue, radiotherapy - Iodide I131, congenital hypothyroidism, use of medications - amiodarone, lithium preparations, interferon alfa, Graves' disease, Toxic nodular goiter)
- etc

# Overall order of tests



# Eye tracking

**Duration of the eye-tracking task: ~ 10 minutes (including calibration).**

Before seeing the stimuli images, participants do a calibration task to ensure accurate eye-tracking measurement.

**Three groups of stimuli images:**

- Grouping,
- Segmentation,
- Accentuation.

# Eye-tracking

## Low-level vision

Representations of edges, colors, and lights.  
Low-level input: image (orientation, contrast, color)

## Mid-level vision

Mid level vision is where the visual system begins to make inferences about the world based on those measurements.  
Mid-level processes: perceptual organization (grouping, visual segmentation, shape assignment)

## High-level vision

Representations of objects, faces, and scenes.  
Higher level perceptual processes: e.g., object recognition, categorization

# Order of stimuli

## **For the "Grouping" and "Segmentation" stimuli:**

the first image is the neutral image (no clear groups or accentuated segments of the image), and then the rest of the stimuli images are in randomised order.

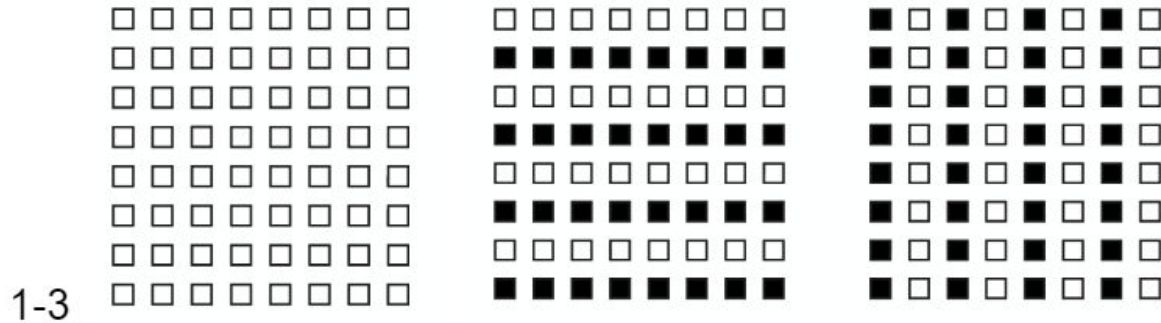
## **The "Accentuating" group:**

stimuli are in a completely randomised order

**After each group, the participants view filler stimuli containing six pictures with different scenes.**

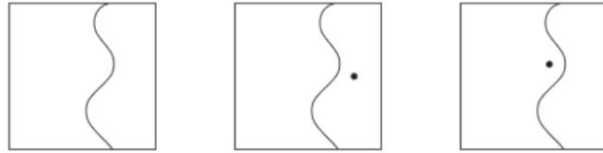
# Examples of stimuli

## Grouping

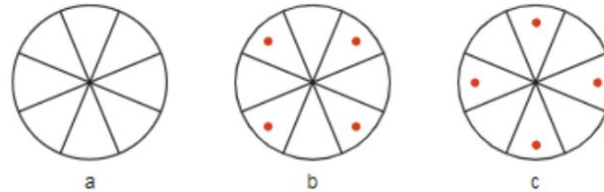


# Examples of stimuli

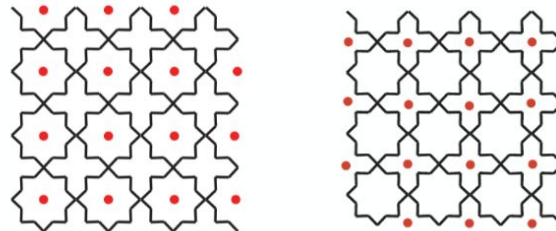
4-6



7-9

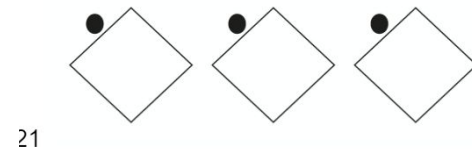
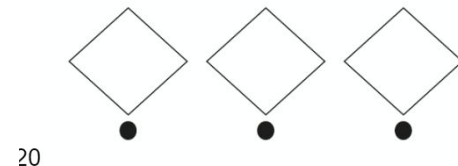
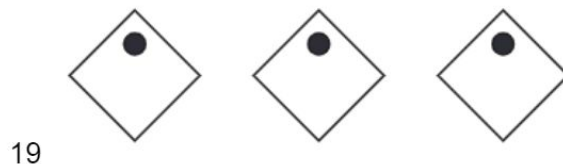
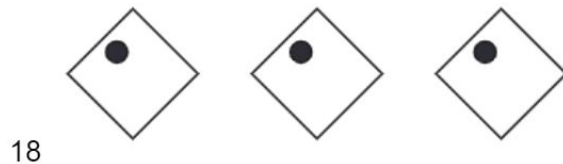
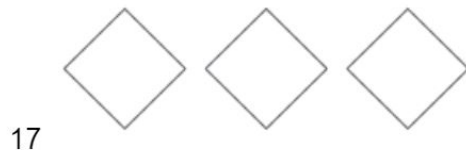
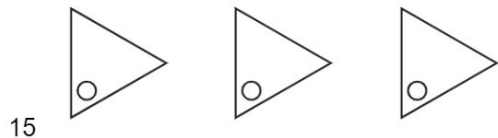
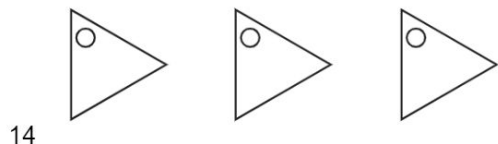
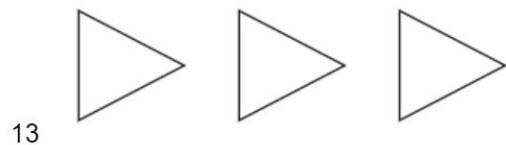
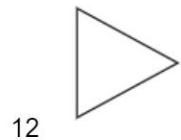


10-11



# Examples of stimuli

## Accentuating



# Eye tracking

## We are looking at:

Perceptual grouping  
Accentuation  
Figure-ground segmentation

## Measured variables:

Fixation length and frequency  
Gaze path  
Saccade speed, amplitude

Processes that are examined:

### **Mid-level vision**

(Perceptual Organization, Segmentation)  
Bottom-up processing



<https://www.tobii.com/products/eye-trackers/screen-based/tobii-pro-spectrum>

# Testing

**All tests are given in a random order.**

The order in which each participant completes the tests is recorded.

# Perspective Taking Test

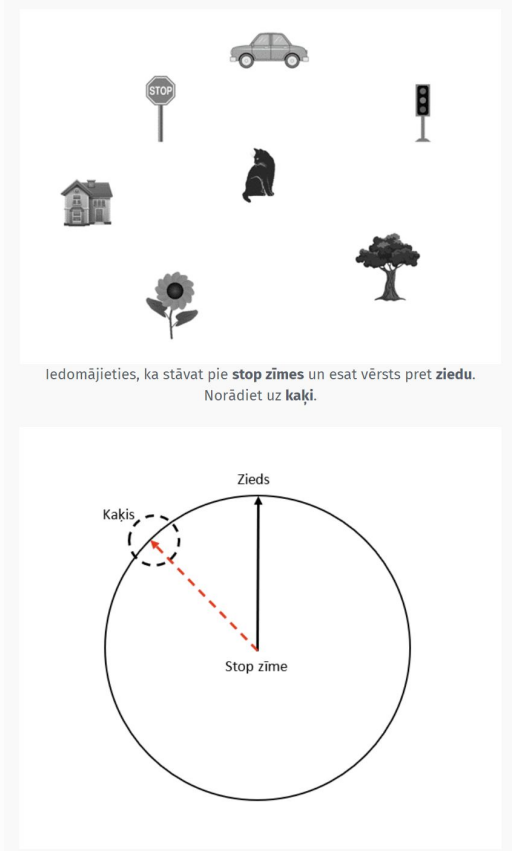
*Kozhevnikov & Hegarty, 2001,  
Hegarty & Waller, 2004*

The test consists of 12 tasks.

A trial example: before the test.

The participant's task: to mark the angle on the circle line, showing the direction of the third object in relation to himself.

The number of correct answers is counted (within 15 degrees offset).



# Mental Rotation Test

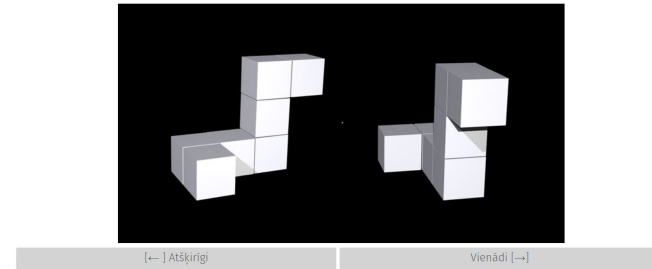
*Shepard & Metzler, 1971,  
Shepard & Metzler, 1988*

The test consists of 48 tasks.

2 trial examples: before the test.

The number of correct answers and reaction speed are counted.

The participant's task: to determine whether the figures shown in the picture are the same or a mirror image.



# Visual Perception Task (Snowy pictures)

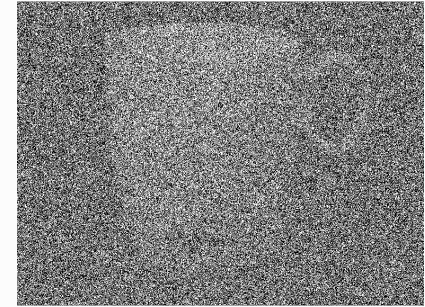
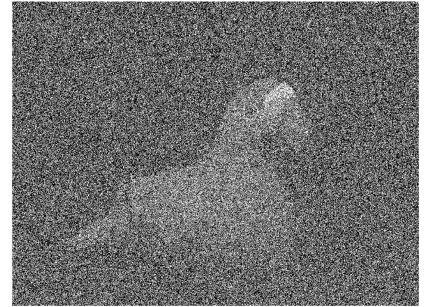
## *Ekstrom et al., 1976*

The test consists of 10 tasks.

2 trial examples: before the test.

As soon as the participant recognises the object depicted in the picture, they have to press the long key ('Space') and then name the object they saw.

The number of correct answers and reaction speed are counted.



# Category test

## *Ekstrom et al., 1976*

"Apaļš"

Nosauciet visas lietas, kas ir apaļas vai pārsvarā apaļas, nekā citā formā!

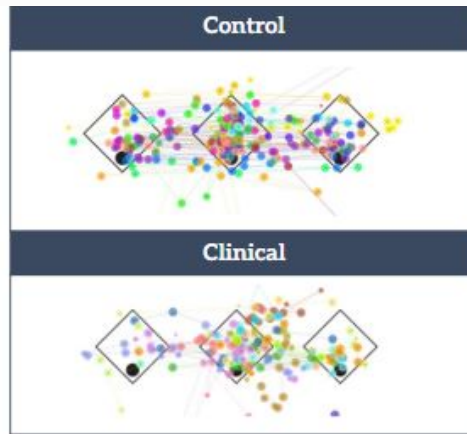
The test consists of 2 tasks.

A trial example: before the test.

The participant is given 3 minutes for each of the two parts of the task, where they have to list (verbally) things according to a given characteristic.

The number of correct association words is counted.

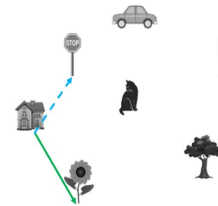
# Preliminary results



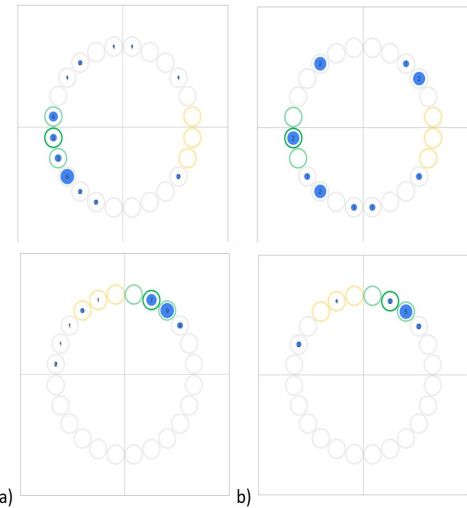
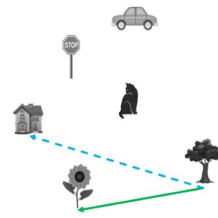
Neurodegenerative impairments:

- cause an increase in fixation number for directional stimuli (accent),
- decrease gaze duration in the perception of accent, but increase in grouping and segmenting,
- narrower scan area.

Imagine you are standing at the **house** and facing the **flower**. Point to the **stop sign**.



Imagine you are standing at the **tree** and facing the **flower**. Point to the **house**.



# Innovations, methodologies and recommendations for the development and management of the sports sector in Latvia

This will be joint project implemented by the five research institutions/ higher education institutions-

Rīga Stradiņš University (RSU),  
Rīga Technical University (RTU),  
University of Latvia (UL),

Latvian Academy of Sport Education (LASE) and  
Liepāja University (LiepU)

Funding  
Latvian Council of Science:  
No. VPP-IZM-Sports-2023/1-0001



# Aim of the project

- 1) Develop evidenced based recommendations for coaches, parents and sport leaders about the training of youth athletes (12-18 years old) with disability involved in adapted sports.
- 2) Develop evidenced based recommendations for coaches and sport leaders about the training of adult athletes with disability involved in adapted sports.
- 3) Develop research methods and knowledge base on monitoring the mental and physical health of athletes involved in grassroots sports.

# Cognitive and perceptual components in sports

The sport performance is constrained not just by physical abilities and overall body condition but also by **cognitive and perceptual components** such as emotion regulation, visuospatial abilities, and personality features.

To achieve a sustainable and successful performance in sport, **emotion regulation is critical** as the athlete's ability to balance emotions impacts her/his performance. **Visuospatial abilities are also critical** for successful performance in sport and results in visuospatial tests have a diagnostic and predictive value.

# Visuospatial abilities

**Visuospatial abilities** critical for both **successful performance in sport** (although to a different degree in different sports (Lord, & Garrison, 1998, Millard et al., 2021, Zelge, 2023a, 2023b))



# Participants

## **Children and teens in two age groups:**

12-14 years

15-18 years

58. education code - Special education programs for students with mental disabilities;

Control group

## **Adults in adapted sports**

## **Adults in grassroots sports**

# Included set of tests (adults)

## The overall sample will be screened with shortened and combined versions of :

An adapted version of Geneva Wheel of Emotions (GWE) (Schlegel & Scherer, 2016);

Perspective test to examine the accuracy of egocentric spatial ability (Kozhevnikov & Hegarty, 2001, Hegarty & Waller, 2004);

Mental rotation test to examine allocentric spatial abilities, reaction time and accuracy (Shepard & Metzler, 1971, Shepard & Metzler, 1988);

The concise version of Big 5 Personality test (Gosling, Rentfrow, & Swann, 2003)

# Included set of tests (adults)

## In-Depth analysis tests conducted in lab:

- a. Santa Barbara Sense of Direction scale to examine the overall sense of direction (Hegarty et al., 2002);
- b. Experiments on eye movements in midlevel vision (perceptual organization)
- c. testing navigational abilities by applying an experimental tool of spatial learning and navigation (Bartušėvica, 2023, Brunec et al., 2023).

# Included set of tests (12-14 years)

## CMTT (Children's Mental Transformation Task)

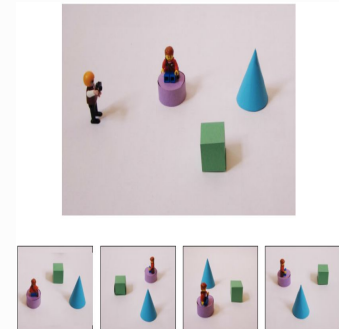
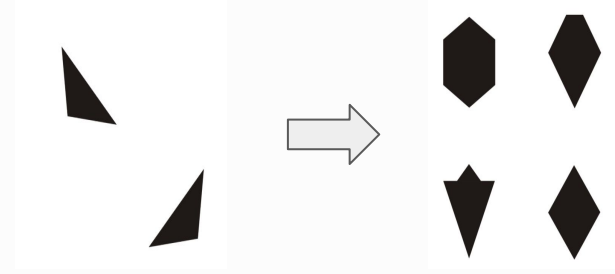
Ehrlich, S., Levine, S.C., & Goldin-Meadow, S. (2006). The importance of gesture in children's spatial reasoning. *Developmental Psychology*, 42, 1259-1268.

Levine, S.C., Huttenlocher, J., Taylor, A. & Langrock, A. (1999). Early Sex Differences in Spatial Skill. *Developmental Psychology*, 35(4), 940-949.

## Perspektivas tests

Frick, A., Möhring, W., & Newcombe, N. S. (2014). Picturing perspectives: Development of perspective-taking abilities in 4- to 8-year-olds. *Frontiers in Psychology*, 5:386. <http://doi.org/10.3389/fpsyg.2014.00386>

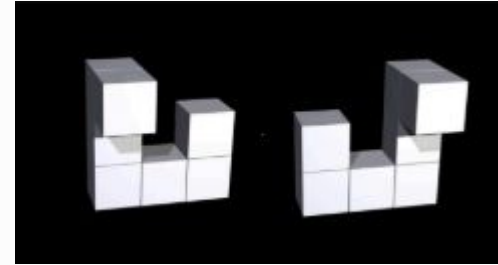
Object perception/rotation (allocentric perception) and perspective perception (egocentric processes): two of the basic spatial processes



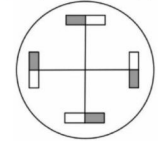
# Included set of tests (15+)

Ganis, G. and Kievit, R.A. (2015) 'A New Set of Three-Dimensional Shapes for Investigating Mental Rotation Processes: Validation Data and Stimulus Set', *Journal of Open Psychology Data*, 3(1), p. e3.

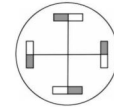
Ramful, A., Lowrie, T., & Logan, T. (2017). Measurement of spatial ability: Construction and validation of the spatial reasoning instrument for middle school students. *Journal of Psychoeducational Assessment*, 35(7), 709-727.



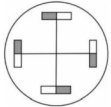
Zemāk redzamais attēls tiek pagriezts par vienu ceturdaļu pretēji pulksteņrādītāja virzienam.



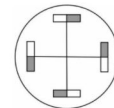
Kurš no zemāk norādītajiem attēliem parāda attēlu pēc pagriešanas?



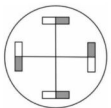
A



B



C



D



**LATVIAN  
ACADEMY  
OF SPORT  
EDUCATION**

## **Measurements in RSU Latvian Academy of Sport Education (RSU LASE)**

- body composition;
- aerobic capacity;
- musculoskeletal fitness;
- flexibility profile;
- etc.

### **Eurofit**

The Eurofit protocol for kids is a set of nine standardized physical fitness tests designed by the Council of Europe to be administered in schools to measure components like flexibility, speed, endurance, and strength.

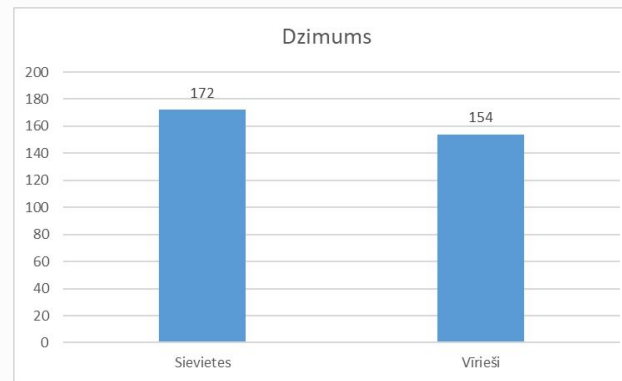
# Results

## Grassroots sports

n=326, gender balanced

However, not all participants completed all tests (Perspectives, Rotations, SBSOD).

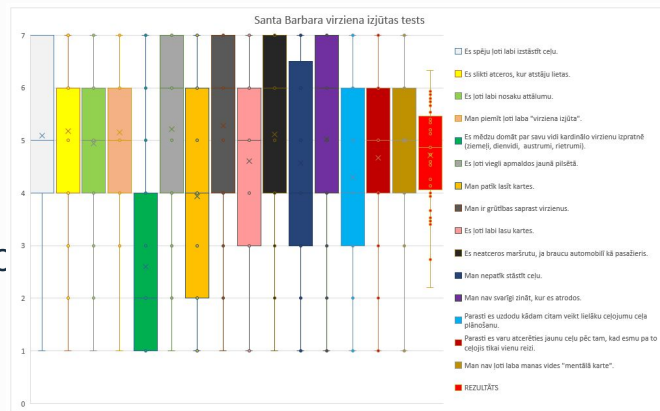
Mean age for women 36.1 (sd=10.7), for men 36.1 (sd=12.0).



## Adapted sports

n=35

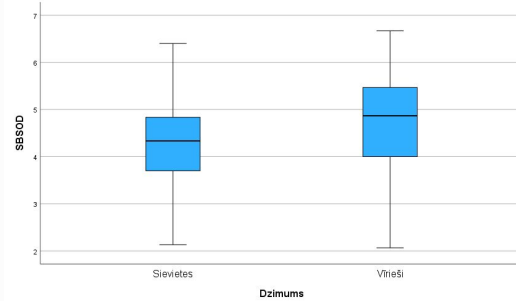
However, not all participants completed all tests (Perspective, Rotation, SBSOD, Maze+eye movements), and the sample was not balanced in terms of gender.



# Results (grassroots sports)

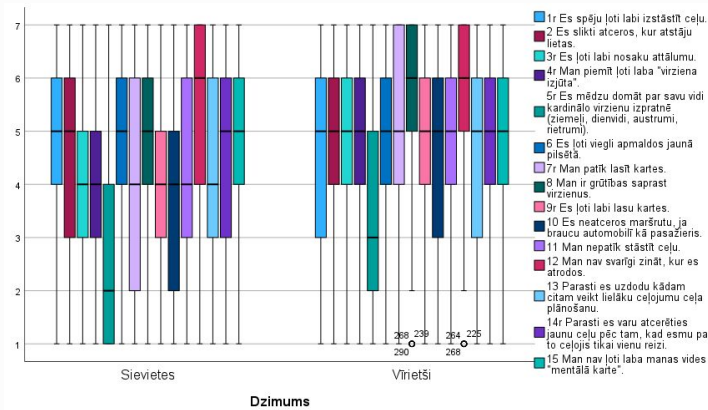
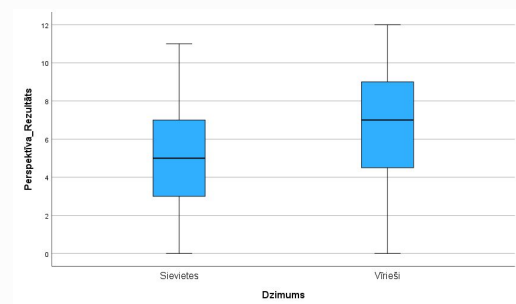
## SBSOD

There is a significant (at alpha level 0.01) difference in the evaluations. Men on average 4.8 (sd=1.0) women 4.3 (sd=0.9)



## MR test

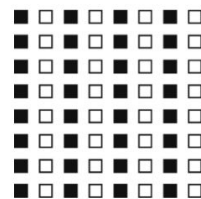
There is a significant difference (at alpha level 0.01) in the number of correct answers. Men average 6.4 (sd=2.8) women 4.9 (sd=3.0)



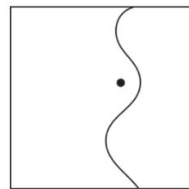
# Results (adapted sports)

There is a tendency for children with educational code 58 to make shorter and more frequent gaze fixations when looking at stimuli from all groups.

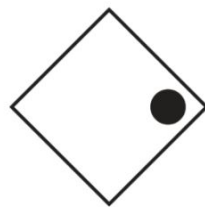
Scanning range is more heterogeneous for code 58 participants (less related to accent). This could indicate weaker stimulus-guided attention. Children with educational code 58 also have a different gaze transfer strategy compared to the control group, weaker sensitivity to accent (less sensitivity to stimulus-guided attention).



G\_1\_3



S\_1\_3

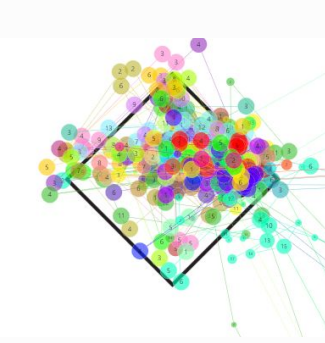
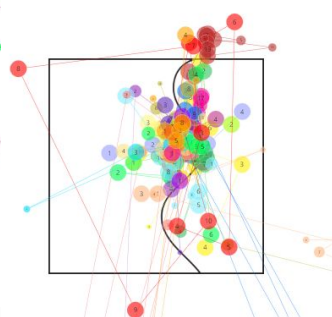
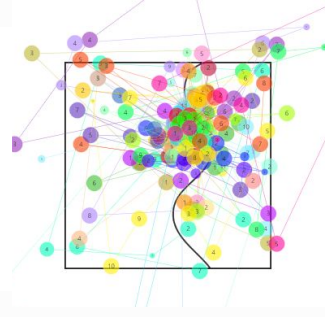
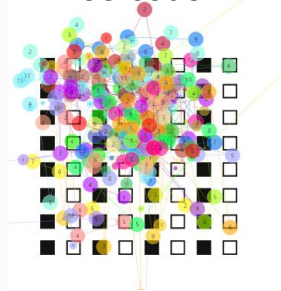


A\_R\_2\_4\_1

control



58.code



# Internship



Robert Blumberg Distinguished  
Lecture in Cognitive Science 2022

## Navigation, the spatial domain and STEM

Prof. Emily Farran  
University of Surrey,  
United Kingdom

Registration and more information:

[www.lpcs.lu.lv](http://www.lpcs.lu.lv)



📍 Art Museum RIGA BOURSE  
Doma laukums 6, Riga  
Remote version on Zoom

📅 16.01.2023 13:00

Robert Blumberg Distinguished Lecture in Cognitive Science was initiated 2018 in collaboration between the Laboratory of Perception and Cognitive Systems at the Faculty of Computing, University of Latvia, and Robert Blumberg, honorary member of UL, patron, board member of the organization "Friends of the University of Latvia", and the Honorary Consul of the Republic of Latvia in the State of Illinois. Supporters: Riga Stradins University, University of Latvia Foundation.



Laboratory for  
Perceptual and Cognitive  
Systems





## University of Surrey, UK

SPATIAL COGNITION TO ENHANCE MATHEMATICAL  
LEARNING (SPACE)

In this study, researchers from the University of Surrey, Loughborough University, University College Dublin, and Birkbeck (the SPACE team) are using spatial training to enhance spatial skills. An independent team from the Centre of Evidence & Implementation (CEI) will evaluate the effectiveness and feasibility of the SPACE program for Year 2 maths lessons.



# Internship

# Results

## Teacher Delivered Block Construction Training Improves Children's Mathematics Performance

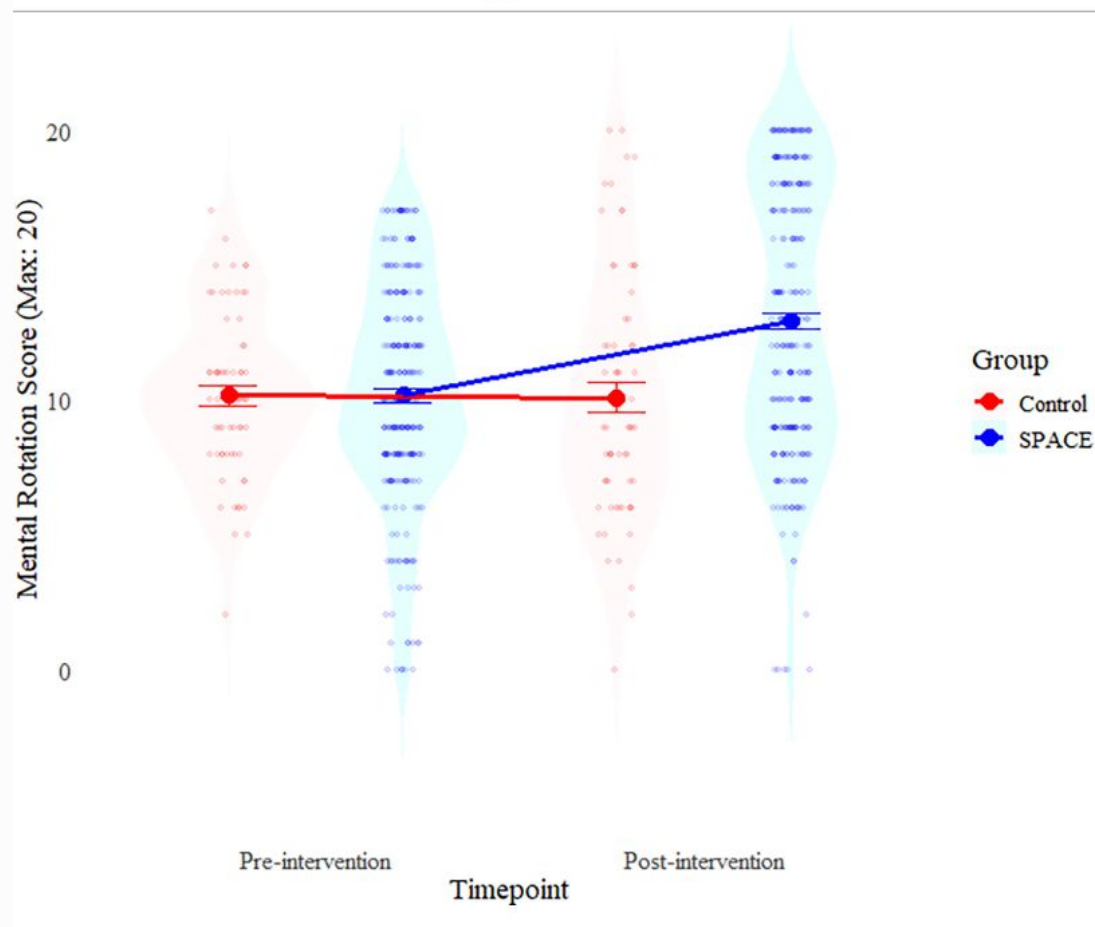
Emily K. Farran ✉, Katie A. Gilligan-Lee, Denis Mareschal, Marija Živković, Santa Bartuševica, Derek Bell, Tim Jay, Camilla Gilmore

### Are associations between spatial ability and mathematics at 6-7 years moderated by gender?

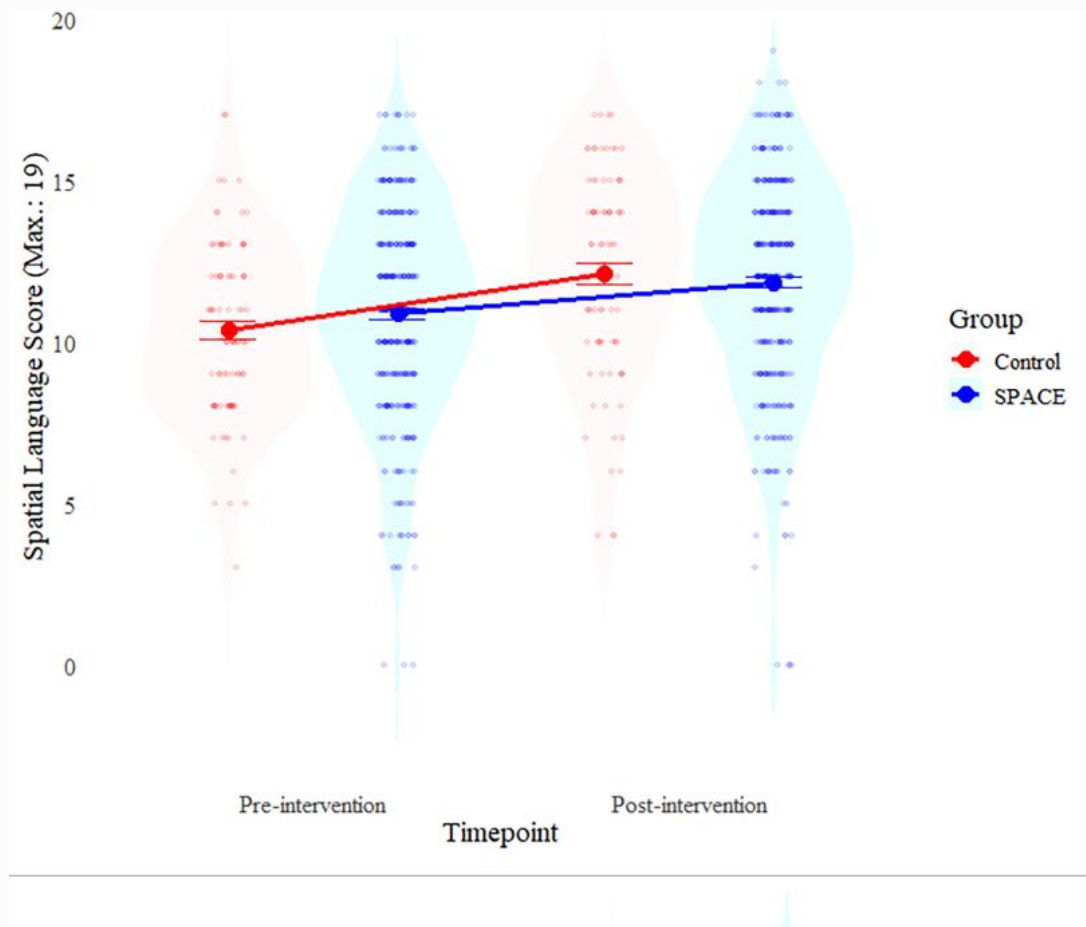
Santa Bartuševica<sup>1</sup>, Marija Živković<sup>2</sup>, Camilla Gilmore<sup>3</sup>, Katie Gilligan-Lee<sup>4</sup>, and Emily K. Farran<sup>5</sup>

1. Laboratory for Perceptual and Cognitive Systems, University of Latvia, Latvia
2. Technological University Dublin, Ireland
3. Department of Mathematics Education, University of Loughborough, Loughborough, England
4. School of Psychology, University College Dublin, Dublin, Ireland
5. School of Psychology, University of Surrey, UK

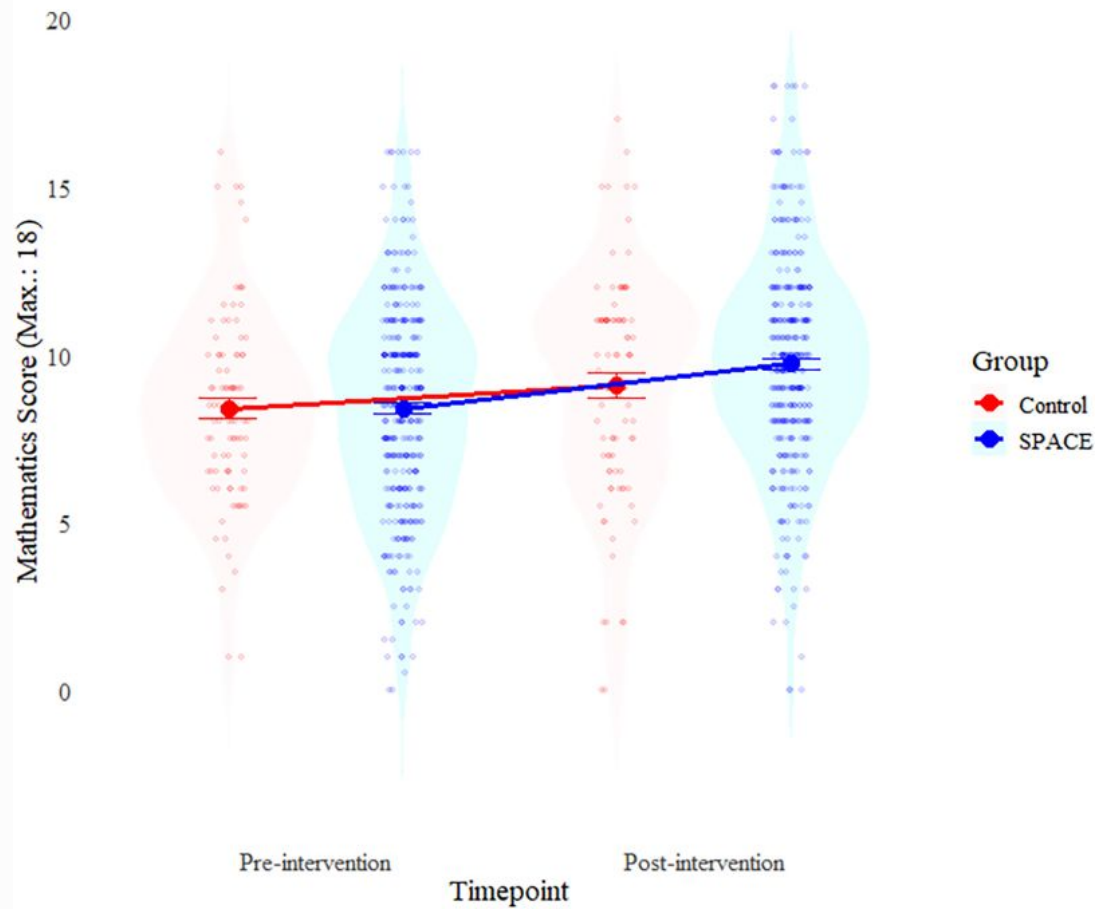
# Results



# Results



# Results



# Results

	Estimate ( $\beta$ )	SE	t	p
Step 1				
Age (months)	.6083	.1456	4.176	< .001***
Gender(M)	-0.085	.2922	-.290	0.722
Step 2				
Mental rotation (pt)	.585	.126	4.633	< .001***
Spatial language (pt)	1.616	.128	12.651	< .001***
Step 3				
Mental rotation: Gender	-.164	.257	-.638	.524
Spatial language: Gender	.328	.260	1.261	.208

# Conferences

## **Data Analysis Methods for Software Systems. 14th Conference Druskininkai, Lithuania.**

Santa Bartušēvica, Jurgis Šķilters, Solvita Umbraško, Līga Zariņa, Laura Zeļģe, Agnese Anna Pasare, Ardis Platkājis, Jānis Mednieks, Aleksejs Ševčenko, Nauris Zdanovskis, Artūrs Šilovs, Edgars Naudiņš

*“Development of an Integrative Approach to the Assessment of Cognitive Abilities in Patients With Neurodegenerative Diseases of the Central Nervous System”*

## **82nd International Scientific Conference of the UL session "Cognitive Science". (2024)**

Santa Bartušēvica, Laura Zeļģe, Jurgis Šķilters, Solvita Umbraško and Līga Zariņa.

*Exploring spatial abilities and individual factors in athletes.*

## **82nd International Scientific Conference of the UL session "Cognitive Science". (2024)**

Agnese A. Pastare, Jurgis Šķilters, Solvita Umbraško, Santa Bartušēvica, Līga Zariņa, Laura Zeļģe, Ardis Platkājis, Jānis Mednieks, Aleksejs Ševčenko, Nauris Zdanovskis, Artūrs Šilovs, Edgars Naudiņš.

*Depresijas iezīmju saistība ar kognitīvām spējām pieaugušajiem ar un bez neirodeģeneratīvām saslimšanām.*

## **82nd International Scientific Conference of the UL session "Cognitive Science". (2024)**

Jurgis Šķilters, Megija L. Gintere, Elza Klūģe, Baingio Pinna, Santa Bartušēvica, Līga Zariņa, Solvita Umbraško, Laura Zeļģe, Agnese A. Pastare, Ardis Platkājis, Jānis Mednieks, Aleksejs Ševčenko, Nauris Zdanovskis, Artūrs Šilovs, Edgars Naudiņš.

*Perceptual organization, perception of accent and their neurodegenerative distortions.*

## **82nd International Scientific Conference of the UL session "Cognitive Science". (2024)**

Agnese A. Pastare, Jurgis Šķilters, Solvita Umbraško, Santa Bartušēvica, Līga Zariņa, Laura Zeļģe, Ardis Platkājis, Jānis Mednieks, Aleksejs Ševčenko, Nauris Zdanovskis, Artūrs Šilovs, Edgars Naudiņš.

*Vizuāli telpisko spēju saistība ar galvas smadzeņu domēnu tilpumu mērījumiem pieaugušajiem ar un bez neirodeģeneratīviem traucējumiem.*

# Conferences

## Spatial Cognition 2024, Dublin

### NEURODEGENERATIVE CONSTRAINTS IN SPATIAL ABILITIES: A MULTIDIMENSIONAL APPROACH

Santa Bartuševiča<sup>1</sup>, Jurgis Škilters<sup>1</sup>, Solvita Umbrāško<sup>1</sup>, Līga Zarīna<sup>1</sup>, Laura Zelģe<sup>1</sup>, Agnese Anna Pastare<sup>1,2</sup>, Ardis Platkājis<sup>2</sup>, Jānis Mednieks<sup>2</sup>, Aleksejs Ševčenko<sup>2</sup>, Nauris Zdanovskis<sup>2</sup>, Artūrs Šilovs<sup>2</sup>, Edgars Naudiņš<sup>2</sup>, Baingio Pinna<sup>3</sup>, Vilijus Marmā<sup>3,4</sup>

1. Laboratory for Perceptual and Cognitive Systems at the Faculty of Computing, University of Latvia, Latvia
2. Rīga Stradiņš University, Latvia
3. University of Sassari, Italy
4. Lithuanian University of Health Sciences, Lithuania

### NAVIGATING THE MIND: EXPLORING SPATIAL ABILITIES AND INDIVIDUAL FACTORS IN ATHLETES

Santa Bartuševiča<sup>1</sup>, Laura Zelģe<sup>1</sup>, Jurgis Škilters<sup>1</sup>, Solvita Umbrāško<sup>1</sup>, Līga Zarīna<sup>1</sup>

1. Laboratory for Perceptual and Cognitive Systems at the Faculty of Computing, University of Latvia

## COGSCI 2024, Rotterdam.

### Neurodegenerative constraints in stimulus-driven eye movements

Santa Bartuševiča<sup>1</sup>, Jurgis Škilters<sup>1</sup>, Solvita Umbrāško<sup>1</sup>, Līga Zarīna<sup>1</sup>, Laura Zelģe<sup>1</sup>, Agnese Anna Pastare<sup>1,2</sup>, Ardis Platkājis<sup>2</sup>, Jānis Mednieks<sup>2</sup>, Aleksejs Ševčenko<sup>2</sup>, Nauris Zdanovskis<sup>2</sup>, Artūrs Šilovs<sup>2</sup>, Edgars Naudiņš<sup>2</sup>, Baingio Pinna<sup>3</sup>

1. Laboratory for Perceptual and Cognitive Systems, Faculty of Science and Technology, University of Latvia, Latvia
2. Rīga Stradiņš University, Latvia
3. University of Sassari, Italy



# Conferences

**Santa Bartušēvica, Laura Zeļģe, Solvita Umbraško, Līga Zariņa, Jurgis Šķilters, Deniss Fjodorovs (2025) Toward a Framework of Visuo Spatial Measurements in Sports. RSU Research Week 2025**



**Laura Zeļģe, Santa Bartušēvica, Solvita Umbraško, Jurgis Šķilters, Līga Zariņa, Deniss Fjodorovs (2025) Visuo spatial processes in sport: a preliminary analysis. 'Cognitive Science' (83rd International Scientific Conference of the University of Latvia)**

**Jeļena Smilga, Solvita Umbraško, Jurgis Šķilters, Līga Zariņa, Santa Bartušēvica, Laura Zeļģe (2025) Categorization in Parkinson's Disease: a comparative analysis of Latvian and Russian. 'Cognitive Science' (83rd International Scientific Conference of the University of Latvia)**

**Jurgis Šķilters, Līga Zariņa, Solvita Umbraško, Laura Zeļģe, Santa Bartušēvica (2025) Neurodegenerative impacts on eye movements in the processes of grouping, segmenting, and accentuating. 'Cognitive Science' (83rd International Scientific Conference of the University of Latvia)**

# Planned publications/ conferences

## Are associations between spatial ability and mathematics at 6-7 years moderated by gender?

Santa Bartušēvica<sup>1</sup>, Marija Živković<sup>2</sup>, Camilla Gilmore<sup>3</sup>, Katie Gilligan-Lee<sup>4</sup>, and Emily K. Farran<sup>5</sup>

1. Laboratory for Perceptual and Cognitive Systems, University of Latvia, Latvia
2. Technological University Dublin, Ireland
3. Department of Mathematics Education, University of Loughborough, Loughborough, England
4. School of Psychology, University College Dublin, Dublin, Ireland
5. School of Psychology, University of Surrey, UK

## Vizuāli telpiskie procesi pielāgotaiā sportā



Latvijas IV Nacionālais rehabilitācijas kongress

WWW.LNRK.LV

## Submitted: **Substantia Nigra and Neuromelanin Volume Changes in association with Motor Symptoms in Parkinson's Disease Using Semi-Automated Neuromelanin quantification**

Authors: Arturs Silovs \*, Gvido Karlis Šķiburs, Nauris Zdanovskis, Aleksejs Sevčenko, Janis Mednieks, Edgars Naudins, Santa Bartusevica, Solvita Umbrasko, Līga Zarina, Laura Zelge, Agnese Anna Pastare, Jelena Smilga, Jurgis Šķilters, Baingio Pinna, Ardis Platkājis

## Submitted: **Neurodegenerative impairments on the perception of directional effects in midlevel vision: Eye movement analysis and MRI scans**

Jurgis Šķilters, Līga Zariņa, Baingio Pinna, Solvita Umbrāško, Jānis Mednieks, Santa Bartušēvica<sup>1</sup>, Artūrs Šilovs, Aleksejs Ševčenko, Laura Zeļģe, Ardis Platkājis, Nauris Zdanovskis, Edgars Naudiņš, and Agnese A. Pastare

## LU jauno docētāju programma/UL Junior Lecturer Programme

Pedagogu profesionālās kompetences pilnveides izglītība/Professional  
competence development education for teachers

Other  
activities



**Thank you!**