SIPF
Società Italiana di Psicofisiologia e Neuroscienze Cognitive

XXIX Congresso Nazionale SIPF, Palermo, 30/09-2/10/2021

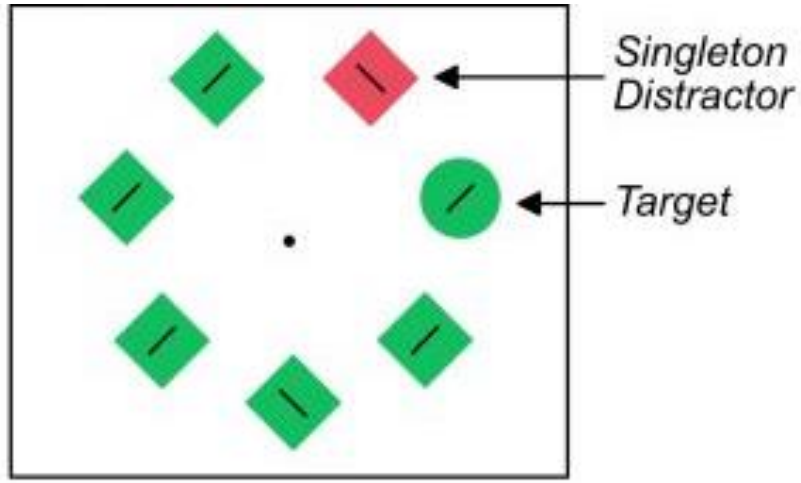
Investigating the role of the dorsal frontoparietal attention network in distractor filtering and in the attention-modulated surround suppression mechanisms by means of TMS

Carlotta Lega

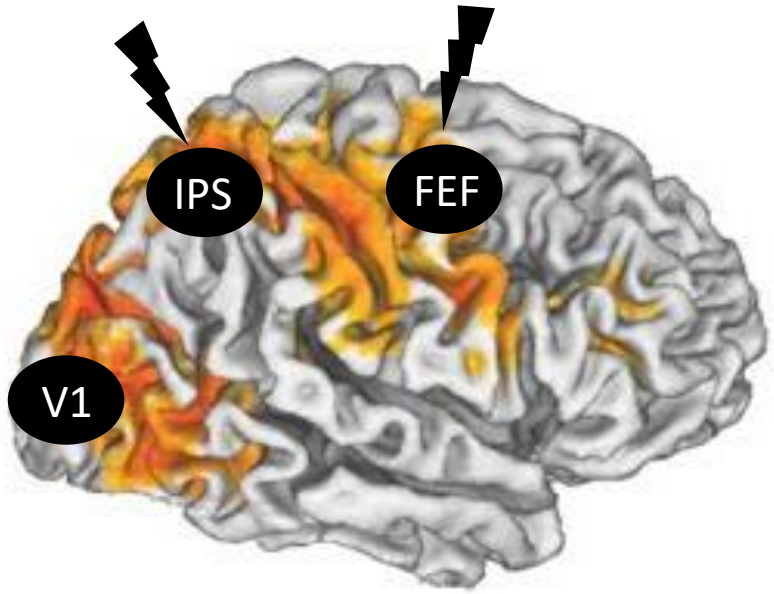
Visual selective attention endows individuals with the capacity to extract the relevant element for in-depth processing, while disregarding irrelevant and potentially distracting elements in the visual environment

The presence of a singleton distractor in a search array results in an unwanted shift of attention to the salient stimulus (attentional capture effect), as indexed by a measurable performance cost relative to trials without the singleton distractor (Theeuwes, 1992; Theeuwes and Burger, 1998; Theeuwes and Godljn, 2002)

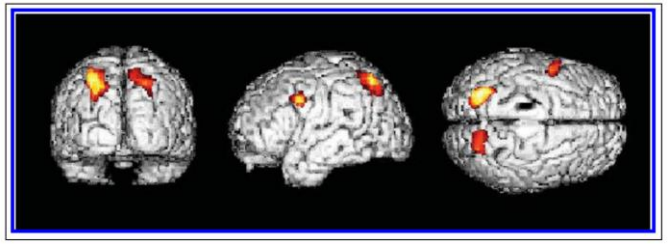
Gaspelin, 2018



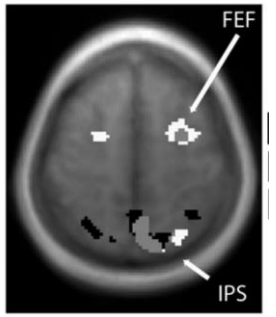
Gaspelin, 2018



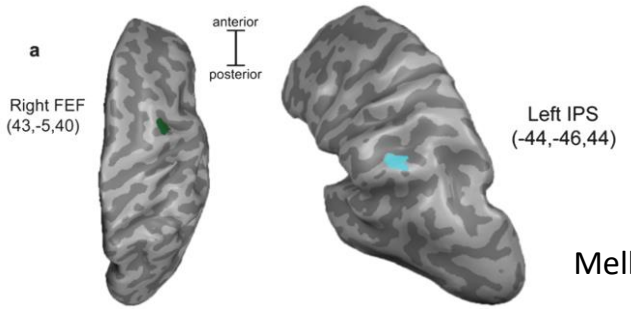
Numerous functional imaging studies demonstrated that attentional control in the presence of potential distraction is supported by the dorsal (mostly bilateral) frontoparietal attention network



De Fockert et al., 2004



Di Quattro et al., 2014



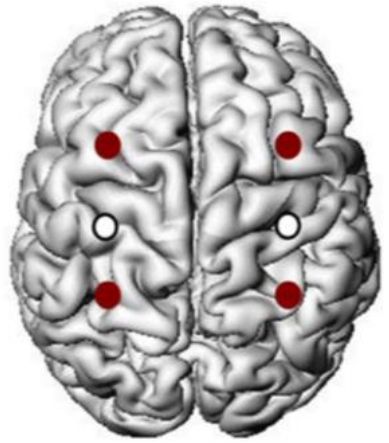
Melloni et al., 2011

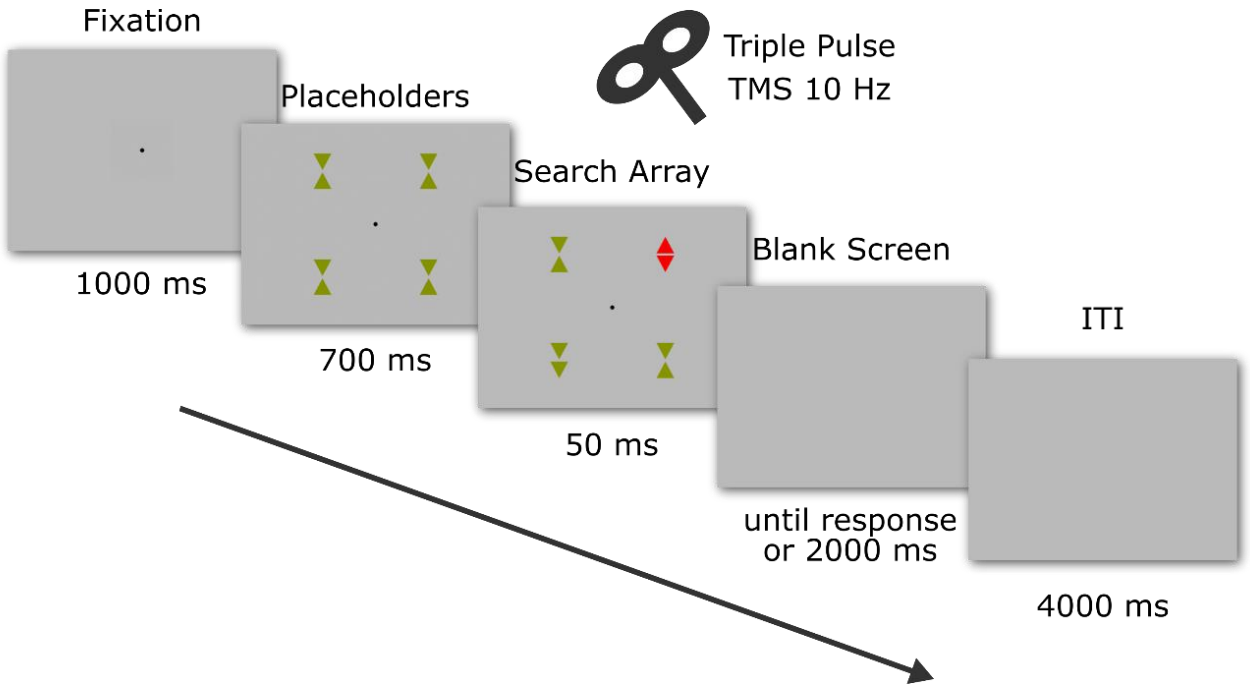
INTRODUCTION STUDY 1

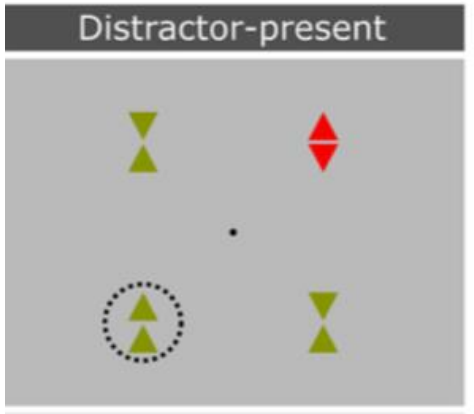
Behavioral/Cognitive

Probing the Neural Mechanisms for Distractor Filtering and Their History-Contingent Modulation by Means of TMS

Carlotta Lega,[1] Oscar Ferrante,[1] Francesco Marini,[2] Elisa Santandrea,[1] Luigi Cattaneo,[1,3] and Leonardo Chelazzi[1,3]
[1]Department of Neuroscience, Biomedicine and Movement Sciences, University of Verona, Verona I-37134, Italy, [2]Swartz Center for Computational Neuroscience, University of California San Diego, La Jolla CA 92093, California, and [3]Italian Institute of Neuroscience, Verona I-37134, Italy







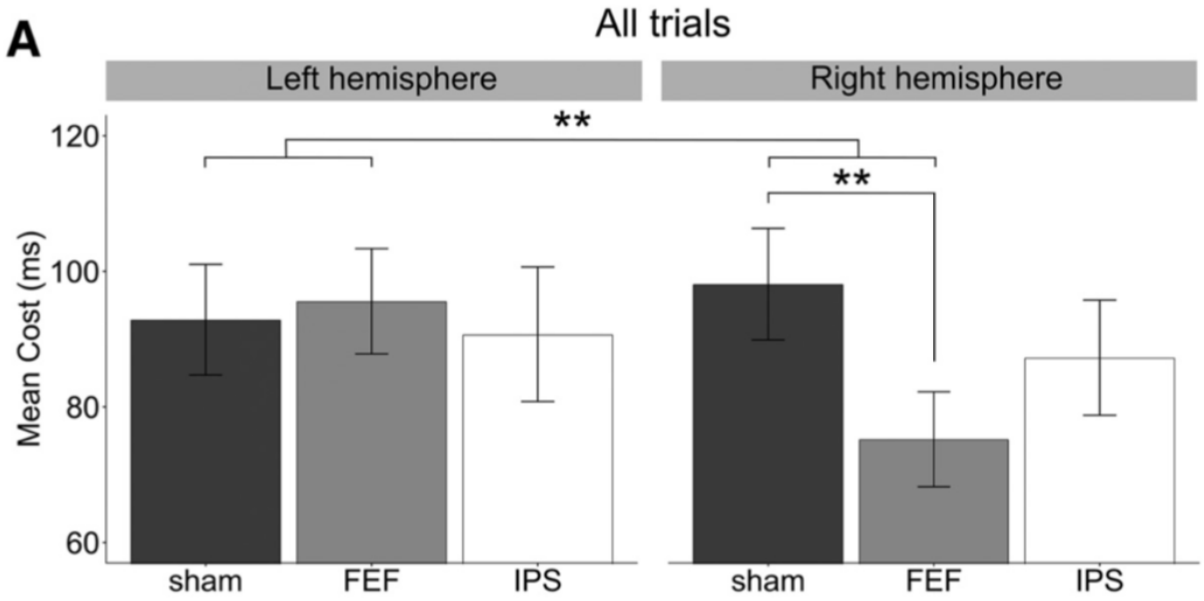
Lega et al., 2019, *JNeurosci*

RESULTS STUDY 1

Behavioral/Cognitive

Probing the Neural Mechanisms for Distractor Filtering and Their History-Contingent Modulation by Means of TMS

Carlotta Lega,[1] Oscar Ferrante,[1] Francesco Marini,[2] Elisa Santandrea,[1] Luigi Cattaneo,[1,3] and Leonardo Chelazzi[1,3]
[1]Department of Neuroscience, Biomedicine and Movement Sciences, University of Verona, Verona I-37134, Italy, [2]Swartz Center for Computational Neuroscience, University of California San Diego, La Jolla CA 92093, California, and [3]Italian Institute of Neuroscience, Verona I-37134, Italy

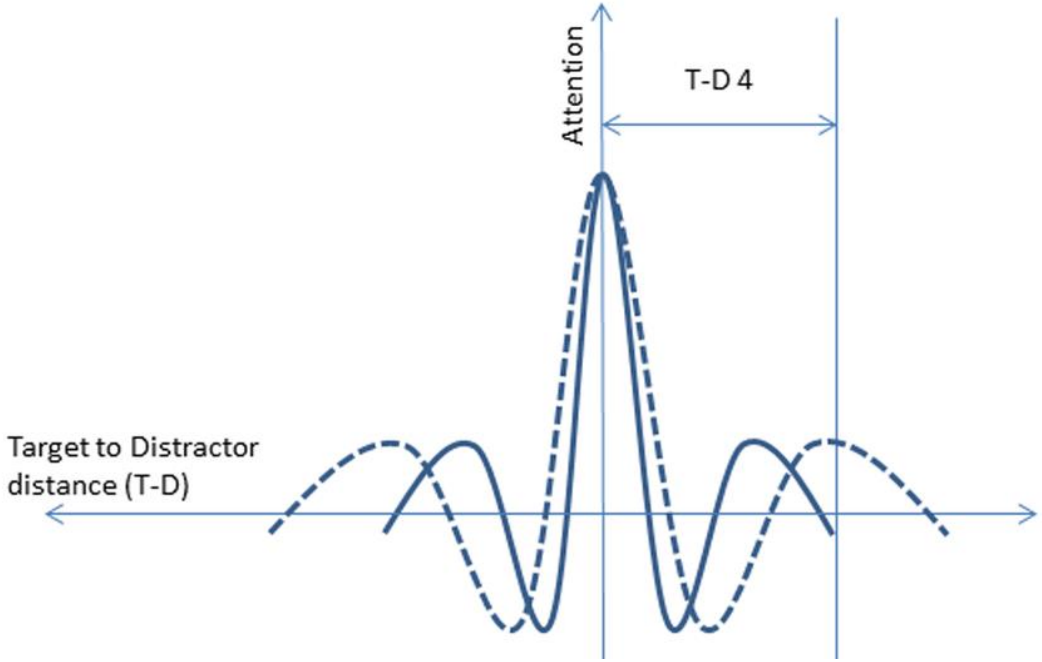


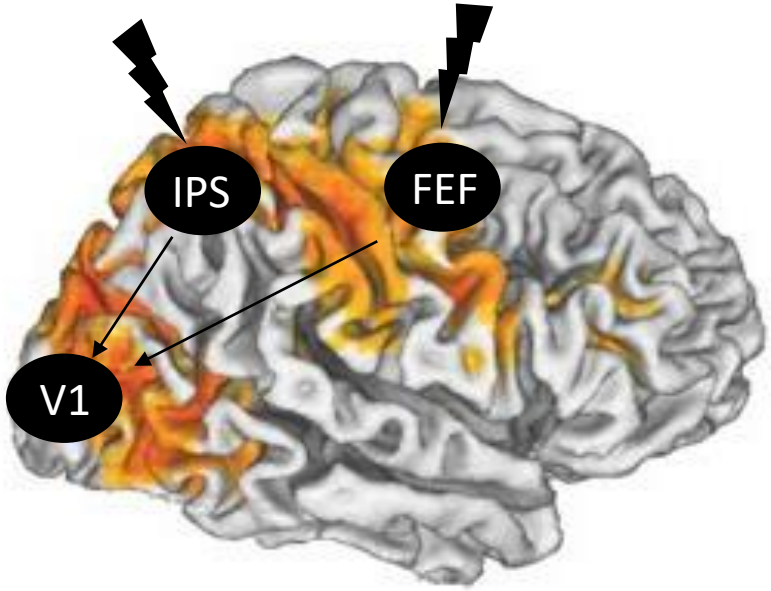
Results showed that TMS stimulation of the right FEF, but not of left FEF or IPS, significantly reduced the behavioral interference caused by a salient singleton distractor during a visual search task

- TMS stimulation may have facilitated the instantiation of distractor suppression
- TMS stimulation may have disrupted the attentional bias towards the salient feature

Lega et al., 2019, *JNeurosci*

Visual selection requiring spatial scrutiny elicits in the immediate surround of the attentional focus an area of attenuated excitability, forming a **center-surround profile** resembling a "**Mexican hat**" (Bahcall and Kowler, 1999; Boehler et al., 2009; Hopf et al., 2006; Müller et al., 2005; Carrasco, 2011; Ronconi et al., 2015)



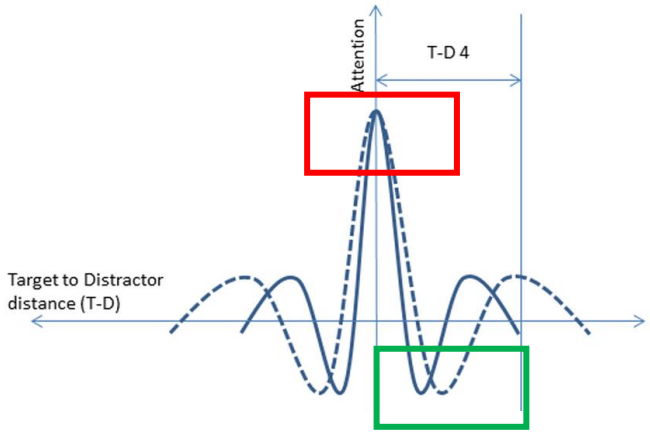


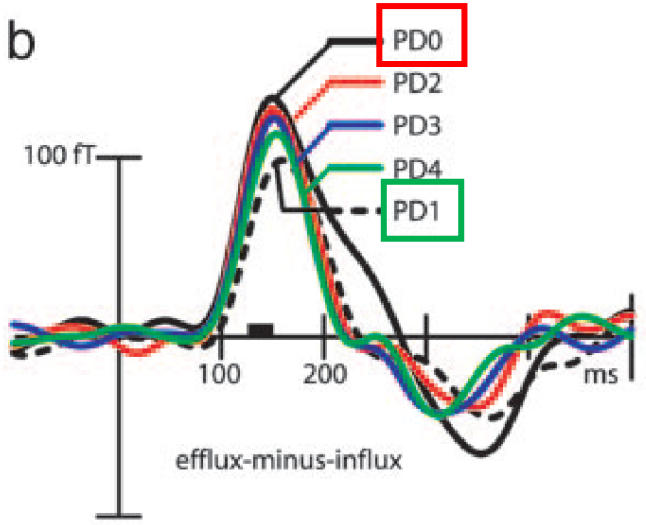
PNAS

Direct neurophysiological evidence for spatial suppression surrounding the focus of attention in vision

J.-M. Hopf*†‡§, C. N. Boehler†‡, S. J. Luck¶, J. K. Tsotsos‖, H.-J. Heinze*†, and M. A. Schoenfeld*

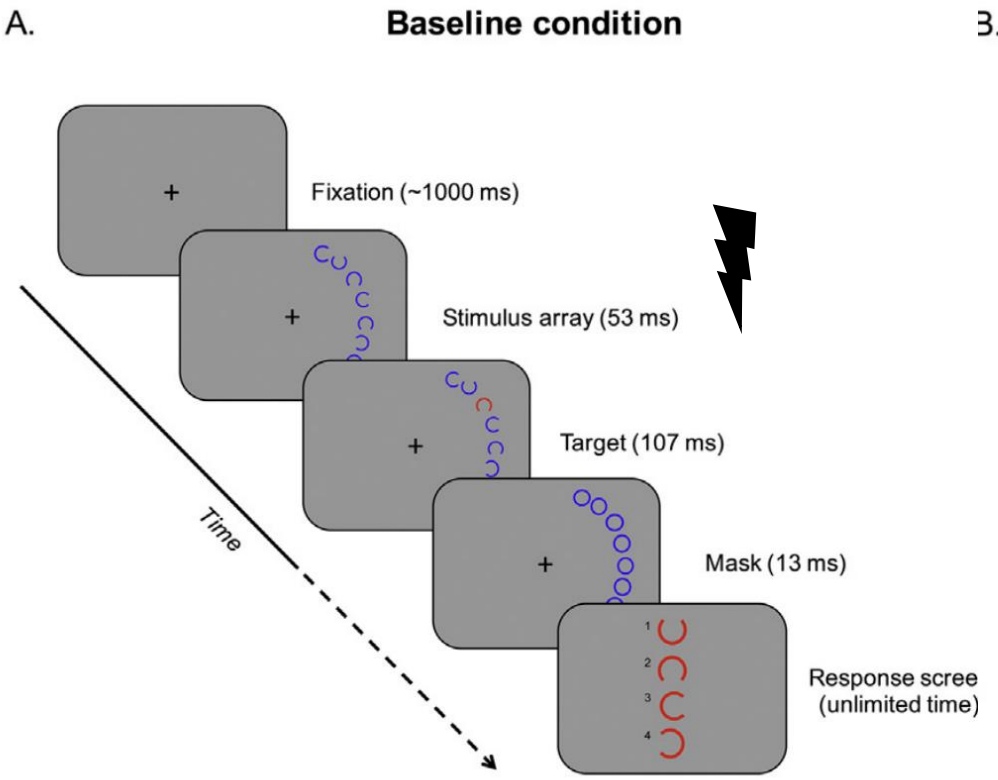
*Department of Neurology II, Otto-von-Guericke-University, D-39120 Magdeburg, Germany; †Leibniz-Institute for Neurobiology, D-39120 Magdeburg, Germany; ¶Department of Psychology, University of Iowa, Iowa City, IA 52242-1407; and ‖Centre for Vision Research and Department of Computer Science, York University, Toronto, ON, Canada M3J 1P3



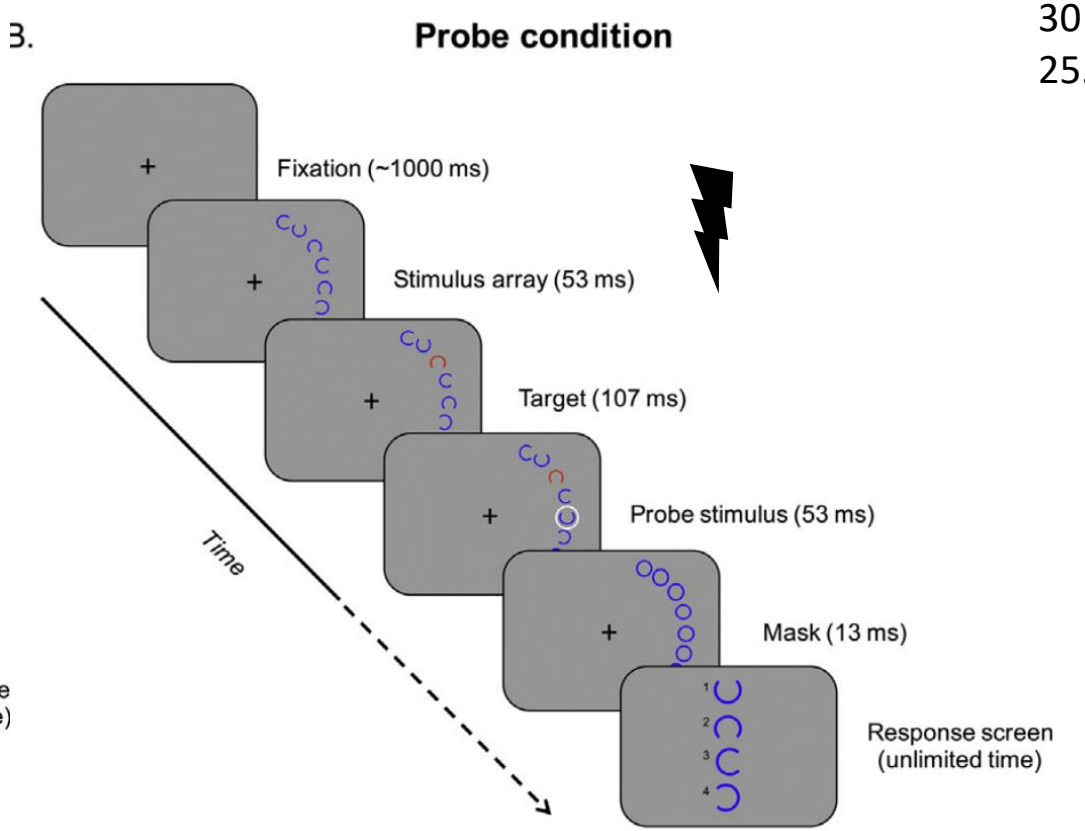


This center-surround profile of the attentional focus is thought to arise from **top-down frontoparietal recurrent activity**, which would modulate activations in early visual cortex

METHODS STUDY 2

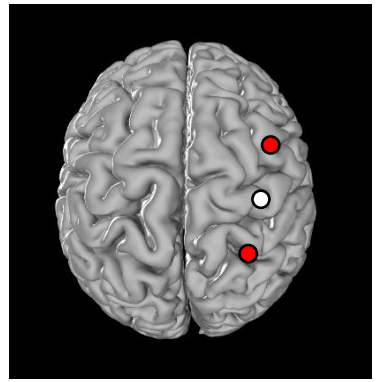


From Ronconi et al., 2018



30 participants (11 M, M = 25.4, SD = 2.80))

Triple-pulse 10 Hz



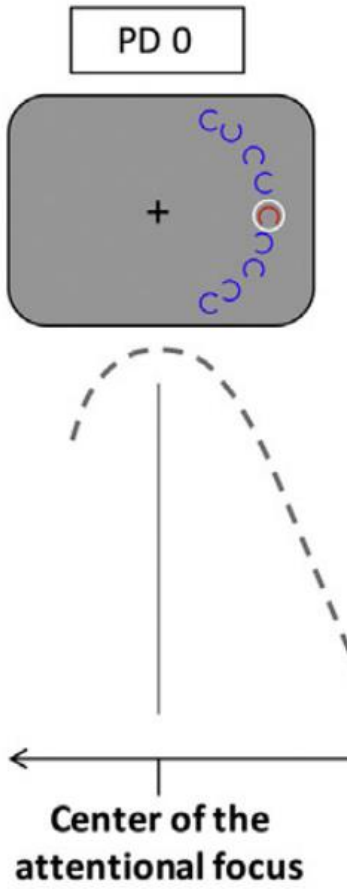
rFEF (36 -1 48)

Sham

rIPS (30 -53 49)

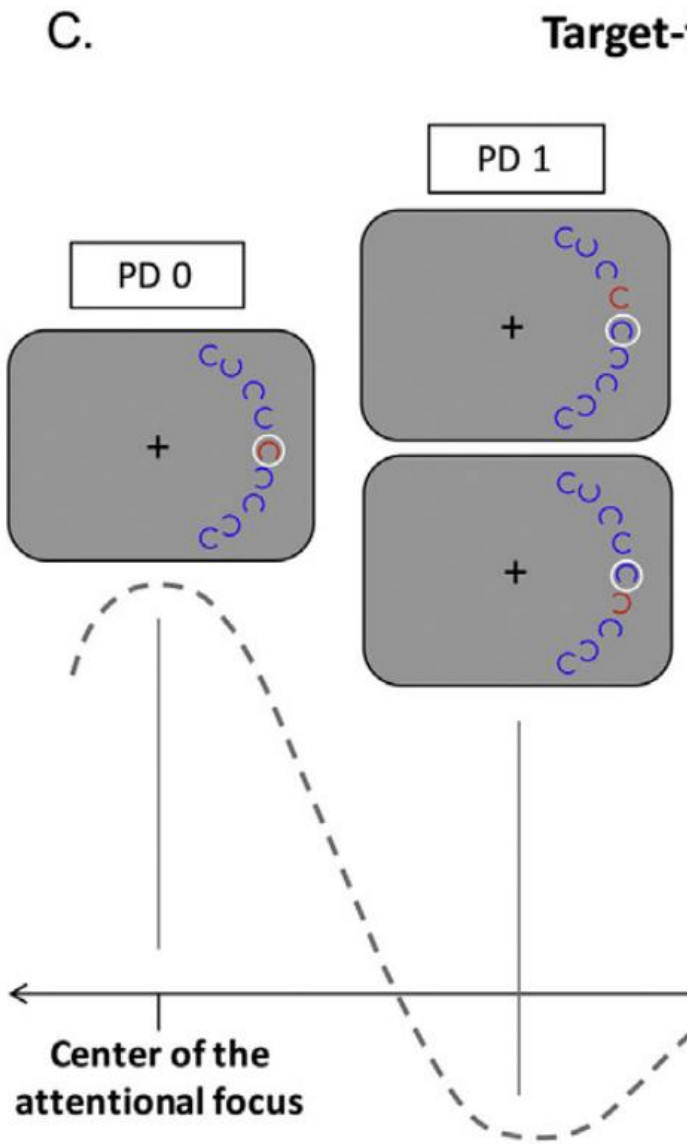
METHODS STUDY 2

C.

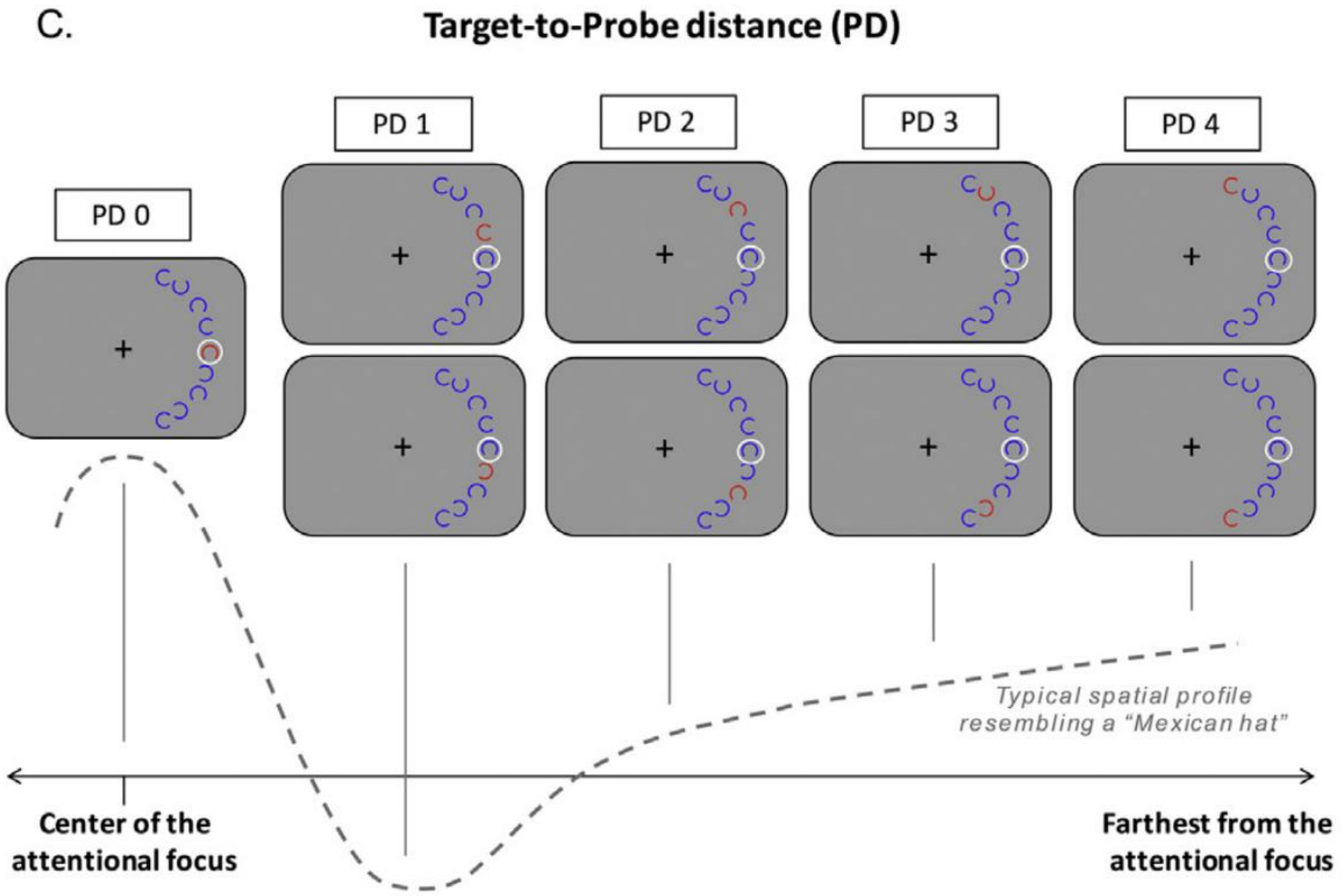


From Ronconi et al., 2018

METHODS STUDY 2

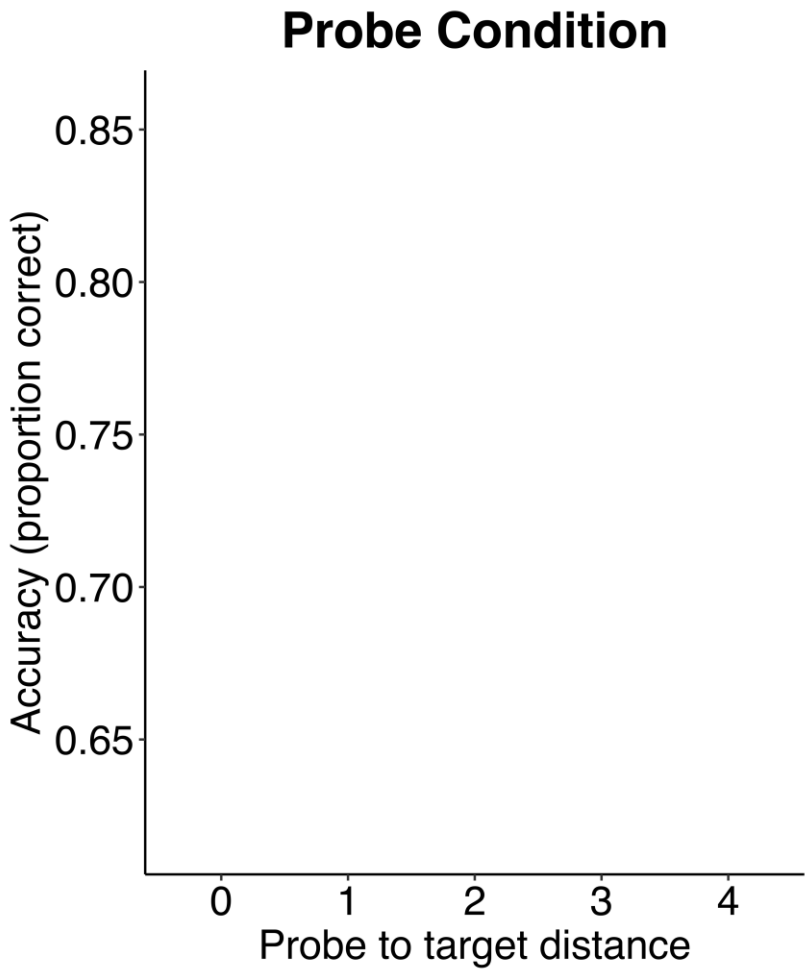


From Ronconi et al., 2018

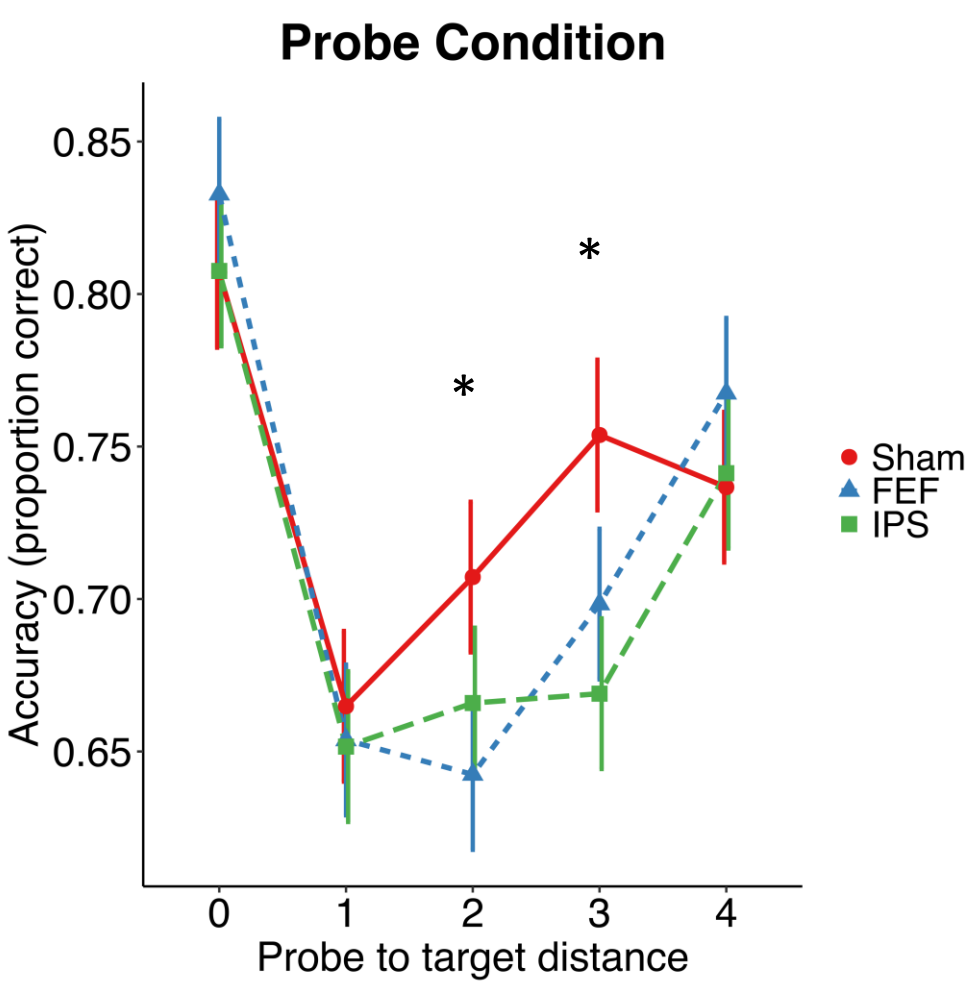


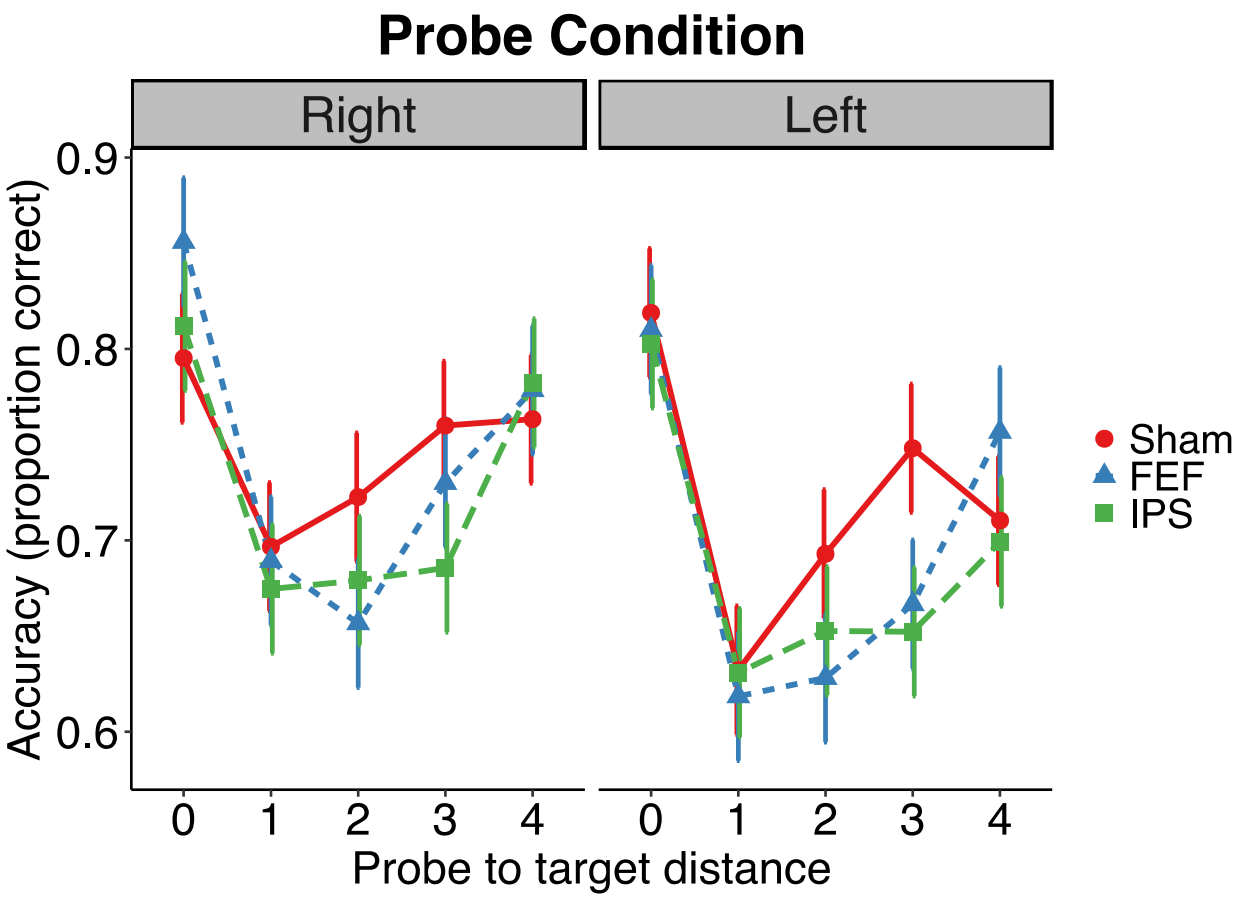
From Ronconi et al., 2018

RESULTS: Probe condition



RESULTS: Probe condition



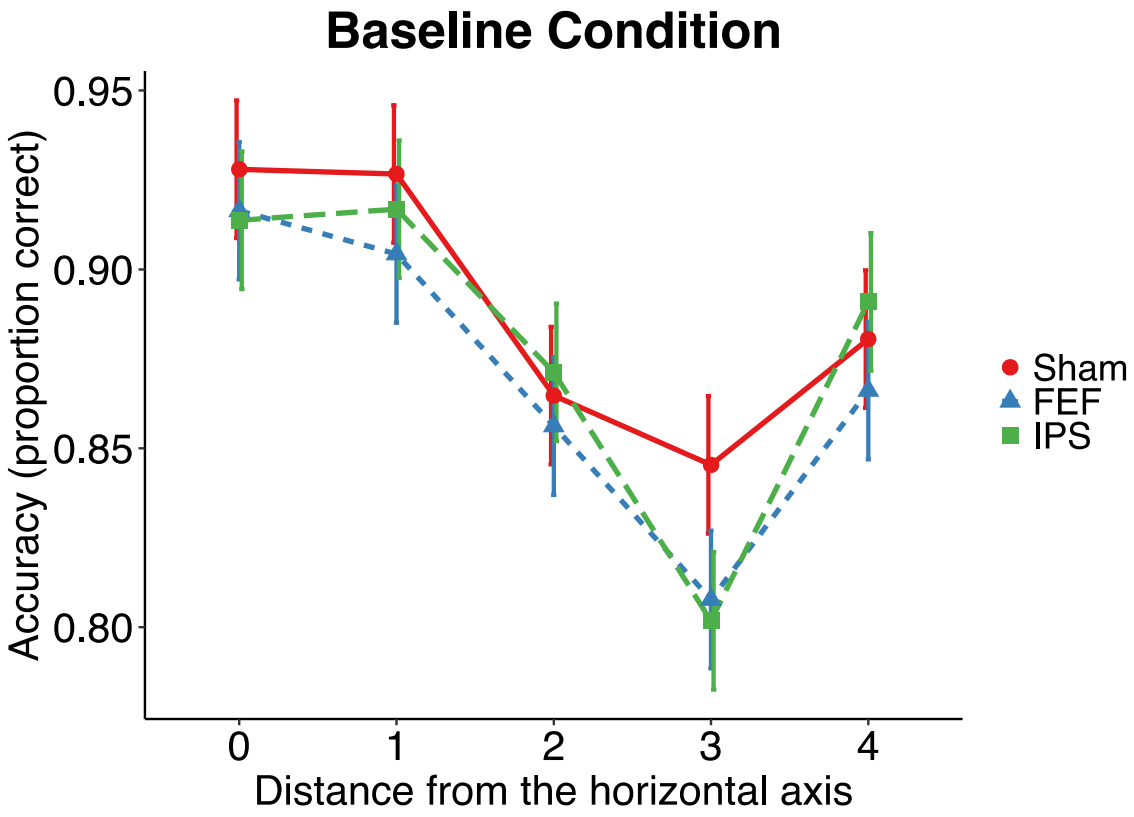


TMS:Distance: $\chi^2(8) = 16.19$, $p = .039$

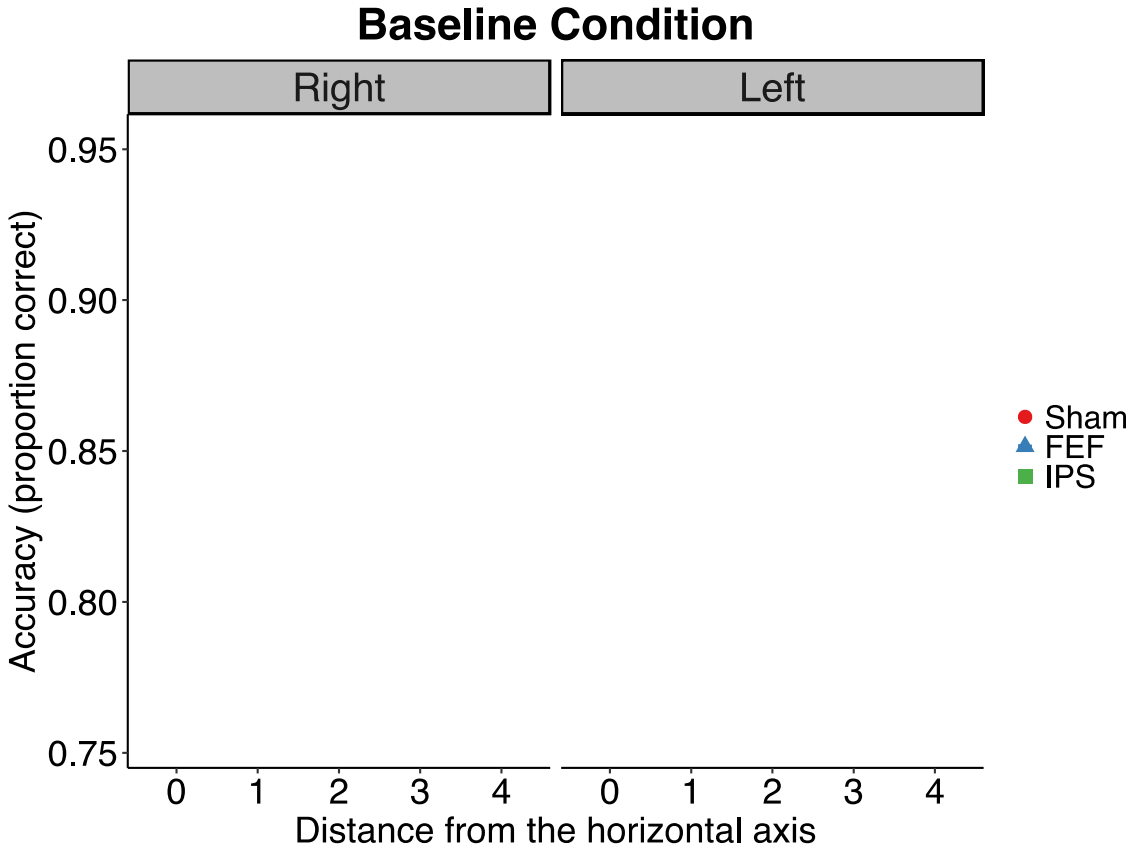
Sham vs. FEF: $\chi^2(1) = 6.29$, $p = .036$

Sham vs. IPS: $\chi^2(1) = 11.24$, $p = .002$

RESULTS: Baseline condition

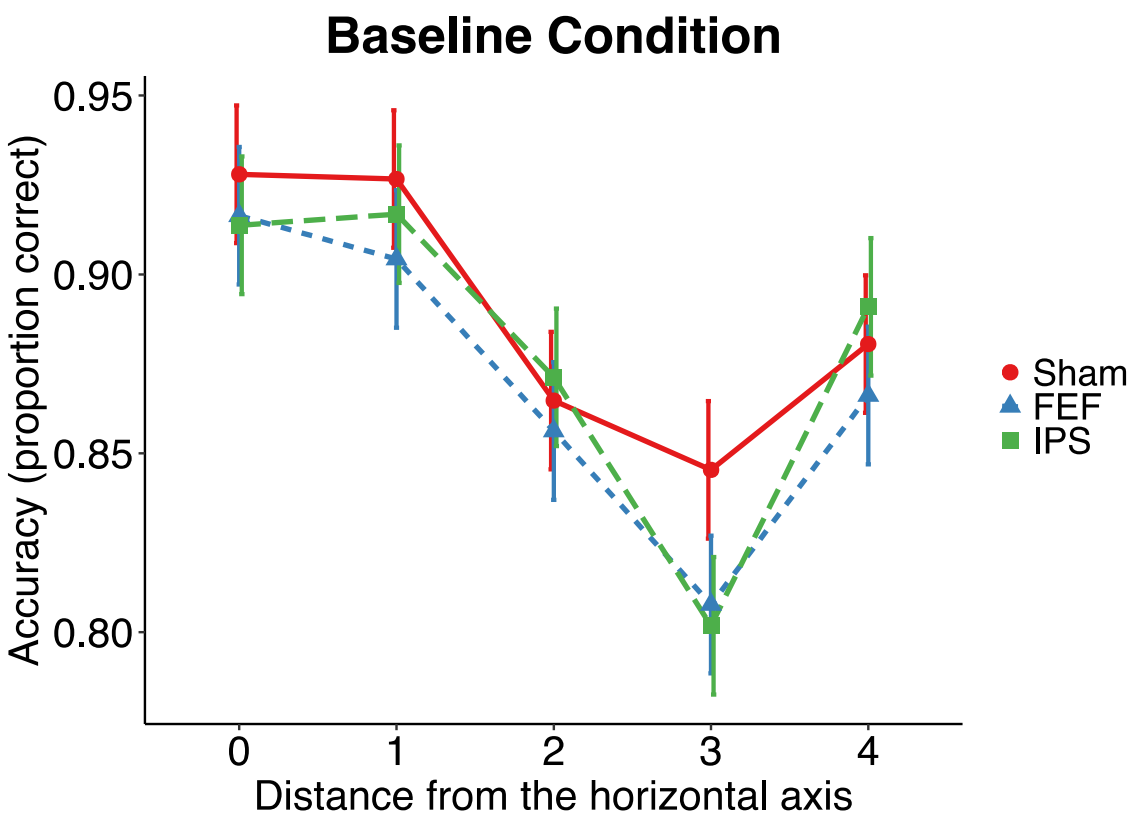


Distance: $\chi^2(4) = 124.69$, $p < .001$

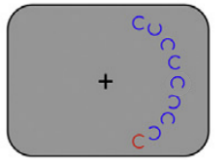


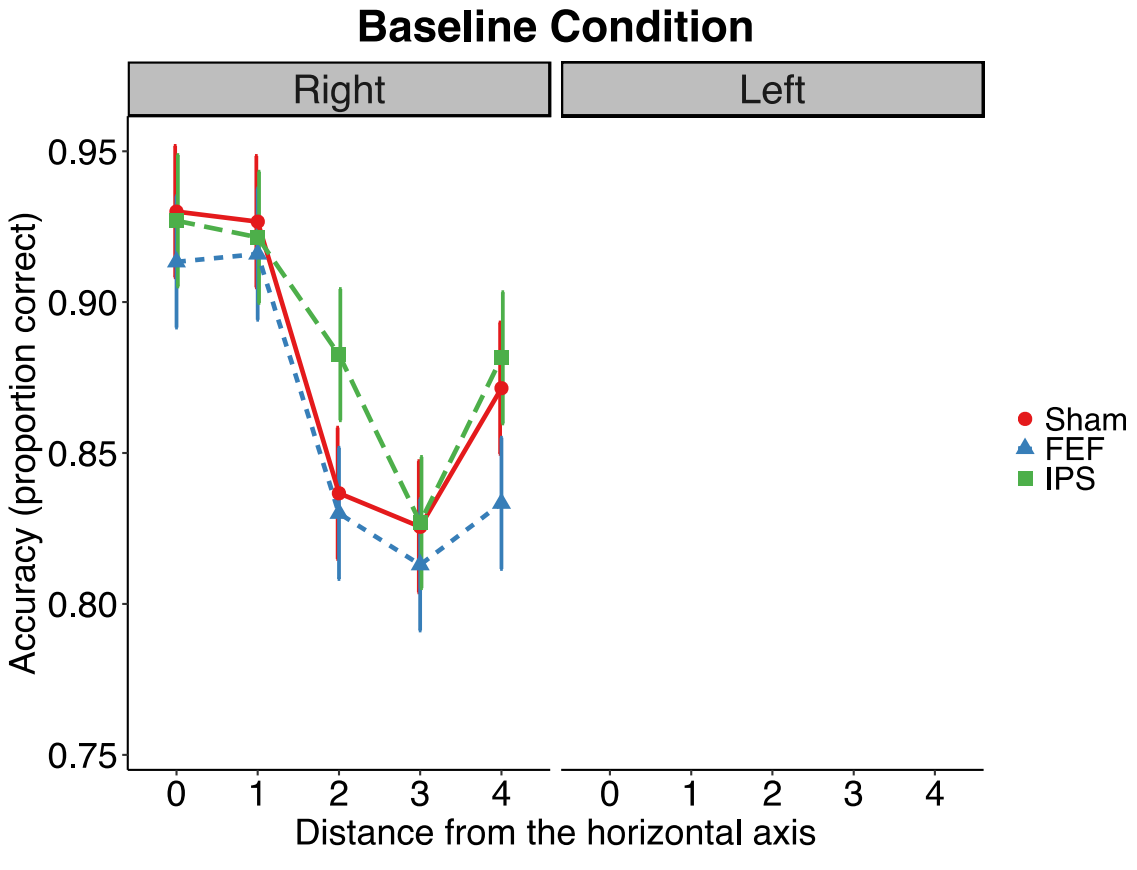
TMS:Side: $\chi^2(2) = 7.69$, $p = .021$

RESULTS: Baseline condition



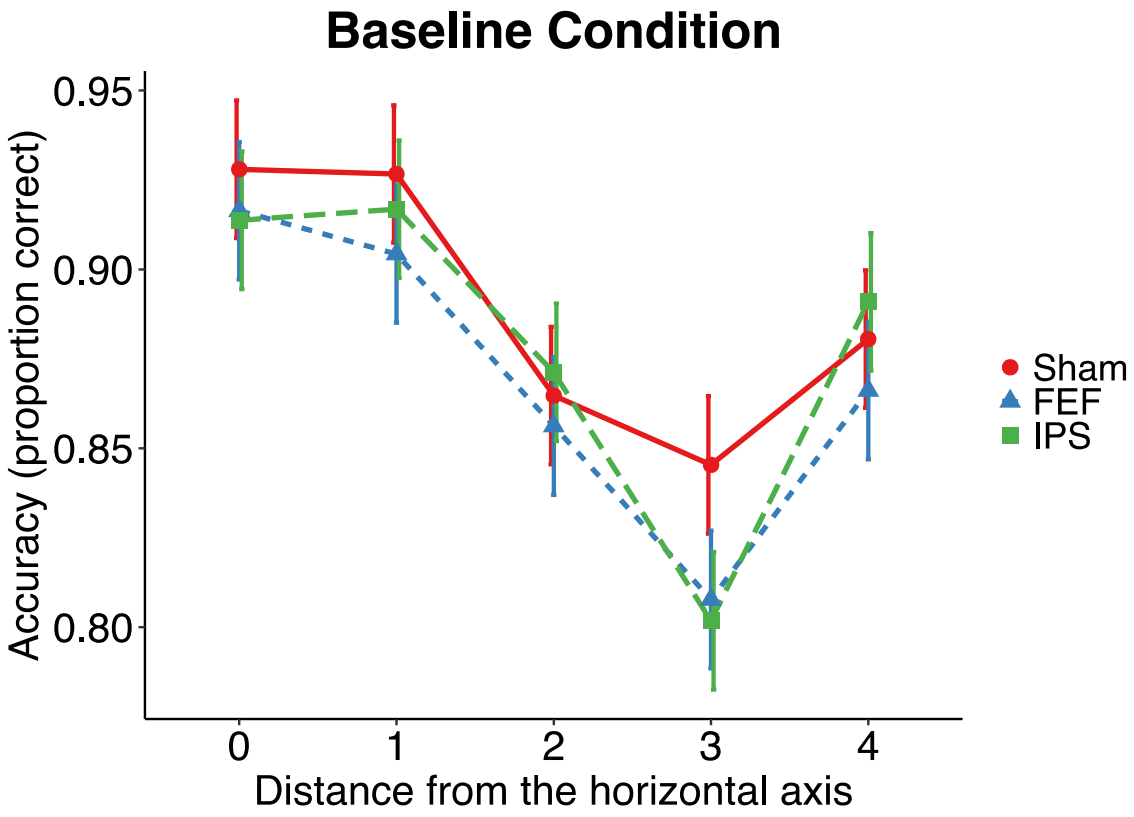
Distance: $\chi^2(4) = 124.69$, $p < .001$





TMS:Side: $\chi^2(2) = 7.69$, $p = .021$

RESULTS: Baseline condition



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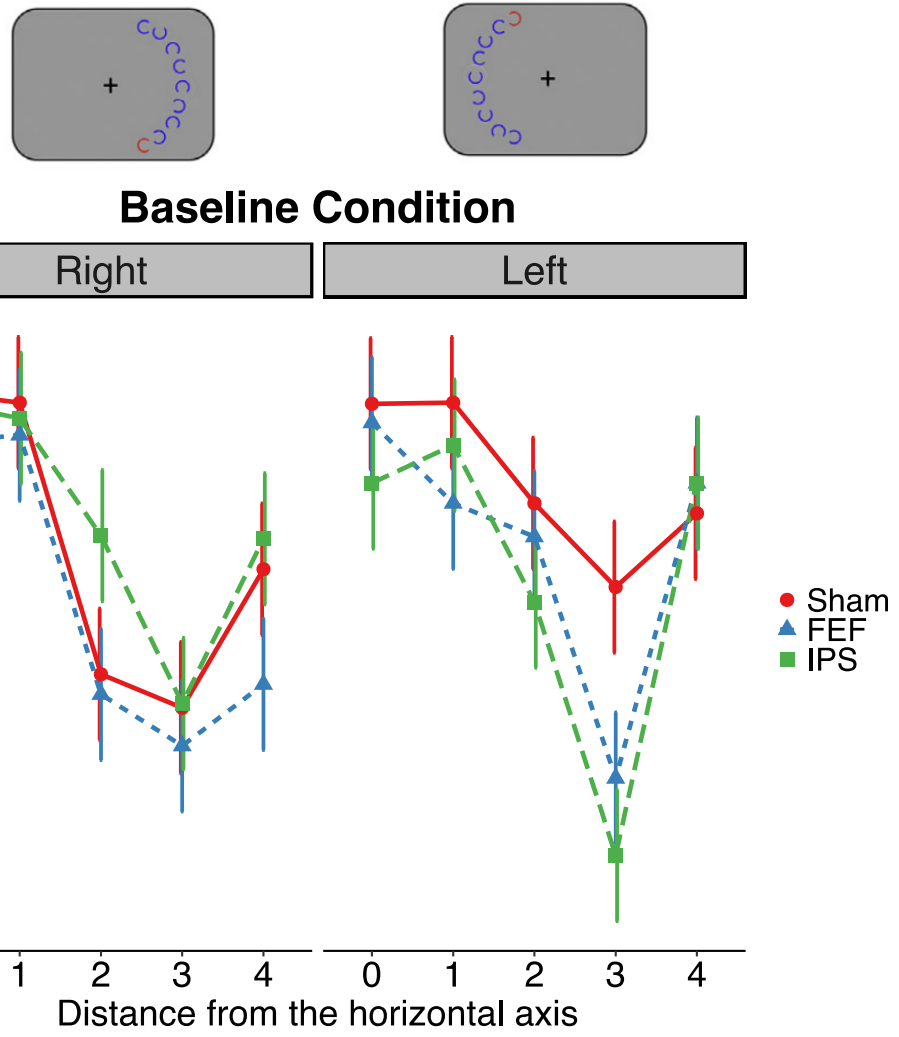
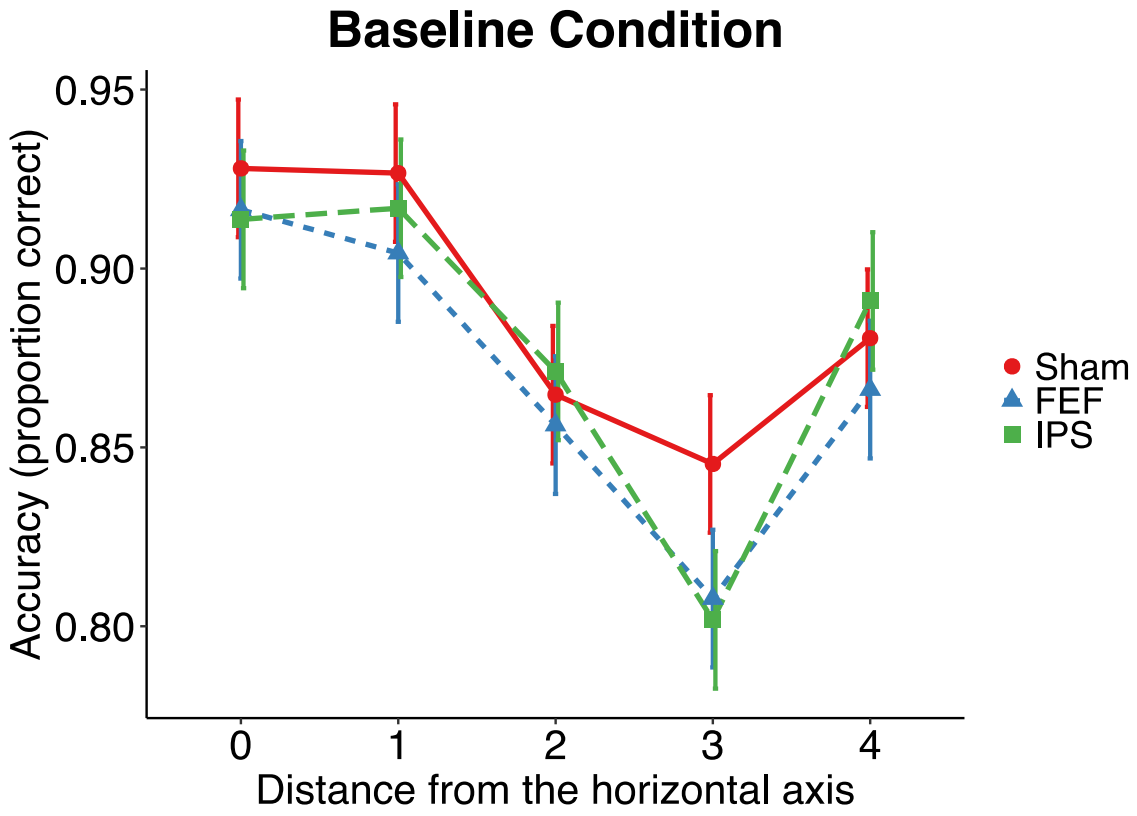
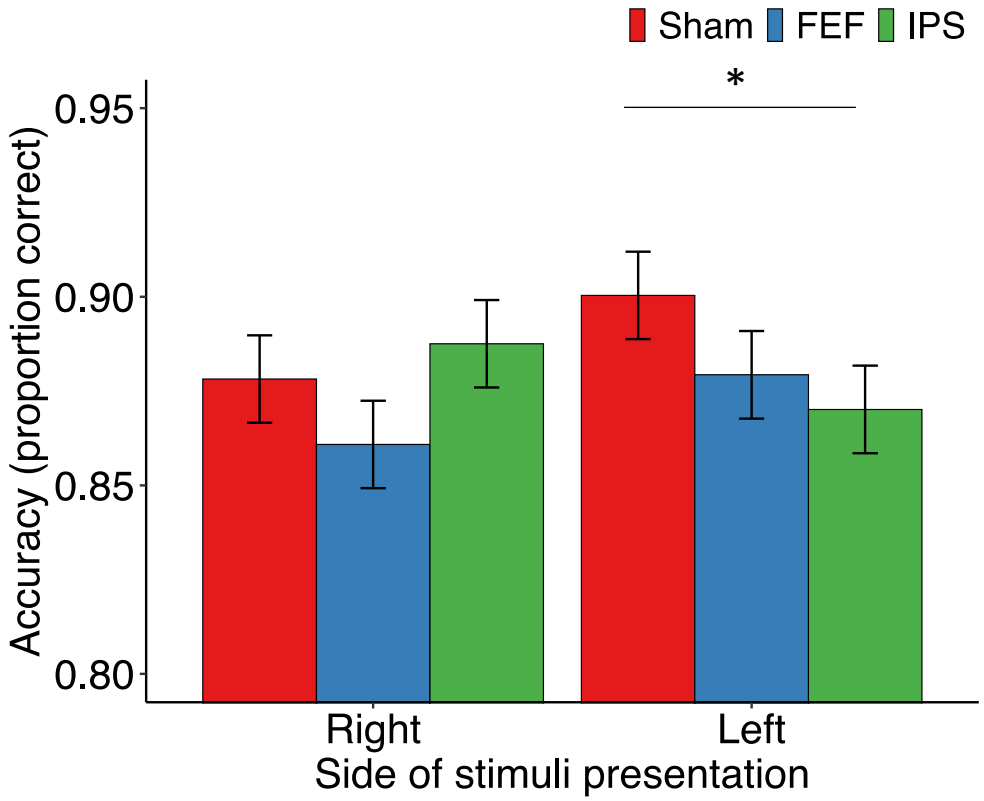


TMS:Side: $\chi^2(2) = 7.69$, $p = .021$

RESULTS: Baseline condition





Distance: $\chi^2(4) = 124.69$, $p < .001$

TMS:Side: $\chi^2(2) = 7.69$, $p = .021$

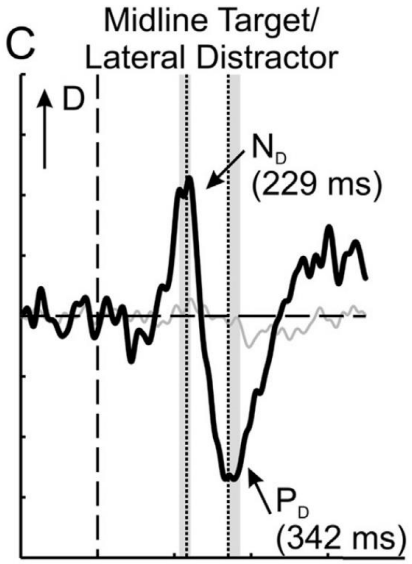
TMS over IPS significantly impact on participants' performance in the baseline condition as a function of the side of stimuli presentation, likely reflecting impairment in the stimulus-driven orienting mechanisms

Stimulation of both FEF and IPS significantly modulate the center surround profile, by widening the inhibitory ring around the attentional focus, regardless of the side of stimuli presentation.

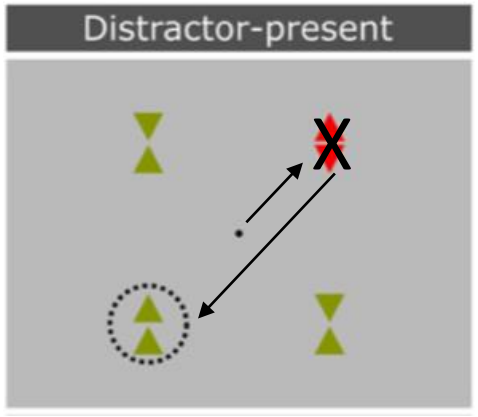
These findings suggest a direct role of the right dorsal attention network in **enhancement and suppression mechanisms that optimizes noise reduction during visual object recognition**

Our results give an important insight into the role of the frontoparietal network in orchestrating spatial attentional mechanisms that are needed to select task-relevant information and to limit interference by salient and confusable surrounding representations.

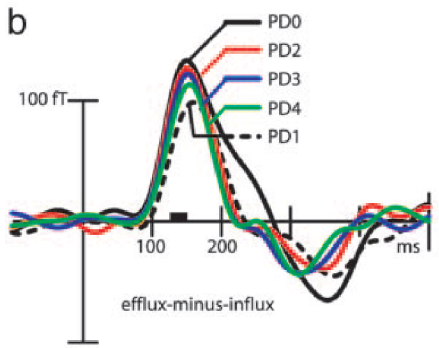
WORK IN PROGRESS AND FUTURE DIRECTIONS



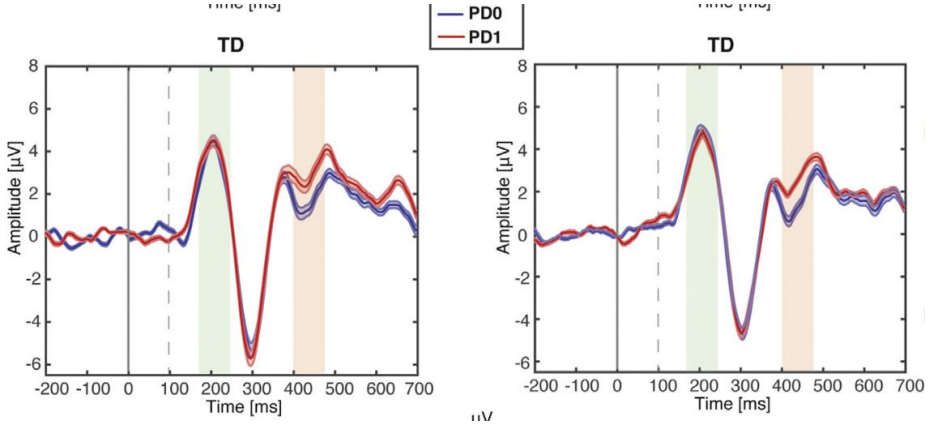
Liesefeld et al., 2017



Eleonora Baldini



Hopf et al., 2005



Ronconi et al., 2018

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Veronica Strina

Elisa Zani

Stefania La Rocca

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Francesco Marini

Elisa Santandrea

Luigi Cattaneo

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Thank you for the attention