thoughts:

Gamma: Attn vs no-attn: increased power [>BU?]; decreased frequency (van Pelt)

What controls this?

Can we distinguish v1/v4/parietal activity (Richter, 2017; 2018): TD-parietal (monkey 7a) 🡪 [beta] 🡪 BU-V1 🡪 [gamma] 🡪 V4 corresponding to behavioral task regulated by directed-attention dot-color change (0.3s-target)?

V1🡪V4 gamma synchronization: Does pattern of theta sampling shift after cue (4Hz🡪8Hz) (Landau, 2015). Landau reports no relation to microsaccades (MS) but see Lowet, 2019.

‘Theta/Delta’-V4 sampling correlates with MS-target orientation; Lowet, 2019): “Locus of Attention Influences the Direction of MSs Rhythmically Occurring at 3–4 Hz”; attentional modulation of firing rates in V4 emerged shortly after an MS toward the cued stimulus and vanished when an MS was directed away; Fano factor of V4 neurons was reduced (increased reliability) only after MSs were directed toward the attended stimulus; significant increase of IT firing rate after MSs toward attended stimuli compared to MSs away from attended stimuli, combining all attention conditions; “The influential concept of ‘‘covert spatial attention,’’ which is that extrafoveal stimuli can be attended without any movement of the eyes, may be based on a flawed assumption.”

Attentional bins controlled by Theta sampling? Sergent, 2013 ‘retroperception’ due to post-stimulus cueing; also see Lowet, 2019 MS shortly before cue also predicts increased activity

Current Biology 23, 150–155,2013 <http://dx.doi.org/10.1016/j.cub.2012.11.047> Report

**Cueing Attention after the Stimulus Is Gone Can Retrospectively Trigger Conscious Perception** Claire Sergent, Valentin Wyart, Mariana Babo-Rebelo, Laurent Cohen, Lionel Naccache, and Catherine Tallon-Baudry

**Summary** Is our perceptual experience of a stimulus entirely deter- mined during the early buildup of the sensory representa- tion, within 100 to 150 ms following stimulation [1, 2]? Or can later influences, such as sensory reactivation, still determine whether we become conscious of a stimulus [3, 4]? Late visual reactivation can be experimentally induced by postcueing attention after visual stimulus offset [5]. In a contrary approach from previous work on postcued atten- tion and visual short-term memory, which used multiple item displays [6, 7], we tested the influence of postcued attention on perception, using a single visual stimulus (Gabor patch) at threshold contrast. We showed that attracting attention to the stimulus location 100 to 400 ms after presentation still drastically improved the viewers’ objective capacity to detect its presence and to discriminate its orientation, along with drastic increase in subjective visibility. This retroperception effect demonstrates that postcued attention can retrospectively trigger the conscious perception of a stim- ulus that would otherwise have escaped consciousness. It was known that poststimulus events could either suppress consciousness, as in masking, or alter conscious content, as in the flash-lag illusion. Our results show that conscious perception can also be triggered by an external event several hundred ms after stimulus offset, underlining unsuspected temporal flexibility in conscious perception.

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Lowet, 2019: MS occurrence is tightly temporally coordinated with a low 3- to 4-Hz LFP theta rhythm (Bosman et al., 2009; Lowet et al., 2016) and alpha rhythms (Bellet et al., 2017) that are suggested to be involved in stimulus processing and attention (Lakatos et al., 2005; Schroeder and Lakatos, 2009). ]

[J Neurophysiol.](https://www.ncbi.nlm.nih.gov/pubmed/21177995) 2011 Mar;105(3):1150-8. doi: 10.1152/jn.00907.2010. Epub 2010 Dec 22.

**Spatial summation in macaque parietal area 7a follows a winner-take-all rule.**

[Oleksiak A](https://www.ncbi.nlm.nih.gov/pubmed/?term=Oleksiak%20A%5BAuthor%5D&cauthor=true&cauthor_uid=21177995)1, [Klink PC](https://www.ncbi.nlm.nih.gov/pubmed/?term=Klink%20PC%5BAuthor%5D&cauthor=true&cauthor_uid=21177995), [Postma A](https://www.ncbi.nlm.nih.gov/pubmed/?term=Postma%20A%5BAuthor%5D&cauthor=true&cauthor_uid=21177995), [van der Ham IJ](https://www.ncbi.nlm.nih.gov/pubmed/?term=van%20der%20Ham%20IJ%5BAuthor%5D&cauthor=true&cauthor_uid=21177995), [Lankheet MJ](https://www.ncbi.nlm.nih.gov/pubmed/?term=Lankheet%20MJ%5BAuthor%5D&cauthor=true&cauthor_uid=21177995), [van Wezel RJ](https://www.ncbi.nlm.nih.gov/pubmed/?term=van%20Wezel%20RJ%5BAuthor%5D&cauthor=true&cauthor_uid=21177995).

**Abstract**

While neurons in posterior parietal cortex have been found to signal the presence of a salient stimulus among multiple items in a display, spatial summation within their receptive field in the absence of an attentional bias has never been investigated. This information, however, is indispensable when one investigates the mechanisms of spatial attention and competition between multiple visual objects. To examine the spatial summation rule in parietal area 7a neurons, we trained rhesus monkeys to fixate on a central cross while two identical stimuli were briefly displayed in a neuron's receptive field. The response to a pair of dots was compared with the responses to the same dots when they were presented individually. The scaling and power parameters of a generalized summation algorithm varied greatly, both across neurons and across combinations of stimulus locations. However, the averaged response of the recorded population of 7a neurons was consistent with a winner-take-all rule for spatial summation. A control experiment where a monkey covertly attended to both stimuli simultaneously suggests that attention introduces additional competition by facilitating the less optimal stimulus. Thus an averaging stage is introduced between ∼ 200 and 300 ms of the response to a pair of stimuli. In short, the summation algorithm over the population of area 7a neurons carries the signature of a winner-take-all operation, with spatial attention possibly influencing the temporal dynamics of stimulus competition, that is the moment that the "winner" takes "victory" over the "loser" stimulus.

Neuron. 2012 September 6; 75(5): 875–888. doi:10.1016/j.neuron.2012.06.037.

**Attentional Stimulus Selection through Selective Synchronization between Monkey Visual Areas**

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These studies revealed that neurons **activated** by an attended as compared to an unattended stimulus show enhanced gamma-band synchronization in monkey area V4 (Fries et al., 2001; Taylor et al., 2005; Bichot et al., 2005; Fries et al., 2008; Buffalo et al., 2011) and area V2 (Buffalo et al., 2011), and either reduced (Chalk et al., 2010), unchanged, or enhanced (Buffalo et al., 2011) gamma-band synchronization in area V1. For area V4, the enhancements of gamma-band synchronization have been shown to be functionally relevant: A key behavioral consequence of attention, an enhanced speed of change detection, is predicted selectively by neuronal synchronization in the gamma-frequency range, but not by synchronization in other frequency ranges or by neuronal firing rates (Womelsdorf et al., 2006; Hoogenboom et al., 2010)