




58<sup>TH</sup> SCIENTIFIC CONFERENCE FOR STUDENTS  
OF PHYSICS AND NATURAL SCIENCES



**OPENREADINGS  
2015**


PROGRAMME AND ABSTRACTS



MARCH 24-27  
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**LATVIJAS UNIVERSITĀTE**  
 ANNO 1919

**OPENREADINGS 2015**  
 58th Scientific Conference for Students of Physics and Natural Sciences  
 24-27th of March



**IfADO**




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**ACCOMMODATION LAG UNDER MONOCULAR AND BINOCULAR CONDITIONS IN SYMPTOMATIC AND ASYMPTOMATIC EMMETROPES**

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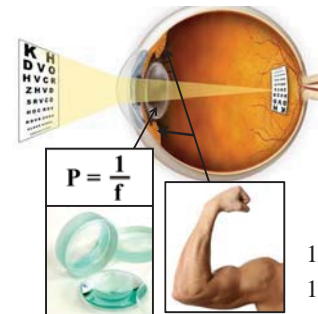

**ESF**  
 EIROPAS SAVIENĪBA  
 EIROPAS SOCIĀLAIS FONDS  
 EGIUDĪJUMS TAVĀ NĀKOTNĒ


▣ Long hours
▣ Close distance
▣ Work & free time


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## Accommodation

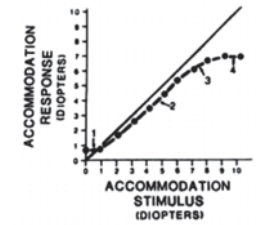


$P = \frac{1}{f}$





$1/40 \text{ cm} = 2,50\text{D}$   
 $1/25 \text{ cm} = 4,00\text{D}$

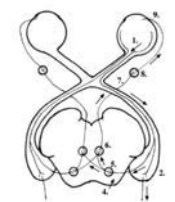


**ACCOMMODATION RESPONSE (DIOPTERS)**  
**ACCOMMODATION STIMULUS (DIOPTERS)**

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□ Other factors that influence eye accommodation:

- ▣ age
- ▣ illumination
- ▣ pupil size
- ▣ target spatial frequency
- ▣ cognitive demand
- ▣ etc.




1. Nervus opticus  
 2. Corpus geniculatum laterale  
 3. Tectum opticum  
 4. Colliculus superior  
 5. Nucleus pretectalis  
 6. Edinger-Westphal nucleus  
 7. Nervus oculomotorius  
 8. Ganglion ciliare  
 9. Musculus sphincter pupillae

Neural pathways involved in the light reflex and accommodation.

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## Method

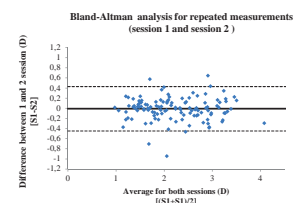
- ▣ 20 subjects ( $24 \pm 4$  years)
  - ▣ 50% with symptoms
  - ▣ 50% without symptoms
- ▣ Accommodation was measured with open field autorefractometer Shin-Nippon, SRW-5000
  - ▣ 3 distances (40 cm, 30 cm un 24 cm)
  - ▣ For each distance monocular and binocular condition
  - ▣ One measurement was 2 min long, ~130 data points
  - ▣ Random order
  - ▣ 3 min rest after each measurement
  - ▣ Dynamic task stimulus
  - ▣ Whole experiment ~1,5h long



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## Data repeatability

- ▣ All experiment was replicated twice within  $7 \pm 2$  days
- ▣ High repeatability ( $r = 0,95$ )
- ▣ Standard deviation for repeated sessions 0,22 D



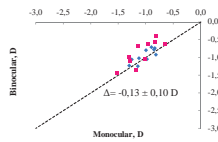
Bland-Altman analysis for repeated measurements (session 1 and session 2)

Y-axis: Difference between 1 and 2 session (D) [SI-SI]/2  
 X-axis: Average for both sessions (D) [(S1+S1)/2]

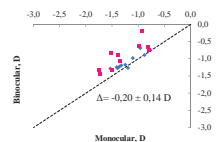
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## Monocular versus binocular

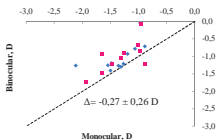
Accommodation lag 40 cm



Accommodation lag 30 cm



Accommodation lag 24 cm

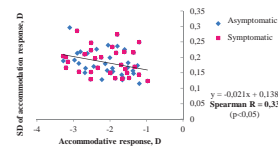


- Accommodation lag binocularly < monocularly ( $p < 0,001$ )
- Difference (mon-bin) 24 cm > 40 cm ( $p < 0,01$ )
- No difference between symptomatic and asymptomatic ( $p > 0,05$ )

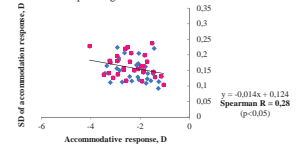
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## Standard deviation (SD) analysis

Accommodative response correlation with corresponding monocular SD



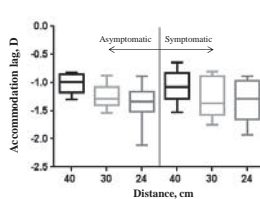
Accommodative response correlation with corresponding binocular SD



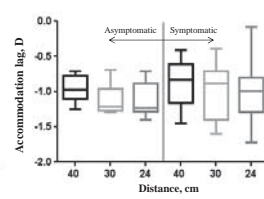
- With increased demand, SD also increase ( $p < 0,05$ )
- Lag SD binocularly < monocularly ( $p < 0,001$ )
- No difference between symptomatic and asymptomatic group

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Monocular



Binocular

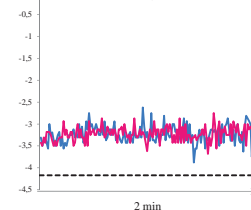


- IQR for symptomatic group is larger in both monocular and binocular condition
- In monocular condition there is no difference between symptomatic and asymptomatic group
- In binocular condition accommodation for symptomatic subjects tends to be more uptight

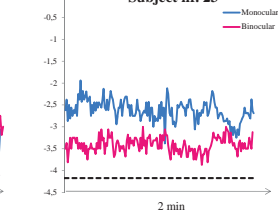
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## Monocular versus binocular accommodative response

Subject nr. 16



Subject nr. 23



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## Conclusion

- In binocular condition eye accommodation work more precisely and more stable
- For symptomatic group in binocular condition accommodation tends to be even more uptight then necessary and that could lead to fatigue
- Experiment should be improved by adding more subjects in the symptomatic group

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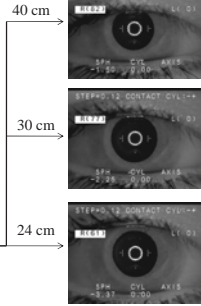
Thank you!



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## Open field autorefractometer



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## CISS survey

Possible Subjective Symptoms	Frequency			
	Never (0)	Seldom (1)	Frequently (2)	Always (3)
1. Do your eyes feel tired when reading or doing close work?				
2. Do your eyes feel uncomfortable when reading or doing close work?				
3. Do you have headaches when reading or doing close work?				
4. Do you feel sleepy when reading or doing close work?				
5. Do you lose concentration when reading or doing close work?				
6. Do you have trouble remembering what you have read?				
7. Do you have double vision when reading or doing close work?				
8. Do you see the words move, jump, swim or appear to float on the page when reading or doing close work?				
9. Do you feel like you read slowly?				
10. Do your eyes ever hurt when reading or doing close work?				
11. Do your eyes ever feel sore when reading or doing close work?				
12. Do you feel a "pulling" feeling around your eyes when reading or doing close work?				
13. Do you notice the words blurring or coming in and out of focus when reading or doing close work?				
14. Do you lose your place while reading or doing close work?				
15. Do you have to reread the same line of words when reading?				
<b>Total score</b>				