Investigation of motion perception in elite skiers with visual impairment

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Purpose

- Role of motion perception in skiing
  - Dynamic Visual Acuity (DVA)
  - Global Motion Perception (GMP)
    - Translational
    - Radial

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Measures of visual function

- Obstacles
  - Fellow skiers
  - Trees
  - Gates
- Tracks
  - Ungroomed snow
  - Curves
  - Slopes
- Weather
  - Shadows
  - Glare
  - Fog

Static Visual Acuity (SVA)

Dynamic Visual Acuity (DVA)

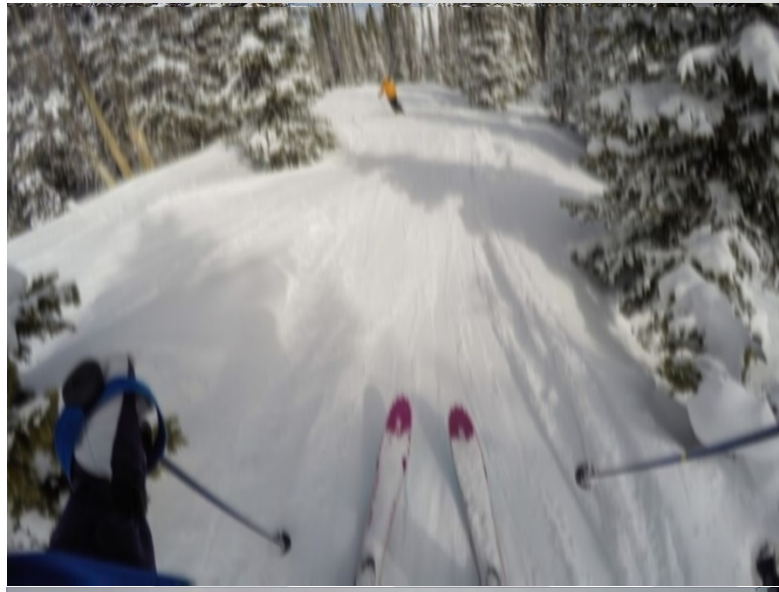
Visual Field (VF)

Contrast Sensitivity (CS)

Global Motion Perception (GMP)

Light Sensitivity

Glare Sensitivity



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Study design

- Cross-sectional cohort
- 2017 World Para Alpine & Para Nordic championships

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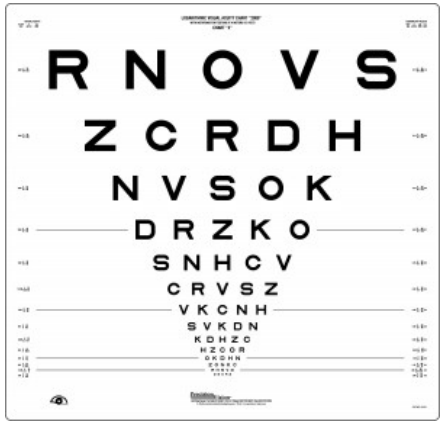
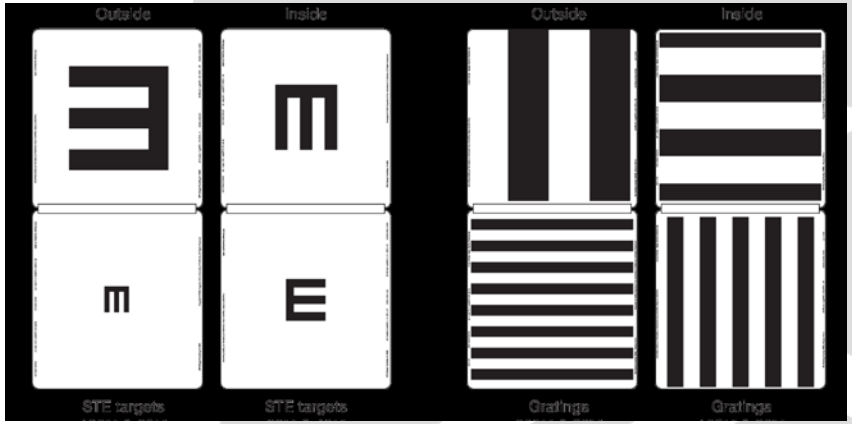
Methods

- Static visual acuity
- Dynamic visual acuity
- Global motion perception
- Contrast sensitivity[1]
- Visual field
  1. LP or NLP
  2. $\leq 5^{o}$
  3. $>5^{o}$ & $\leq 20^{o}$
  4. $>20^{o}$





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1. Dorr M, Wille M, Viulet T, Sanchez E, Bex PJ, Lu ZL, Lesmes L. Next-generation vision testing: the quick CSF. *Current Directions in Biomedical Engineering.* 2015;1:131–134

Data Analysis

- Descriptive
- Correlational
  - GMP & Visual functions
  - DVA & Visual functions
  - GMP & Performance
  - DVA & Performance

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Results

Thirty-six Paralympic skiers

- 15 Alpine (7 females, 8 males)
- 21 Nordic (7 females, 14 males)
- Age: 25.50 (16 to 58 years)

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Descriptive statistics

Variable	N	Median	Min	Max
SVA	36	1.56	.04	4.10
AULCSF	26	.28	.00	1.90
Peak CS	26	.76	.00	1.46
DVA	25	1.70	.50	2.30
MP Trans	30	62.25	9.33	100
MP Rad	30	64.50	12.83	100

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Correlations MP Vs. Other Measures

	MP Translational		MP Radial		DVA	
	Spearman's rho	Sig (2-t), N	Spearman's rho	Sig (2-t), N	Spearman's rho	Sig (2-t), N
SVA	.437	.016, 30	.440	.015, 30	.819	.000, 25
AST AULCSF	-.467	.016, 26	-.392	.048, 26	-.743	.000, 24
AST Peak CS	-.506	.008, 26	-.355	.075, 26	-.600	.002, 24
MP trans			.658	.000, 30	.500	.011, 25
MP rad	.658	.000, 30			.352	.084, 25

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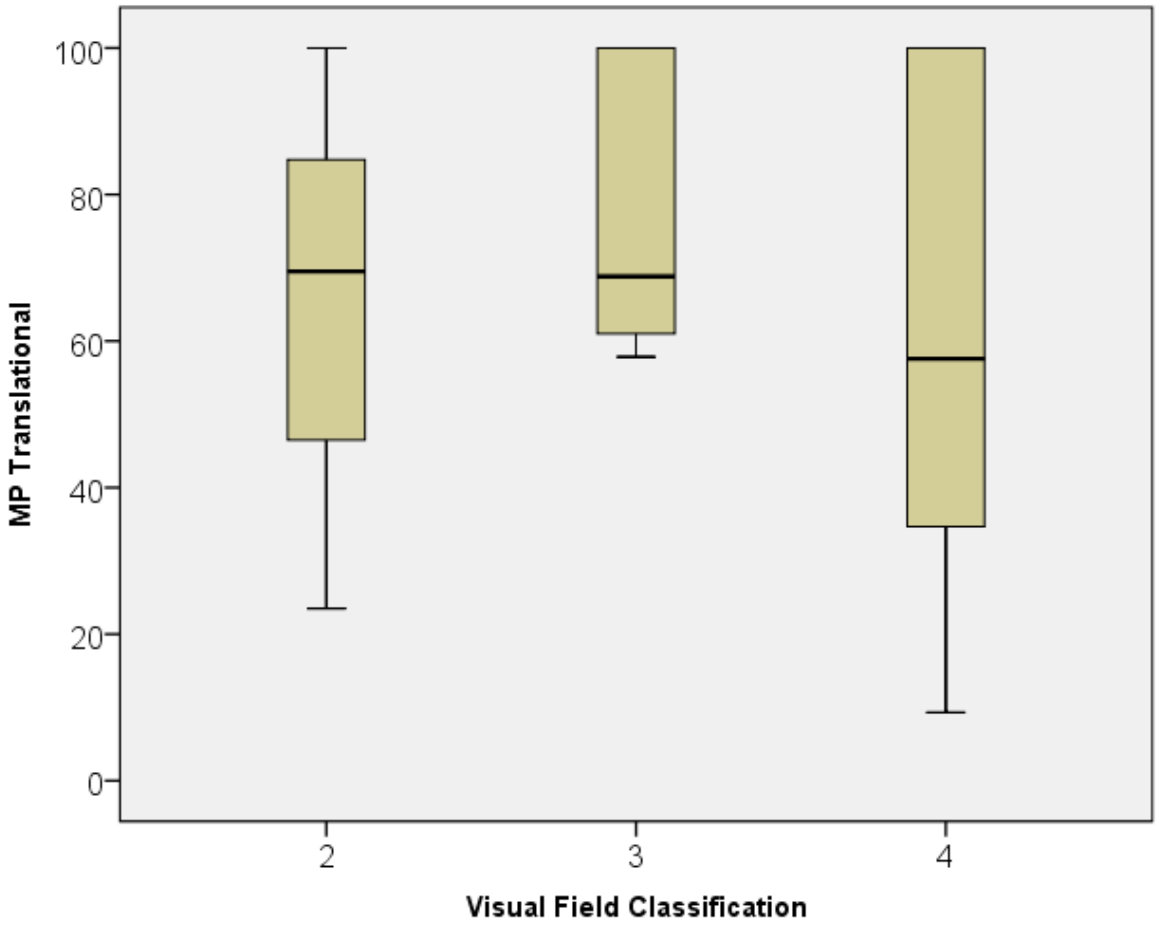
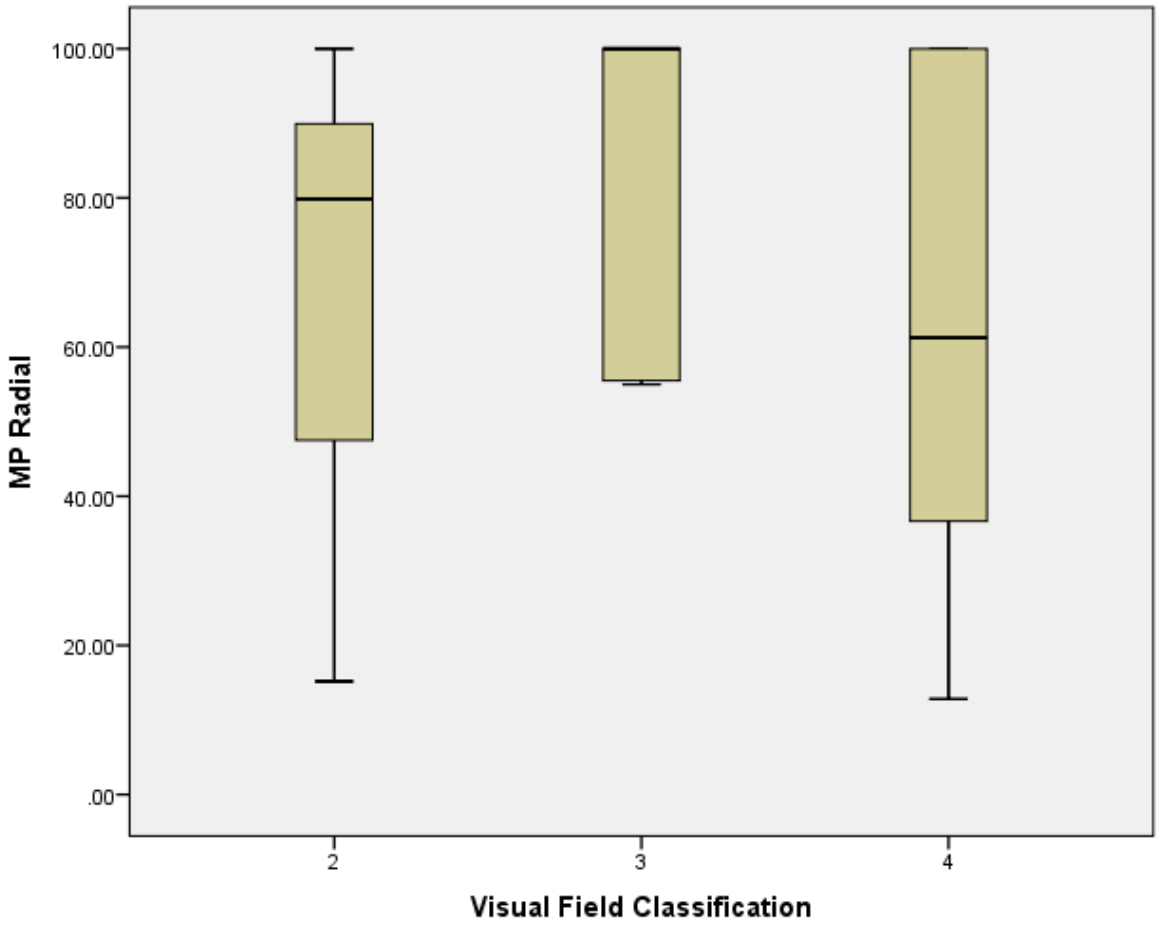
MP Vs. Visual field





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Motion Vs. Performance

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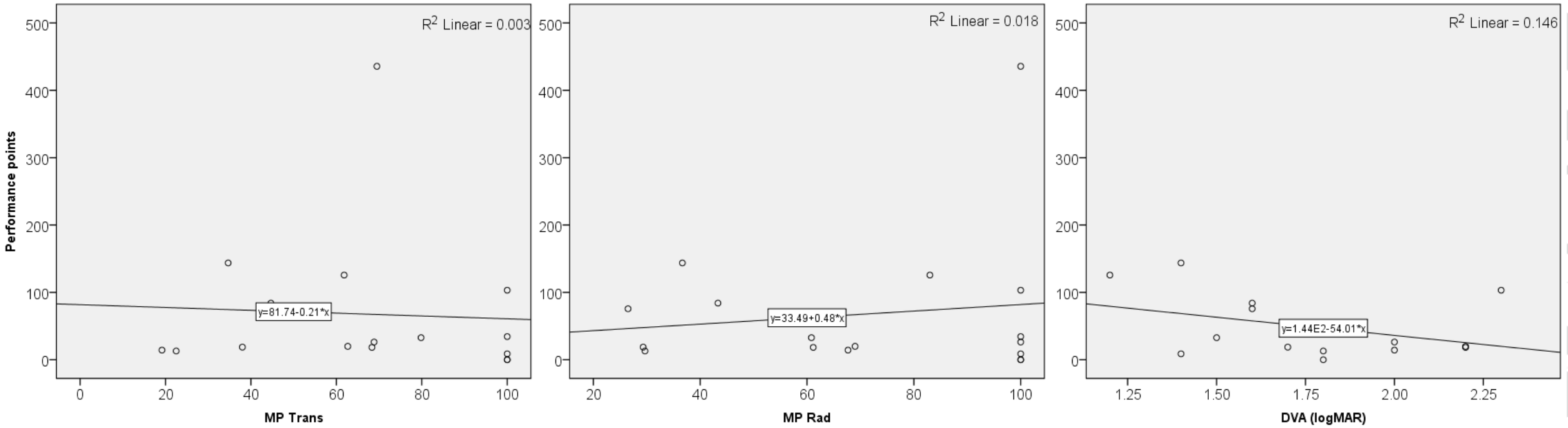
Nordic – Motion Vs. Performance



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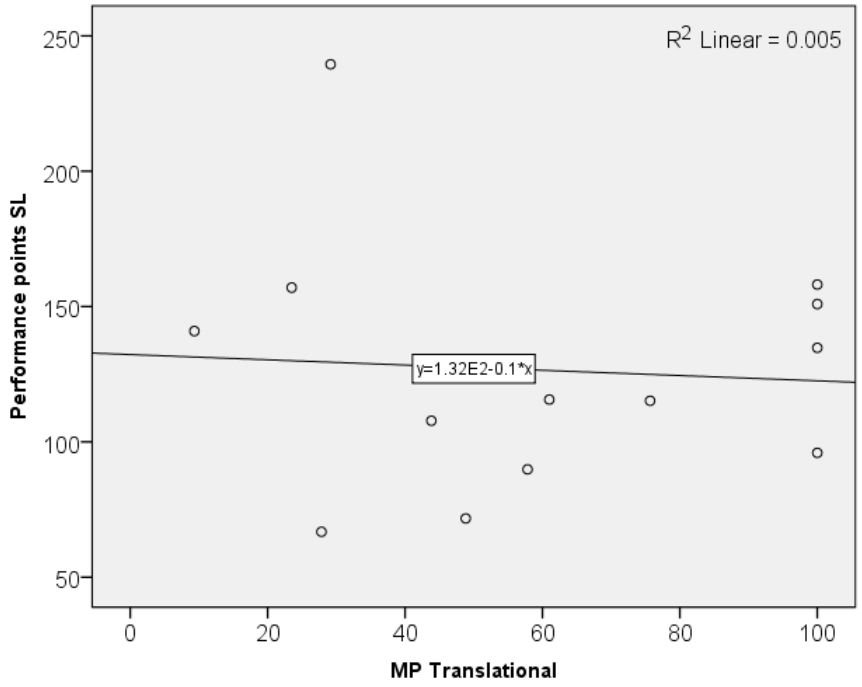
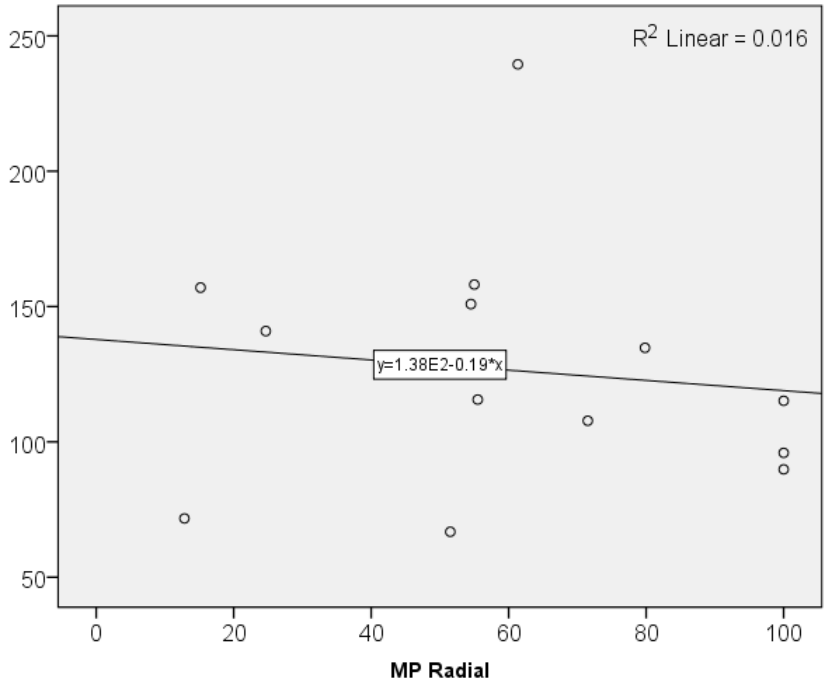
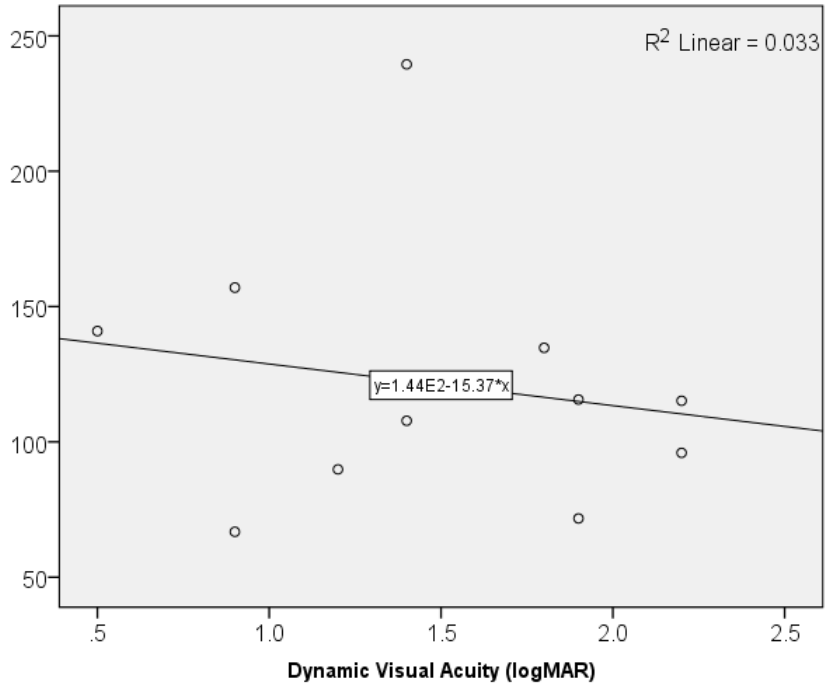
Alpine SL – Motion Vs. Performance







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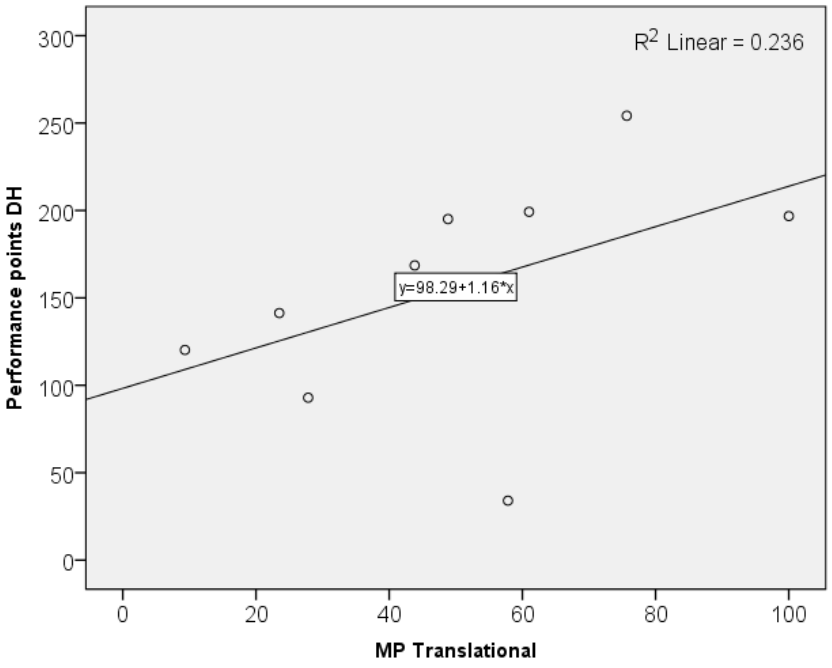
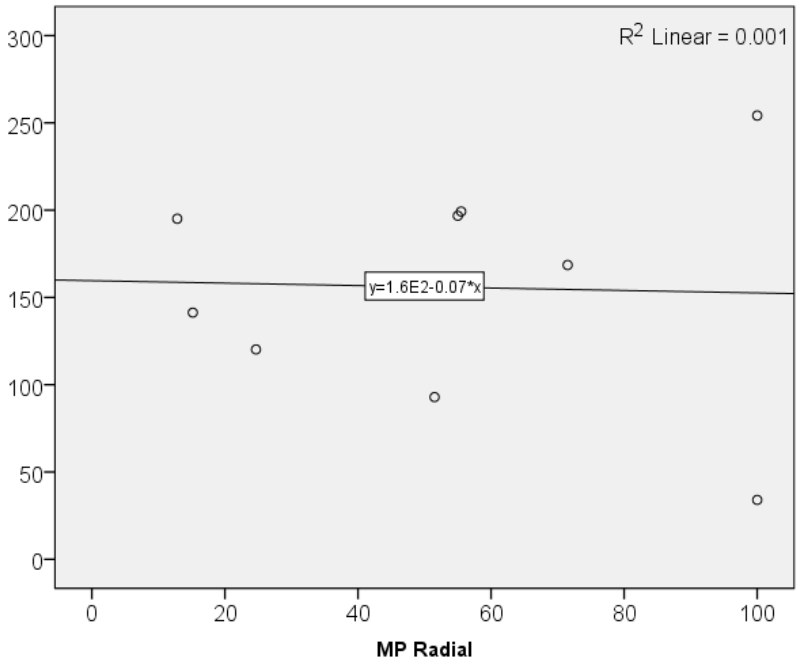
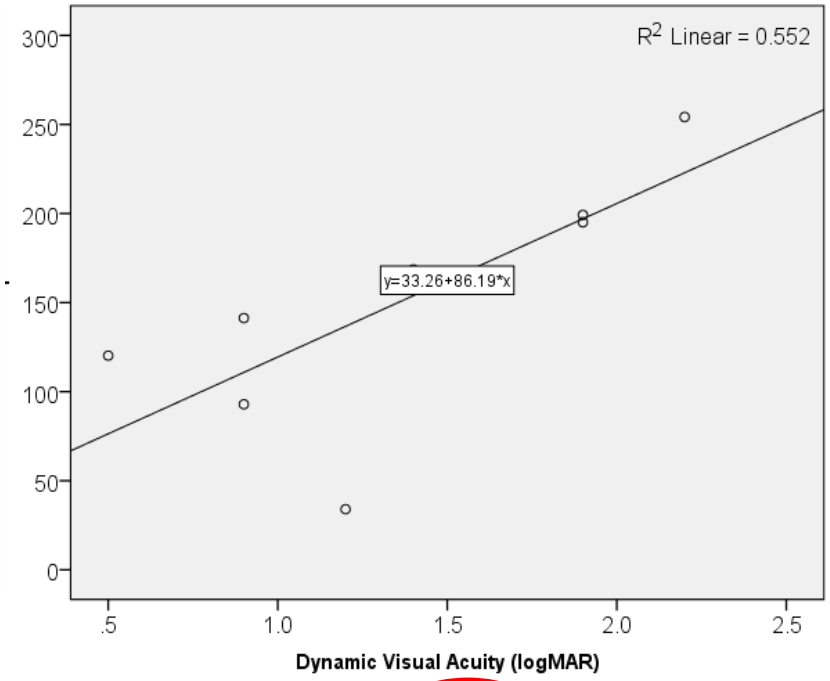
Alpine DH – Motion Vs. Performance







Spearman's rho: .650 (.05,9)
R^2: 0.236

Spearman's rho: .807 (.01,8)
R^2: 0.552

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Discussion

- MP trans and visual functions[1]
- MP rad and visual functions[2]
- GMP and performance
- DVA and performance

1. Chakraborty A, Anstice NS, Jacobs RJ, et al. Global motion perception is independent from contrast sensitivity for coherent motion direction discrimination and visual acuity in 4.5-year-old children. Vision Res. 2015;115:83-91. doi:10.1016/j.visres.2015.08.007.
2. Morrone MC, Tosetti M, Montanaro D, Fiorentini a, Cioni G, Burr DC. A cortical area that responds specifically to optic flow, revealed by fMRI. Nat Neurosci. 2000;3(12):1322-1328. doi:10.1038/81860.

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Conclusion

- No significant correlations between MP and skiing performance in all disciplines except DH
- No significant correlations between DVA and skiing performance in all disciplines except DH

- Future Work
  - Combined effect of multiple impairments on performance
  - Regression analysis for interaction effects

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