Dynamic shifts in internal and external hippocampal processing during event perception

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Event models guide event perception[1]

- Active representations of the current situation (event models) may guide event perception via predictive processing.
- For accuracy, event models need to be updated when the event changes (i.e., at event boundaries).
- **Does updating involve integrating information from the external world with internal knowledge about how events typically unfold?**
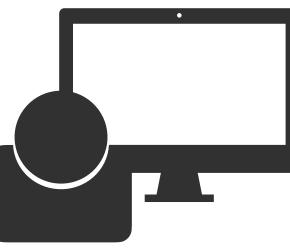
We examined **dynamic functional connectivity**[2] (dFC) between a region involved in **event representations**[3] (hippocampus; Hipp) and networks[4] associated with:

- More **internal** (DMN) vs **external** (visual) information processing.
- **Modulation** of attention to internal vs external processing[5] (VAN).

Sherlock imaging dataset[6] (n = 14)
- participants viewed BBC Sherlock ep.1 in scanner.
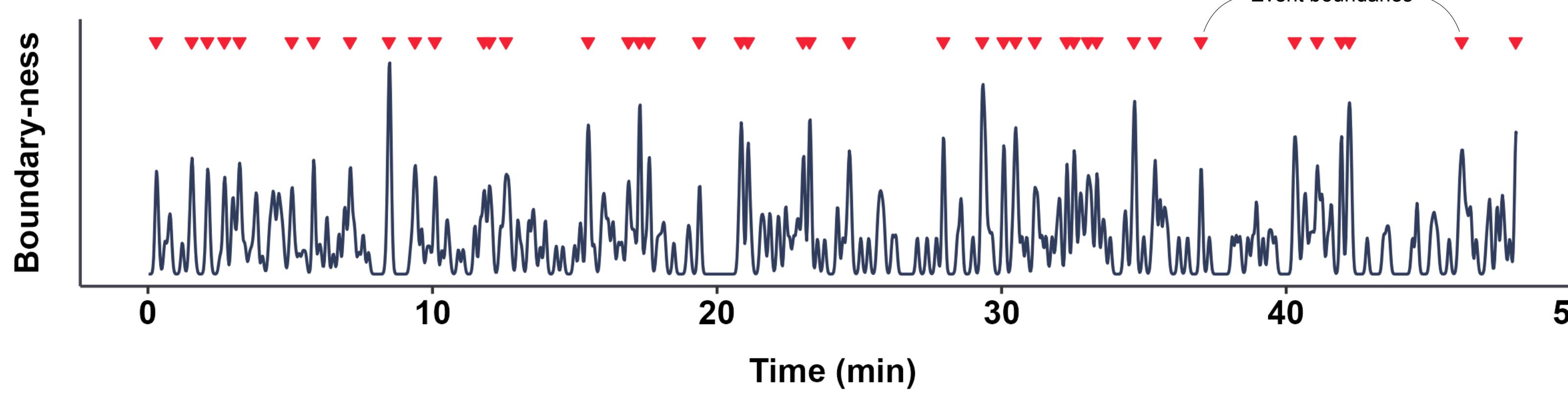
Segmentation task - coarse (n = 11)

~5 min   ~12s overlap
1   2   3   ● ● ●   10
~50 min
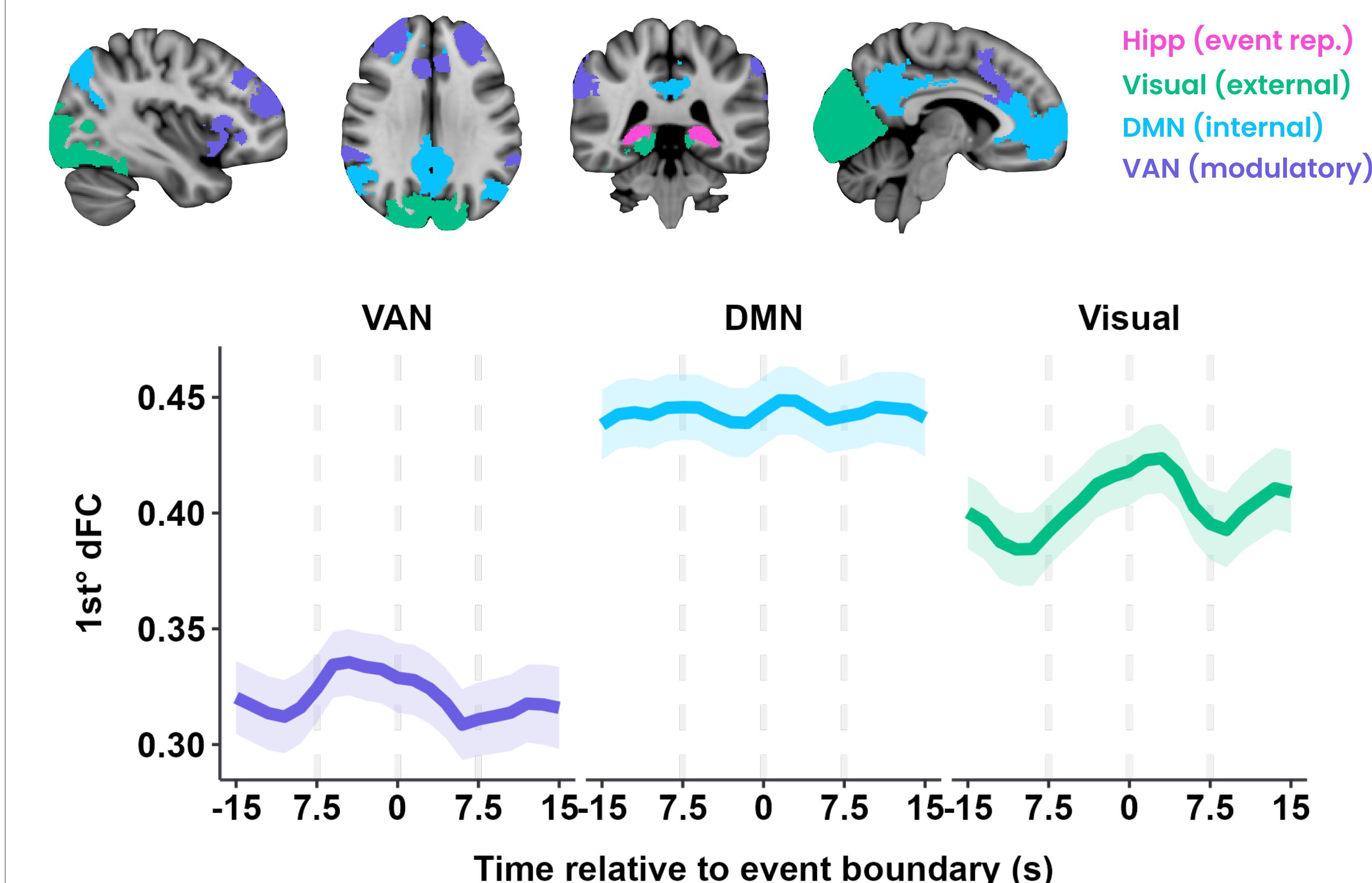
"Press the *spacebar* when one event ends and another begins."
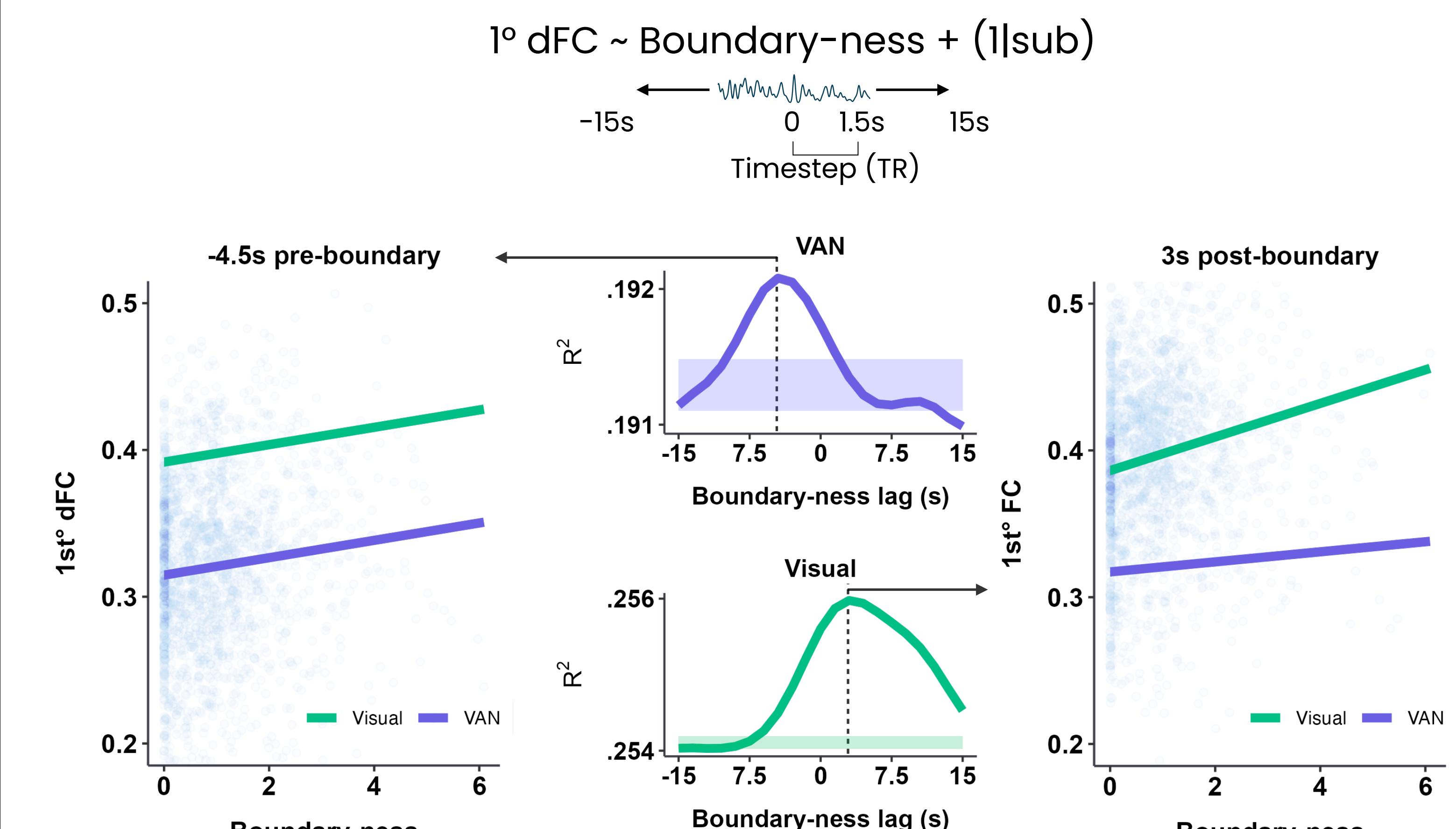
Event boundaries: peaks in group button press density estimates.

1° Hipp dFC transitions from modulatory to external around event boundaries.

Hipp (event rep.)
Visual (external)
DMN (internal)
VAN (modulatory)

VAN   DMN   Visual

1st° dFC (y-axis: 0.30–0.45)
Time relative to event boundary (s)
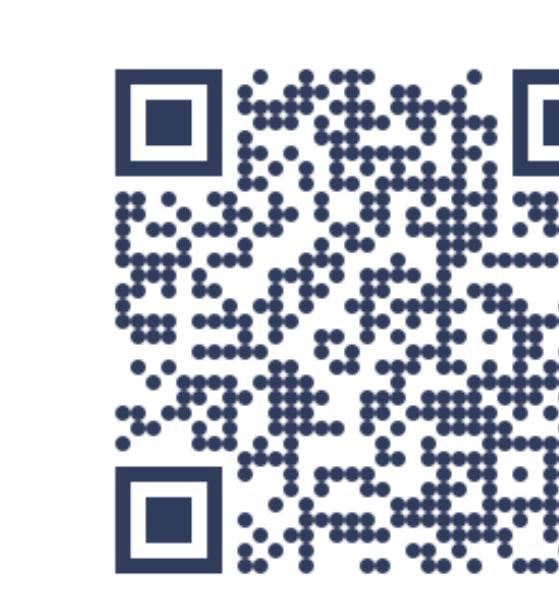
Boundary-ness explains 1° Hipp dFC to modulatory and external networks at different times

1° dFC ~ Boundary-ness + (1|sub)

-15s   0   1.5s   15s
Timestep (TR)

-4.5s pre-boundary   VAN   3s post-boundary

1st° dFC R^2 (.191–.192)   1st° FC
Boundary-ness   Boundary-ness lag (s)   Boundary-ness

Visual
R^2 (.254–.256)
Boundary-ness lag (s)

Visual   VAN

- Boundary-ness does not explain hipp-DMN dFC.
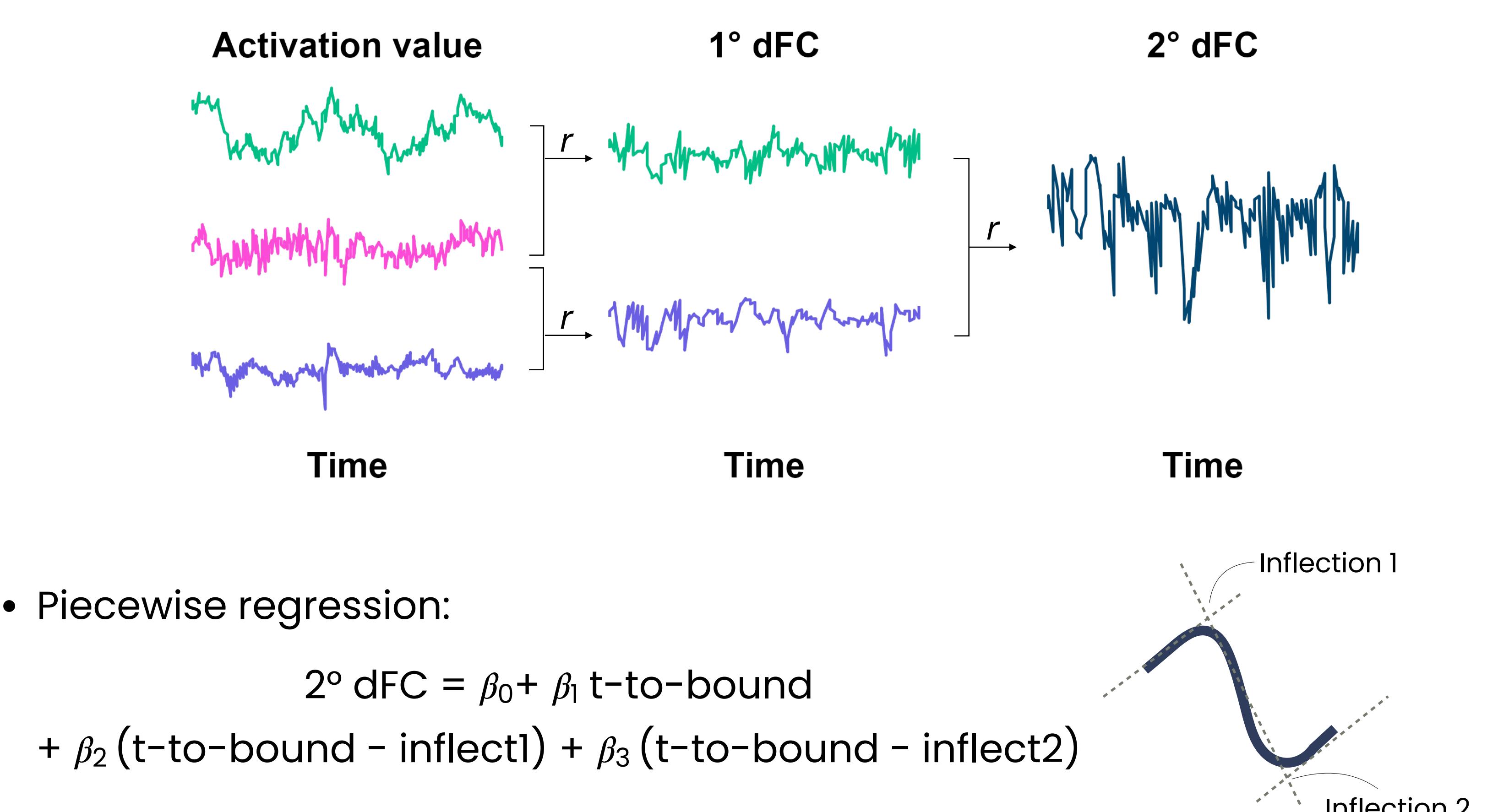
References
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2. Owen, et al., (2021). *Nat Comms*. 12: 5728.
3. Richmond & Zacks (2017). *TiCS*, 21(12): 962 – 980.
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5. Sestieri, et al., (2017). *NatRevNeuro*, 18(2): 183-192.
6. Chen, et al., (2017). *Nat Neuro*, 20: 115 - 125.
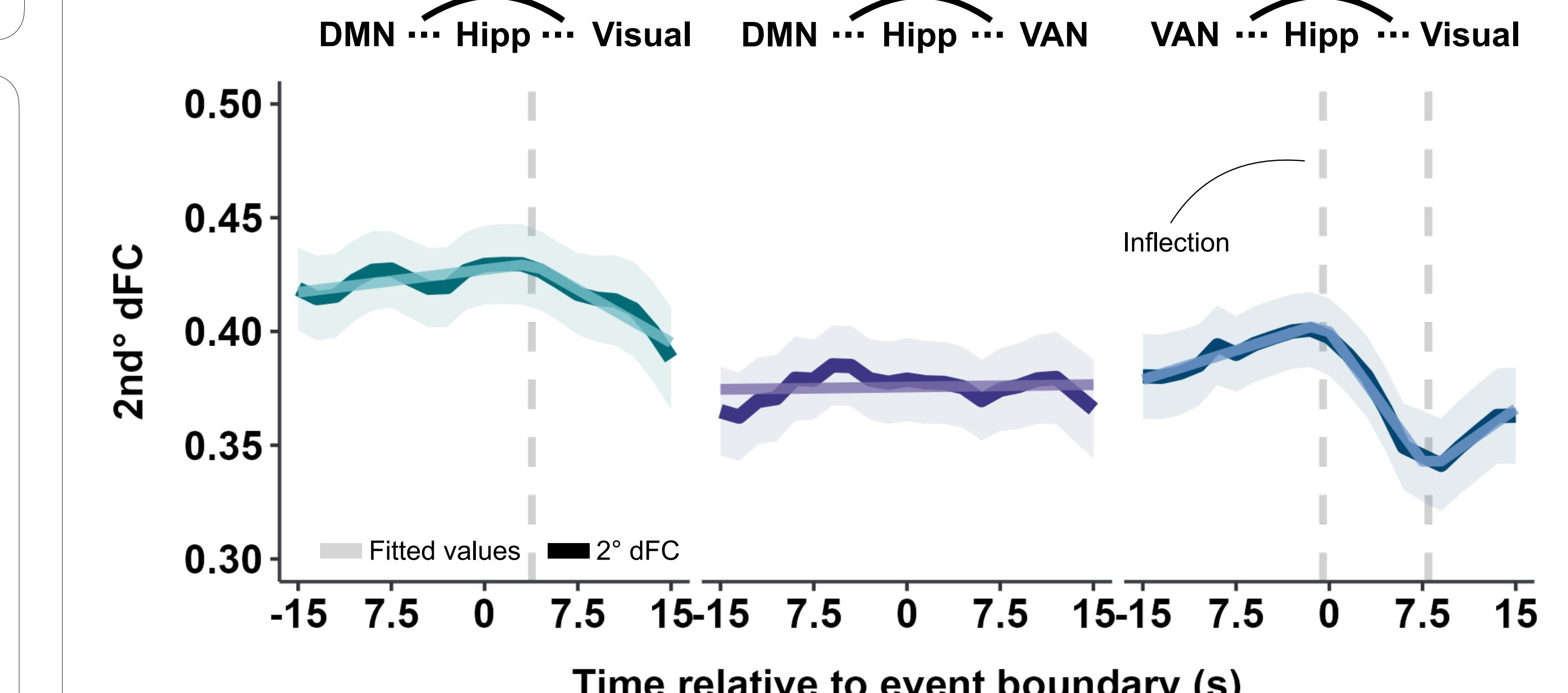
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2° Hipp dFC changes across event boundaries.

Activation value   1° dFC   2° dFC
Time   Time   Time

- Piecewise regression:

$$2° \text{ dFC} = \beta_0 + \beta_1 \text{ t-to-bound} + \beta_2 (\text{t-to-bound} - \text{inflect1}) + \beta_3 (\text{t-to-bound} - \text{inflect2})$$

Inflection 1
Inflection 2

DMN ⋯ Hipp ⋯ Visual   DMN ⋯ Hipp ⋯ VAN   VAN ⋯ Hipp ⋯ Visual

2nd° dFC (y-axis: 0.30–0.50)

Inflection

Fitted values   2° dFC

Time relative to event boundary (s)

- 2° dFC between hipp-DMN & hipp-VAN remains constant across event boundary.

Conclusion

Hippocampal dFC is modulated by event structure:

- Stronger association with modulatory/ control network **precedes** increases with external network.
- Disengage both modulatory and external networks **following** event boundaries.
- **Constant** engagement with internal network.