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Visual Function of Para Nordic Skiers with Visual Impairment

Allianz: Global ParaSport

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Research Goal


- The purpose of this study is to develop new, evidence based classification systems for Alpine and Nordic VI skiers
 - Need tests of visual function that accurately reflect skiers' visual demands

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Methods

- Cross-sectional exploratory study
- Para Alpine skiers
 - IPCAS Landgraaf Competition, Landgraaf, Netherlands, November 2015
- Para Nordic skiers
 - International Para Nordic World Cup, Finsterau, Germany, February 2016
- Comparison of skiers' performance with visual function

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Visual Function Measures

- Static visual acuity
 - ETDRS, Berkeley Rudimentary Vision Test
- Dynamic visual acuity and Low contrast visual acuity
 - mov&, V&mp Vision Suite
- Contrast sensitivity
 - 2015/16: Pelli-Robson
- Colour Vision
 - Large D-15
- Glare Sensitivity and Glare Recovery
 - Mars chart and transilluminator

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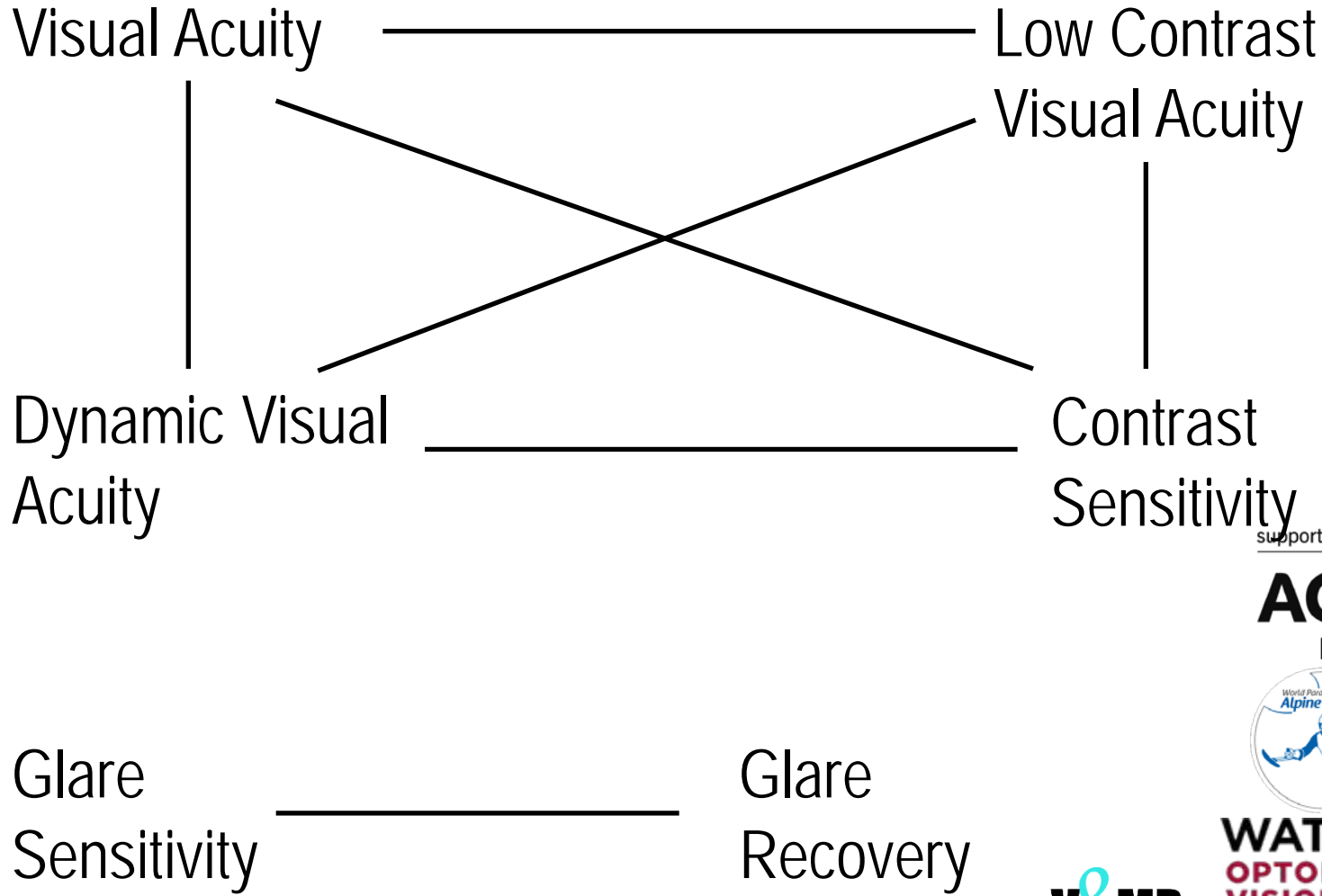


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Participants

Visual Function Tests	n	Mean \pm SD	Range
Static Visual Acuity (logMAR)	55	1.54 \pm 0.72	0.14 – 3.50
Contrast Sensitivity (logCS)	50	0.64 \pm 0.50	0.00 – 1.55
Dynamic Visual Acuity (logMAR)	51	1.92 \pm 0.57	0.48 – 2.72
Low Contrast Visual Acuity (logMAR)	48	1.77 \pm 0.66	0.38 – 2.70
Glare Sensitivity (change in logCS)	48	0.12 \pm 0.19	-0.36 – 0.72
Glare Recovery (change in logCS)	47	-0.04 \pm 0.15	-0.44 – 0.24
Colour Vision	53	33 with defect	20 without defect

Significant Correlations



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Performance Measure

- IPC Alpine Skiing Points and IPC Nordic Skiing Points
 - Points given for finishing a race
 - First place competitor: 0 points
 - Other competitors assigned points based on time difference in relation to first place
 - Points = penalty
- IPCAS/IPCNS points averaged over a season

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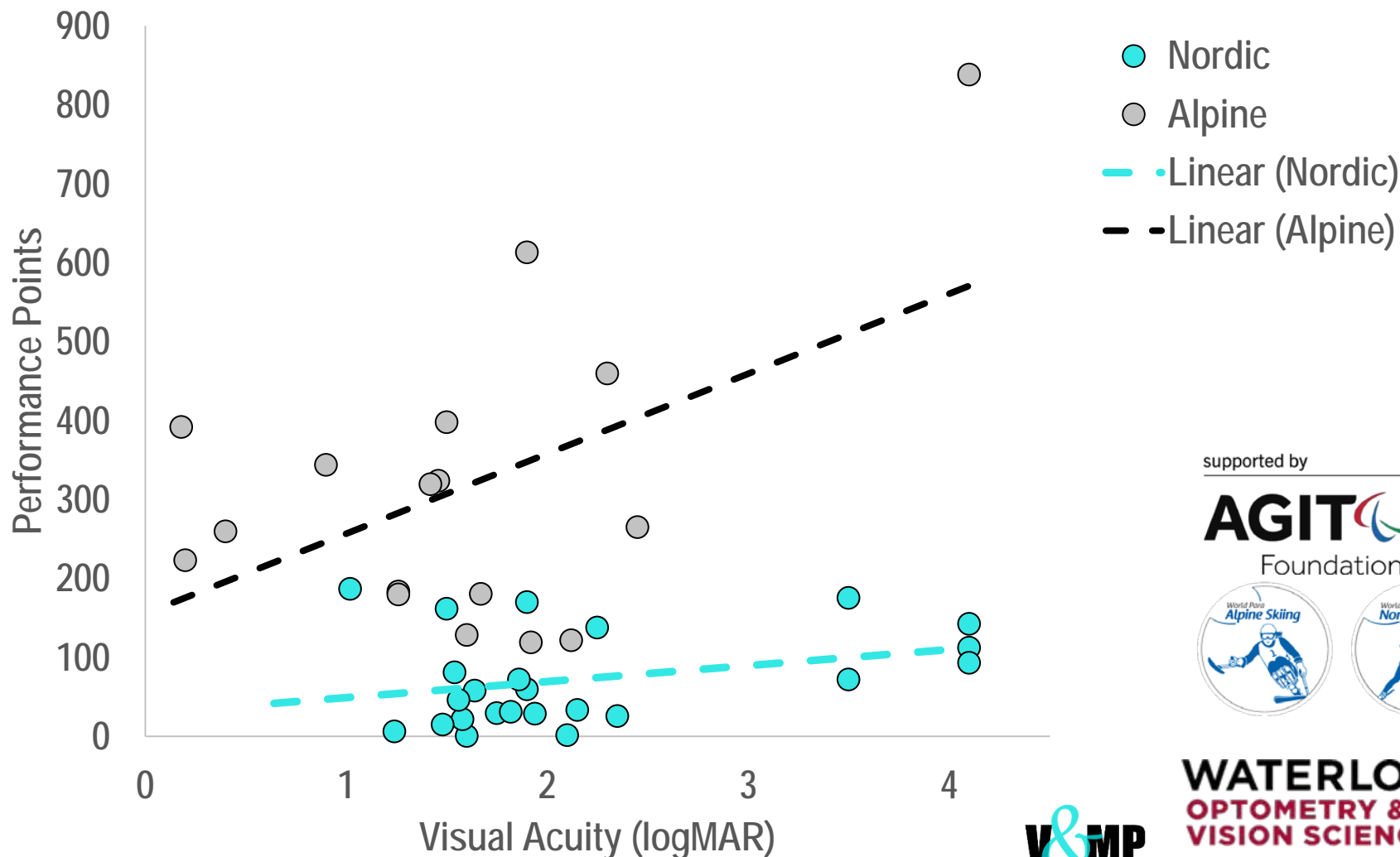
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Visual Acuity vs. Performance



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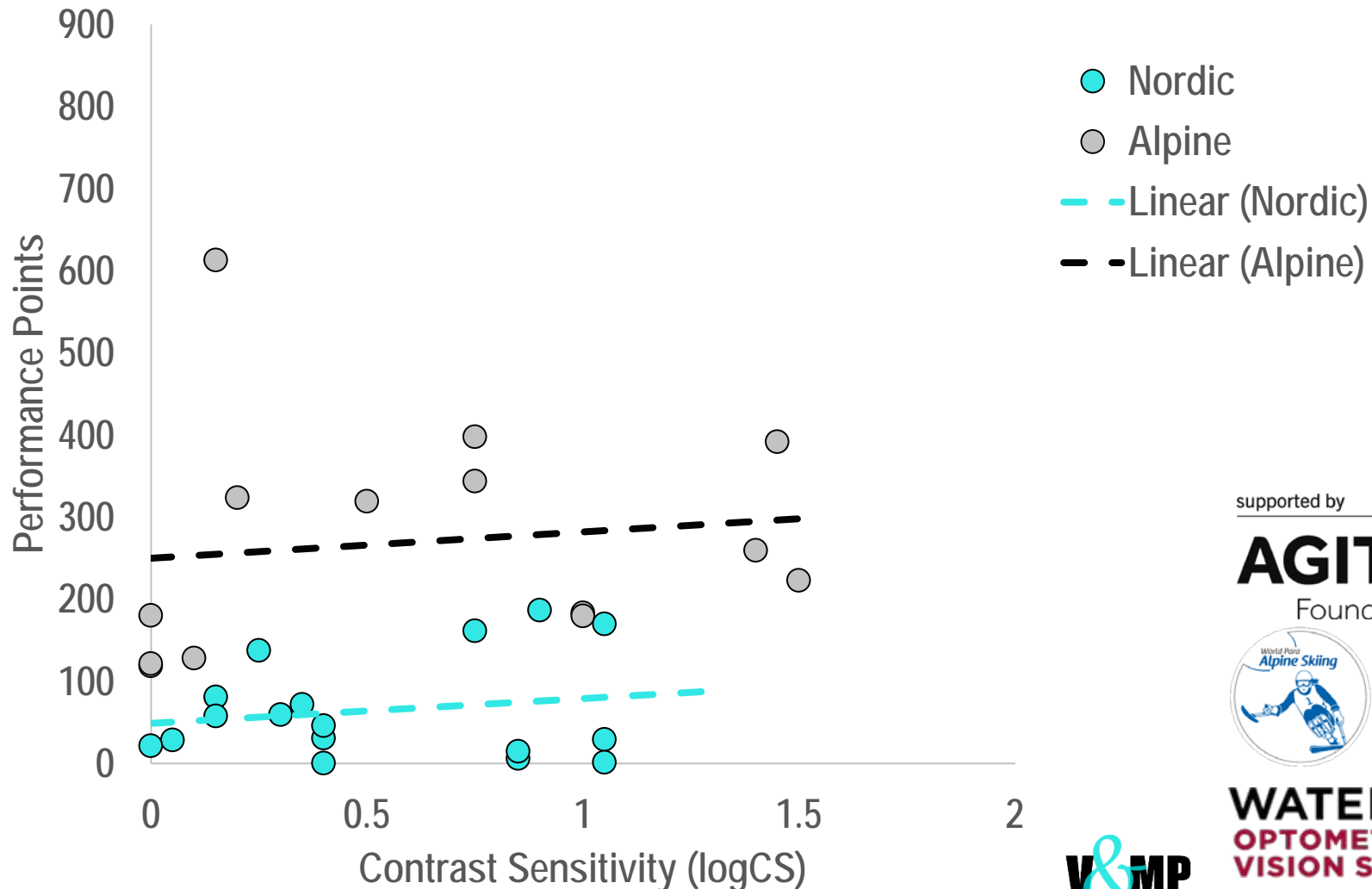
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Contrast Sensitivity vs. Performance




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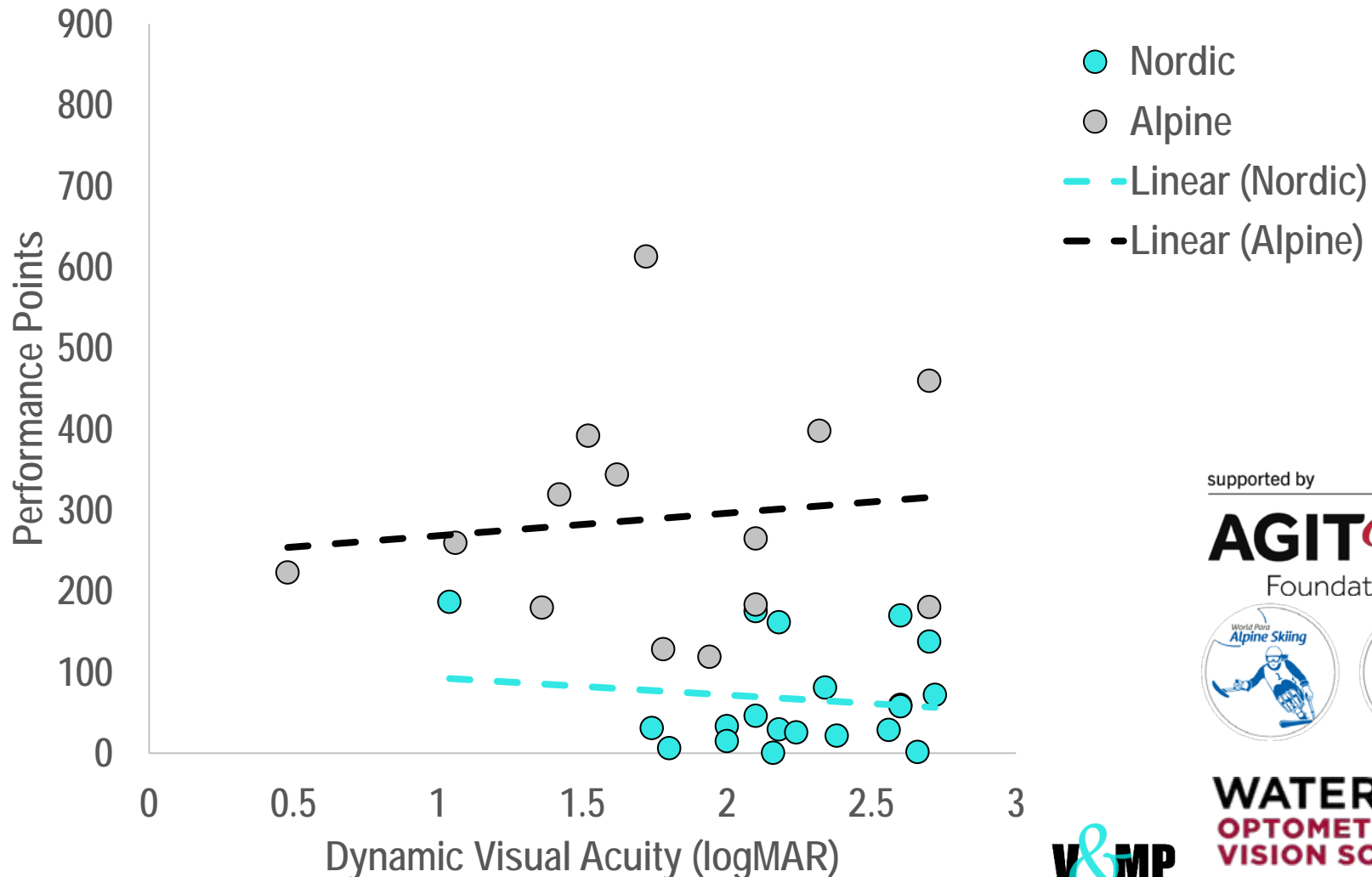
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Dynamic Visual Acuity vs. Performance



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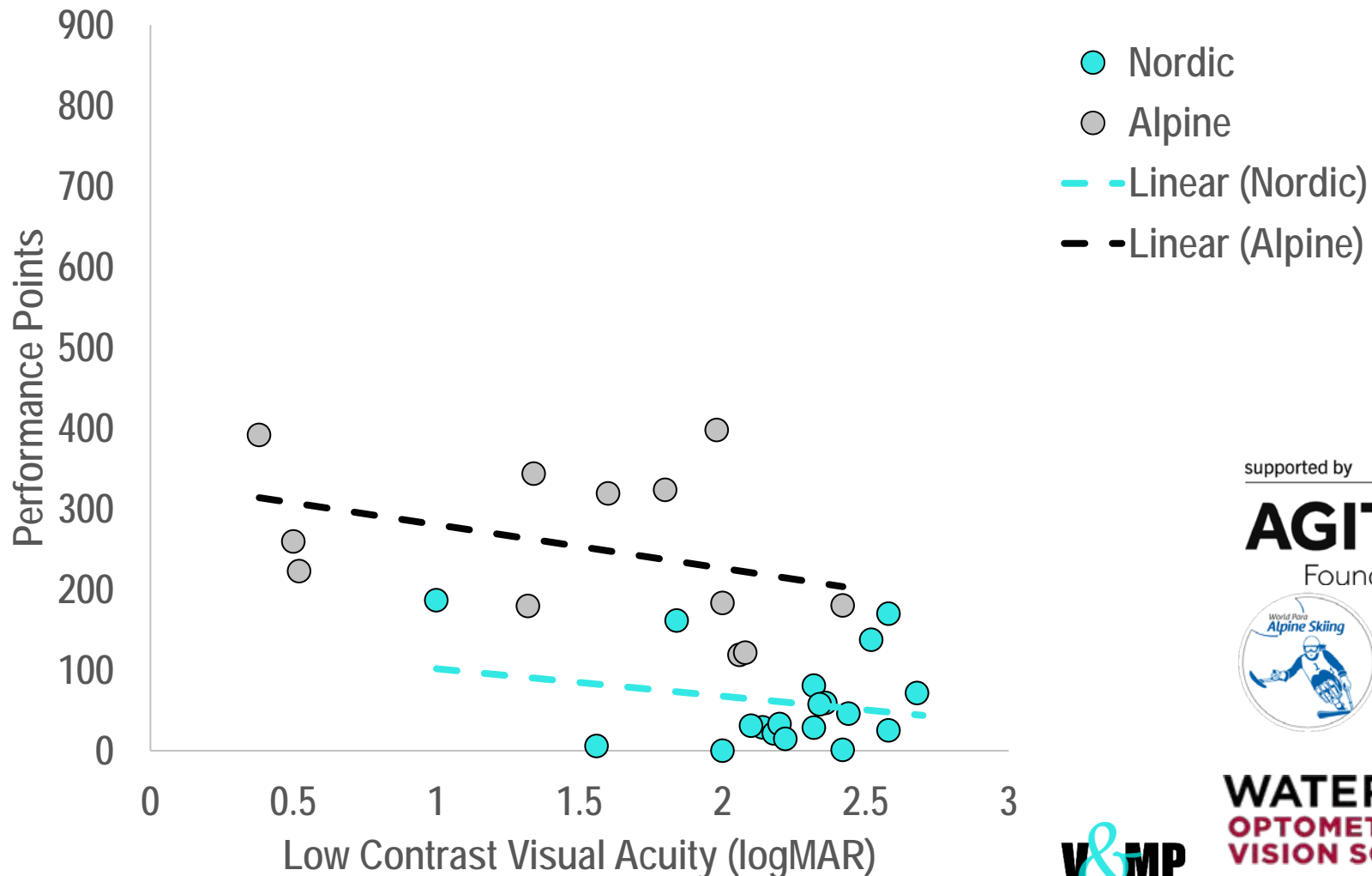
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Low Contrast Visual Acuity vs. Performance




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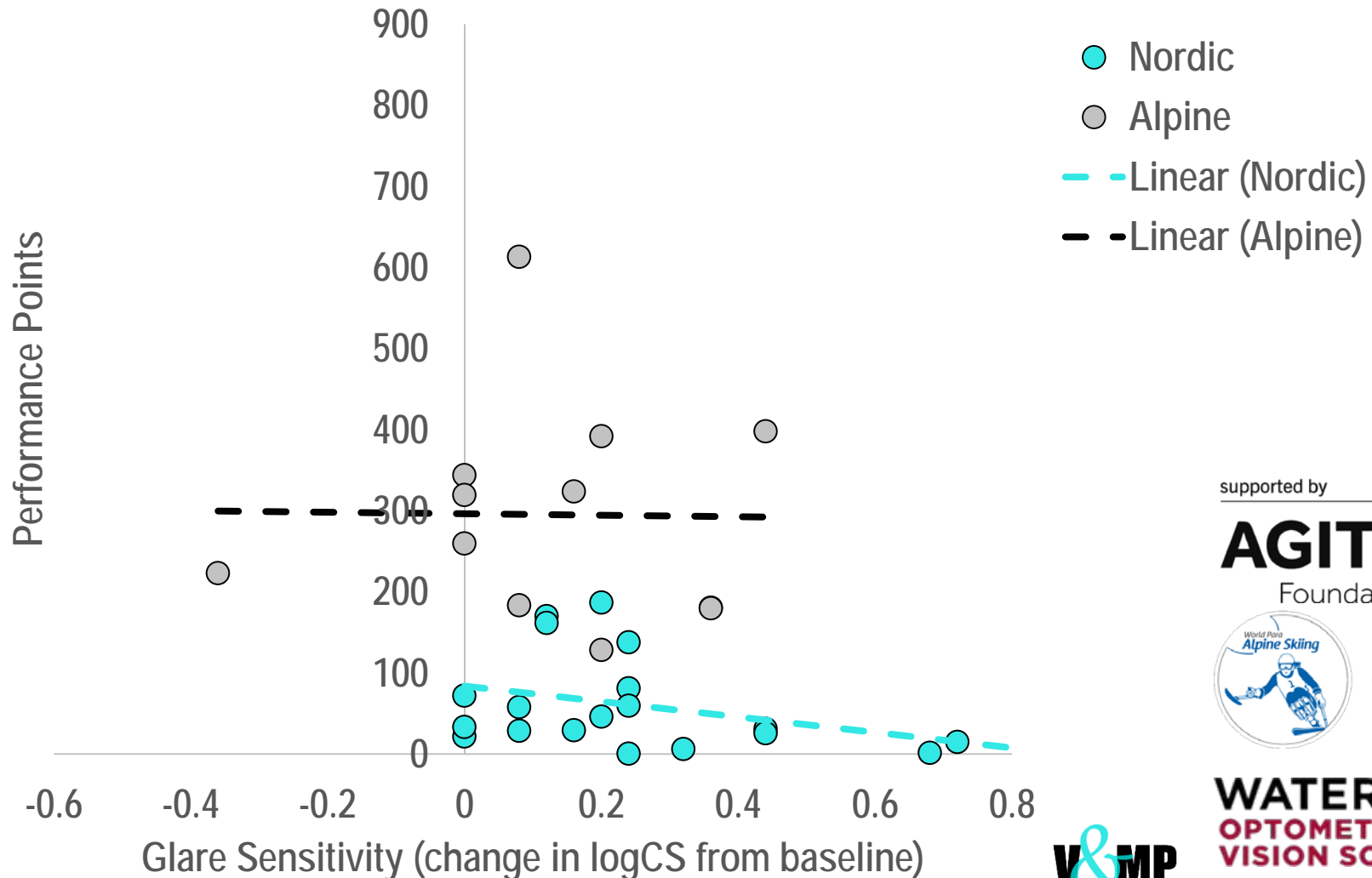
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Glare Sensitivity vs. Performance



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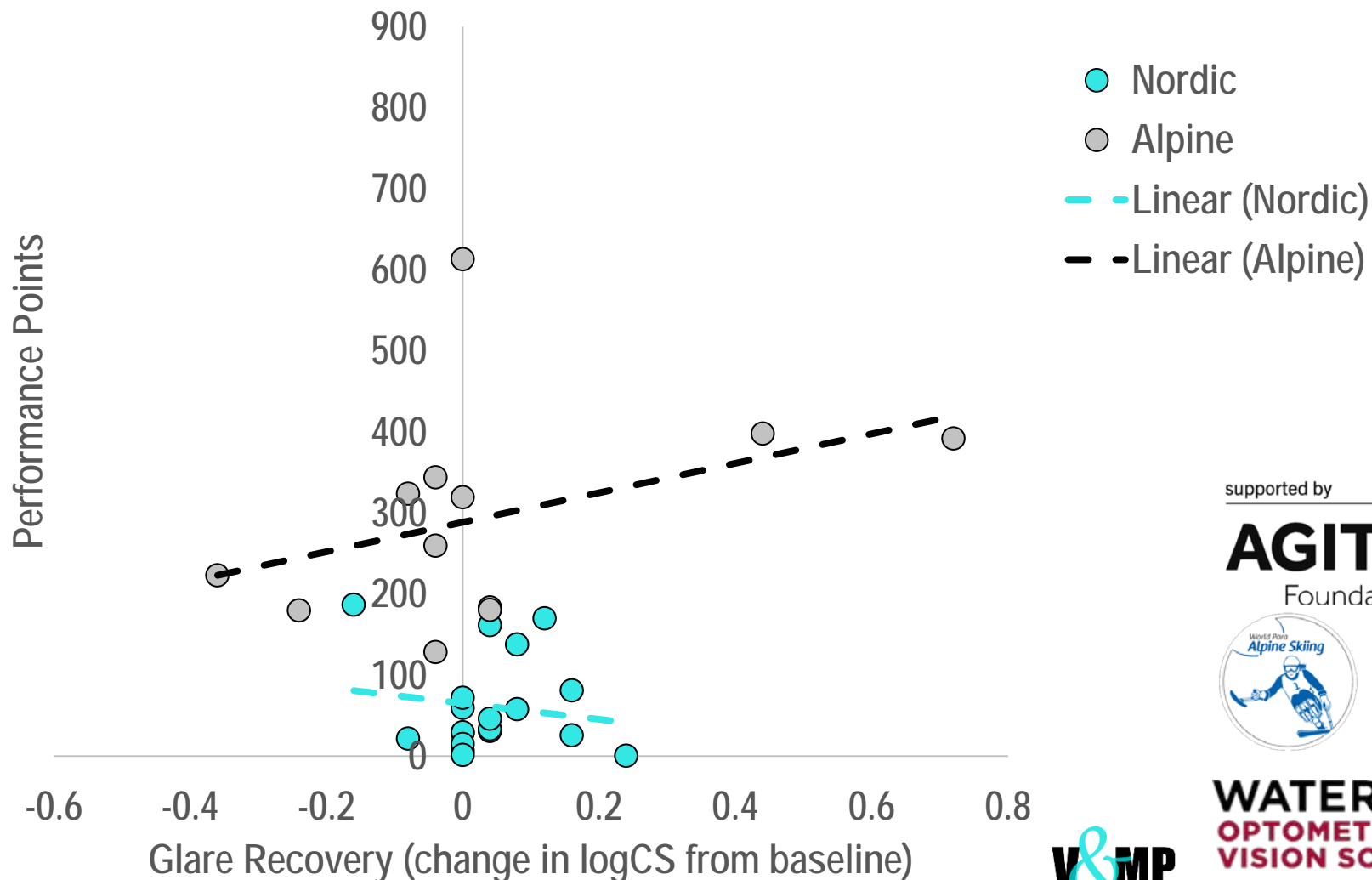
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Glare Recovery vs. Performance



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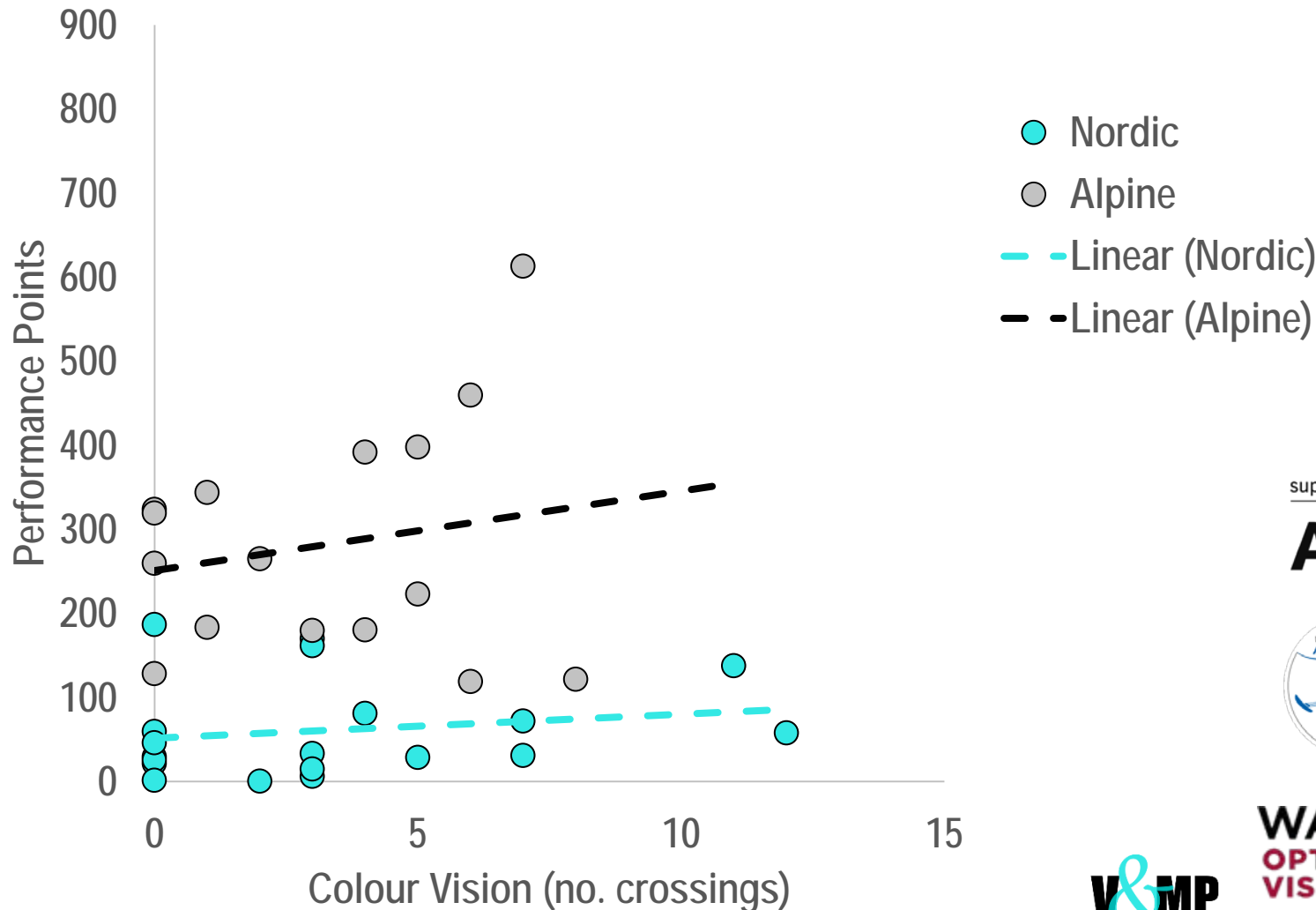
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Colour Vision vs. Performance




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Summary


- A wide range of visual function was measurable
 - Measures of visual acuity were well correlated
 - Contrast sensitivity was correlated with visual acuity
 - Glare sensitivity and glare recovery were well correlated
- Some tests did not work well in this population
 - Pelli-Robson contrast sensitivity
 - Monocular glare testing
- Poor correlations between individual factors and skiing performance
- No single factor predicts Nordic skiing performance
 - Visual Acuity appears to be predictive of Alpine skiing performance

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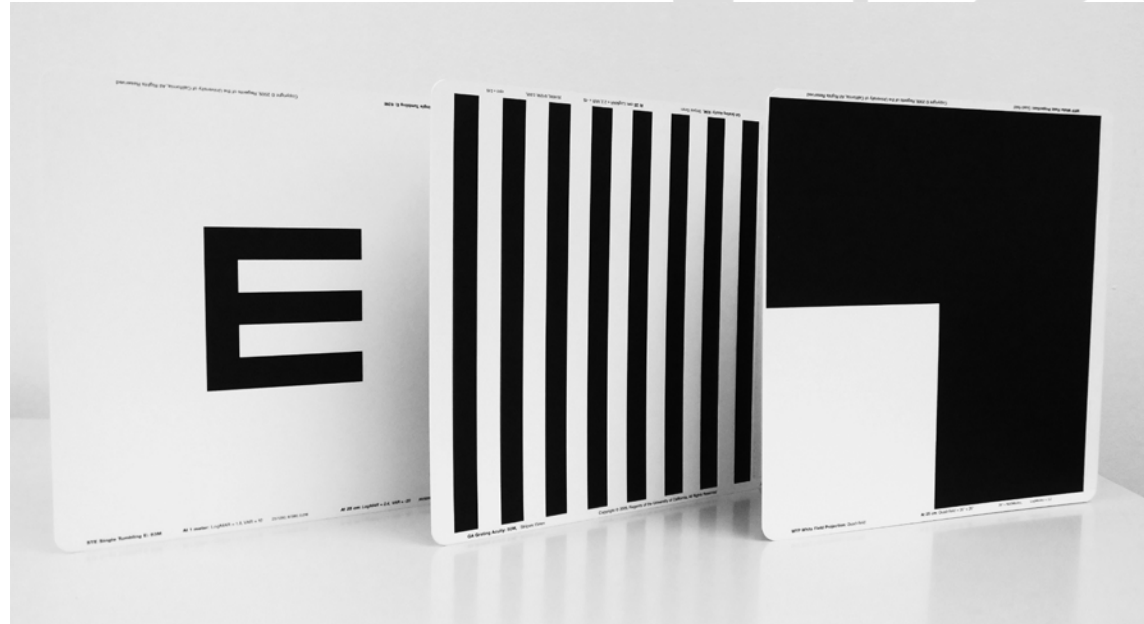
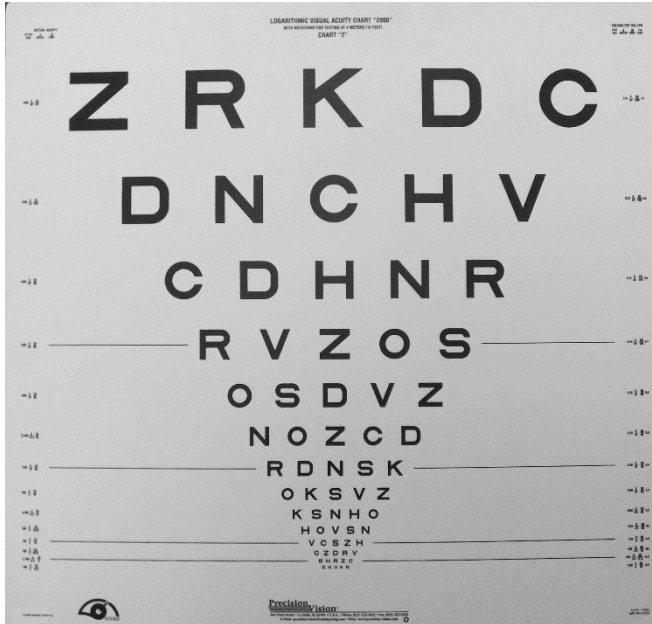
Performance Measure

- International Paralympic Committee Nordic Skiing Points
 - Single race points
 - Athlete A race points
$$= (\text{time}_{\text{athlete A}} / \text{time}_{\text{first place}}) \times \text{race factor}$$
 - International Ranking
 - 5 best race points averaged over two seasons
 - Normalization of race conditions, race distances, gender

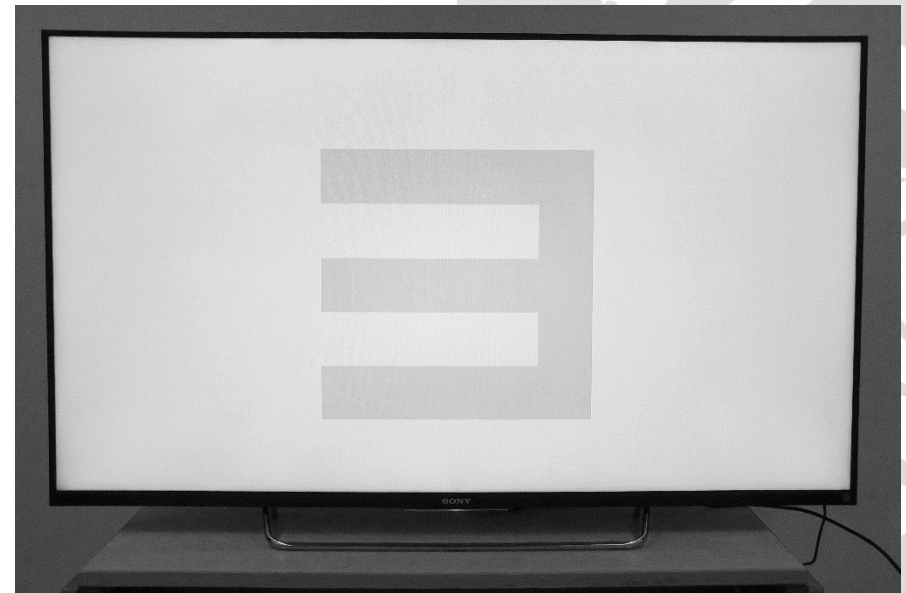
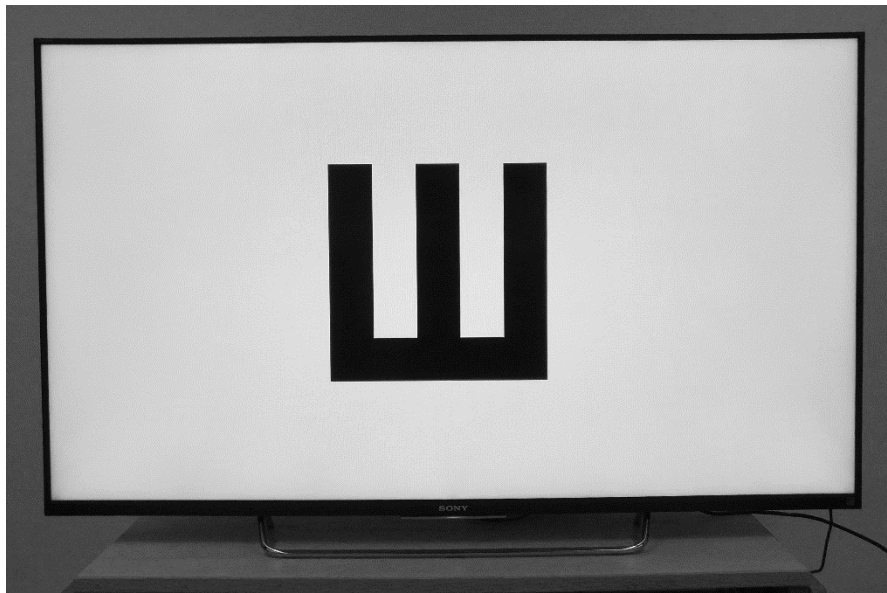
Classification Criteria

- Classification category is determined by visual acuity of visual field of the better eye only
- B1: VA worse than 2.6 logMAR
- B2: VA between 1.5 and 2.6 logMAR or VF radius less than 5 degrees
- B3: VA between 1.0 and 1.4 logMAR or VF radius less than 20 degrees

Static Visual Acuity



Dynamic Visual Acuity and Low Contrast Visual Acuity



Contrast Sensitivity and Glare (Sensitivity and Recovery)



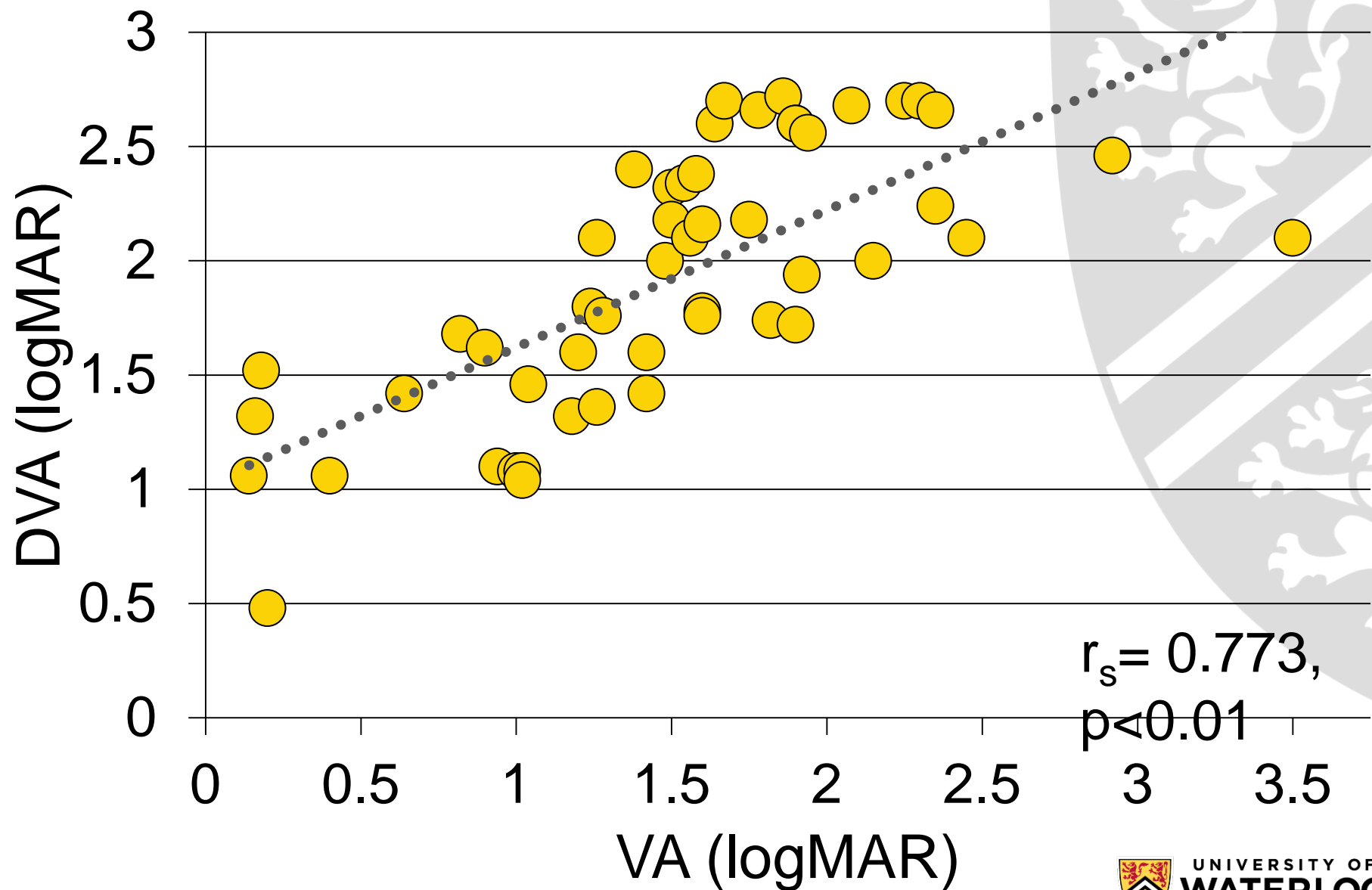


Figure 3: Visual Acuity and Dynamic Visual

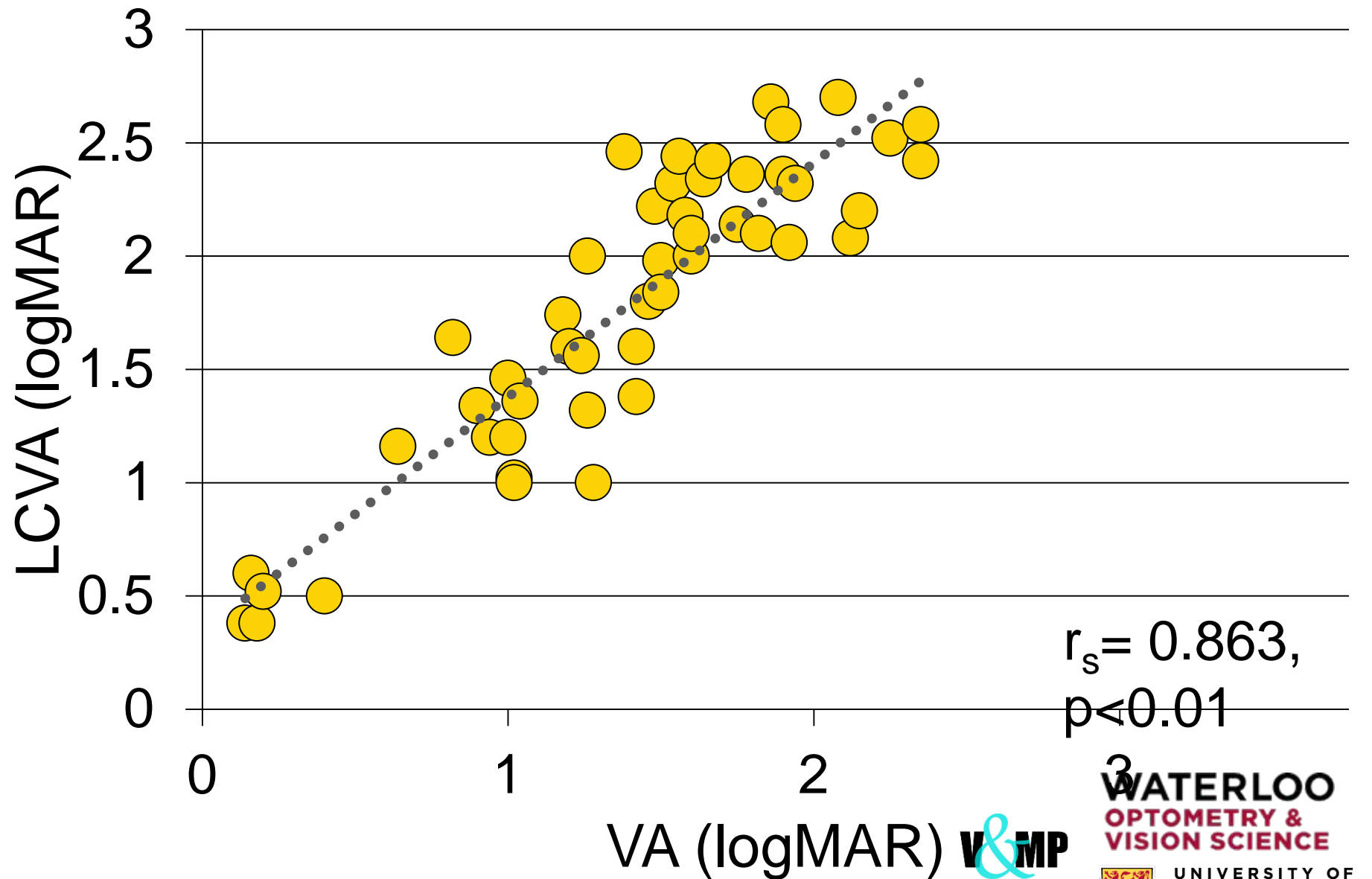


Figure 5: Visual Acuity and Low Contrast

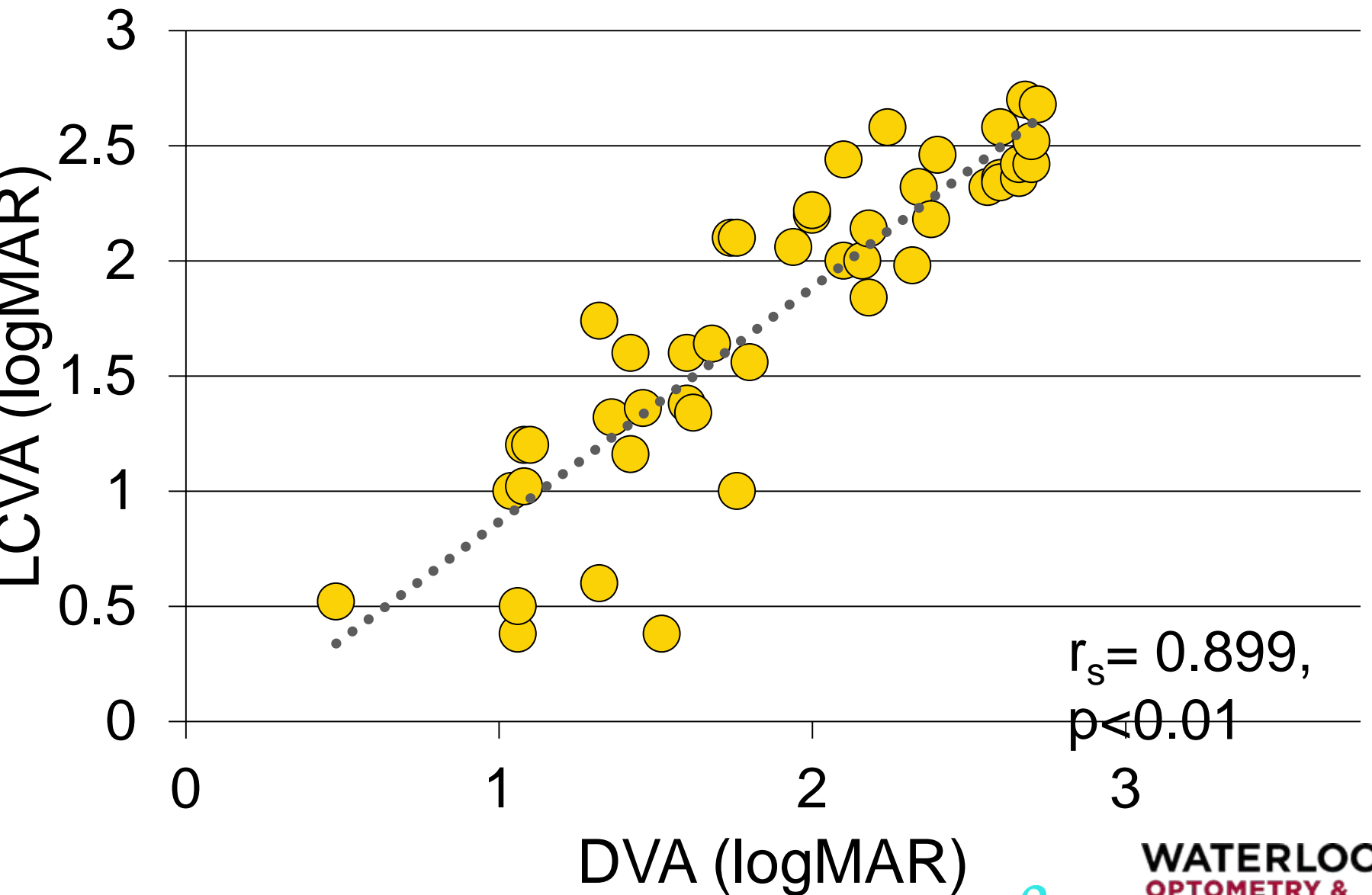


Figure 7: Dynamic Visual Acuity and Low Contrast Visual Acuity

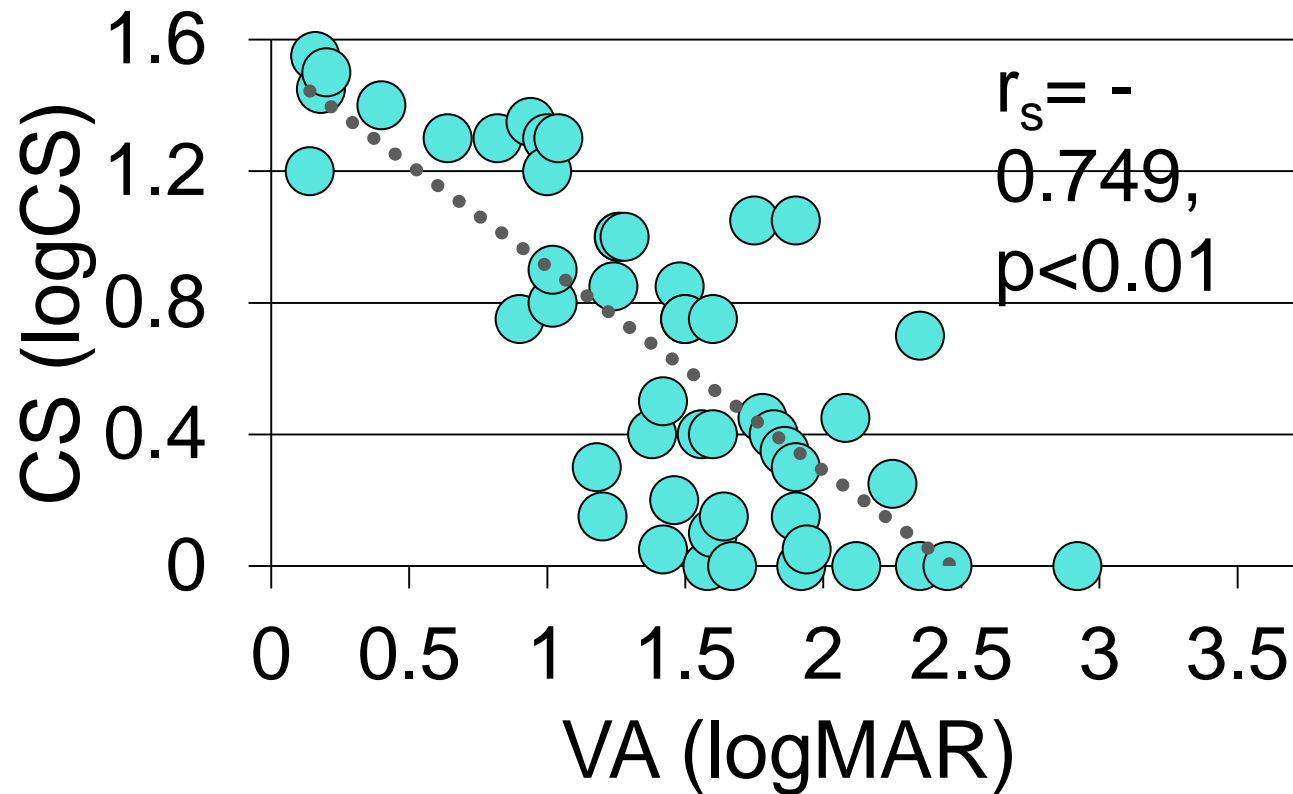
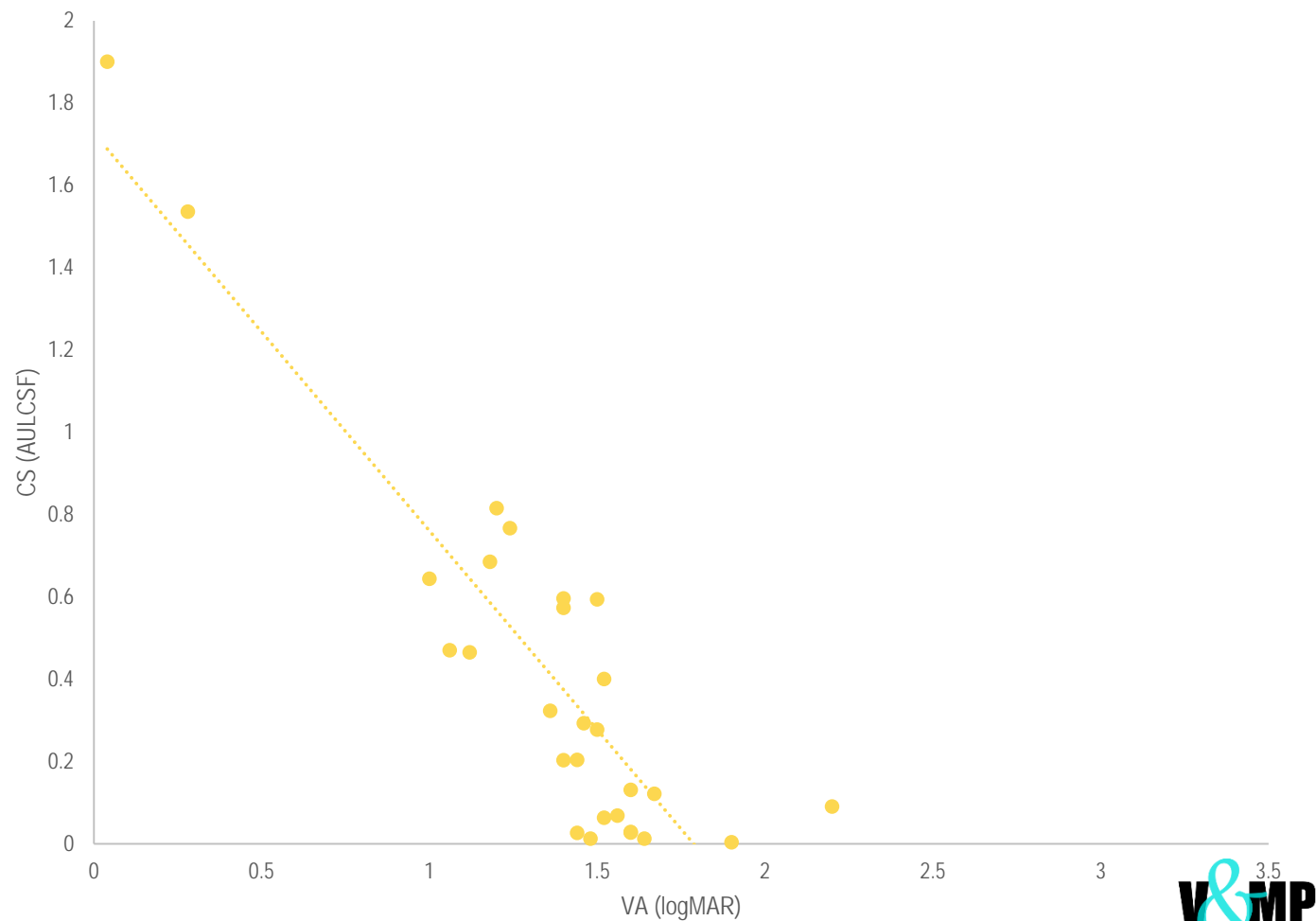


Figure 2: Visual Acuity and Contrast Sensitivity

Visual Acuity and Contrast Sensitivity



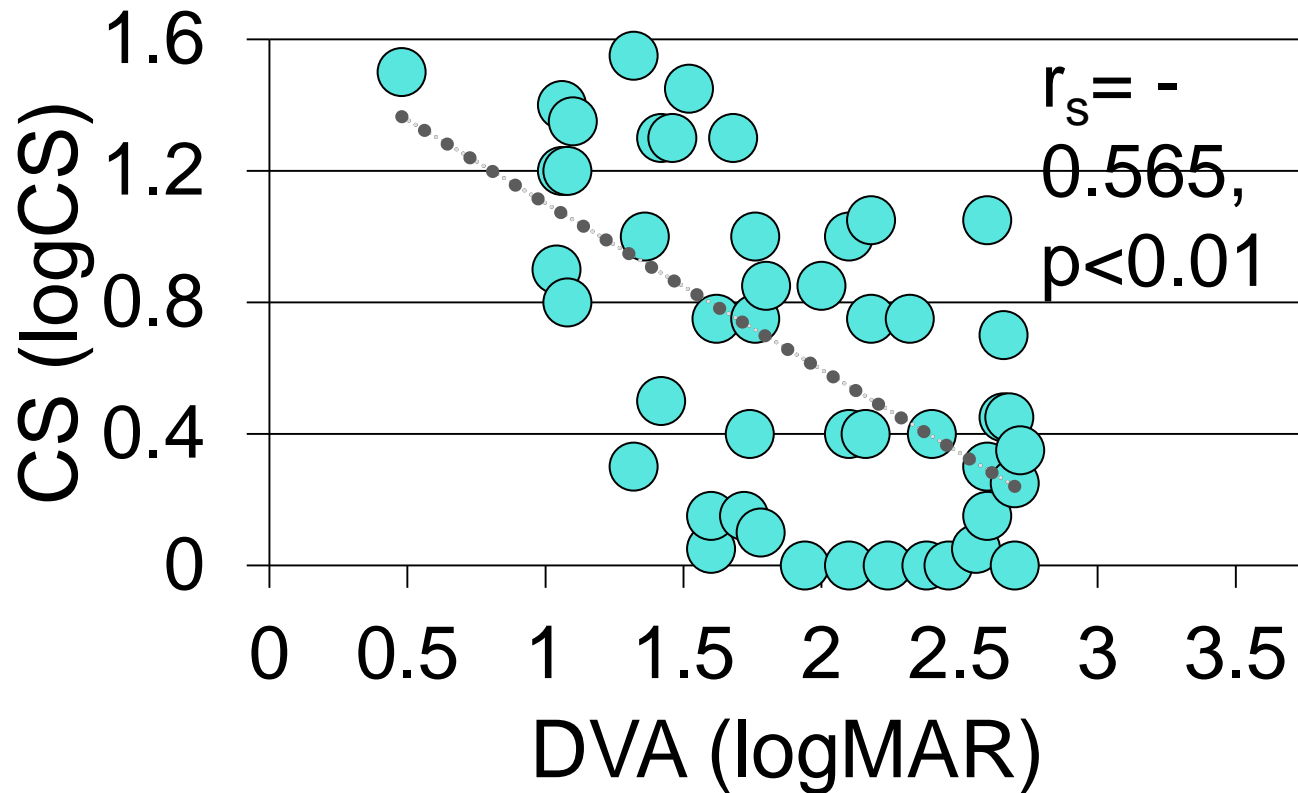


Figure 6: Dynamic Visual Acuity and Contrast Sensitivity

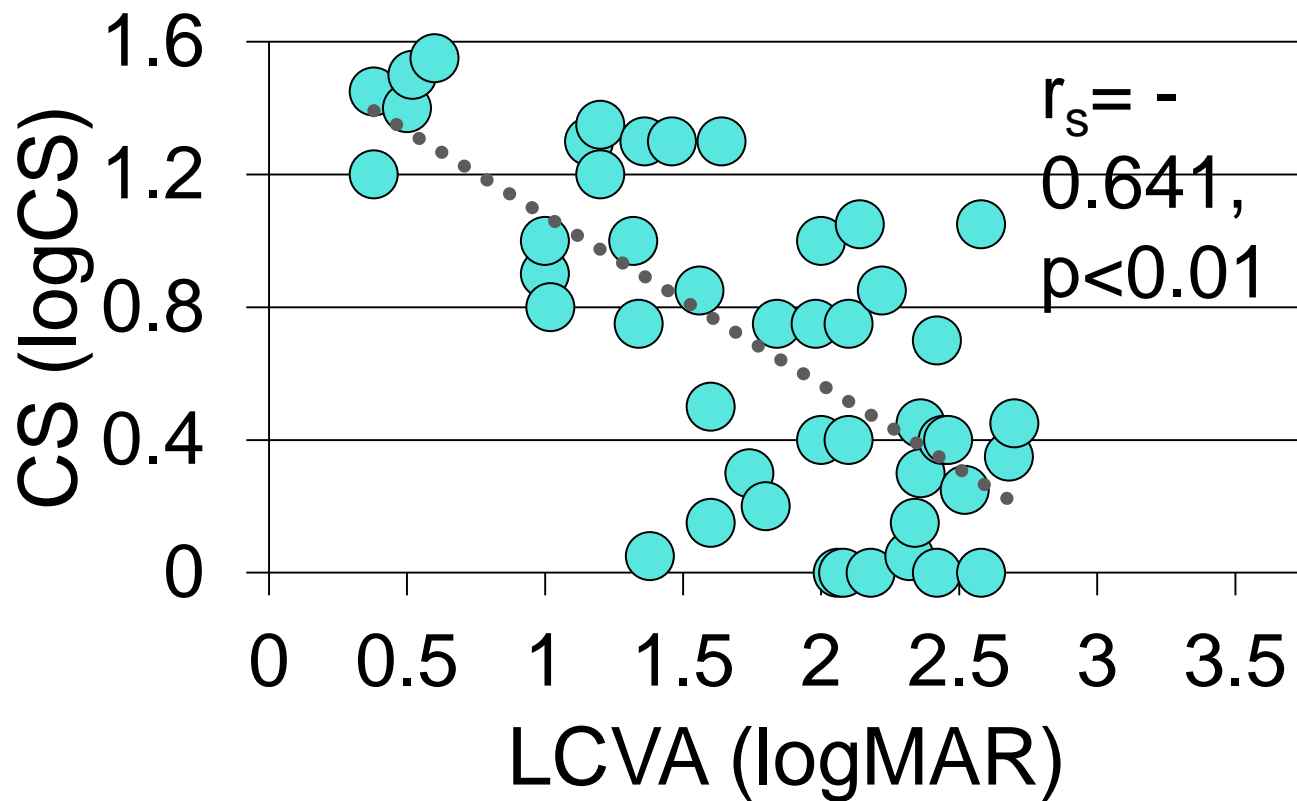


Figure 4: Low Contrast Visual Acuity and Contrast Sensitivity

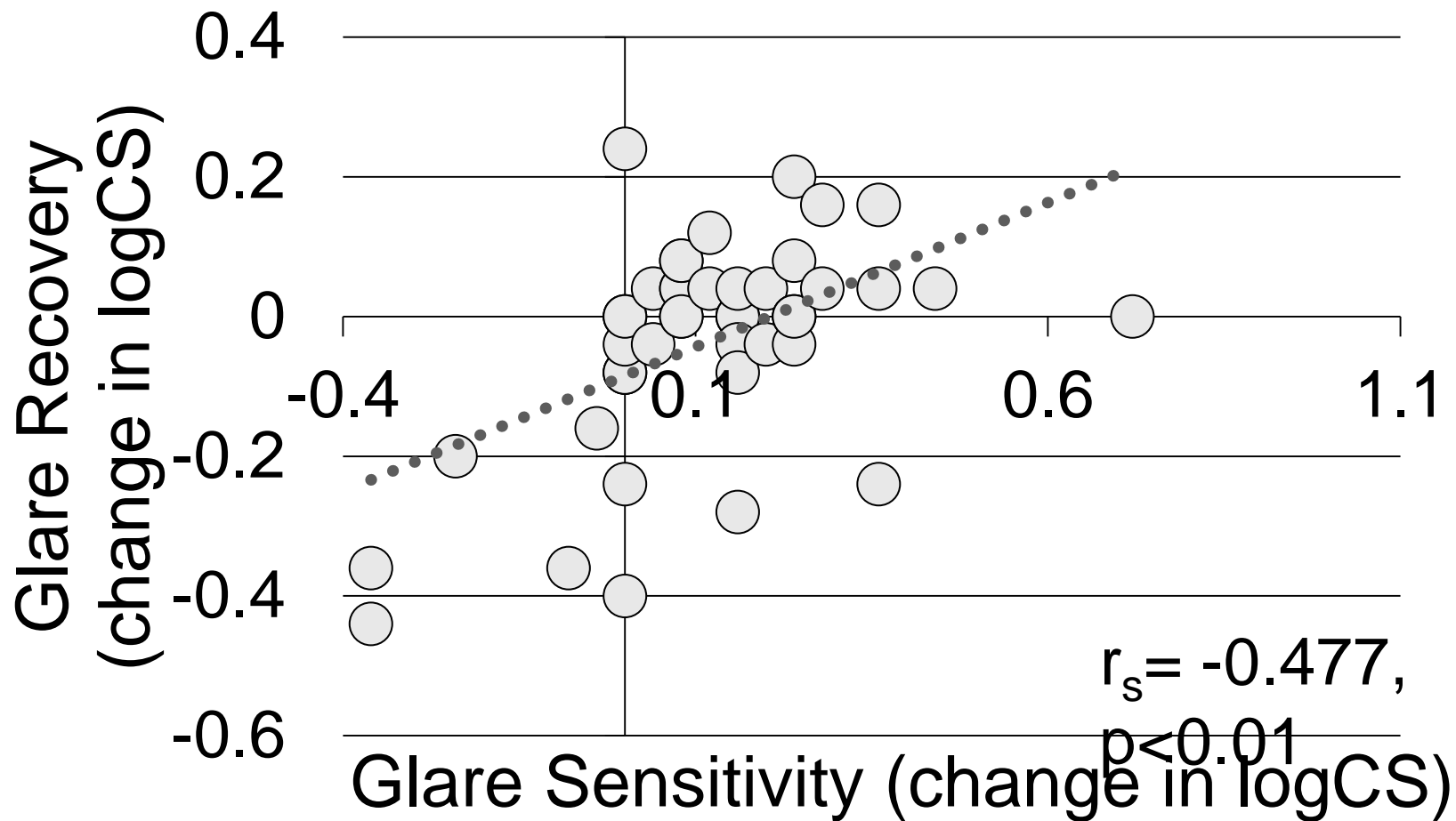


Figure 1: Glare Sensitivity and Glare Recovery