MRC Brain Network Dynamics Unit

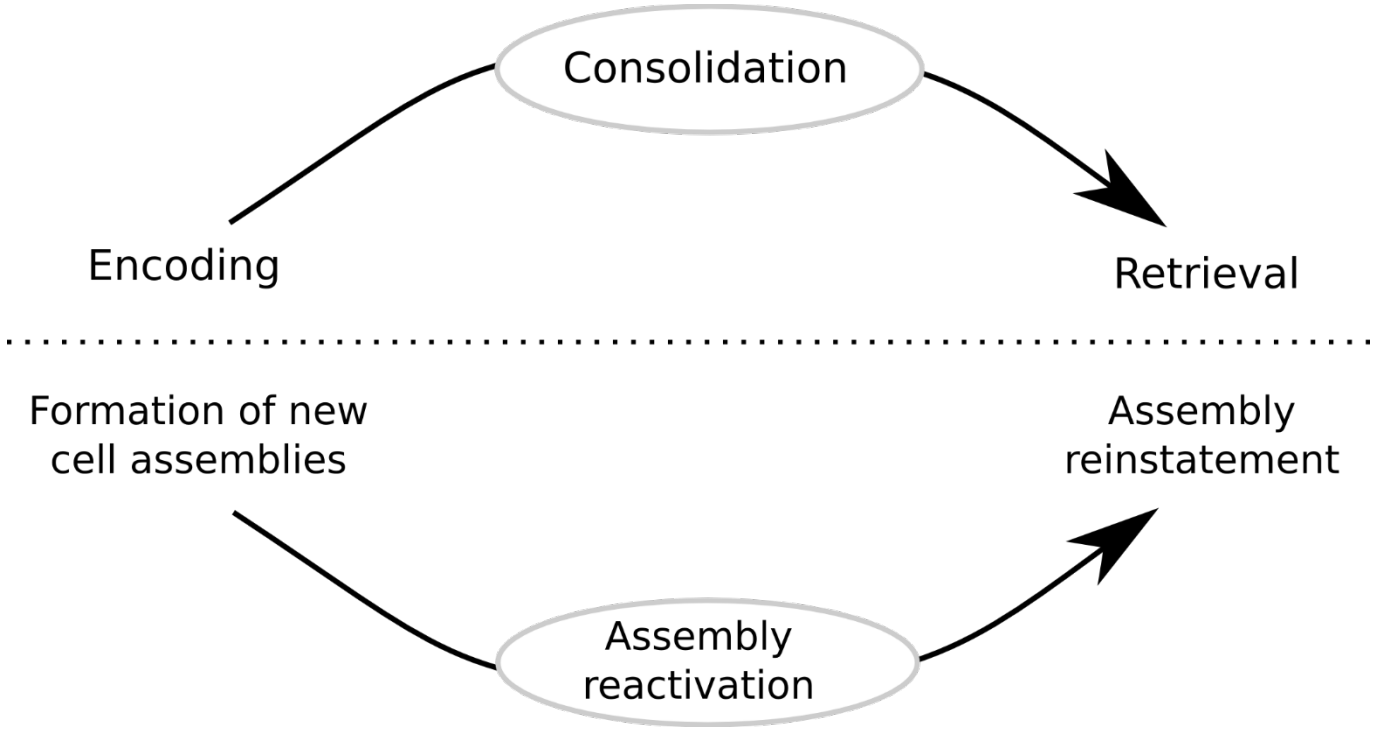
UNIVERSITY OF OXFORD

Hippocampal reactivation stabilizes recently formed cell assembly patterns

Gido van de Ven

January 2017

Memory-consolidation:
cell assembly / reactivation hypothesis



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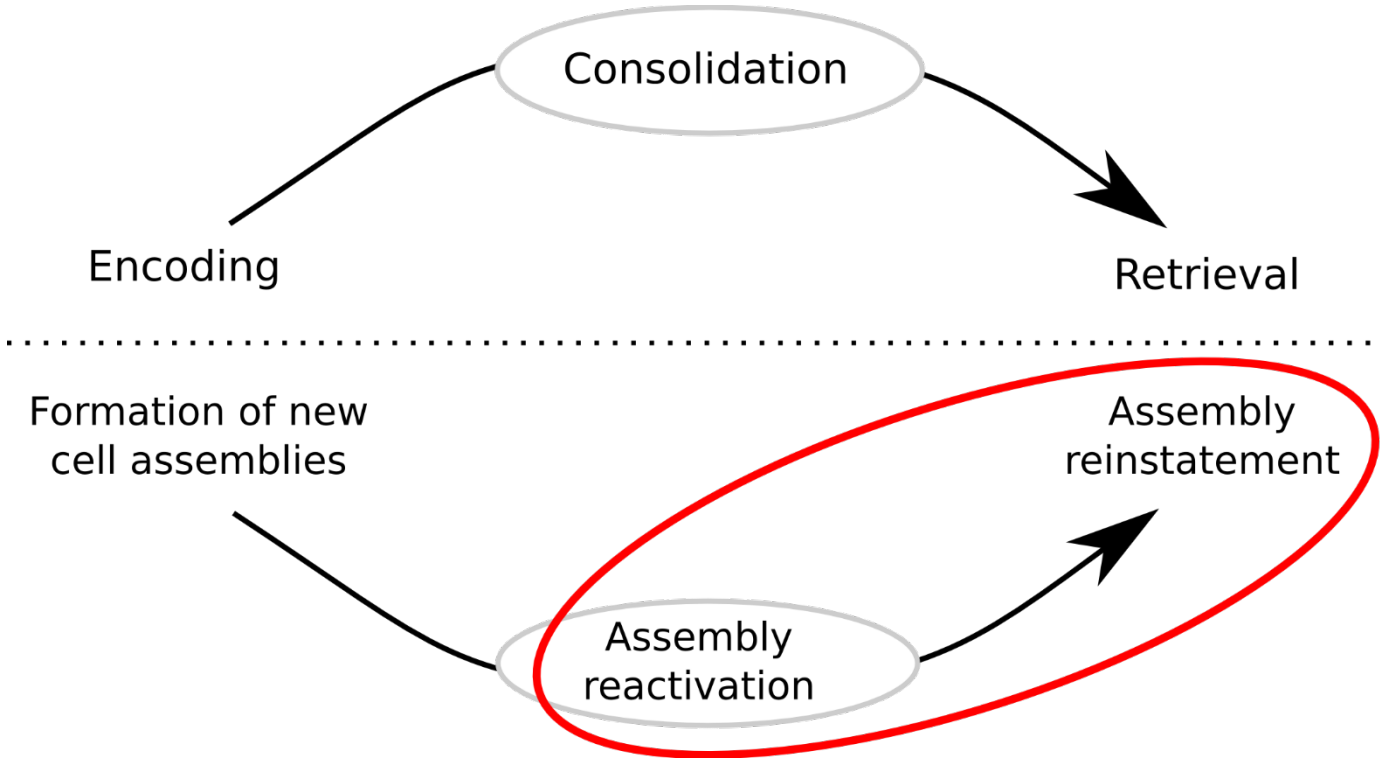
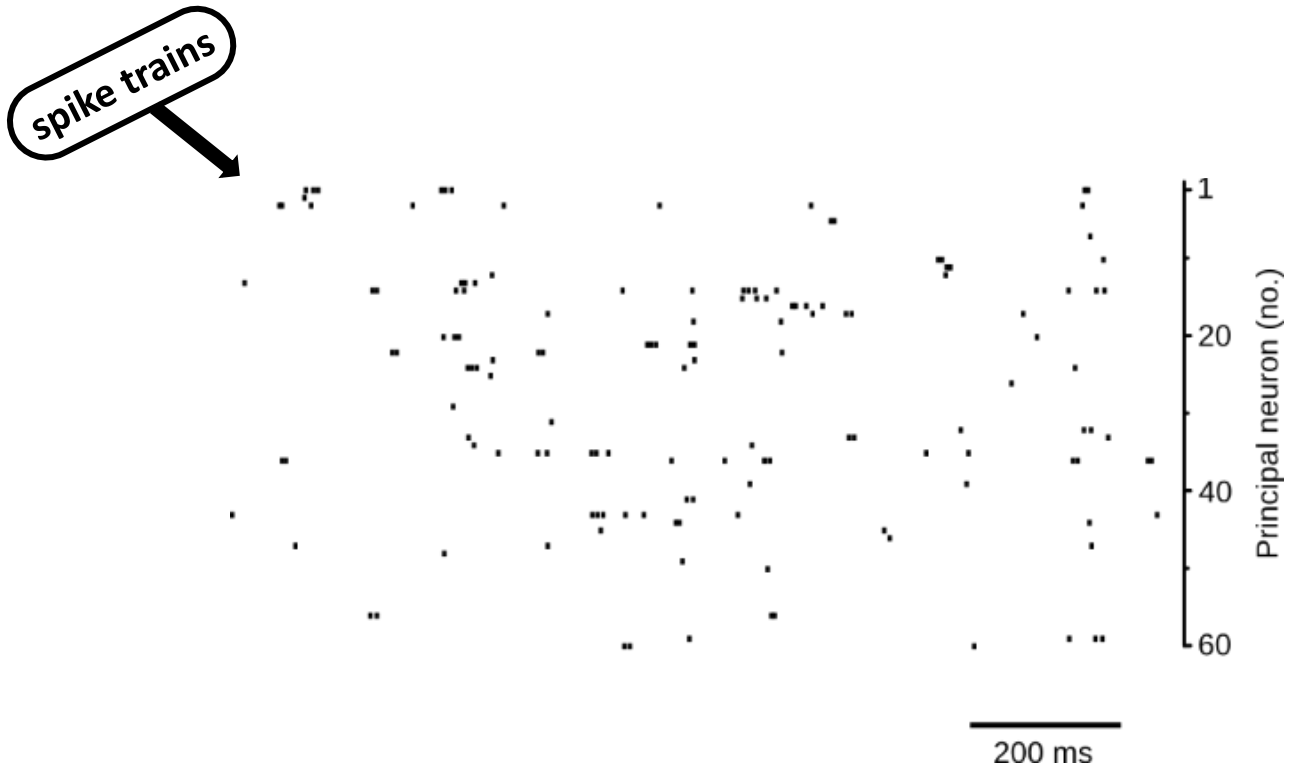
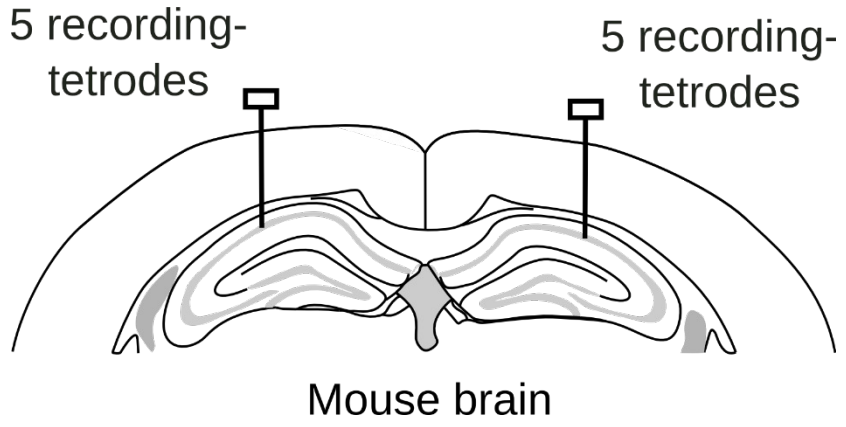
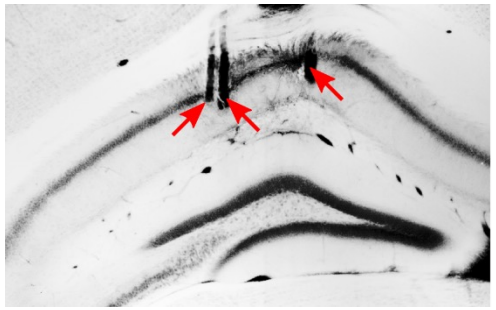
cell assembly / reactivation hypothesis

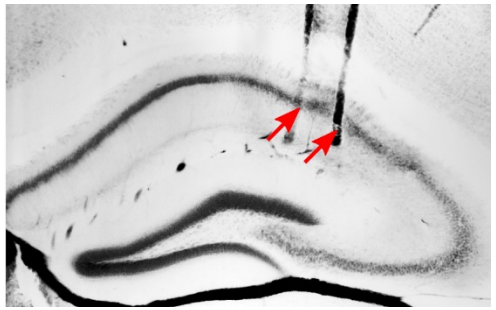


Identification of “cell assemblies”









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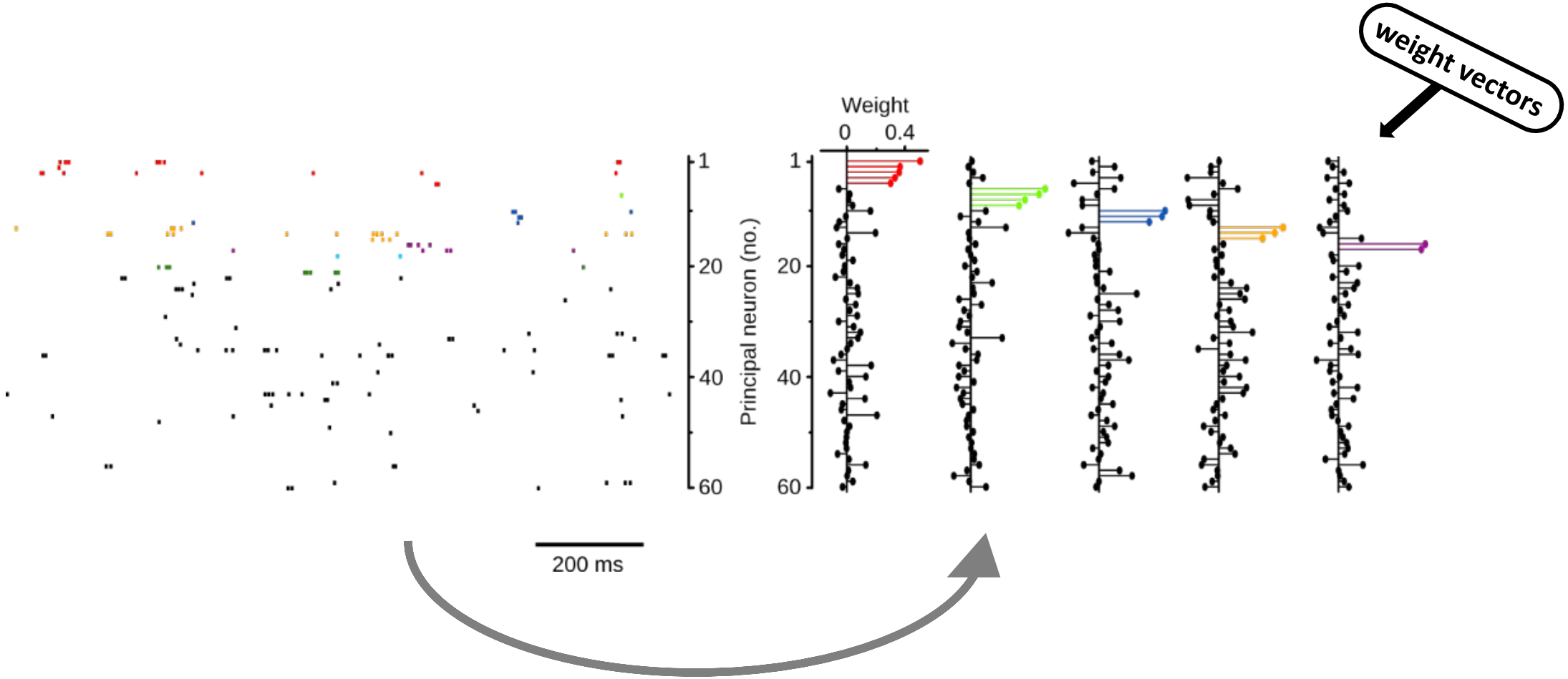
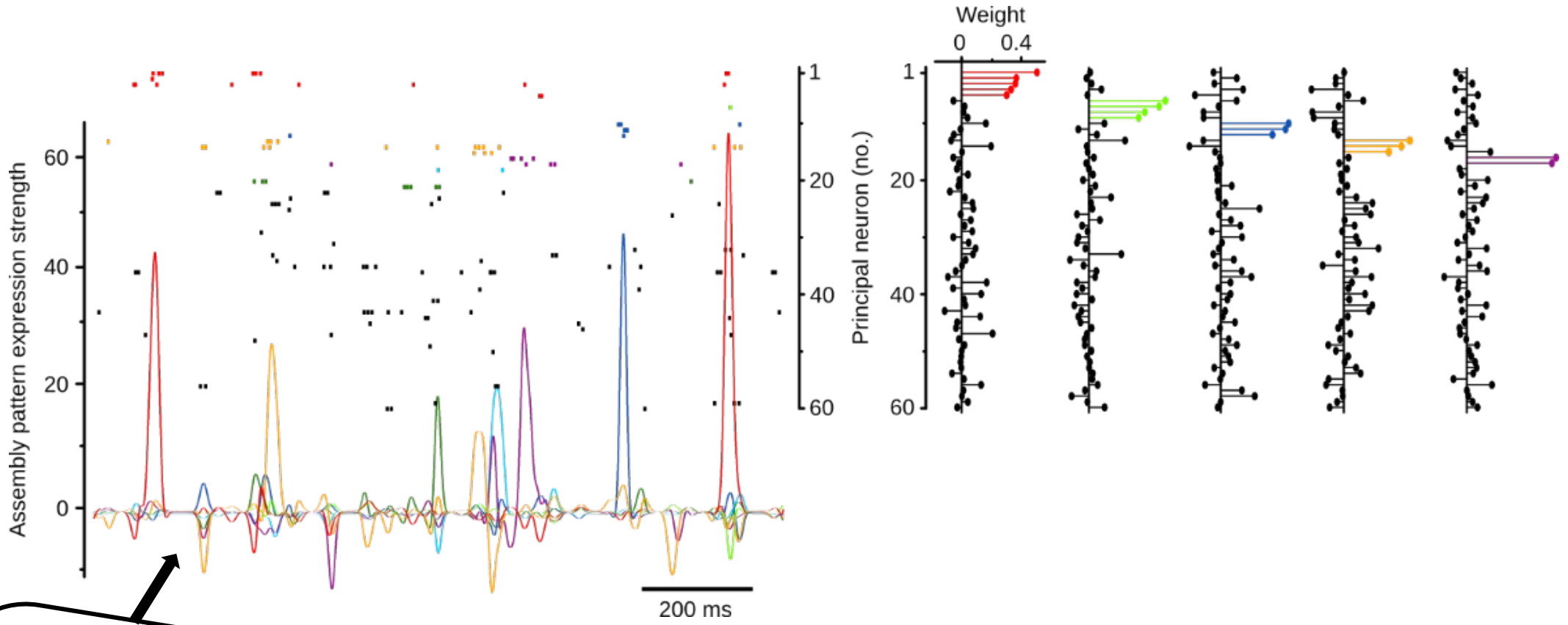


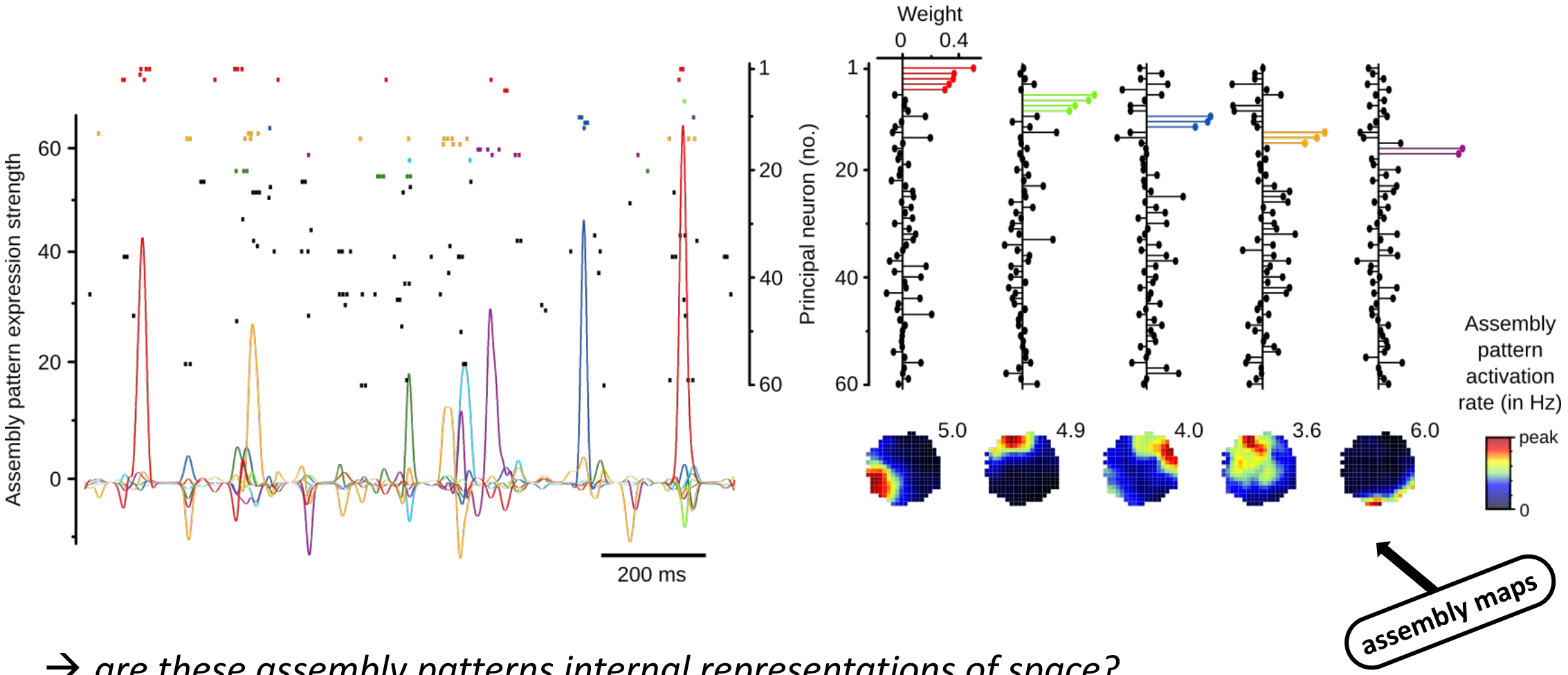
Assembly-detection method based on PCA and ICA

Identification of “cell assemblies”



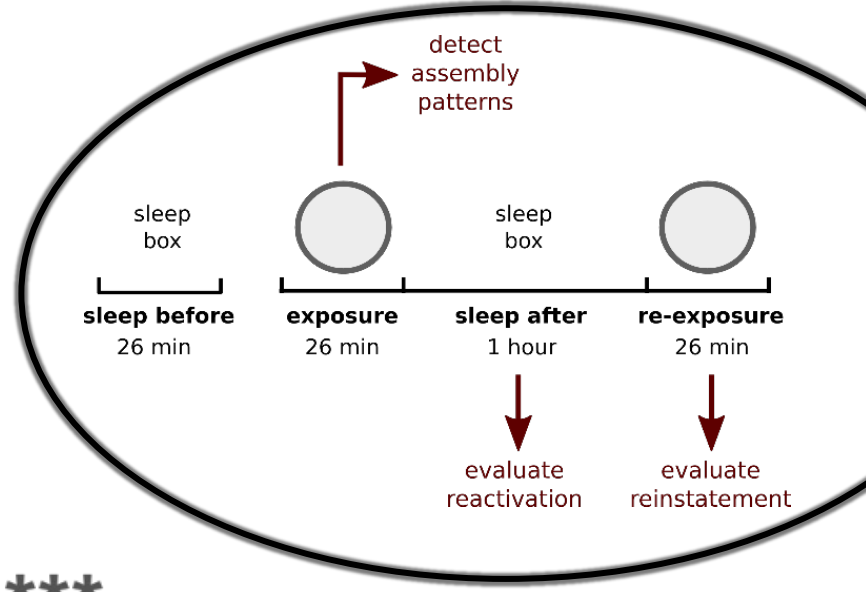
assembly pattern expression-strength tracked over time

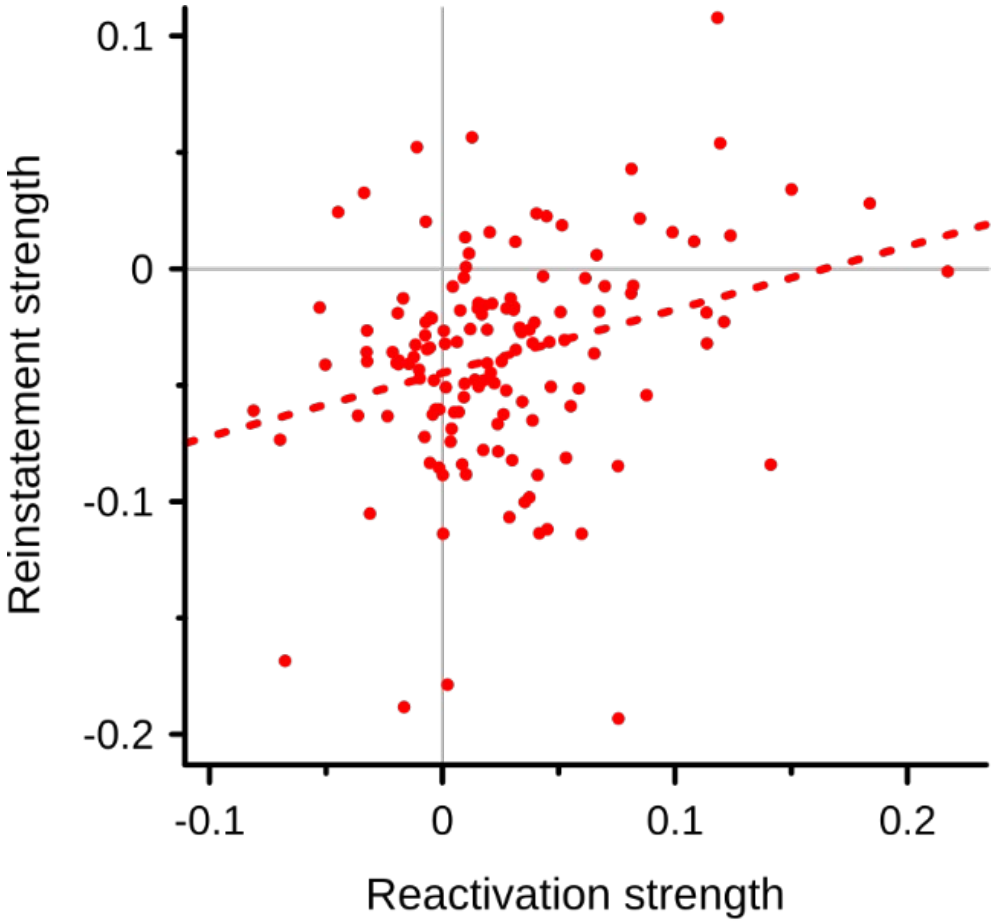
Identification of “cell assemblies”

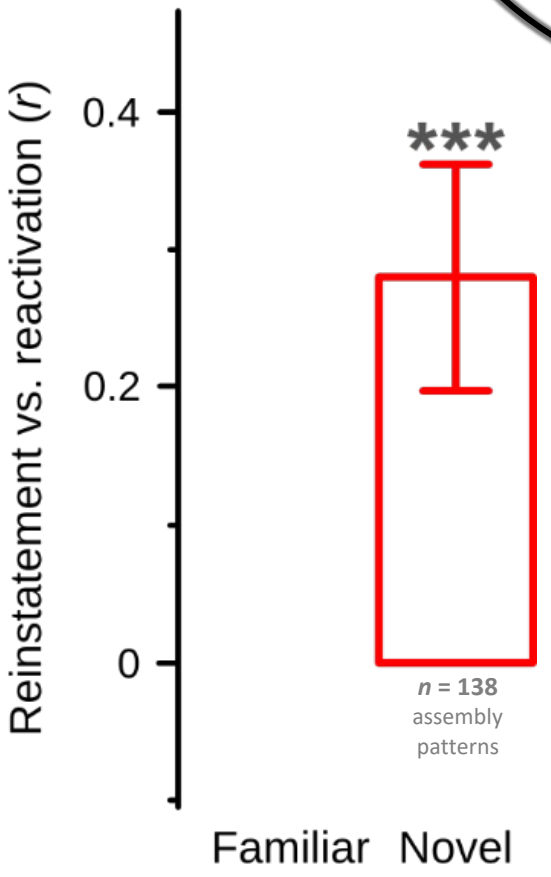


→ *are these assembly patterns internal representations of space?*

An assembly pattern's reactivation predicts it subsequent reinstatement







(based on 43 recording-blocks from 8 mice)

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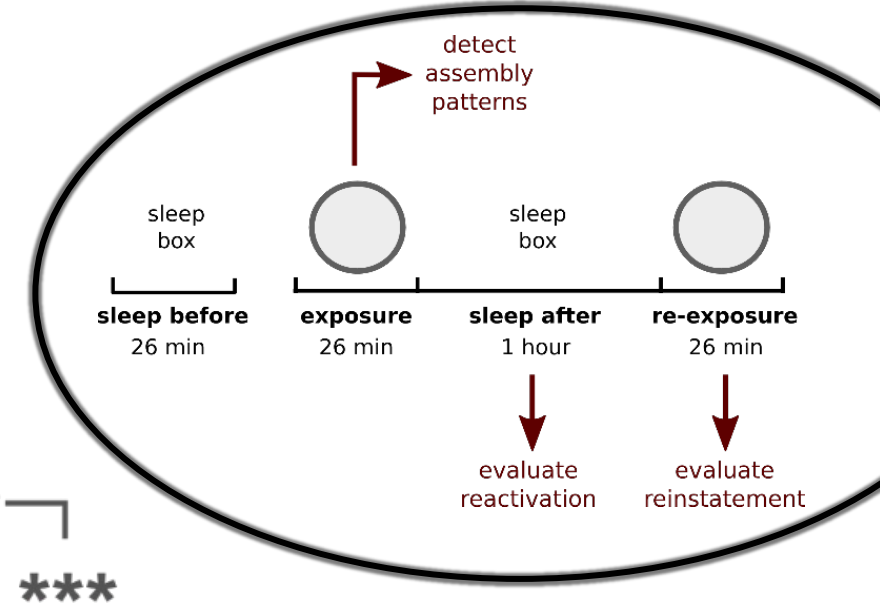
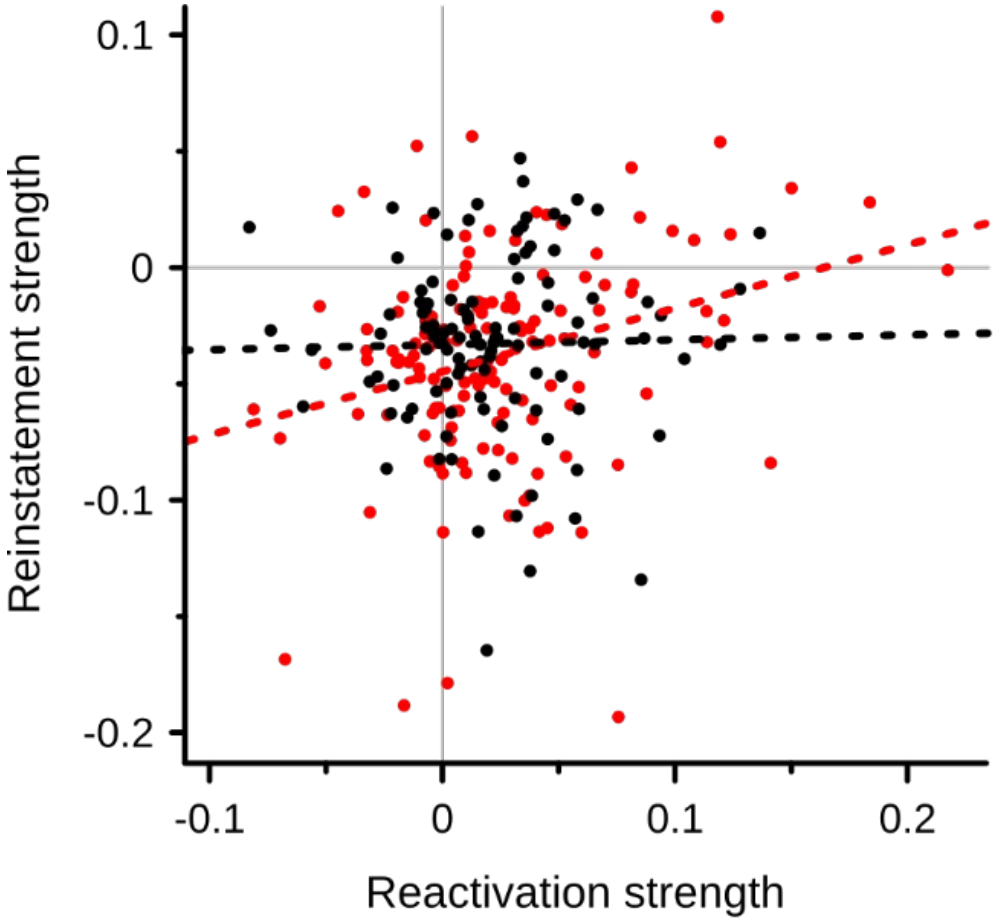
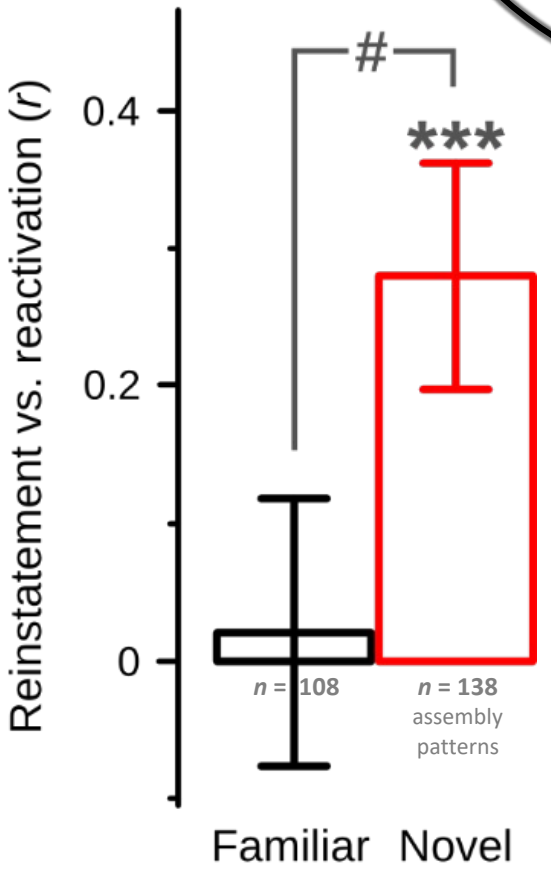
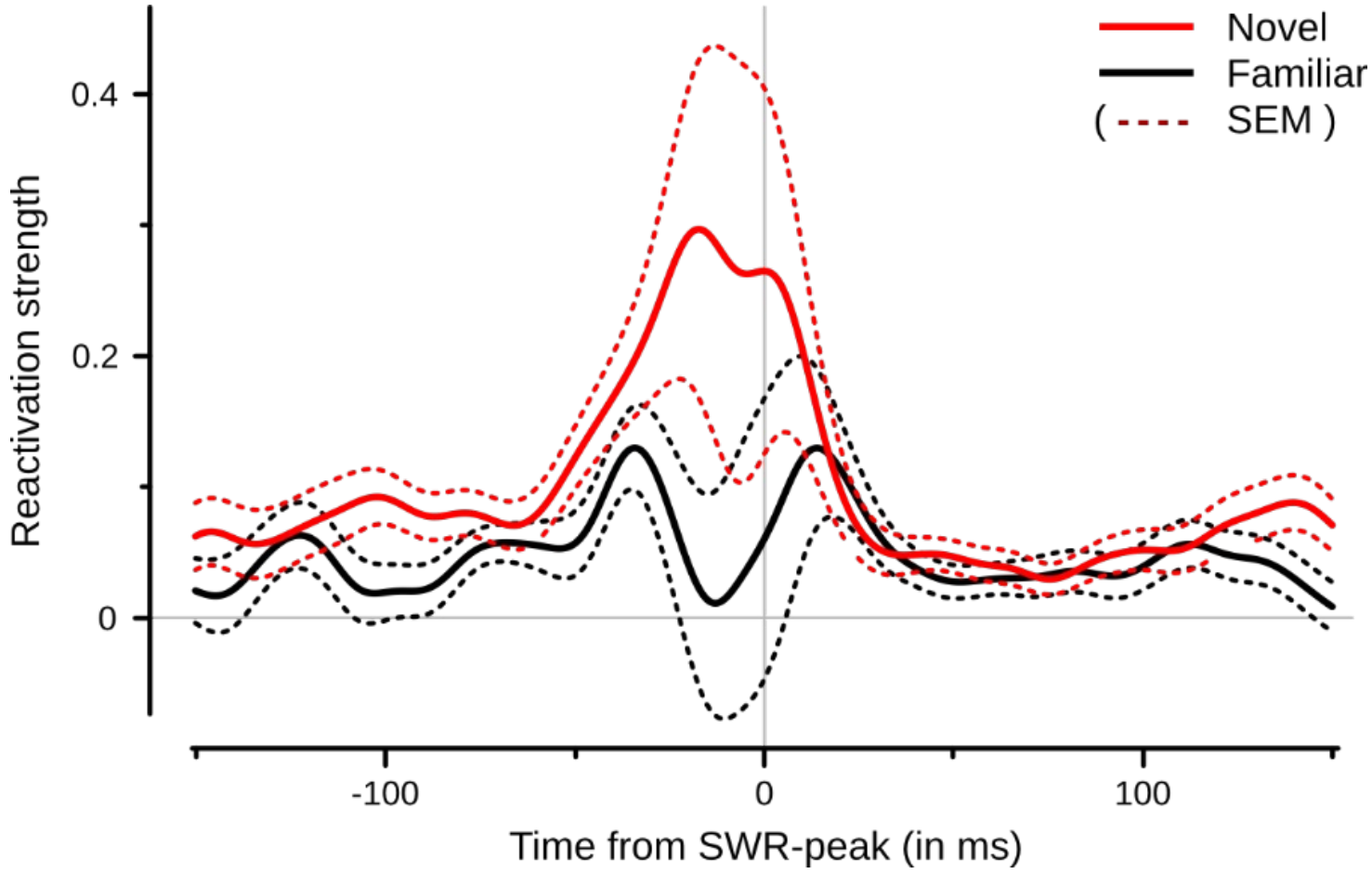






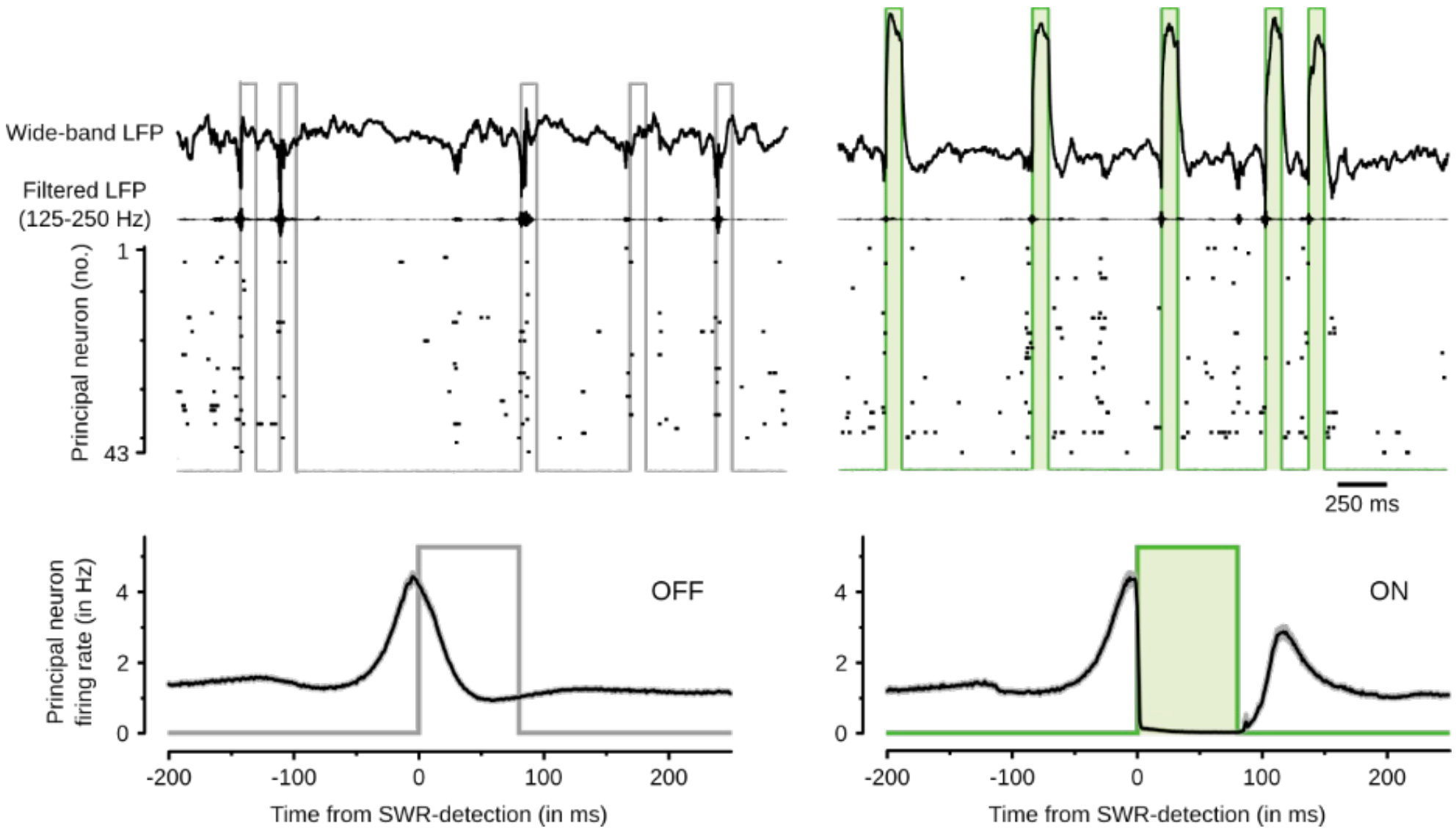
(based on 43 recording-blocks from 8 mice)

Selective disruption of reactivation?



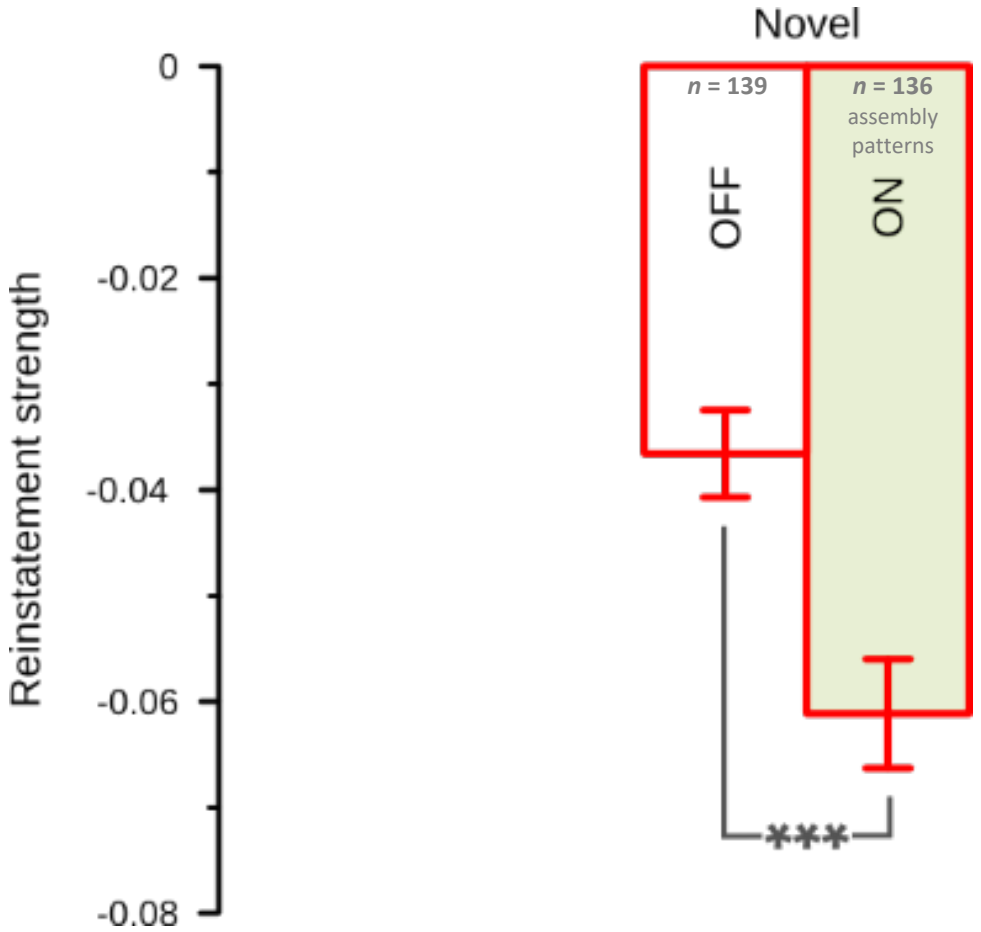
Novel: *n* = 139 assembly-patterns
Familiar: *n* = 108 assembly-patterns
(based on 43 recording-blocks from 8 mice)

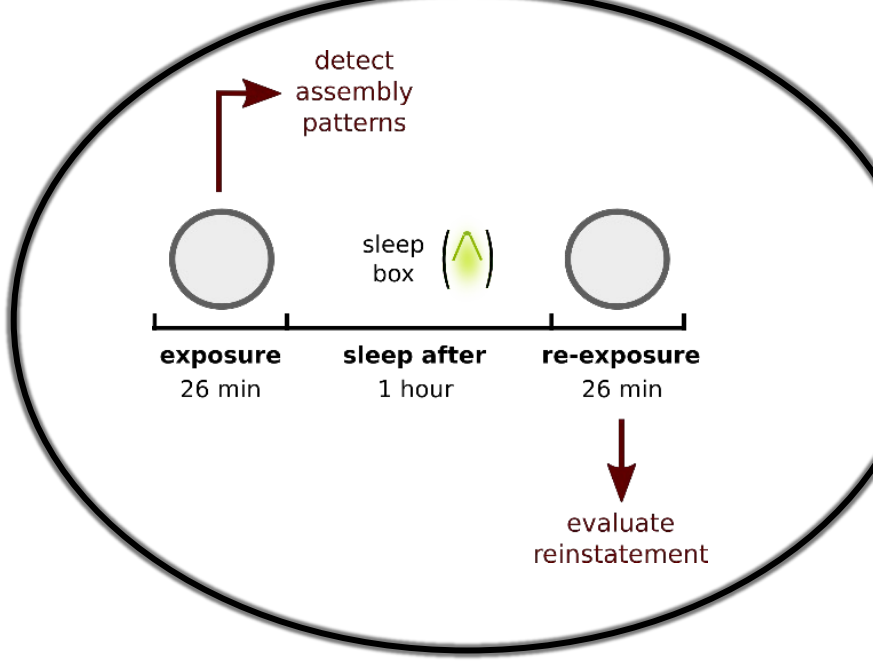
Selective disruption of reactivation: *optogenetic SWR silencing*



OFF: *n* = 1,988 neurons (from 43 sessions)
ON: *n* = 1,527 neurons (from 37 sessions)

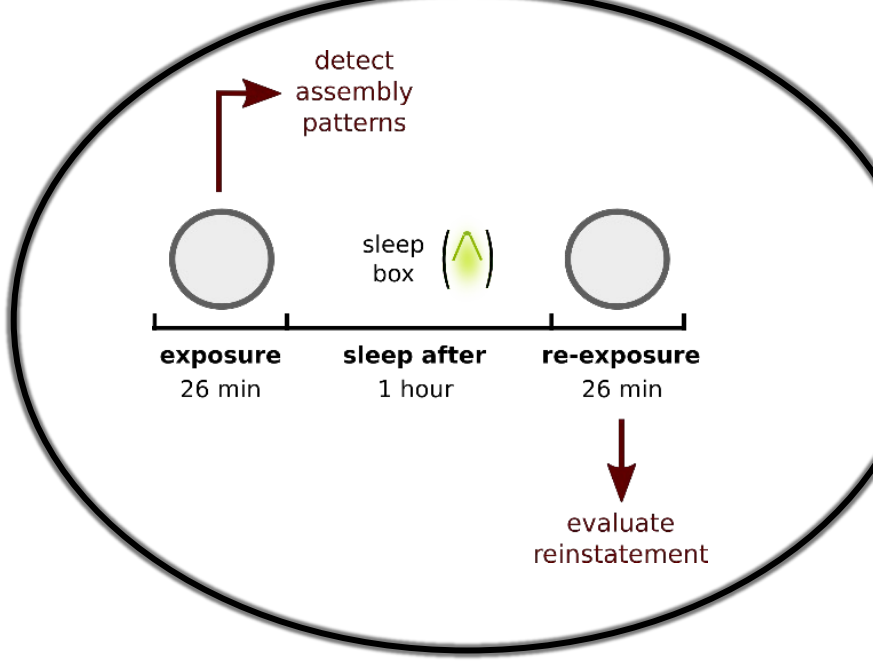
SWR-silencing impairs assembly pattern reinstatement

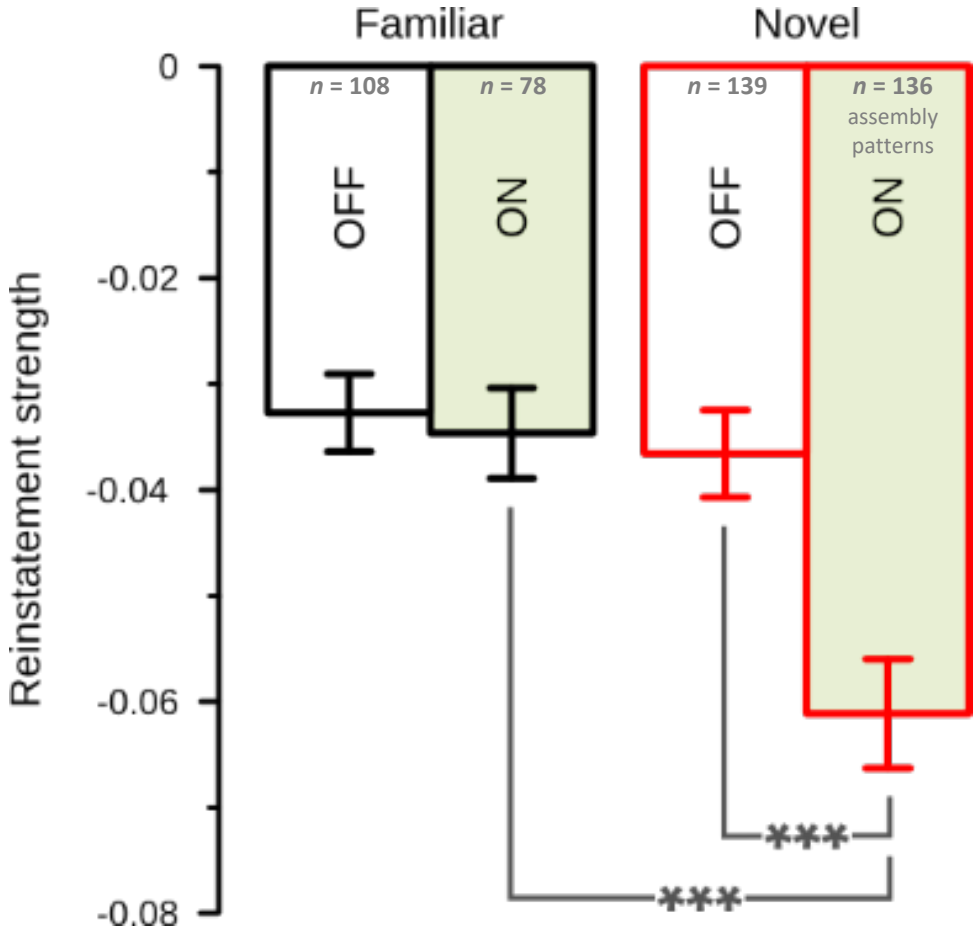




(based on 50 recording-blocks from 8 mice)

SWR-silencing impairs assembly pattern reinstatement

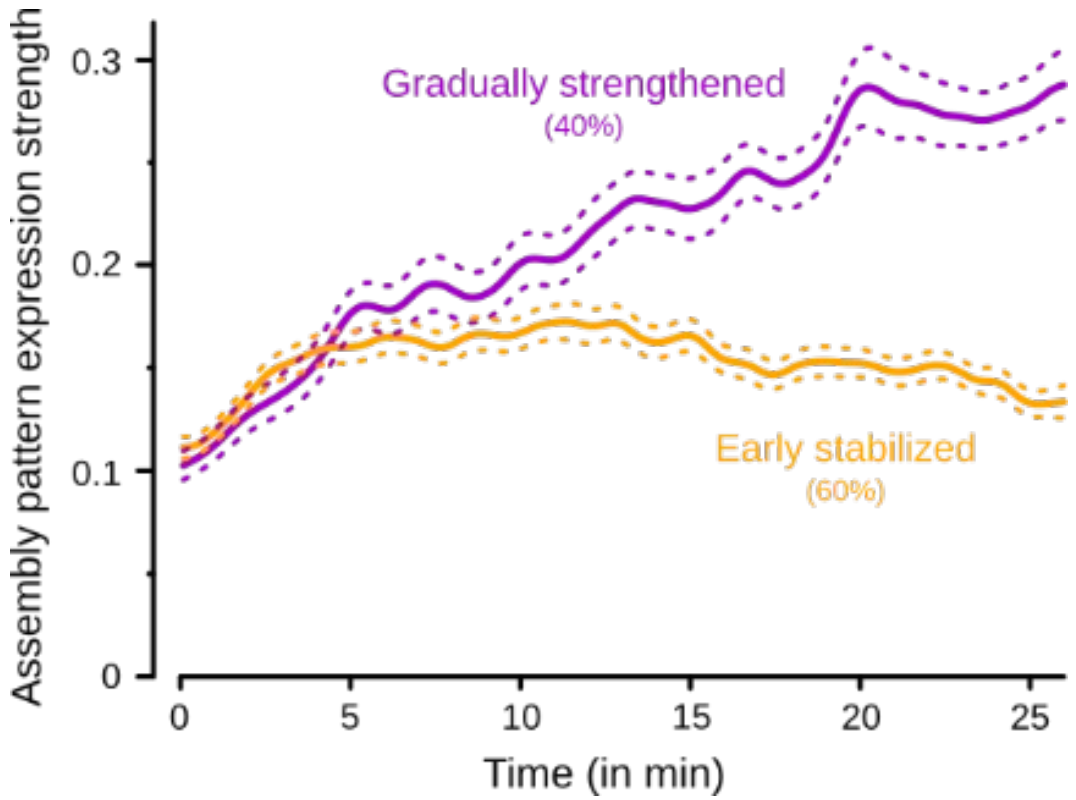




interaction SWR-silencing x enclosure type:
$F(1,318) = 5.05$, $P < 0.05$

(based on 80 recording-blocks from 8 mice)

Only stability of gradually strengthened patterns requires offline reactivation



(based on 50 recording-blocks from 8 mice)

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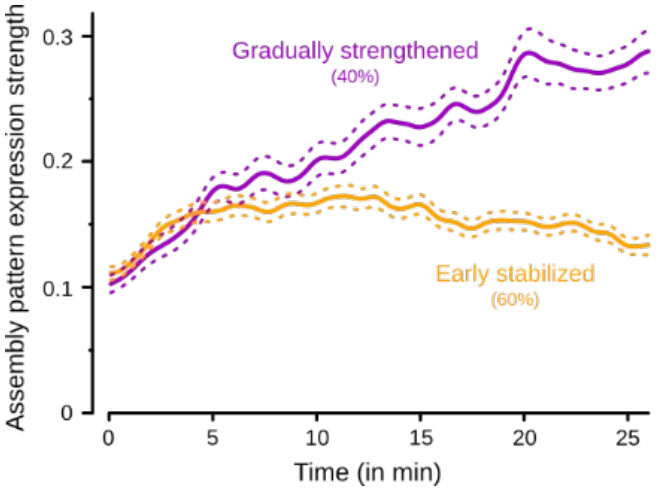
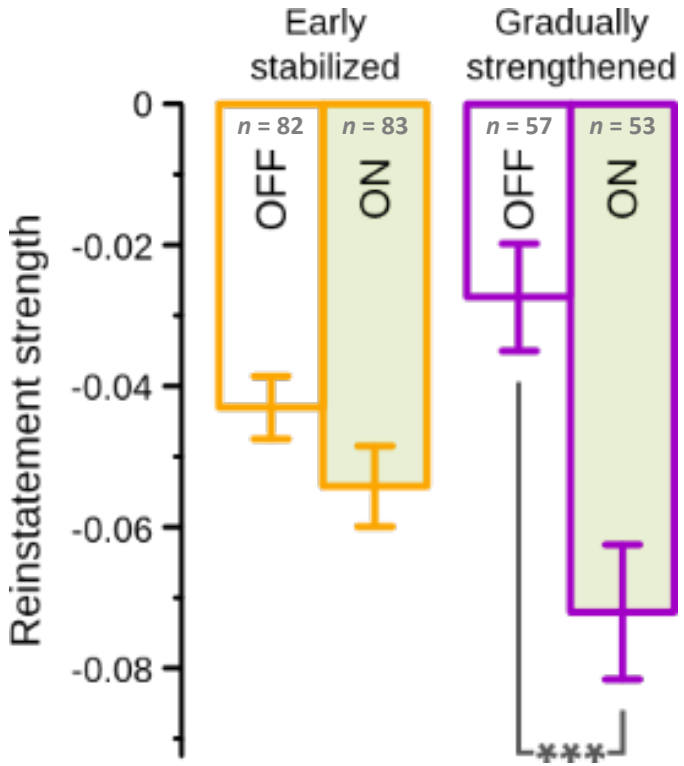
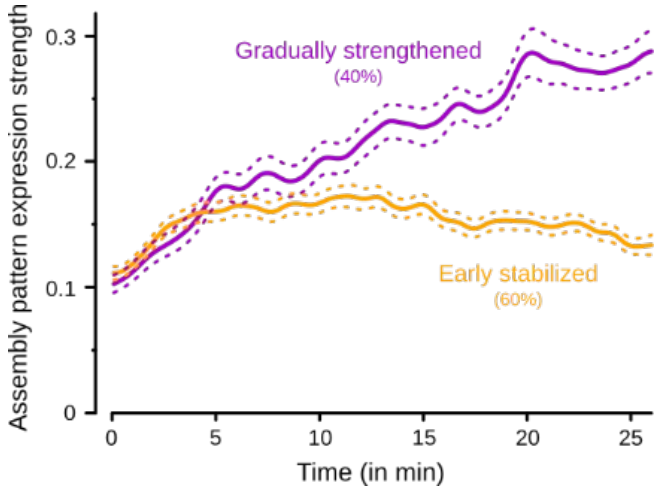


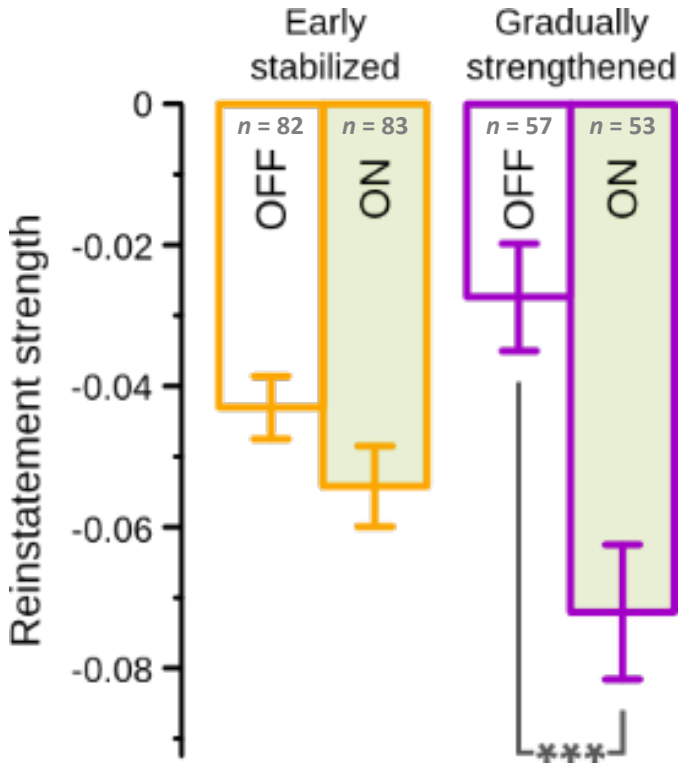


interaction SWR-silencing x pattern type:
$F(1,271) = 6.28$, $P < 0.05$

(based on 50 recording-blocks from 8 mice)

Only stability of gradually strengthened patterns requires offline reactivation





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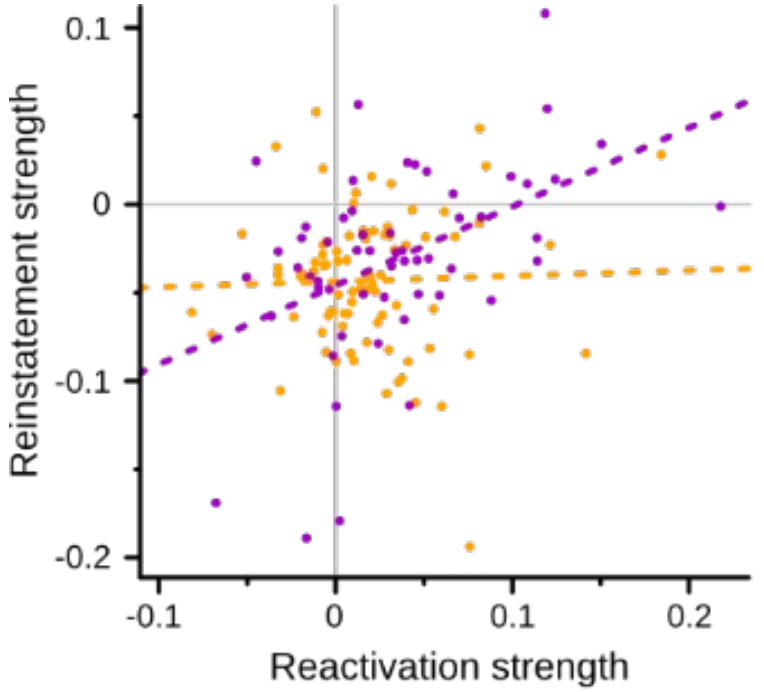

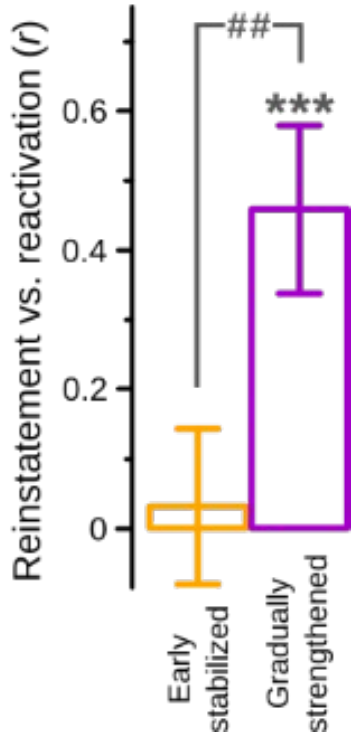

(based on 50 recording-blocks from 8 mice)

One-sentence summary

The stability of “Hebbian-like” assembly patterns, which were gradually strengthened during their initial expression, depends on their offline reactivation.

Acknowledgements

Dupret lab
David Dupret
Stephanie Trouche
Colin McNamara
Natalia Campo-Urriza
Vitor Lopes dos Santos
Alvaro Tejero-Cantero
Claire Bratley
Pavel Perestenko

Vadim Koren
Helen Barron
Alexander Morley
Mohamady El-Gaby
Stephen McHugh

Visualizing tetrode tracks
Ben Micklem
Linda Katona

Animal facility
Jane Janson
Liz Norman
Lisa Conyers
Katharine Whitworth
Kristina Wagner

Heidelberg
Kevin Allen (real-time SWR detection)