

# Perceptual and Working Memory Deficits in Unilateral Neglect

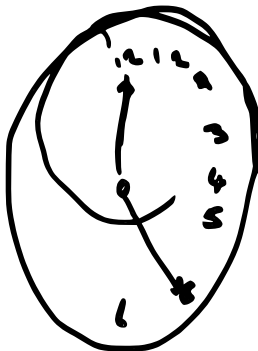
Jason Locklin

Department of Psychology  
University of Waterloo

Supervisor: Dr. James Danckert

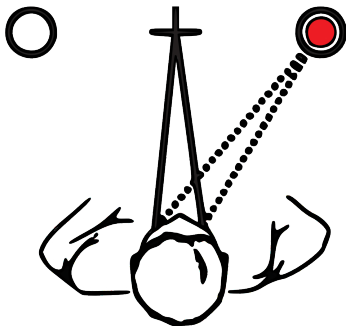
# Unilateral Neglect

- Typically results from damage to the right inferior parietal or superior temporal cortex.
- Inability to respond to the left side of space.



# Neglect as a Lateralized Disorder of Attention

- Preferential orienting rightward
- Delayed re-orienting leftward.
- Limitations



# Overview

- 1 Is visual working memory closely coupled to lateralized attention biases?
- 2 Does treatment of attention deficits with prisms influence perceptual representations?
- 3 Is Saccadic Adaptation capable of influencing perceptual biases

# Visual Working Memory Task

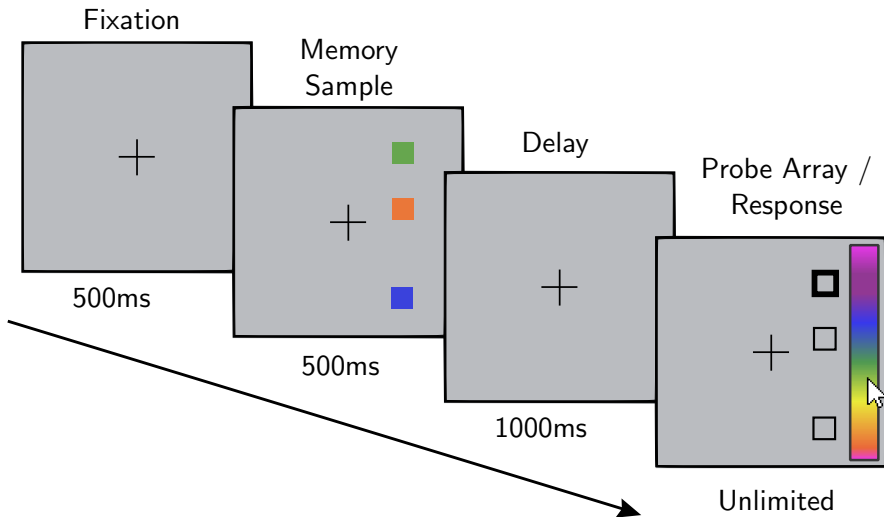
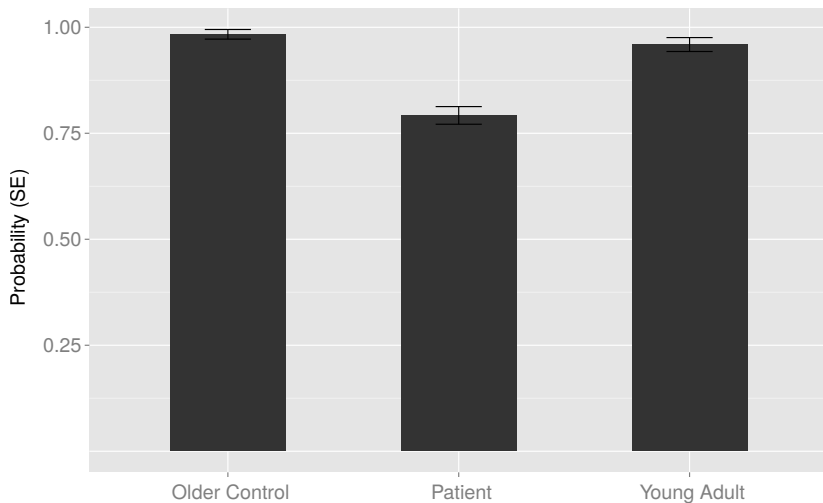
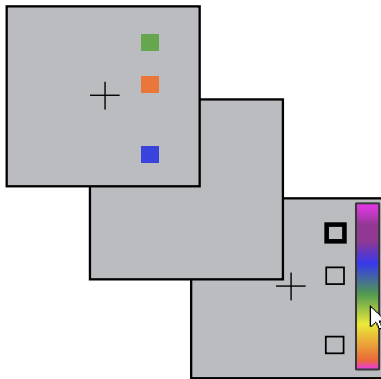
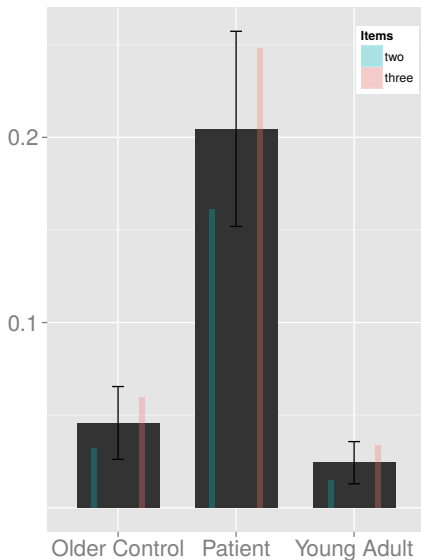


Figure 2.4: Probability of Correct Target Selection



# Figure 2.5: Probability of Non-Target Selection



# Covert Orienting Task

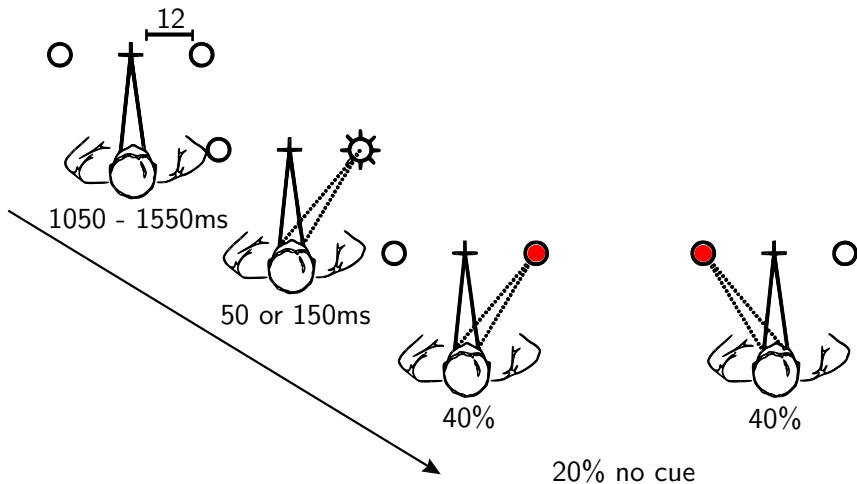
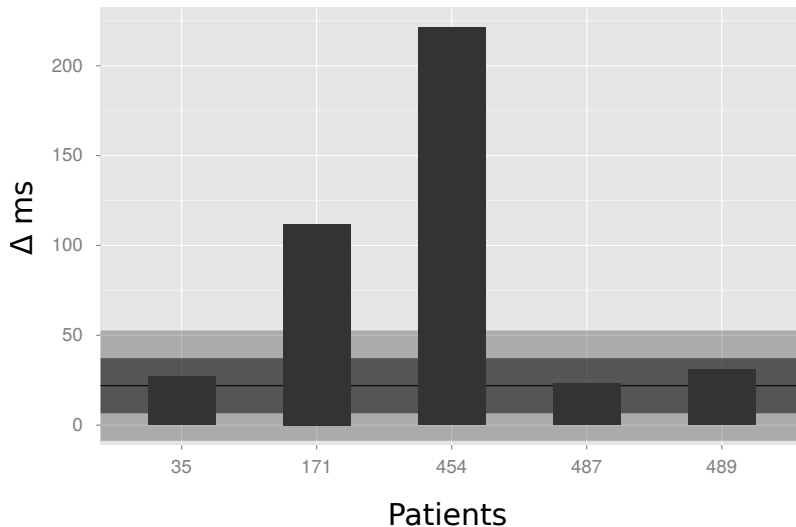




Figure 2.6: Patient Leftward Cue Effect Sizes (CES)



# Overview

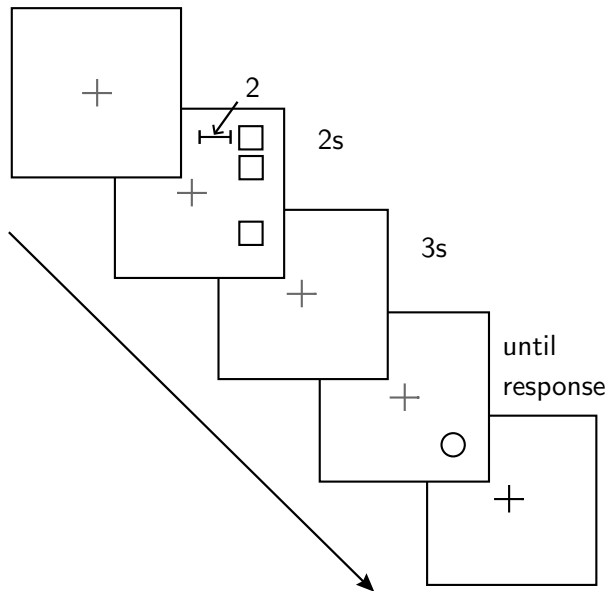
- 1 Is visual working memory closely coupled to lateralized attention biases?
- 2 Does treatment of attention deficits with prisms influence perceptual representations?
- 3 Is Saccadic Adaptation capable of influencing perceptual biases

# Prism Adaptation

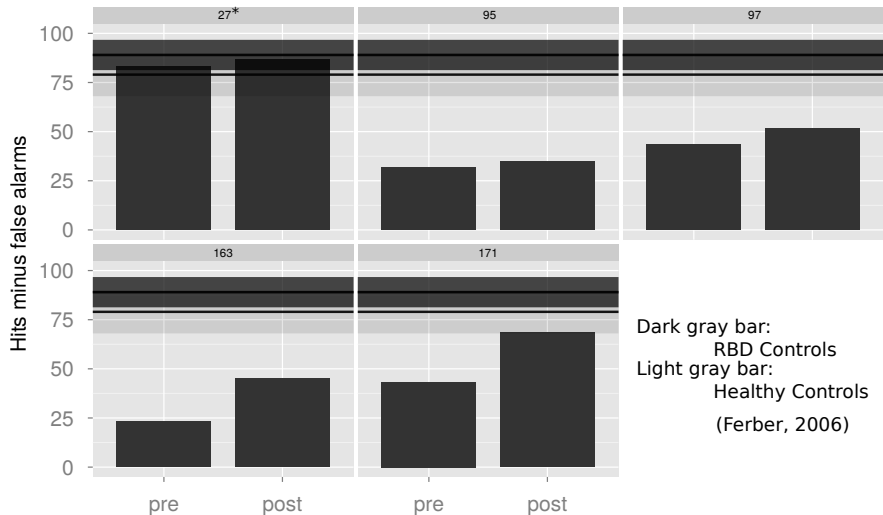
- $10^\circ$  rightward shifting prisms.
- Alternate pointing to left and right table-top targets for 5 minutes.



# Spatial Working Memory Task

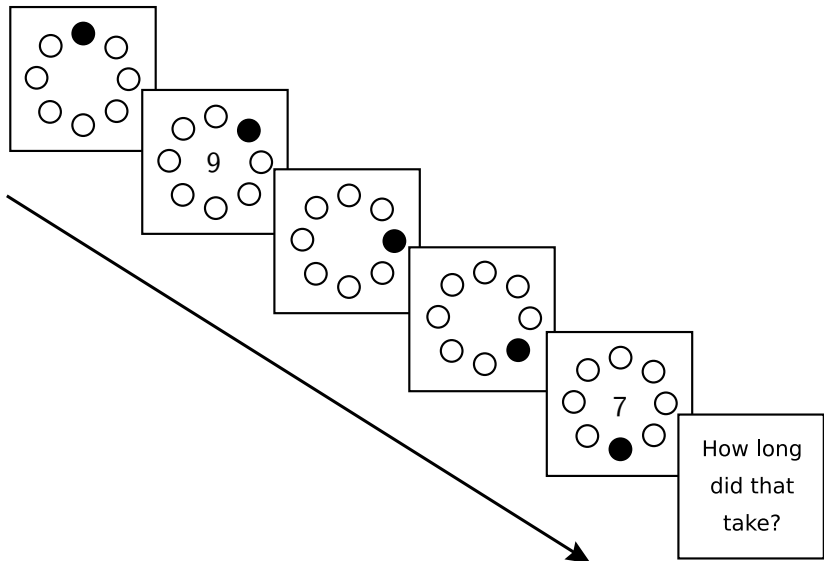


# Figure 3.2: Spatial Working Memory

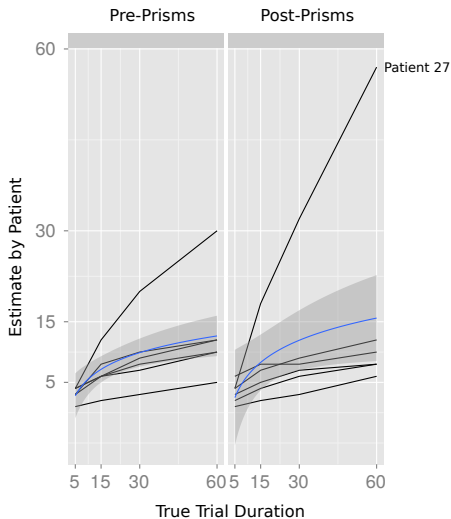


Dark gray bar:  
RBD Controls  
Light gray bar:  
Healthy Controls  
(Ferber, 2006)

# Temporal Estimation Task



# Figure 3.3: Temporal Estimation Across Intervals

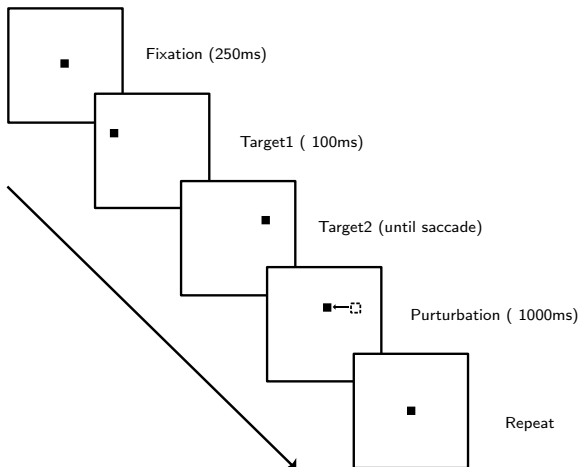


# Overview

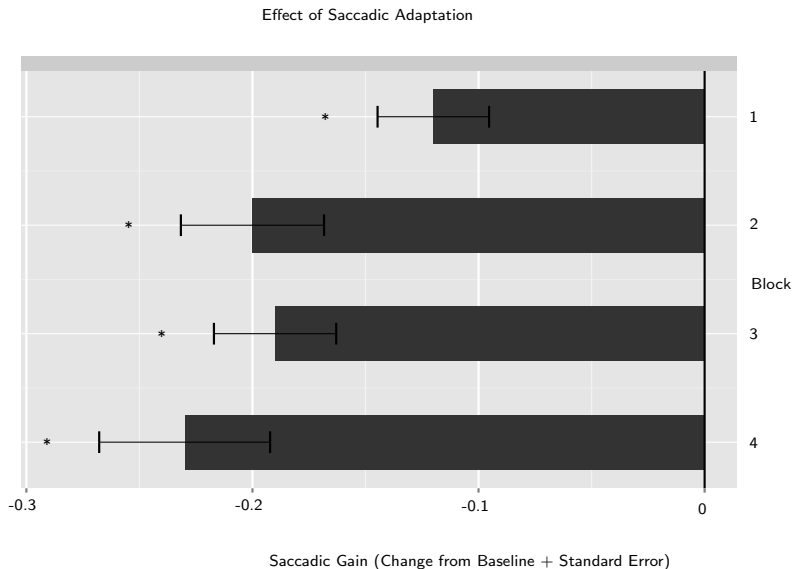
- 1 Is visual working memory closely coupled to lateralized attention biases?
- 2 Does treatment of attention deficits with prisms influence perceptual representations?
- 3 Is Saccadic Adaptation capable of influencing perceptual biases



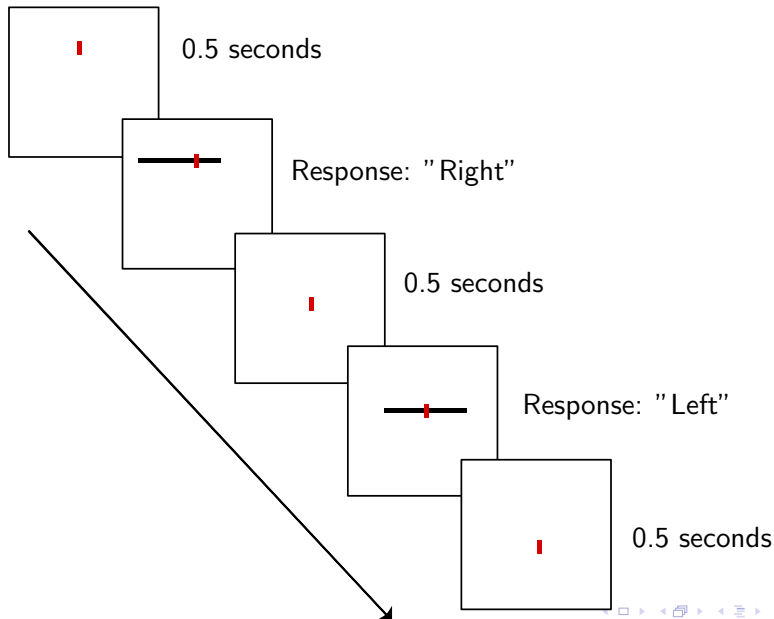
# Saccadic Adaptation



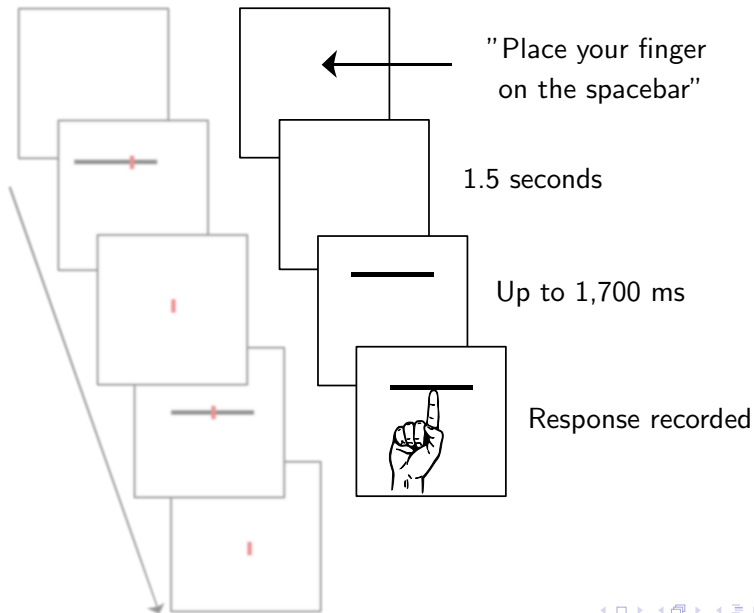
# Figure 4.4: Effect of Saccadic Adaptation



# Landmark Task



## Line Bisection Task



# Impact on Line Bisection (LB) and Landmark Task (LT)

- No measurable change in either LB or LT post adaptation.
- “Strong adapters” also showed no change.

# Overall Conclusions

- WM deficits appear to be independent of lateralized attention deficits in neglect.
- Perceptual representations, more generally, may be uninfluenced by changes in those lateralized attention deficits.
- More research is needed to examine saccadic adaptation as a possible method to influence those perceptual representations.

# Future Directions

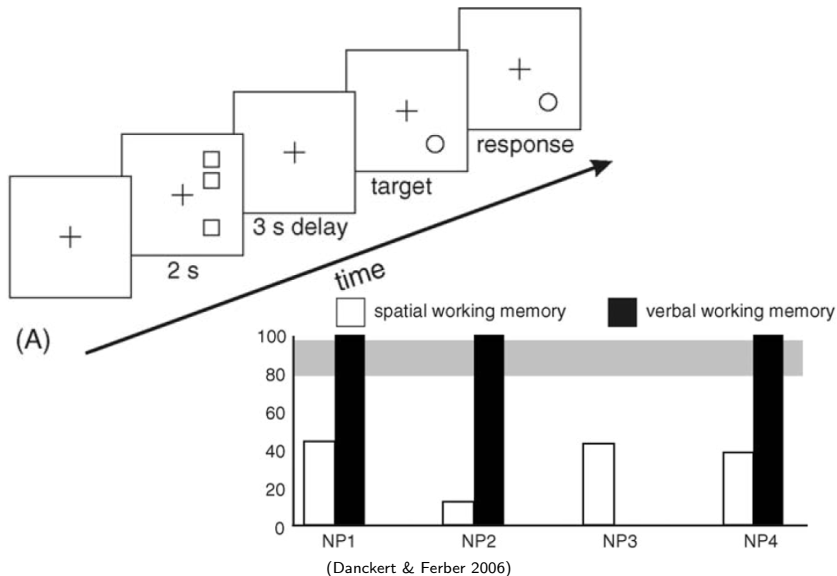
- Improve saccadic adaptation procedure, possibly with whole-field adaptation
- If successful, compare the two in a neglect population.

# Acknowledgements

Dr. James Danckert  
DAAG lab,  
funding agencies, etc.



# Spatial Working Memory



# Table 2.1

	Age	Sex	Handedness	CES	VWM(1)	VWM(2/3)	Stars	Copying	Bisection
487	61	F	Right	23.0	0.15	0.04	0	+	2.2
35	51	F	Right	27.0	0.15	0.04	17	+	0.1
489	66	M	Left	31.0	0.25	0.08	0	+	1.0
171	71	F	Left	112.0	0.13	0.00	0	-	1.4
454	70	M	Right	221.5	0.23	0.17	0	+	6.3
213	65	F	Right	NA	0.2	0.30	100	+	7.3
396	85	M	Right	NA	0.3	0.55	87	+	8.1
465	63	F	Right	NA	0.3	0.45	97	+	12.9

# Exp. 1: Participants and Procedure

- 8 RBD neurological patients, demonstrating Neglect in pre-testing.
- 8 healthy older controls + 9 healthy young adults on first task only
- “Visual” Working Memory and Covert Attention.

# Response Model Calculations

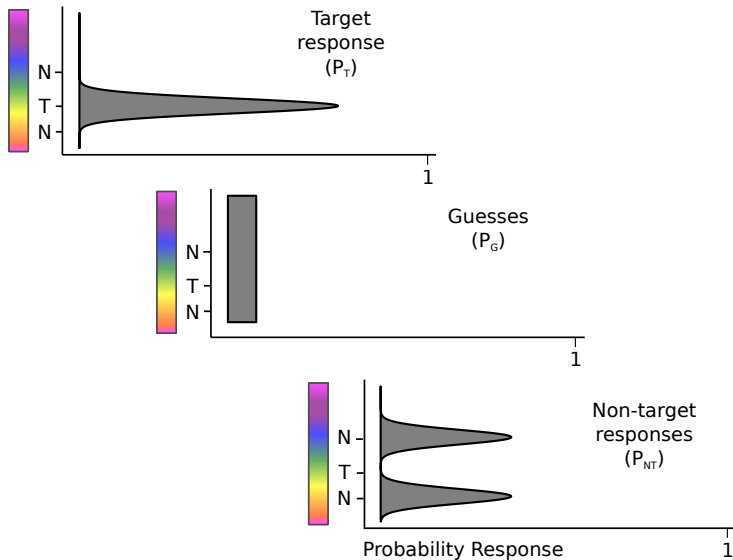
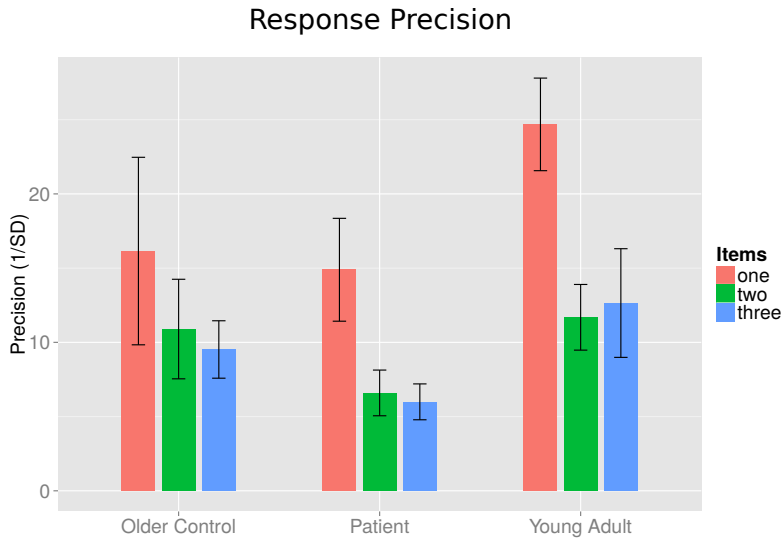


Figure 2.3



## Table 2.2

	Df	Deviance	Resid. Df	Resid. Dev	Pr(>Chi)
NULL			15	22.18	
CES	1	8.62	14	13.56	0.0033
$P_{NT}$	1	1.12	13	12.44	0.2908
$P_G$	1	12.44	12	0.00	0.0004

**Table:** Analysis of deviance table. Each row represents the change in deviance of the model with the addition of one term.  $\text{Pr}(>\text{Chi})$  is the probability of obtaining a greater scaled deviance statistic than the observed under the null hypothesis (new term has true parameter of zero). Both CES and  $P_G$  result in statistically significant model improvement.

# Experiment 2: Participants and Procedure

[noframenumbers]

- 6 RBD neurological patients who demonstrated neglect in pre-testing.
- Line Bisection, Spatial Working Memory, and Time Estimation.

# Table 3.1

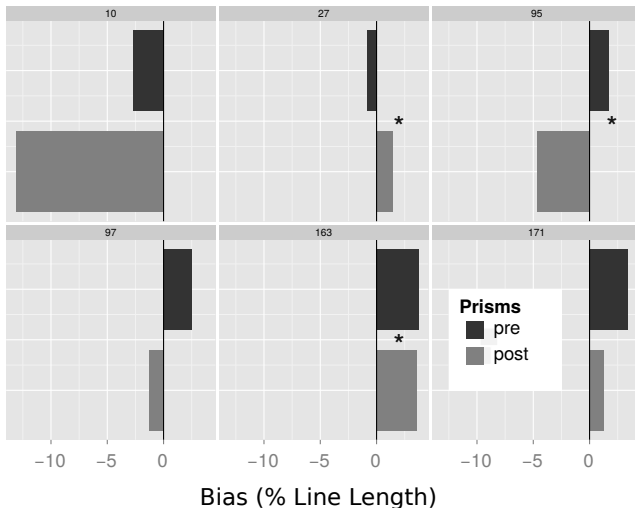
	Age	Sex	Handedness	Star(pre)	Star(post)	Bell(pre)	Bell(post)	Copy(pre)	Copy(post)
10	68	M	Right	93	87	100	89	+	+
27	43	M	Right	0	7	6	0	-	-
95	70	M	Right	7	0	33	39	+	+
163	68	F	Left	30	7	6	29	+	+
97	66	M	Right	0	0	0	0	-	-
171	71	F	Left	0	0	6	6	+	-

	LB(pre)	LB(post)	TE(pre)	TE(post)	SWM(pre)	SWM(post)
10	-0.80	-9.90	0.40	0.40		
27	-0.80	1.20	0.80	1.00	83.00	87.00
95	0.30	-3.80	0.40	0.30	32.00	35.00
163	0.90	4.90	0.40	0.40	23.00	45.00
97	1.90	-1.60	0.60	0.60	43.00	52.00
171	3.80	1.40	0.40	0.50	43.00	68.00

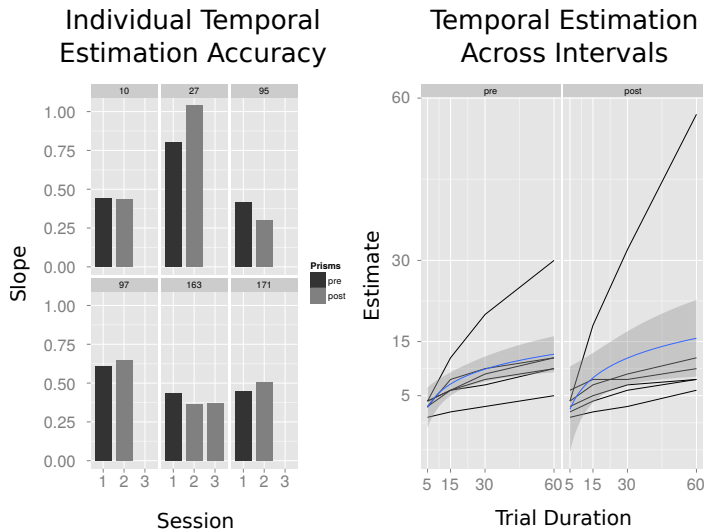


Figure 3.4

## Line Bisection Bias Before and After Prism Adaptation



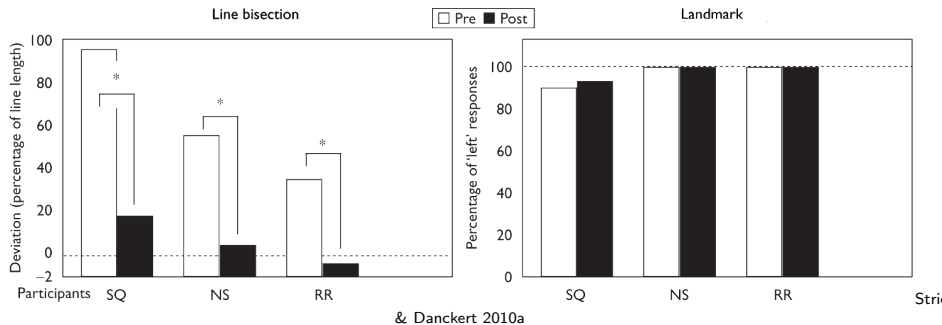
# Figure 3.3



# Experiment 3: Participants and Procedure

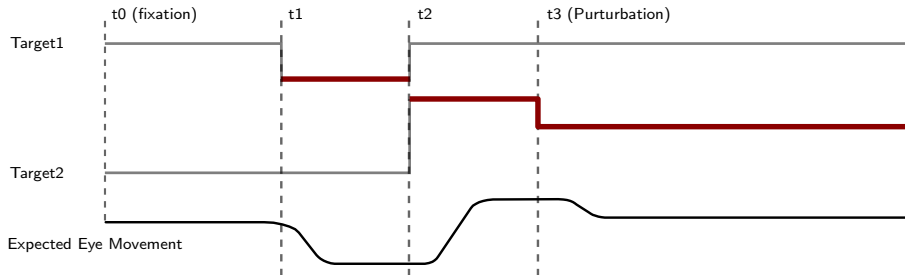
- 37 young adults.
- Baseline Line Bisection (LB) and Landmark Task (LT).
- Up to 4 blocks of Saccadic Adaptation + LB and LT.

# Landmark and Line Bisection Tasks

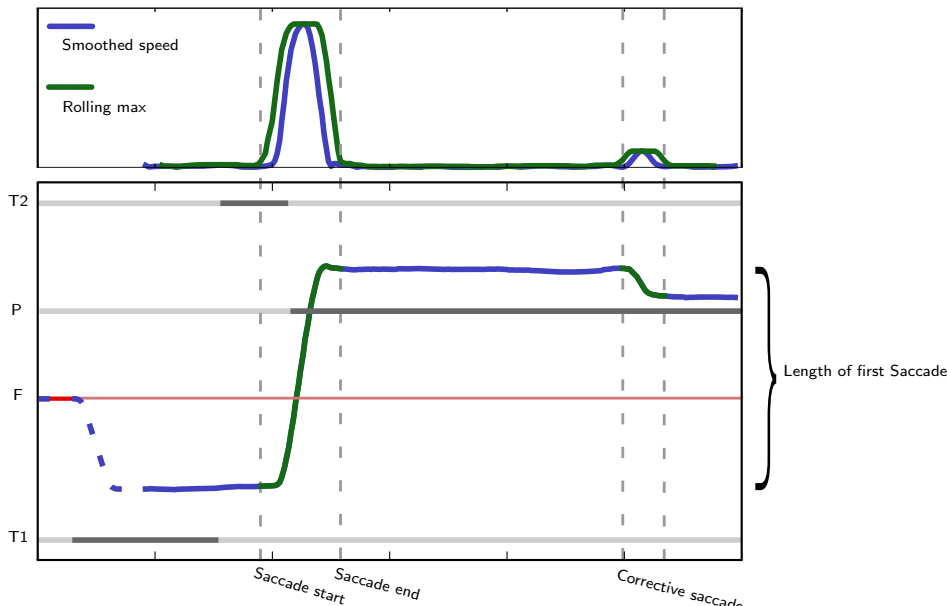


# Saccadic Adaptation Event Time-line

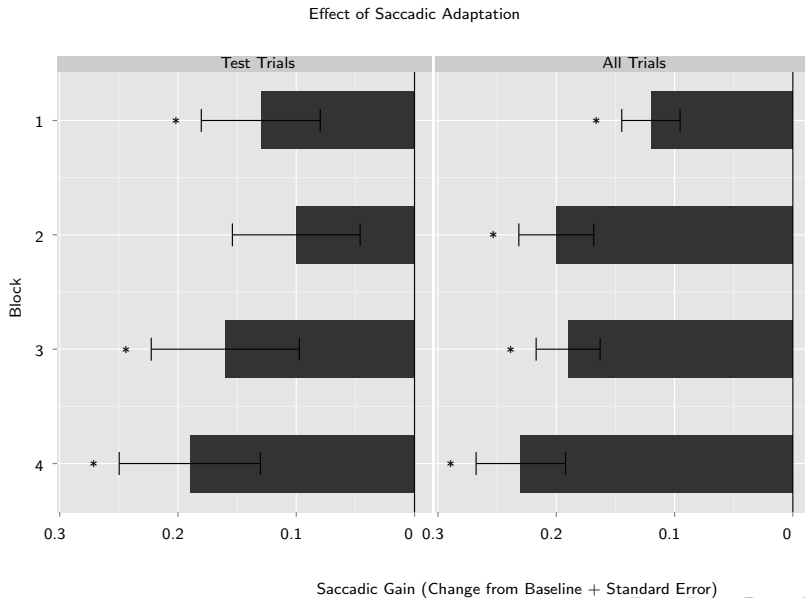
Event Timecourse:



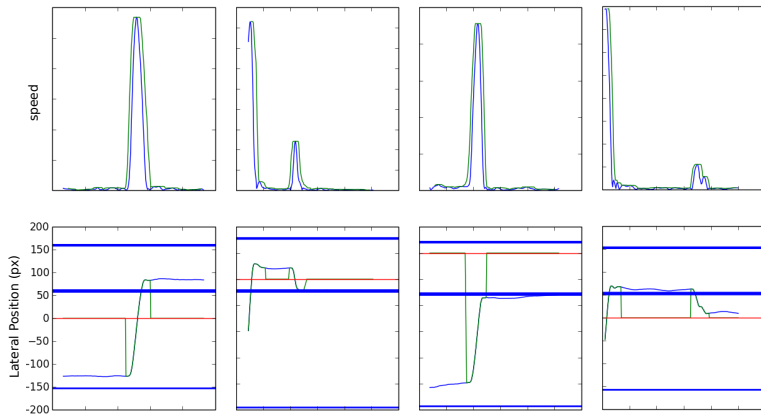
# Analysis of an Example Saccade



# Figure 4.4: Effect of Saccadic Adaptation

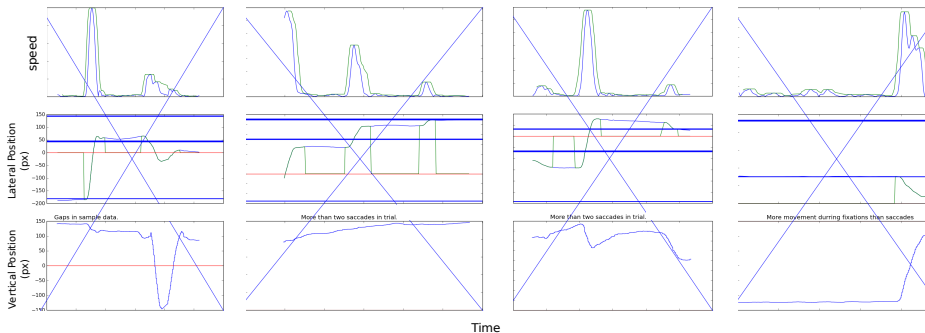


## Included Trials





## Excluded Trials



# Impaired Perceptual Representation as a Key Component of Neglect

## Perceptual deficits:

Chimeric face perception



Perceptual judgment of spatial extent.  
("Landmark Task")



## Working Memory deficits:

- Spatial Working Memory in Right Space.