

The visual world from glance to glance

NVP dissertation-award lecture

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Eye movements

 De Nederlandse Vereniging voor Psychonomie

Opgericht ter bevordering van de psychonomie in Nederland

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NVP Dissertatieprijs

In navolging van voorgaande jaren heeft het bestuur van de NVP om tijdens de winterconferentie van 2013 wederom de traditionele NVP Dissertatieprijs uit te-loven voor het beste proefschrift op het gebied van de psychonomie of een aanverwant terrein.

Wie tussen 1 juli 2011 en 30 juni 2013 gepromoveerd is op een psychonomisch onderwerp aan een Nederlandse universiteit, of op het moment van promoveren lid was van de NVP, kon zich tot 1 juli 2013 kandidaat stellen bij de secretaris van de dissertatieprijscommissie.

De winnaar wordt bekend gemaakt voorafgaand het NVP Wintercongres 2013 via de door de NVP gebruikte kanalen (e-mail, website, De Psychonomie).

De prijs bestaat uit een cheque ter waarde van EUR 500,- en een oorkonde. De winnaar schaart zich in de illustere rij eerdere winnaars, waaronder professor Frans Verstraten, ERC

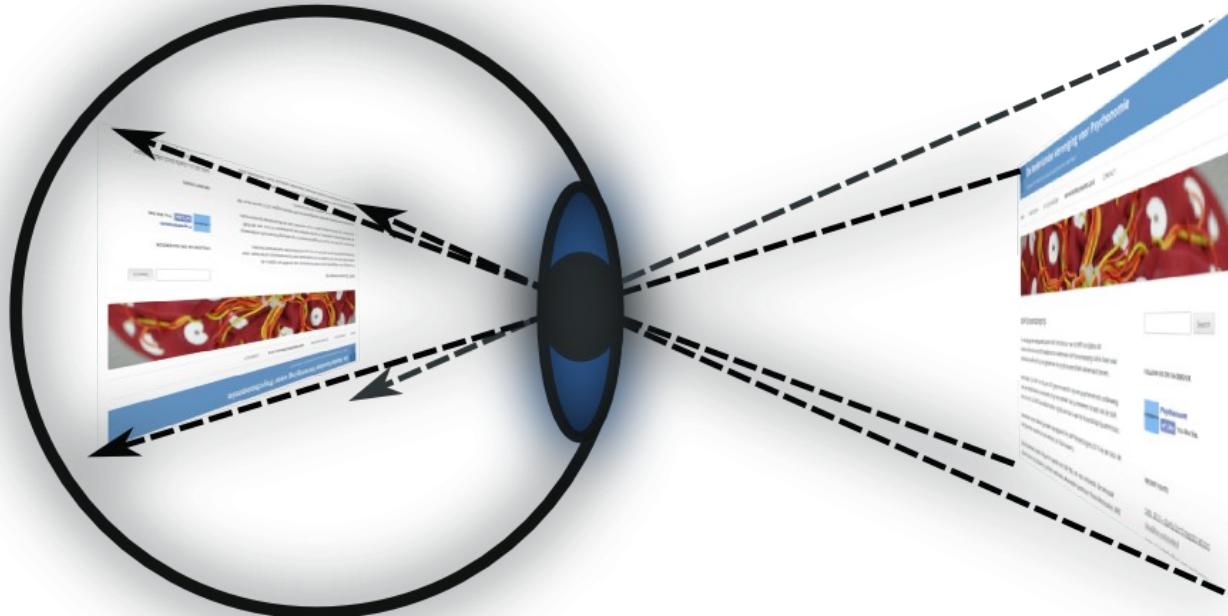
FOLLOW US ON FACEBOOK

 **Psychonomie**  You like this.

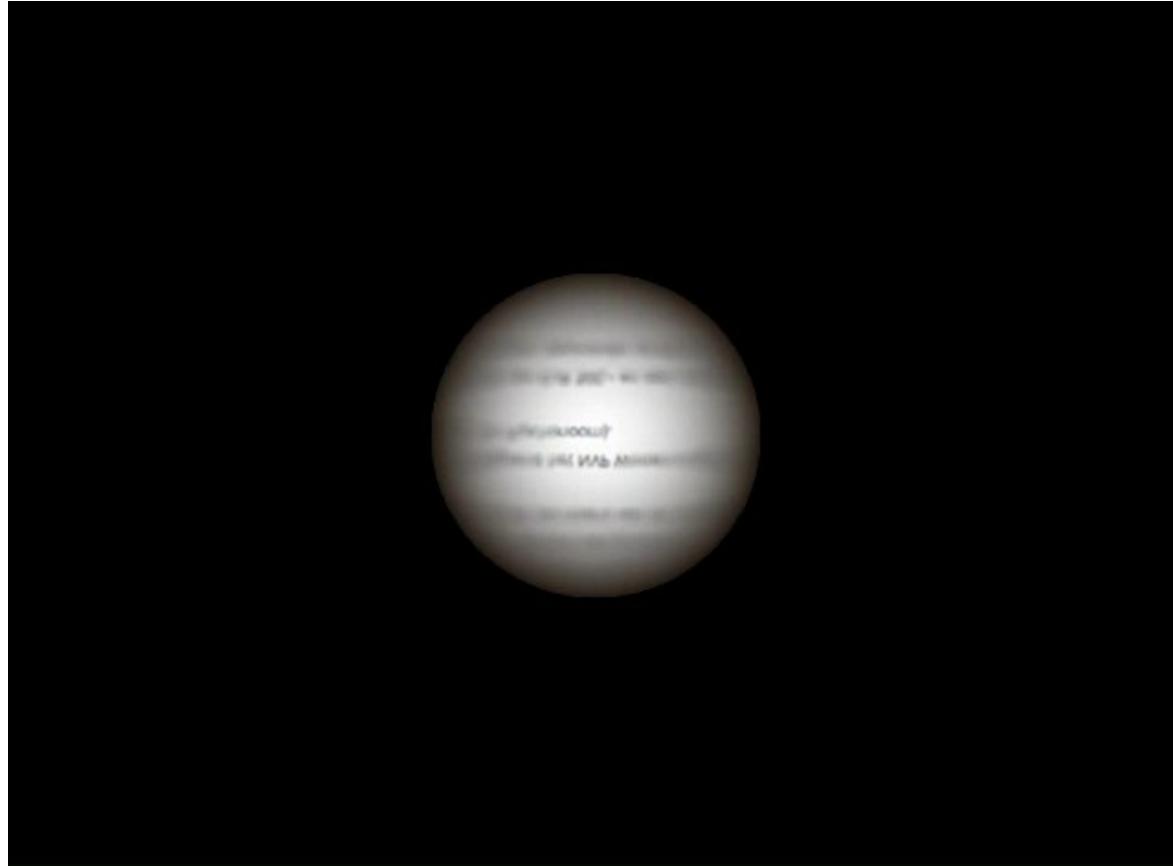
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A retinal perspective

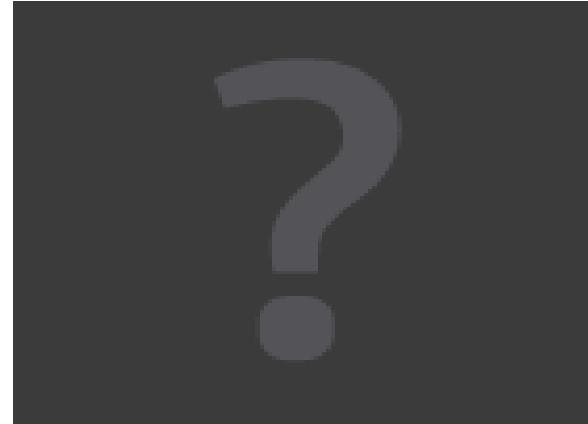


A retinal perspective



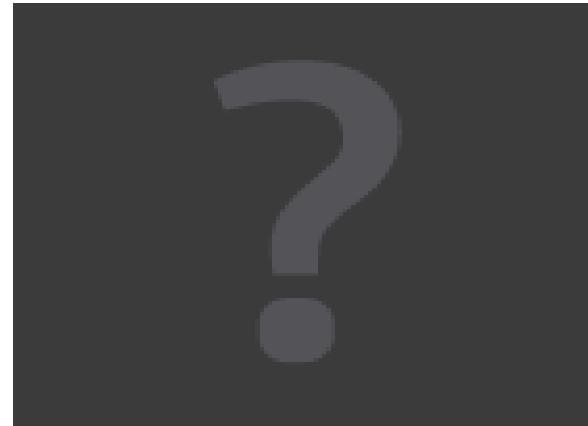
Big question

How do we construct
a *stable* 'inner
picture'



Big question

How do we construct
a *stable* 'inner
picture'

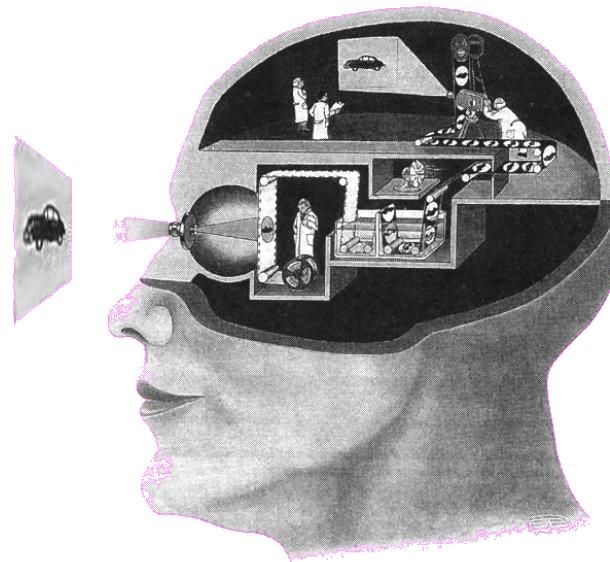


... from *unstable*
visual input?



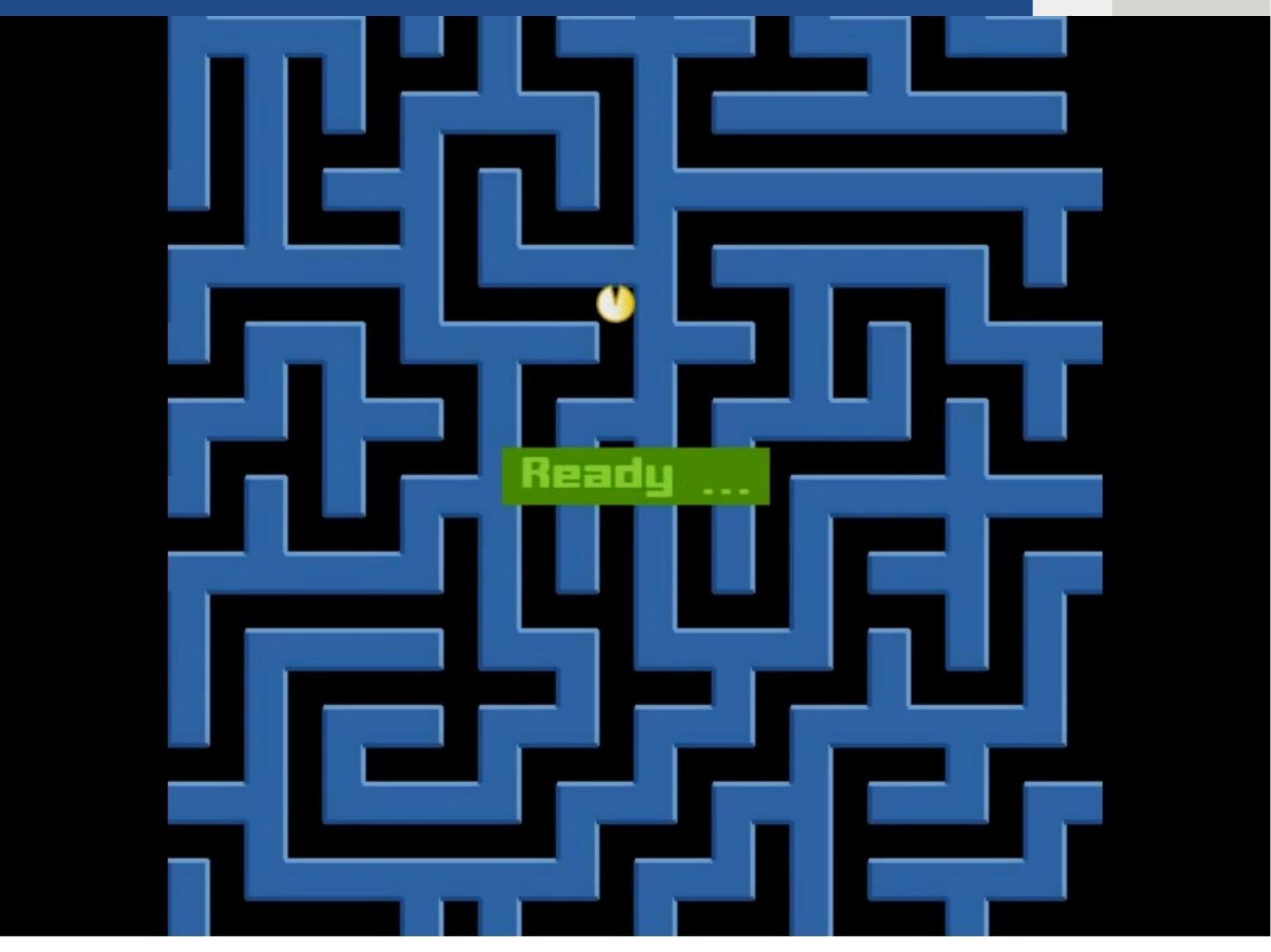
Even bigger question

But ... *Is there even such an inner picture?*





Ready ...



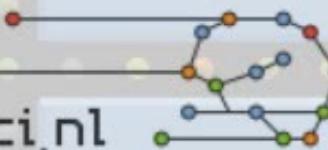
Ready ...

The mysterious maze of

PACMAN

So what's
going on?

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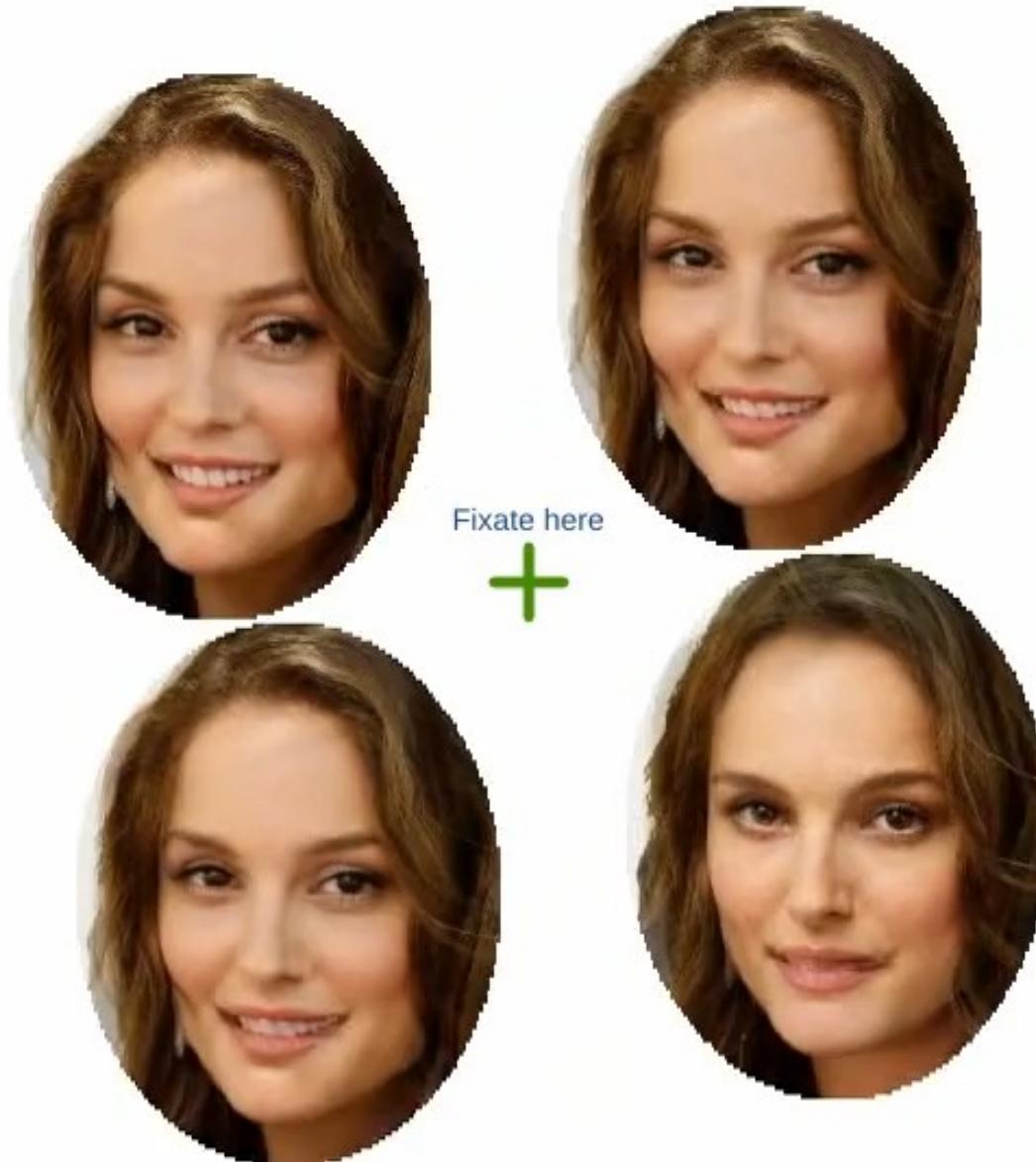


Change blindness

- A change is hard to notice if ...
 - ... it is not unique (like in the Gurnet effect)
 - ... occurs during an eye movement
 - ... occurs during (untracked) object movement
- Let's see another one ...

Invisibly morphing faces illusion

Leighton Meester transforms into Natalie Portman



When the faces move, the morphing is very difficult to see

<http://www.cogsci.nl/>

Sparse representations

Change blindness shows that visual representations are sparse

For more optical illusions, see
<http://www.cogsci.nl/illusions>

Visual stability

- ... is not about stable visual representations
 - One example → Tilt adaptation
- ... but about interaction with the environment
 - One example → Inhibition of return
- Visual stability is more than spatial constancy
 - One example → The pupillary light response

Tilt adaptation

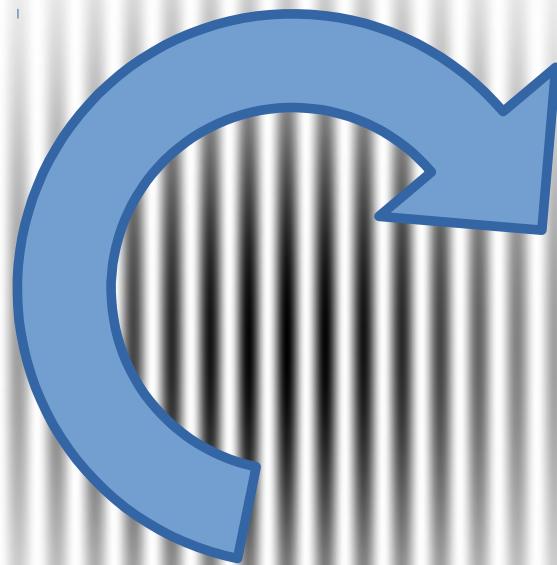
Tilt adaptation

Adapter



Tilt adaptation

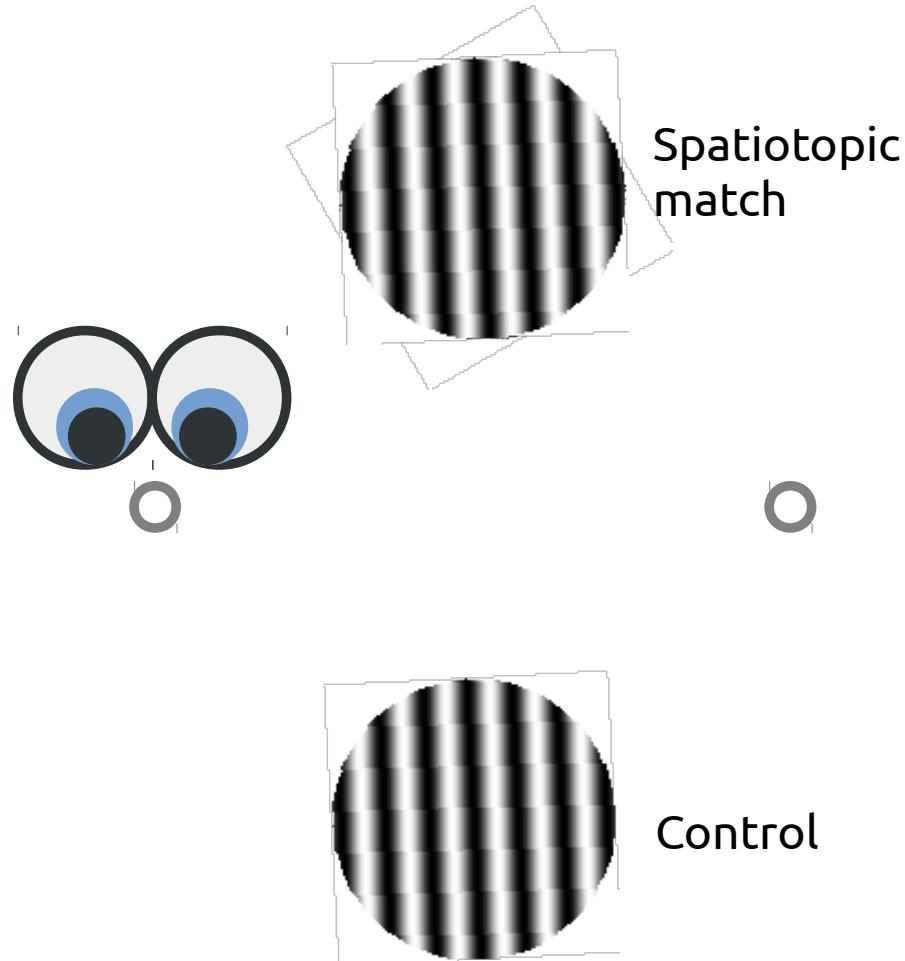
Tester



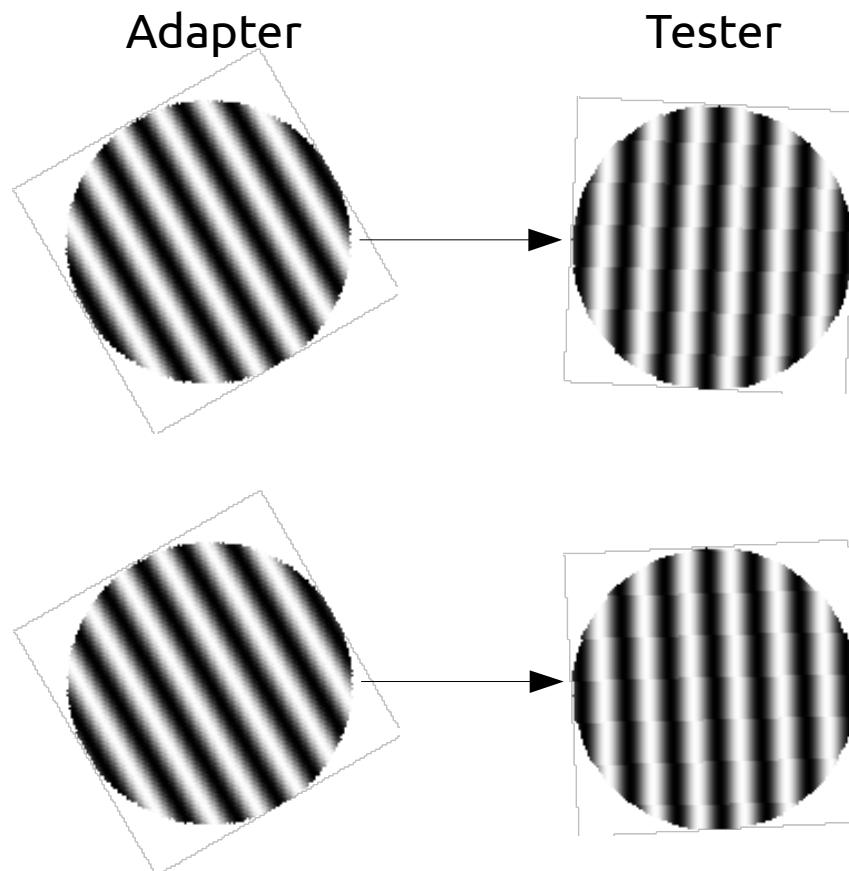
Tilt adaptation

Is there trans-saccadic integration of tilt
adaptation?

Tilt adaptation



Tilt adaptation



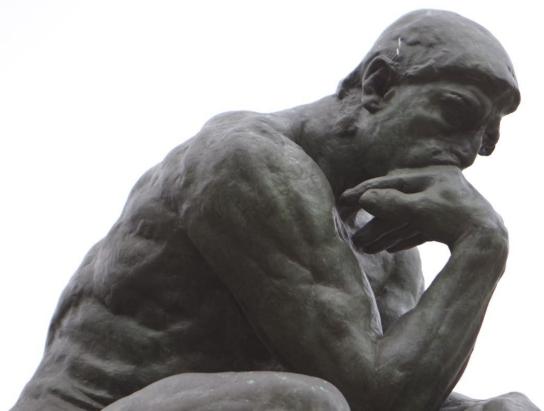
Accurate!

Measure of tilt adaptation

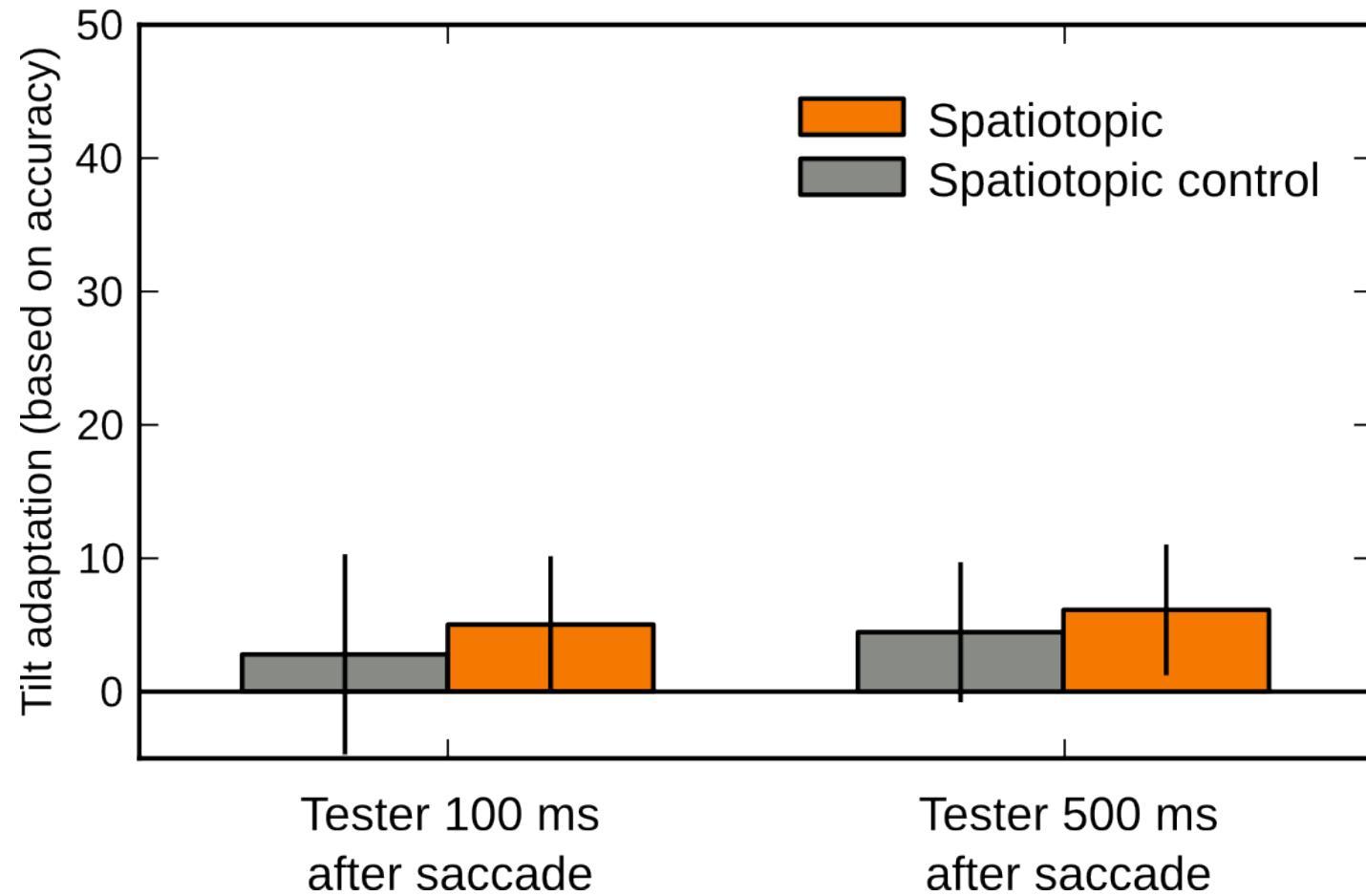
Many errors!

Tilt adaptation

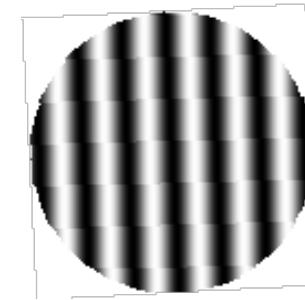
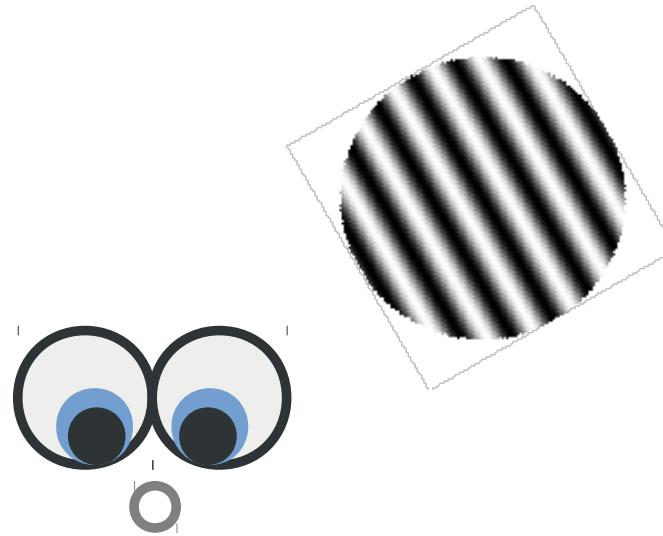
Let's take a moment ...



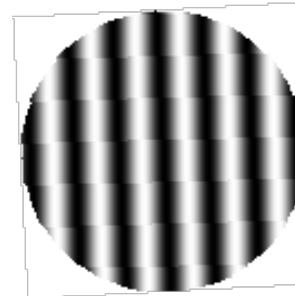
Tilt adaptation



Tilt adaptation

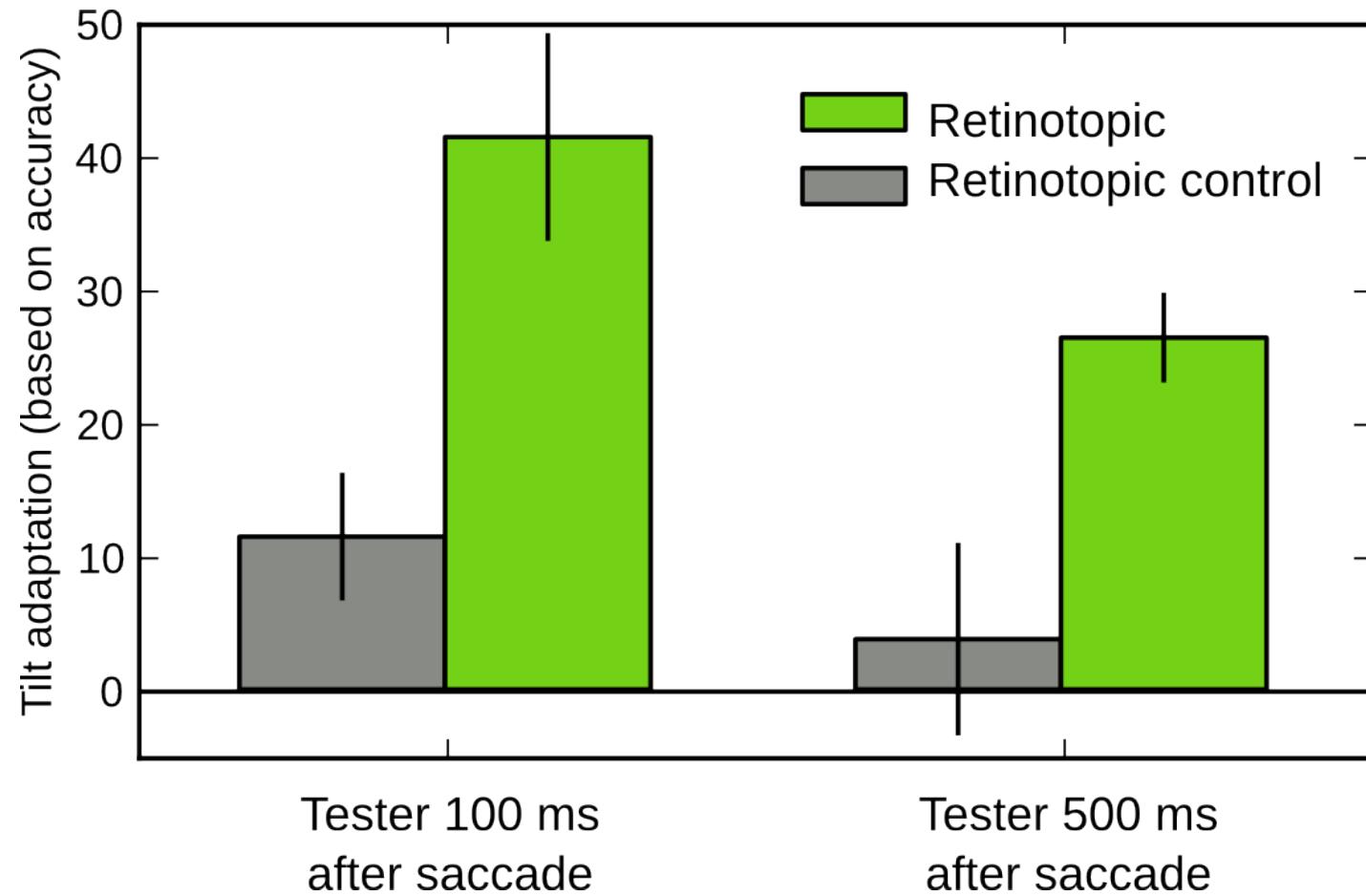


Retinotopic
match



Control

Tilt adaptation

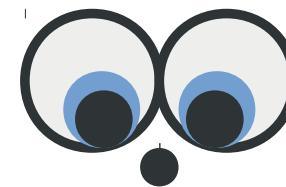
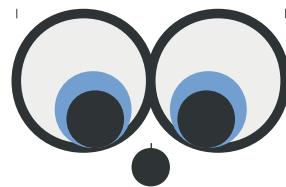
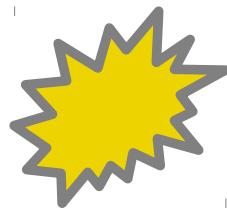


Tilt adaptation

- Tilt adaptation is retinotopic (eye centered)
- No visual stability for tilt adaptation
- Low-level visual information is not preserved across eye movements

Inhibition of return

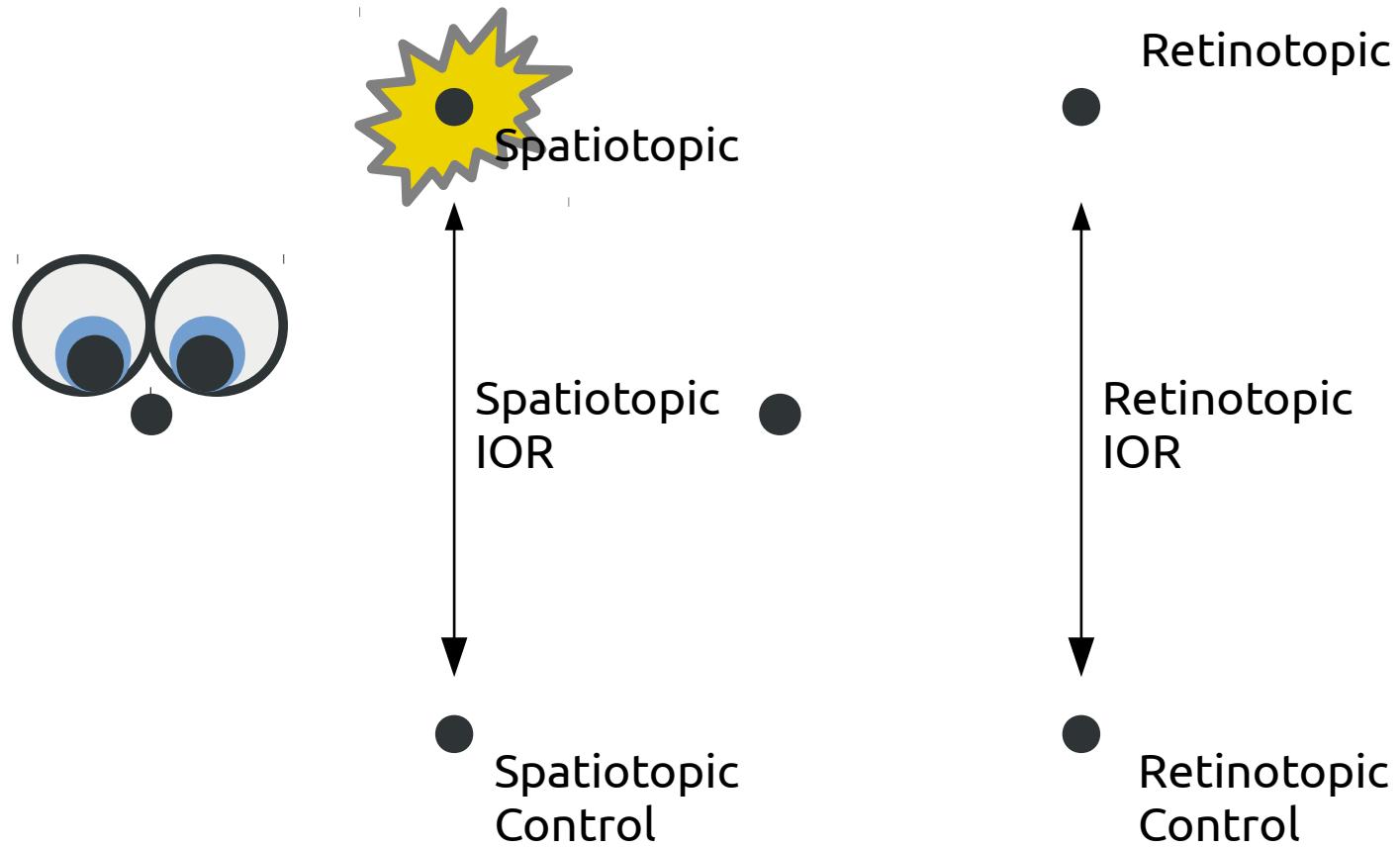
Inhibition of return



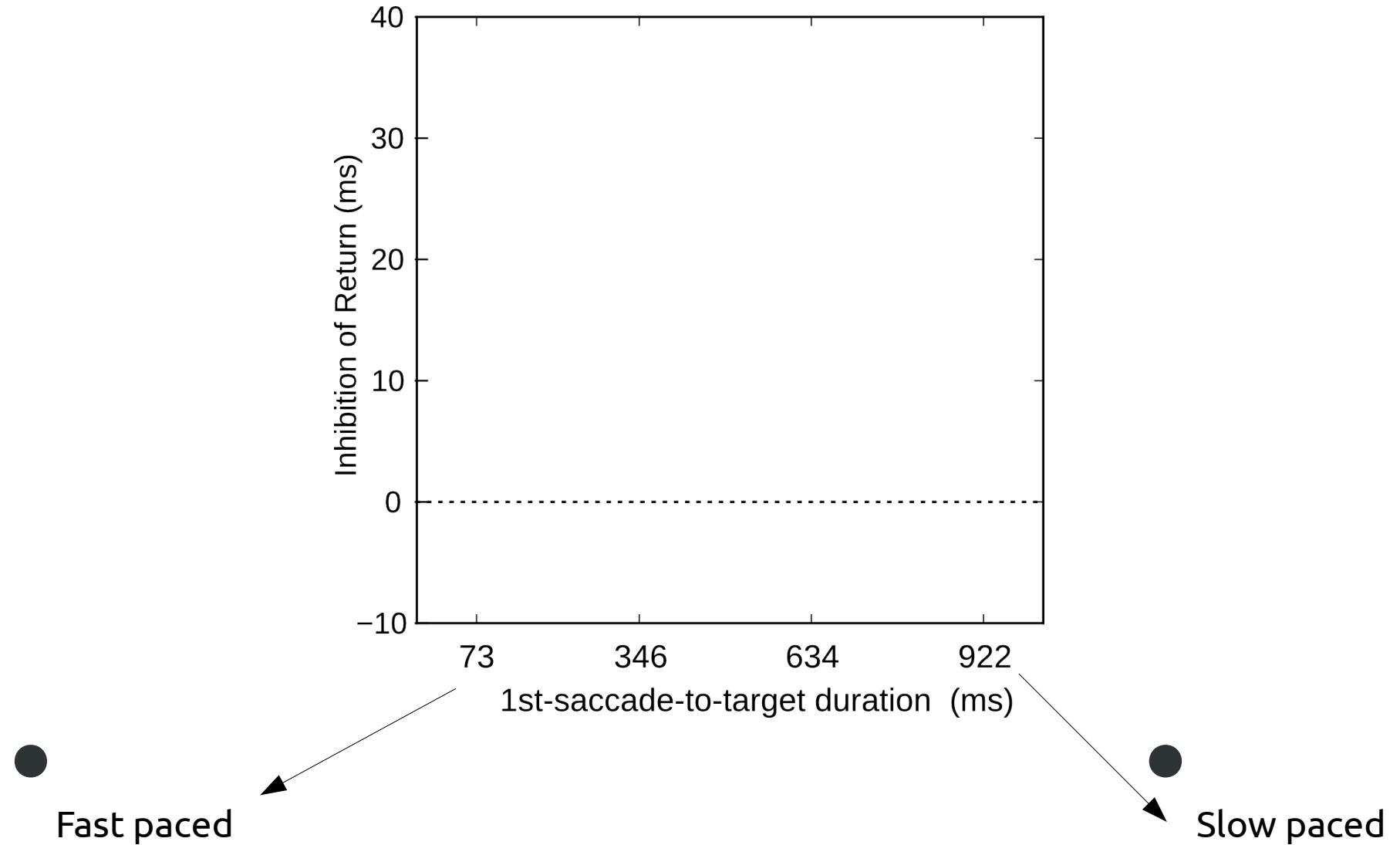
Inhibition of return

- Short SOA (< 200 ms)
 - Faster saccades towards cued side (facilitation)
- Long SOA (> 200 ms)
 - Slower saccades towards cued side (inhibition)
- Inhibition of return facilitates visual search
 - A “been-there-done-that” mechanism
 - Useful (if it works across eye movements)!

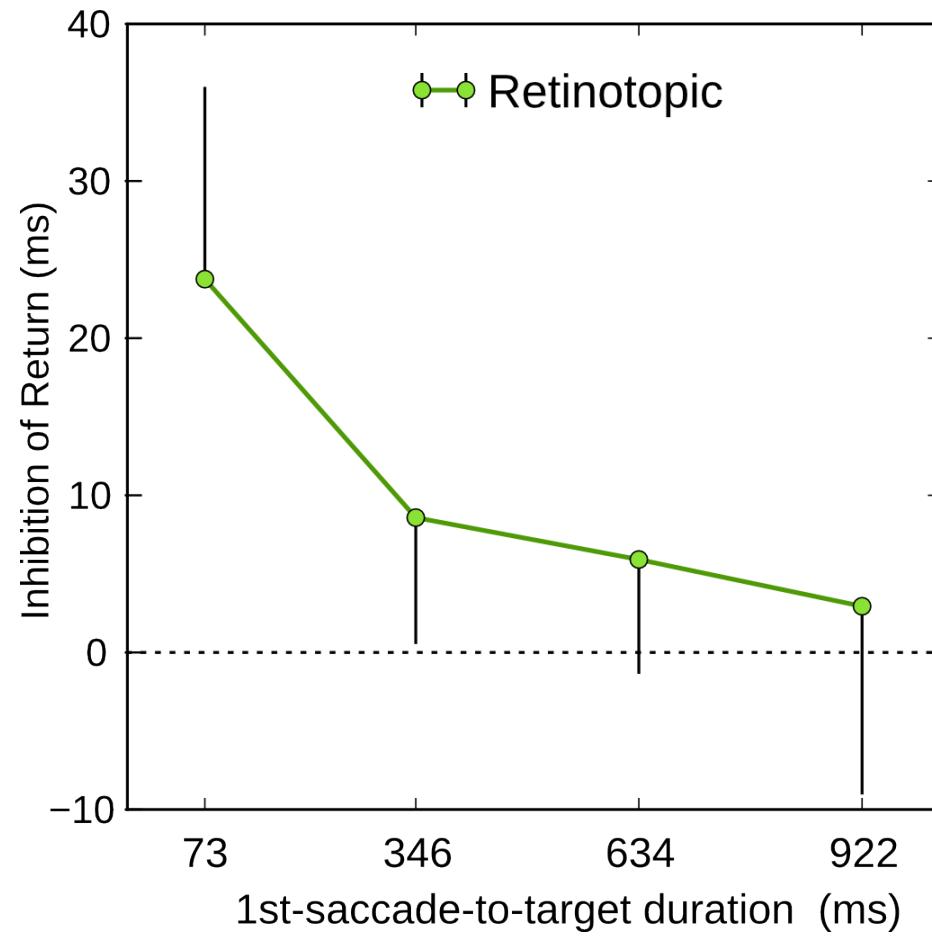
Inhibition of return



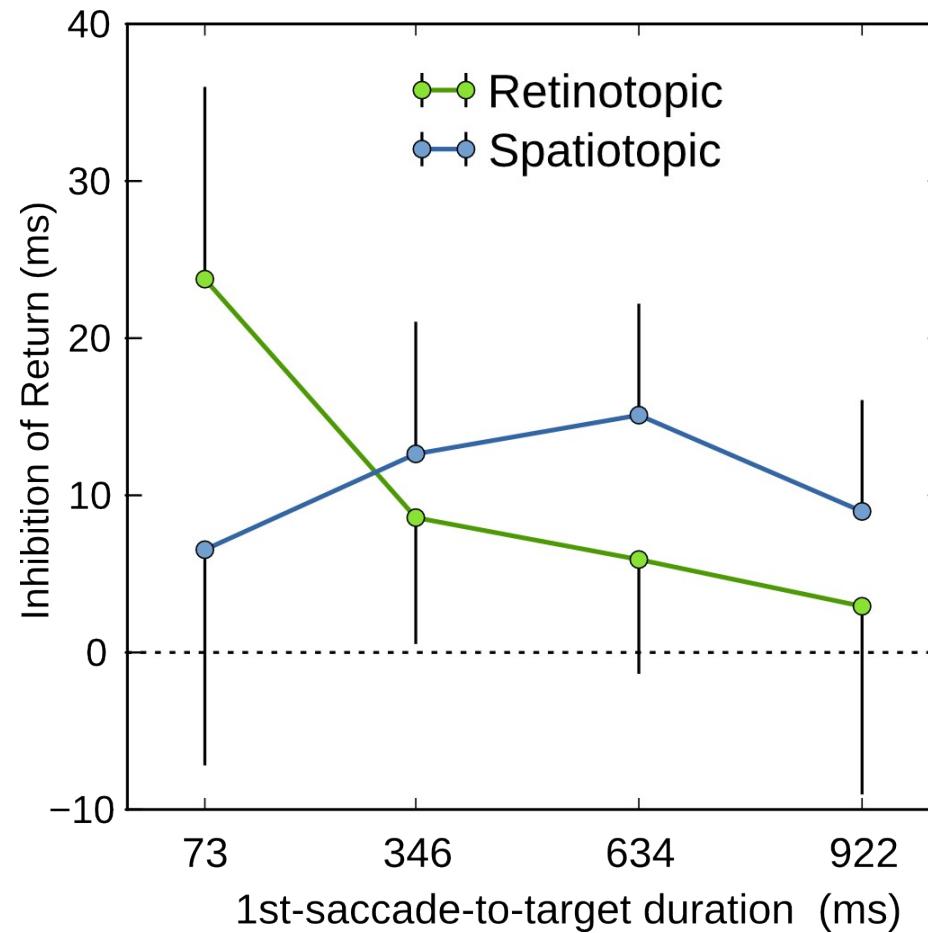
Inhibition of return



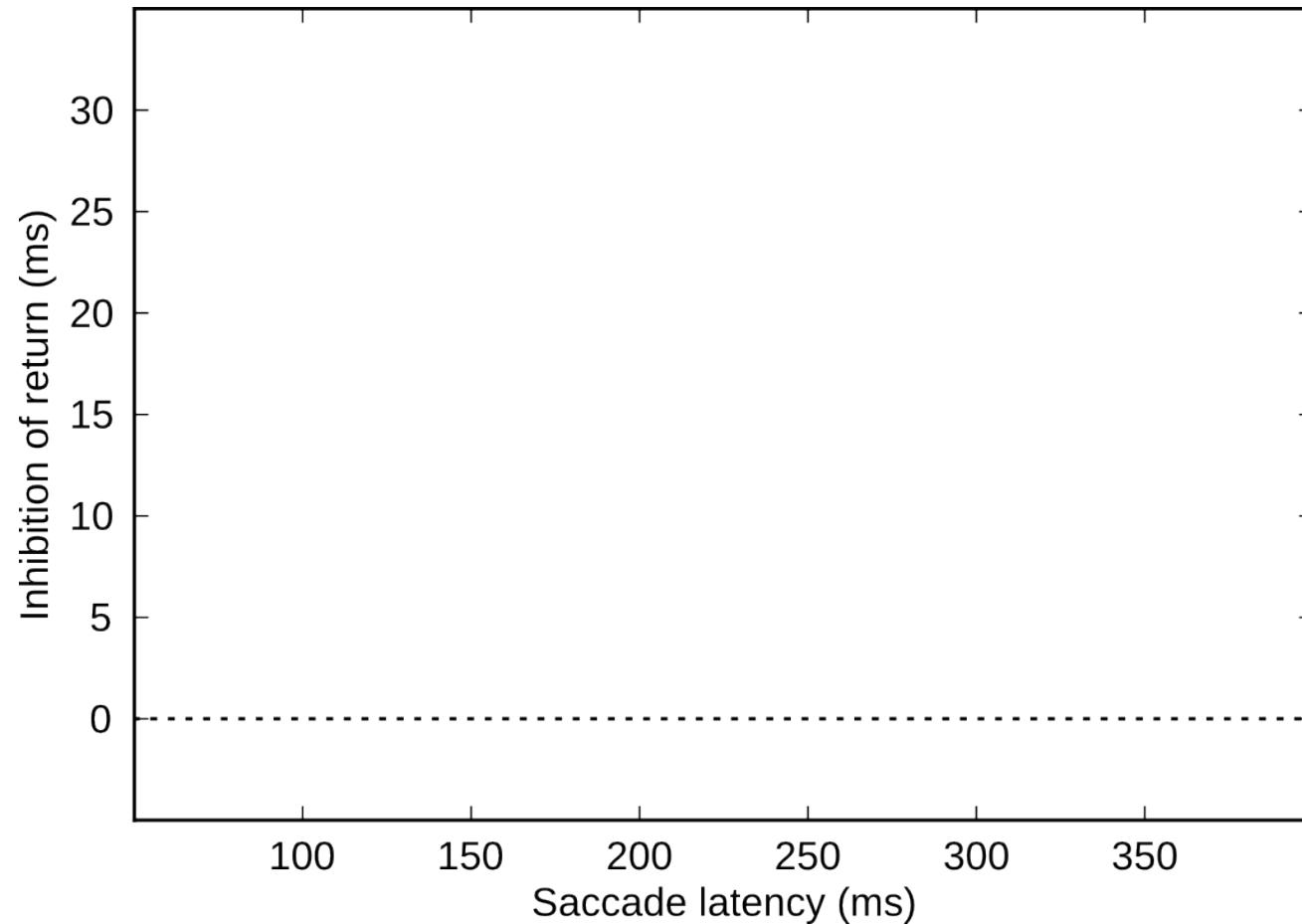
Inhibition of return



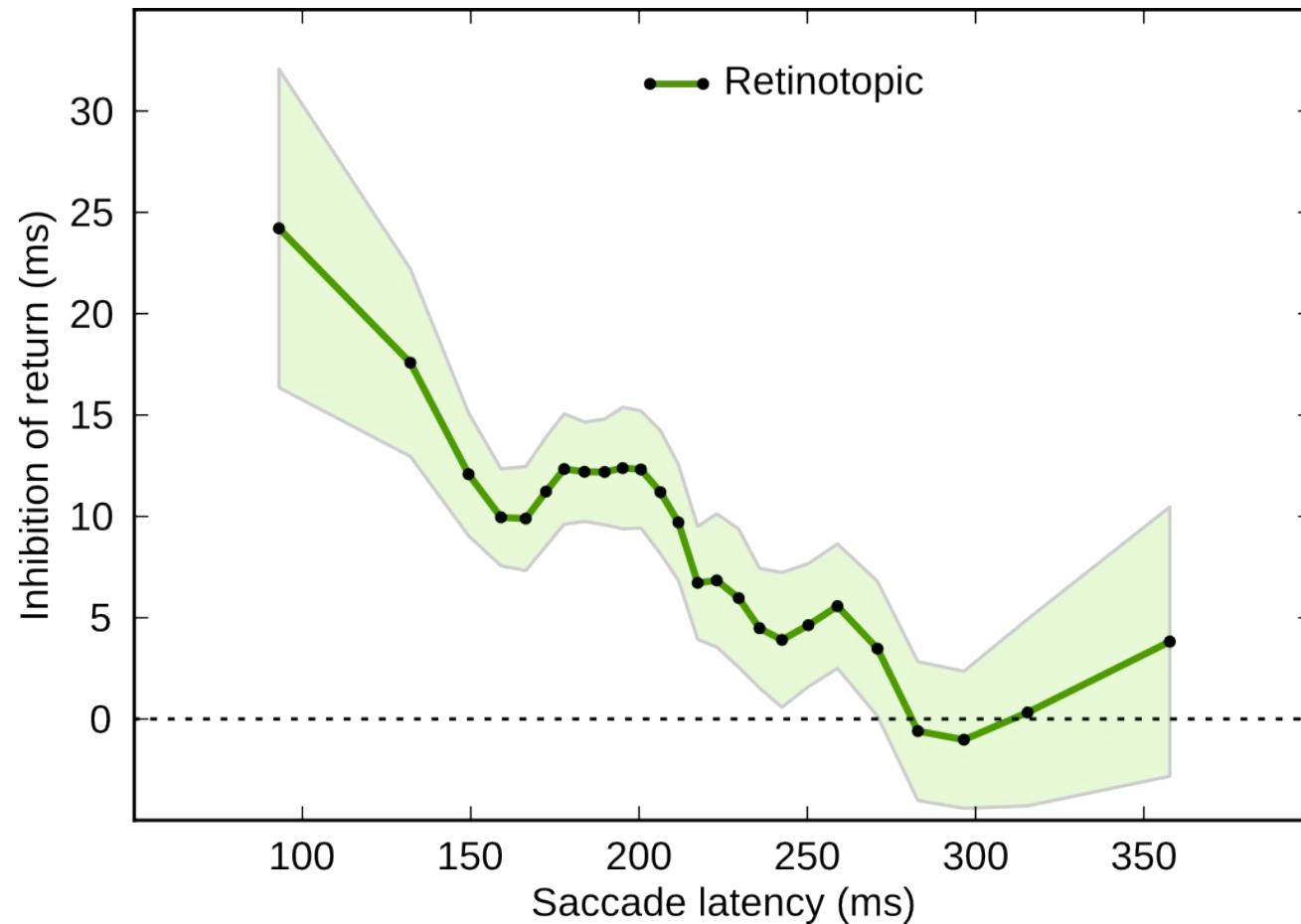
Inhibition of return



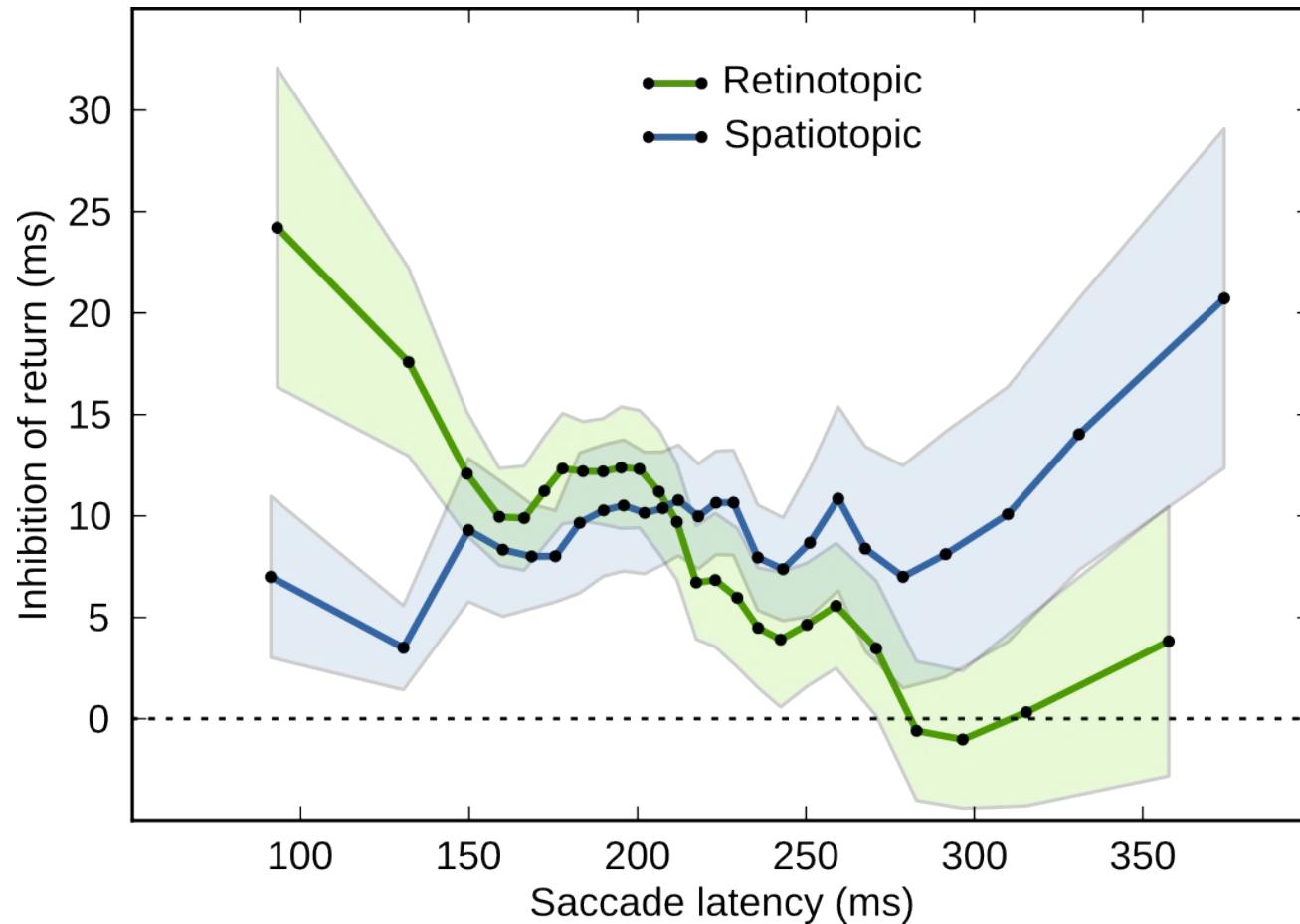
Inhibition of return



Inhibition of return



Inhibition of return



Inhibition of return

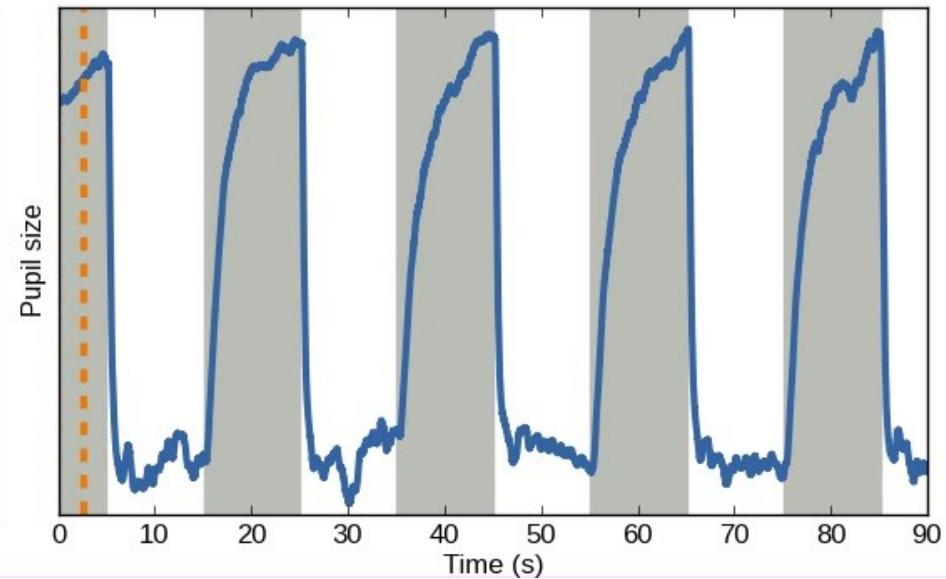
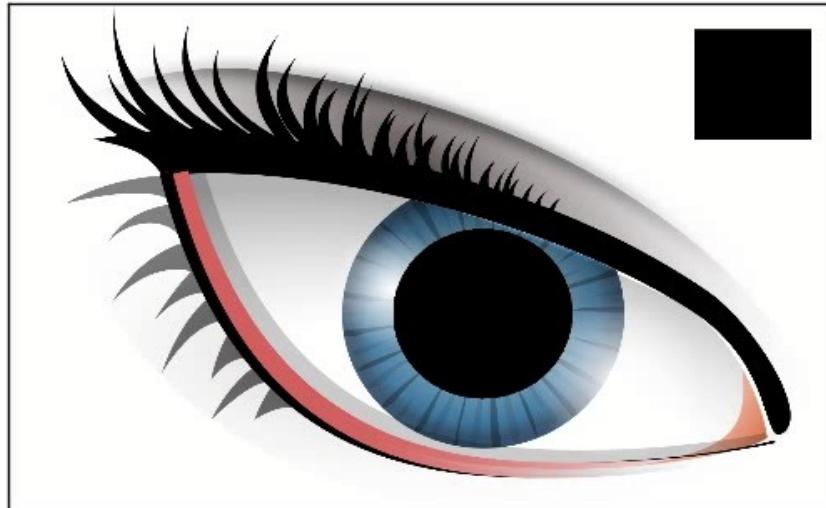
- IOR is both retinotopic (eye centered) and spatiotopic (world centered)
- Retinotopic IOR mostly for
 - Fast responses
 - Fast-paced experiment
 - Epiphenomenon due to retinotopic organization (or rather: purpose to be discovered)
- Spatiotopic IOR
 - Inhibits locations across eye movements
 - Useful!

How is this related

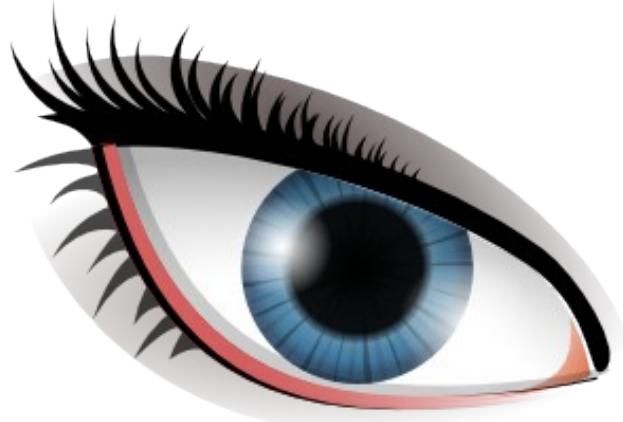
- These two examples highlight a general point
- Little, if any, low-level visual detail is preserved across eye movements
 - **No:** spatiotopic tilt adaptation
- ... but positional information is
 - **Yes:** spatiotopic inhibition of return
- ... because positions are what we act upon

The pupillary light response

The pupillary light response

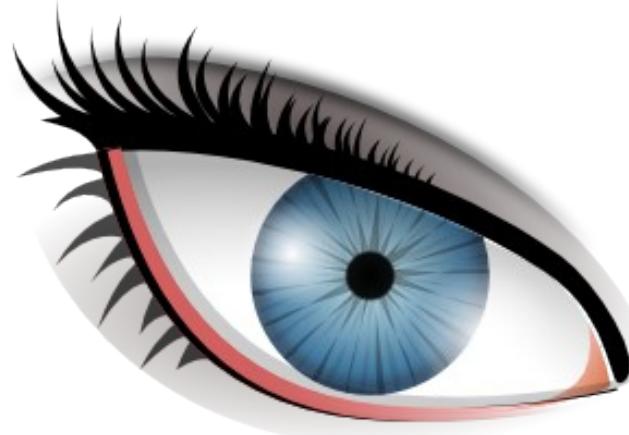


The pupillary light response



Captures lots of light

Has lots of optical
distortions



Captures less light

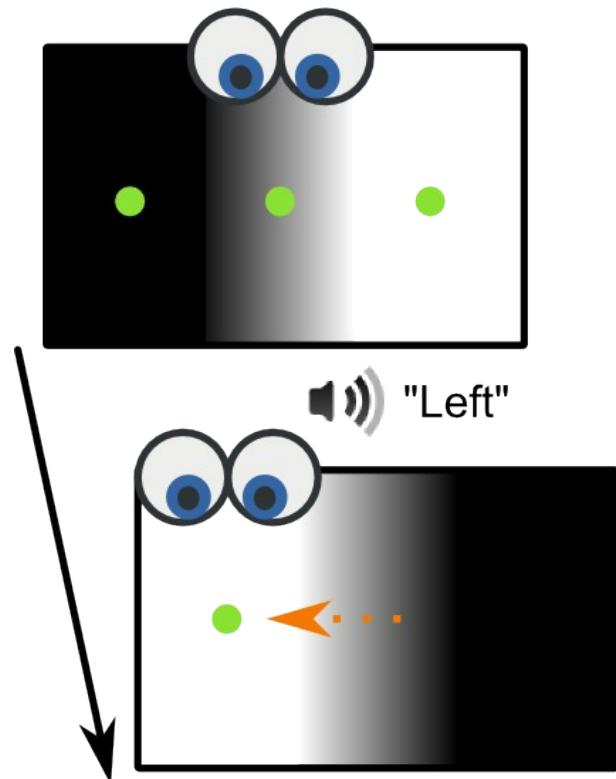
Has less optical
distortions

The pupillary light response

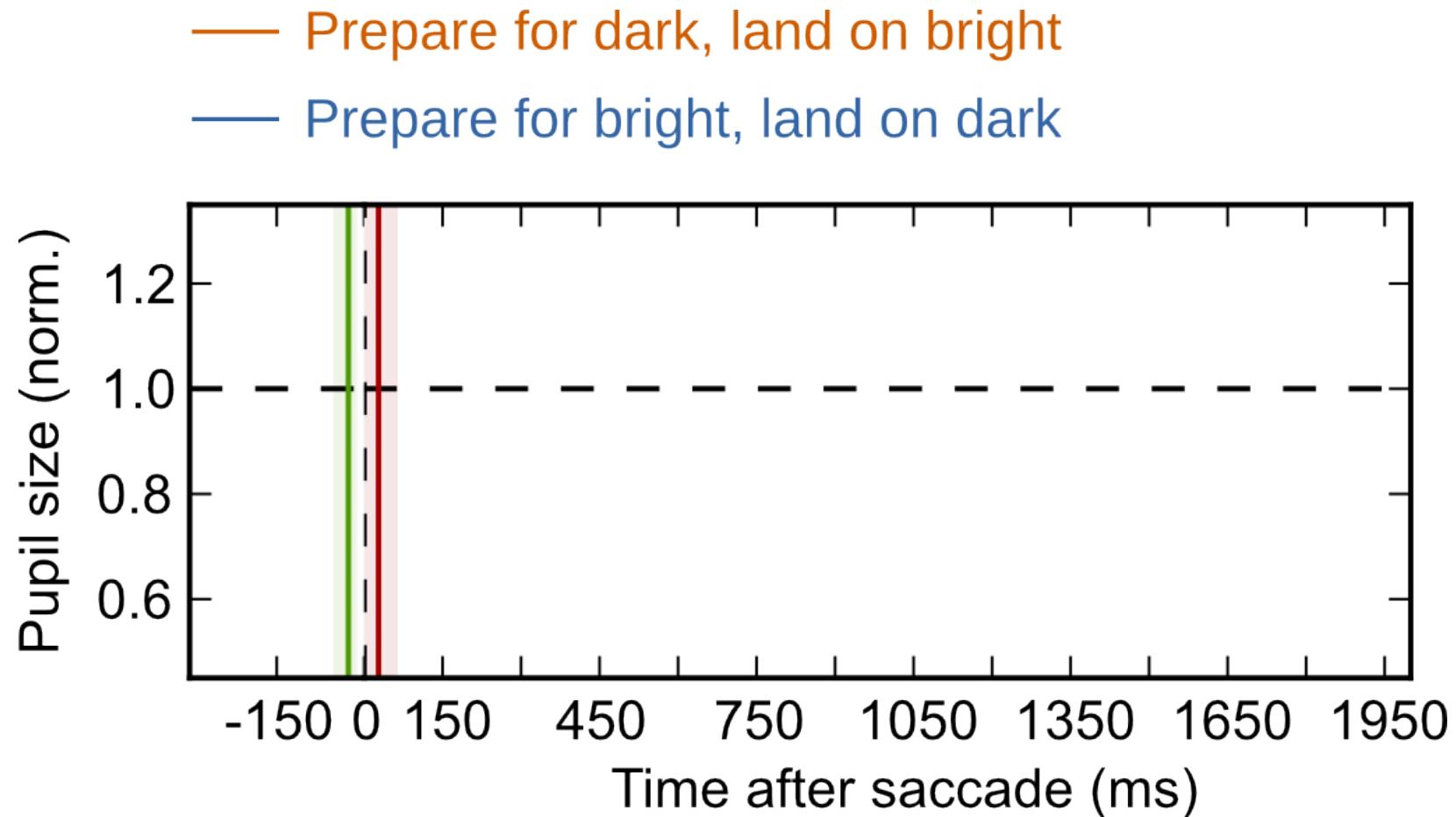
- Optimal pupil size changes from fixation to fixation
 - $\pm 3x$ per second
- How does the pupil keep up?
 - Latency 250 – 500 ms
- Preparation?

The pupillary light response

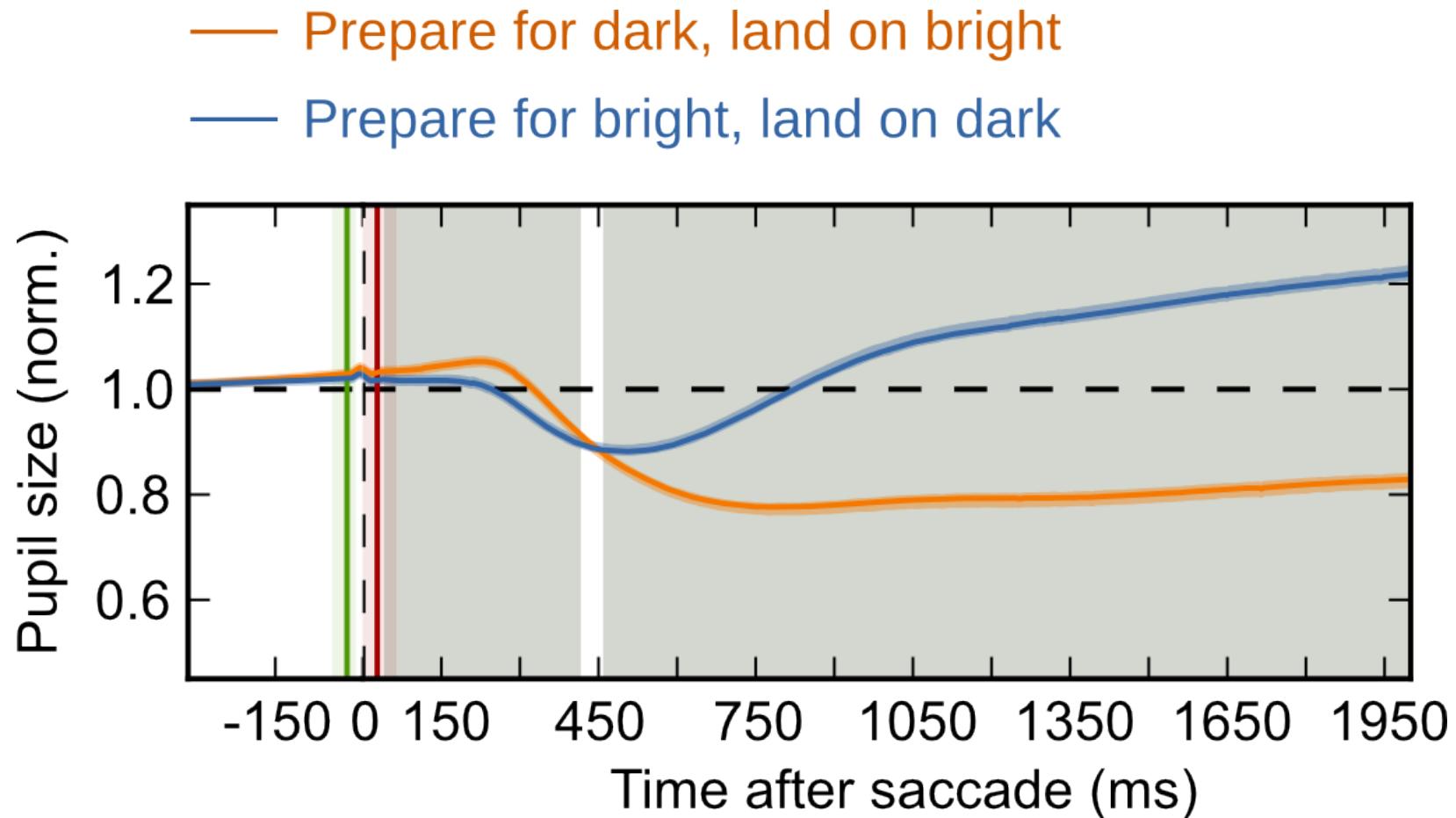
Prepare for **dark**
Land on **bright**



The pupillary light response



The pupillary light response



The pupillary light response



- The pupillary light response is initiated during eye-movement preparation
- This allows the pupil to rapidly track brightness changes in visual input
- “Brightness constancy” across saccadic eye movements

Conclusion

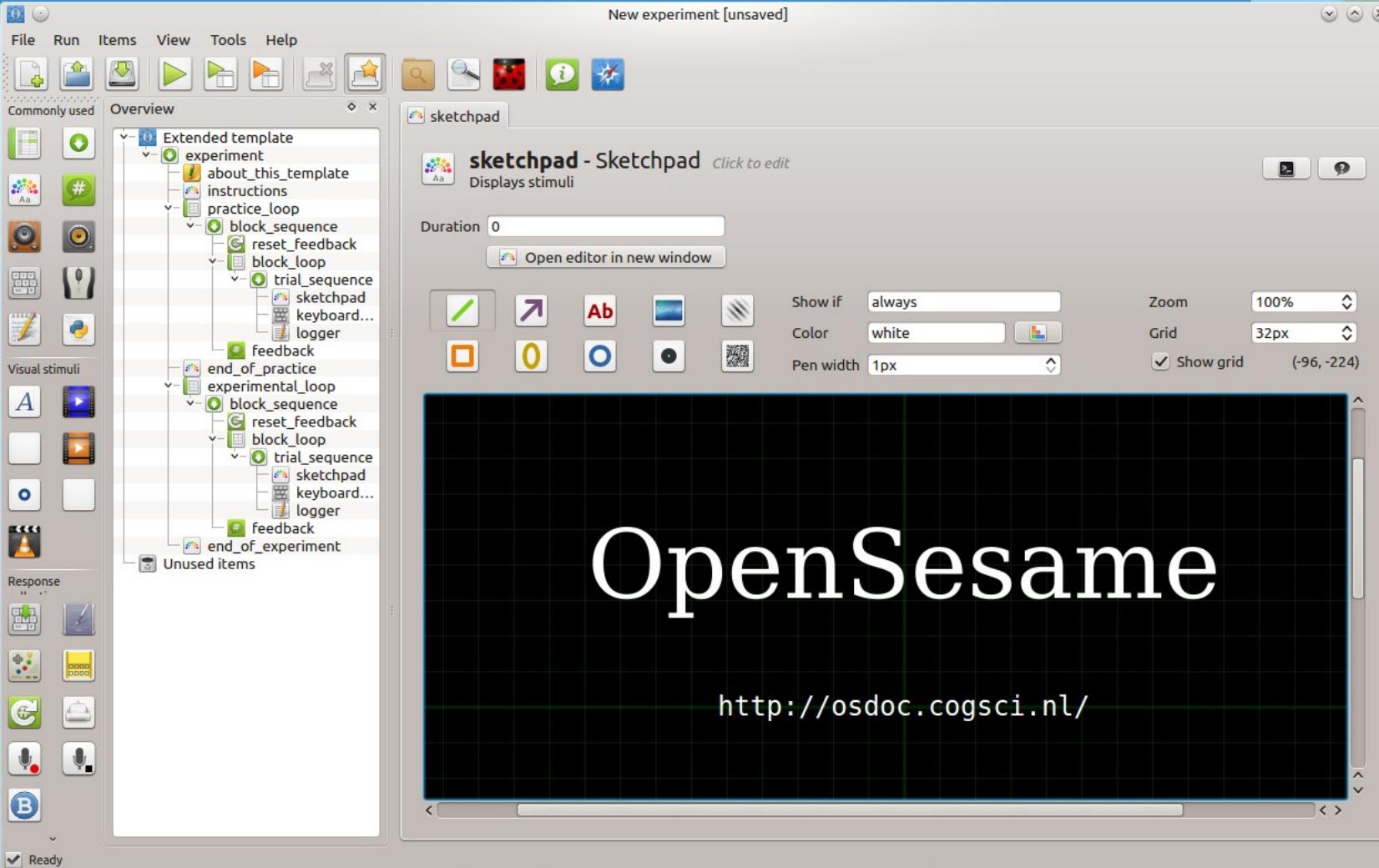
Conclusion

- Visual stability across eye movements is about interacting with the environment ...
 - How can we remember and inhibit locations?
 - How can we look at, point at, and reach out for things?
- ... and not about a subjective experience of visual stability
 - The world is right in front of us! No need to represent everything internally.
 - Taking introspection as a starting point is a bad idea: Change blindness

The visual world from glance to glance

- Spatial constancy — The classic “problem” of visual stability
 - How do we integrate (if indeed we do) visual information across eye movements?
- “Brightness constancy”
 - How do we deal with changes in input brightness across eye movements?
- Cross-modal integration
 - How do we map vision onto touch, audition, and other senses?
- Action
 - How do we map vision onto action?

Thank you



The screenshot shows the OpenSesame software interface. The window title is "New experiment [unsaved]". The menu bar includes File, Run, Items, View, Tools, and Help. The toolbar contains various icons for file operations and tools. On the left, a sidebar titled "Commonly used" lists categories: Overview, Extended template, Visual stimuli, Response, and a section labeled "Unused items". The "Extended template" section shows a hierarchical tree of experiment components: experiment, instructions, practice_loop, block_sequence, reset_feedback, block_loop, trial_sequence, sketchpad, keyboard..., logger, feedback, end_of_practice, experimental_loop, block_sequence, reset_feedback, block_loop, trial_sequence, sketchpad, keyboard..., logger, feedback, and end_of_experiment. The main workspace is titled "sketchpad - Sketchpad Click to edit". It displays a grid background with the text "OpenSesame" and the URL "http://osdoc.cogsci.nl/". The right side of the workspace has settings for Duration (0), Show if (always), Zoom (100%), Color (white), Grid (32px), Pen width (1px), and a checked "Show grid" option.

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