

Clear Comprehension – Everyday mindfulness and the brain

Sacramento Insight Meditation

Rick Maddock, July 30, 2026

Satipatthana Instructions

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diligent, clearly comprehending, mindful, and
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Fit to be trained regarding desires and discontent: - valuing non-reactivity

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“The awareness that emerges through paying attention on purpose, in the present moment, and non-judgmentally to the unfolding of experience moment by moment”(Kabat-Zinn, 2003).

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Some translations of **sampajañña**

Nanamoli & B. Bodhi: “full awareness”

Thanissaro: “clear comprehension”

Sujato: “situational awareness”

Buddhadasa: “wisdom in action”

Joseph Goldstein: “knowing what you are doing and why”



Penetrative Sutta -AN 6.63 excerpt (Thanissaro)

"Intention, I tell you, is kamma.

Intending, one does kamma by way of body, speech, & intellect."

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Sutta on the Two Kinds of Thought -MN 19 (excerpt, Sujato)

Whatever a mendicant frequently thinks about and considers becomes their heart's inclination. ...

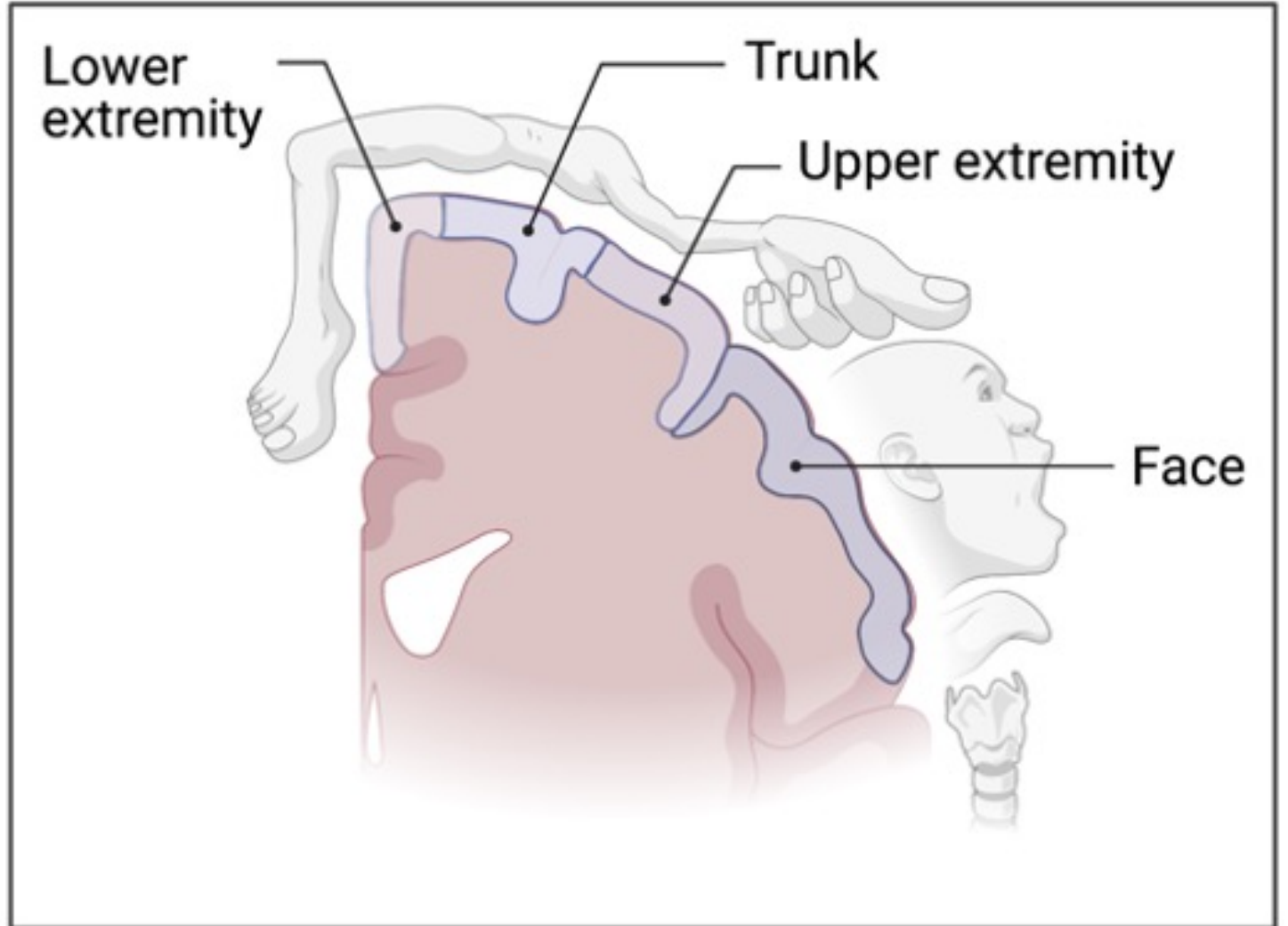
If they often think about and consider cruel thoughts ... their mind inclines to cruel thoughts.

If they often think about and consider thoughts of good will ... their mind inclines to thoughts of good will.

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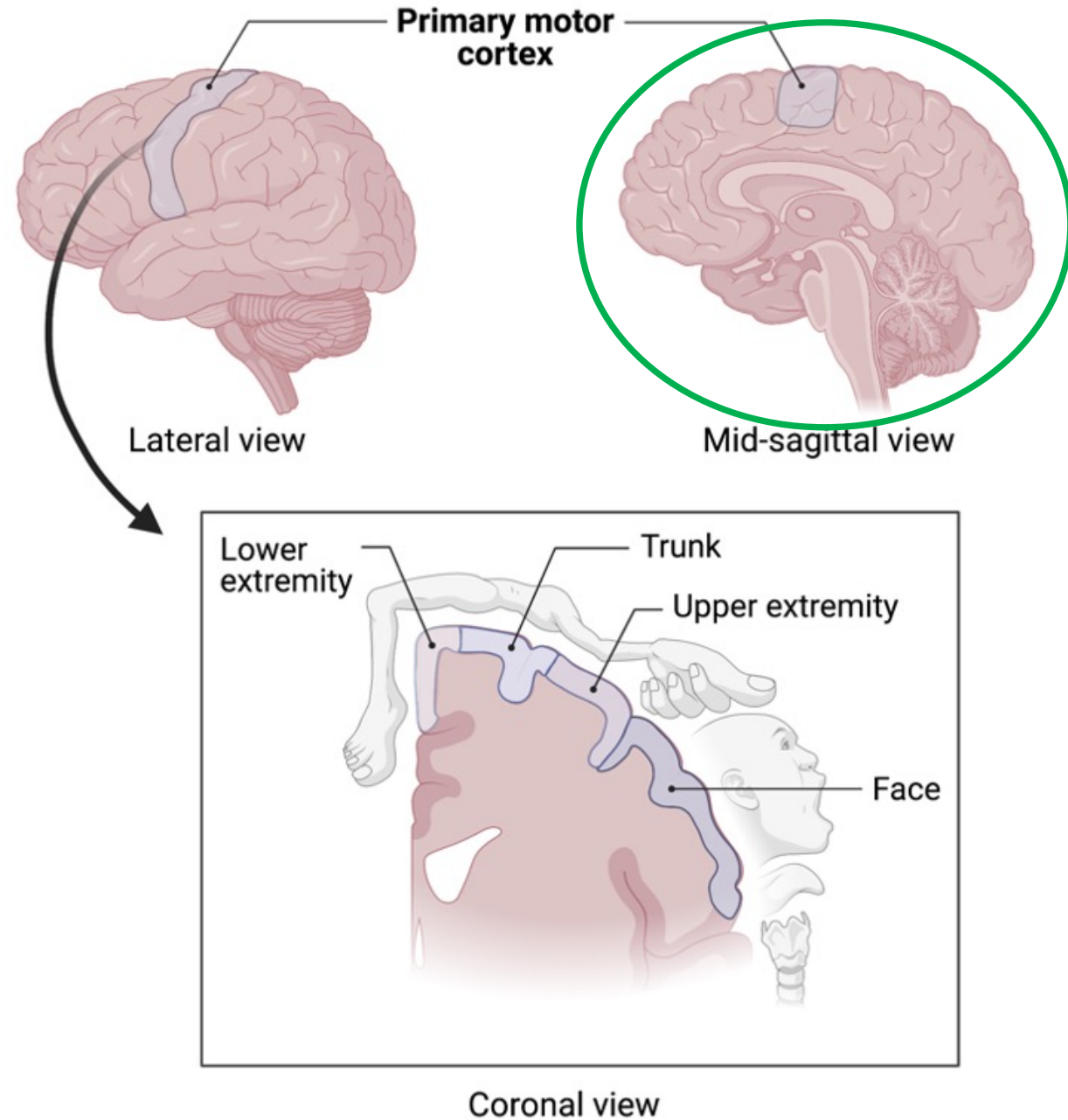
Primary Motor Cortex
is organized as a homunculus.

This can give the impression
of a unified creator of actions
in the brain.



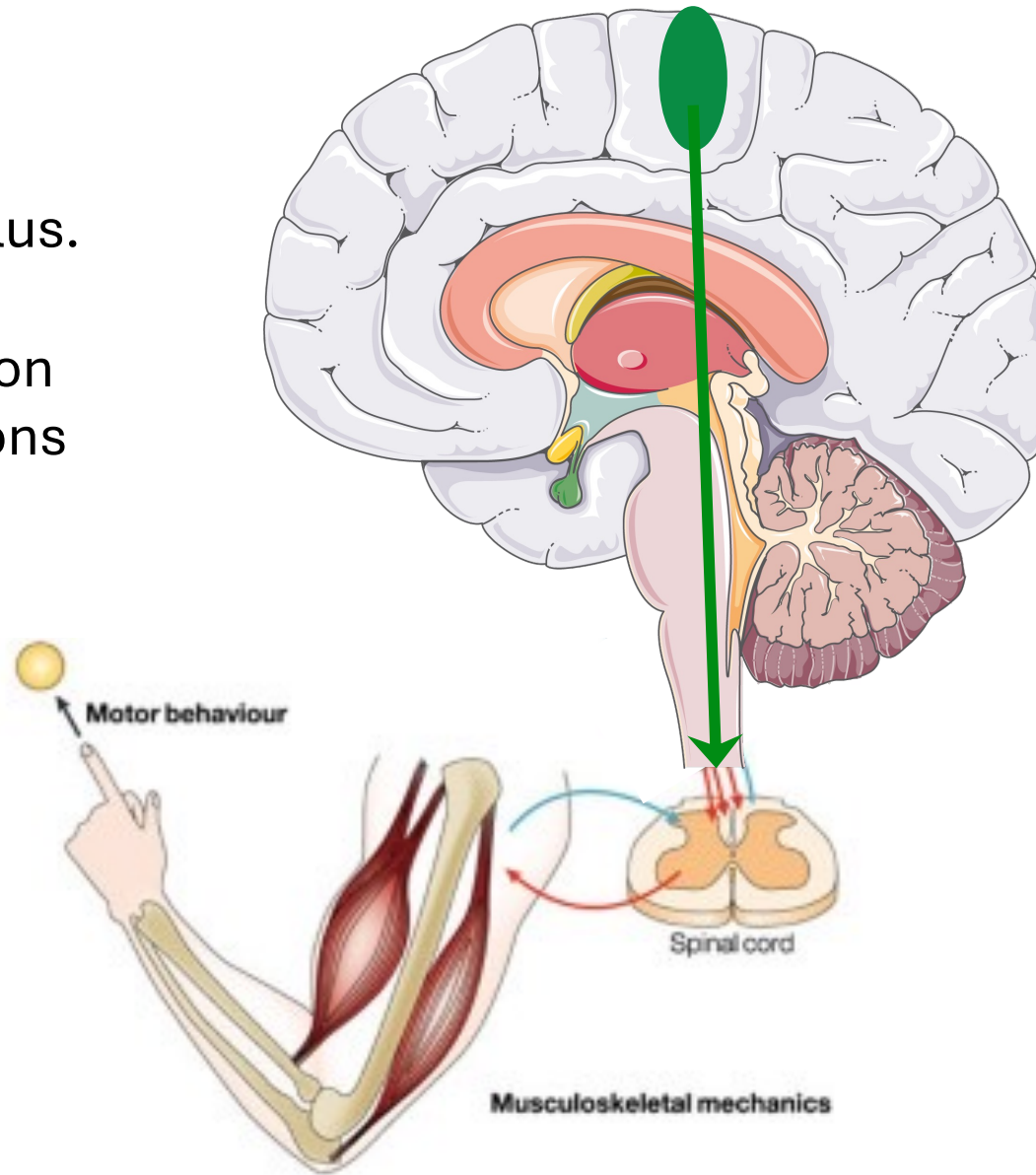
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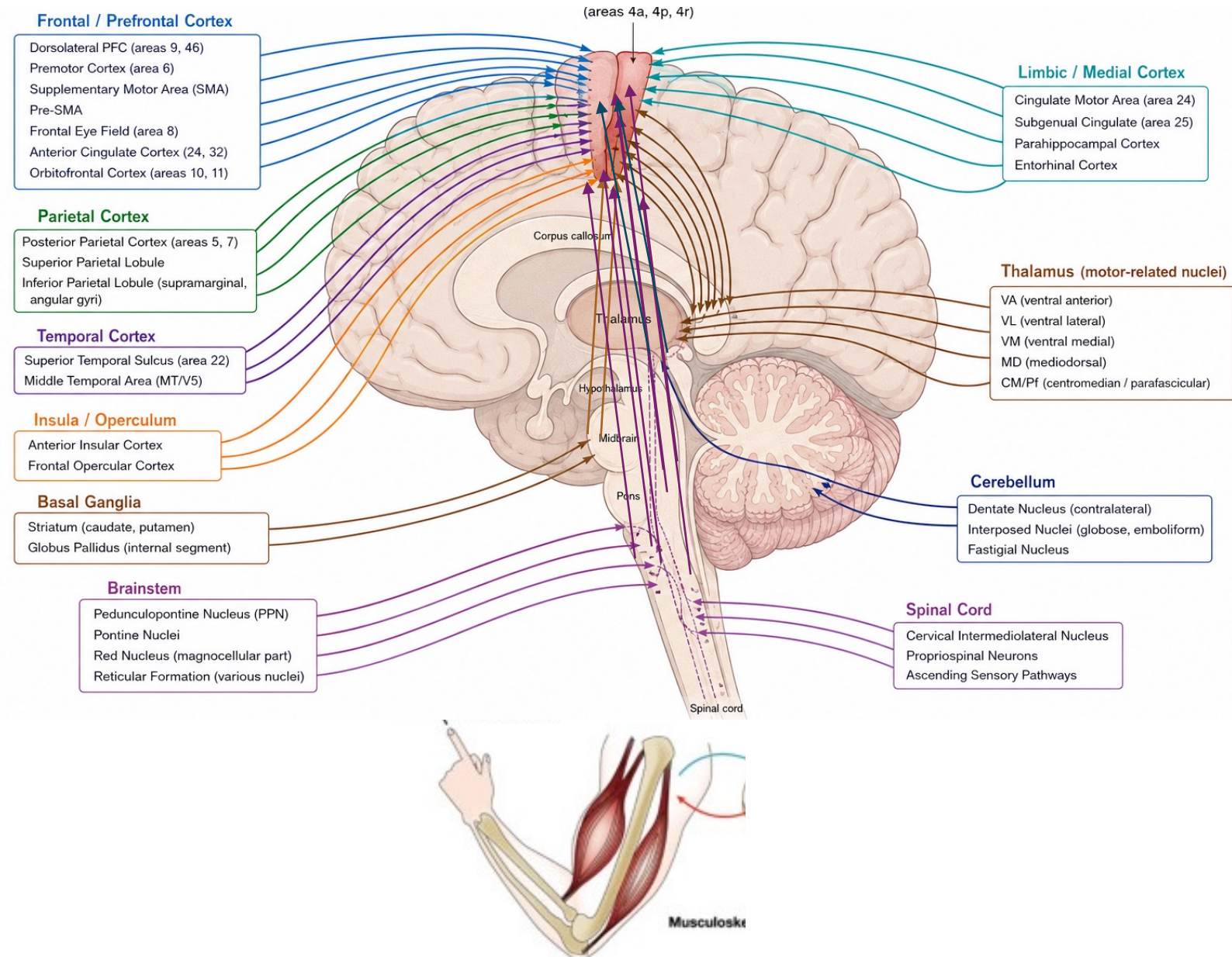
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A volley from the motor
cortex specifies an
action to be carried out.

Actions in fact arise out of a competition among many different response tendencies, not from a single unified agent.



Many, many other brain regions have a direct influence on the motor cortex

Awareness

Frontal / Prefrontal Cortex

Dorsolateral PFC (areas 9, 46)
Premotor Cortex (area 6)
Supplementary Motor Area (SMA)
Pre-SMA
Frontal Eye Field (area 8)
Anterior Cingulate Cortex (24, 32)
Orbitofrontal Cortex (areas 10, 11)

Parietal Cortex

Posterior Parietal Cortex (areas 5, 7)
Superior Parietal Lobule
Inferior Parietal Lobule (supramarginal, angular gyri)

Temporal Cortex

Superior Temporal Sulcus (area 22)
Middle Temporal Area (MT/V5)

Insula / Operculum

Anterior Insular Cortex
Frontal Opercular Cortex

Basal Ganglia

Striatum (caudate, putamen)
Globus Pallidus (internal segment)

Brainstem

Pedunculopontine Nucleus (PPN)
Pontine Nuclei
Red Nucleus (magnocellular part)
Reticular Formation (various nuclei)

(areas 4a, 4p, 4r)

Limbic / Medial Cortex

Cingulate Motor Area (area 24)
Subgenual Cingulate (area 25)
Parahippocampal Cortex
Entorhinal Cortex

Thalamus (motor-related nuclei)

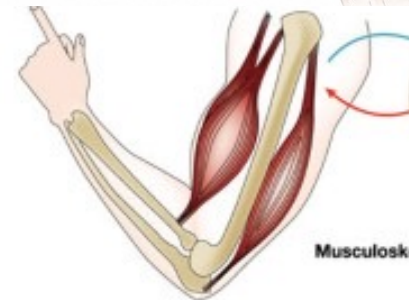
VA (ventral anterior)
VL (ventral lateral)
VM (ventral medial)
MD (mediodorsal)
CM/Pf (centromedian / parafascicular)

Cerebellum

Dentate Nucleus (contralateral)
Interposed Nuclei (globose, emboliform)
Fastigial Nucleus

Spinal Cord

Cervical Intermediolateral Nucleus
Propriospinal Neurons
Ascending Sensory Pathways



Awareness allows
wisdom to have
a seat at the table

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- Posterior Parietal Cortex (areas 5, 7)
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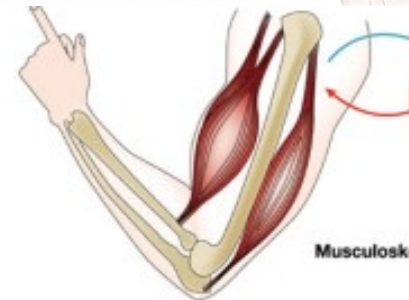
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bhāvanā — “causing to become, development, cultivation”

bhāva — “being, becoming, existence”

“Becoming” often refers to the karmic consequences of action intentions

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Samsaric “becoming”, conditioned by the defilements

Deliberate action intentions require some degree of awareness.

The awareness of action intentions is sampajañña, clear comprehension.

A very simple, voluntary action

With your dominant hand, please tap the tip of your middle finger on a flat surface.

Please ***repeat*** this action about ***three times*** over the next 30 seconds. It is ***not important when*** you do it.

Just do it whenever you ***spontaneously feel like doing it.***

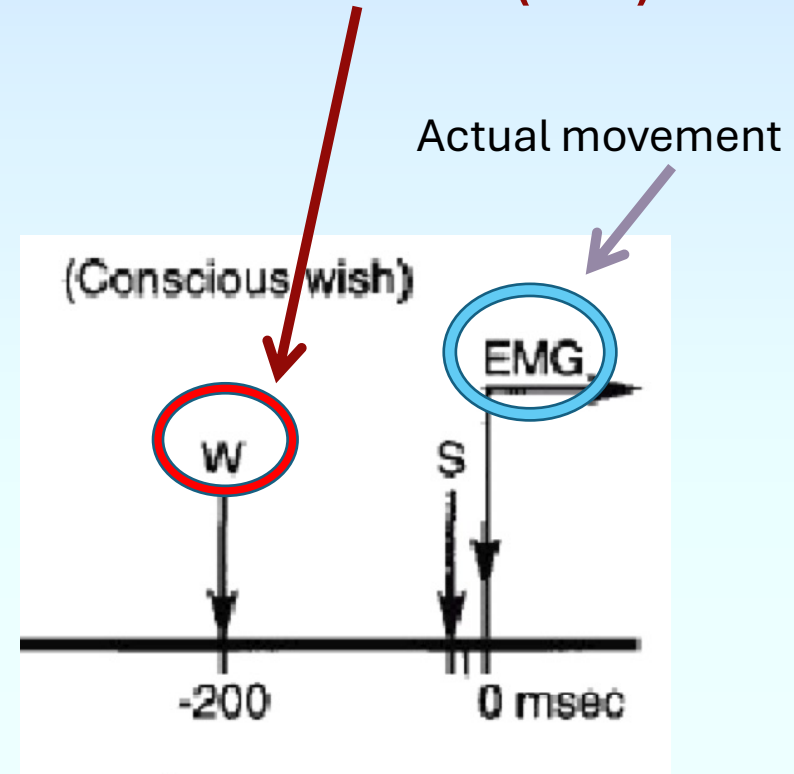
Libet et al. 1983

Asked subjects to make a similar, spontaneous finger movement
EEG was recorded to measure the ***motor readiness potential (RP)***.



Libet et al. 1983

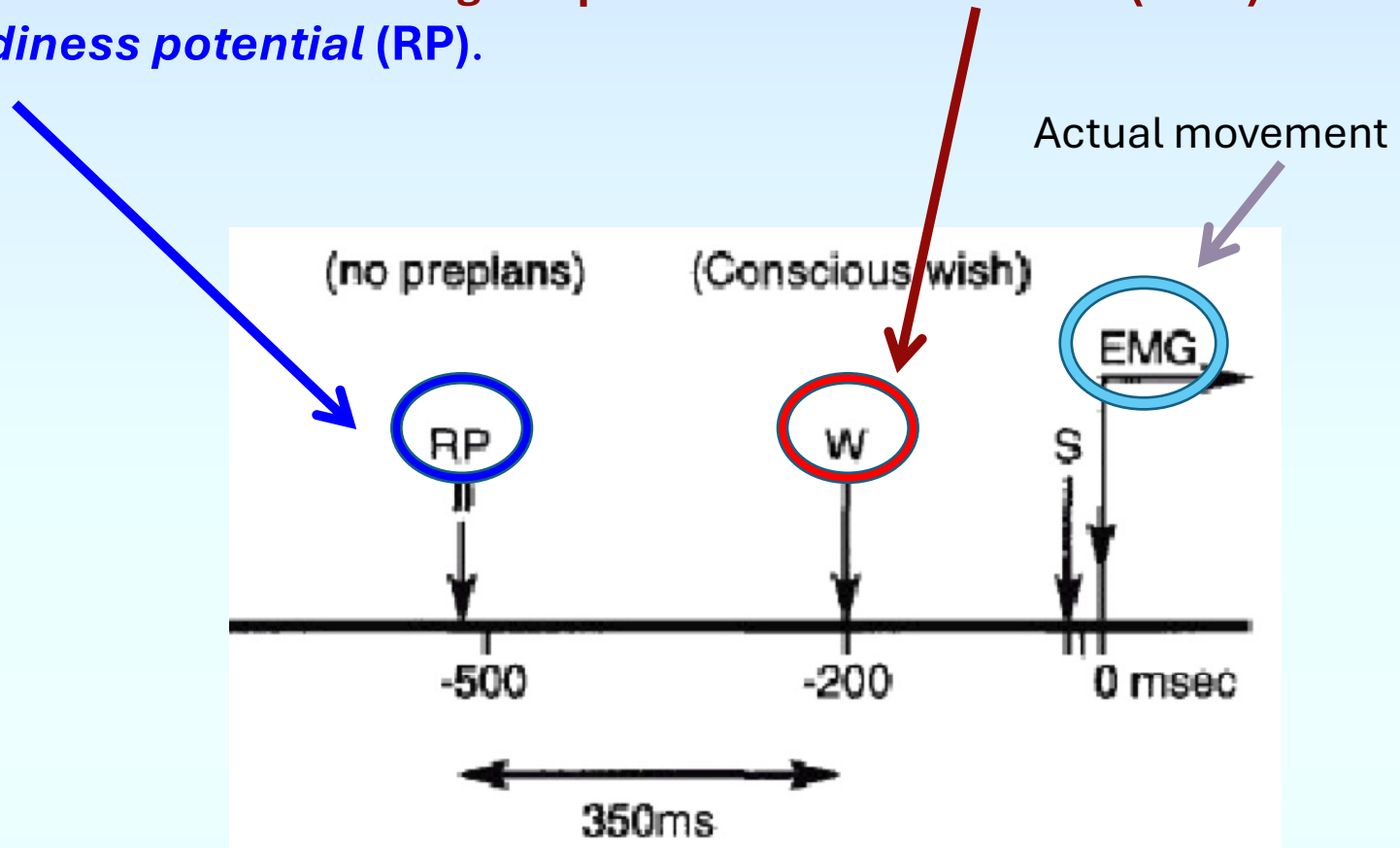
Asked subjects to make a similar, spontaneous finger movement & note when ***first aware of the urge to perform the movement (“W”)***.



Subjects reported awareness of the intention to move ***~200 ms before*** the movement occurred (EMG spike).

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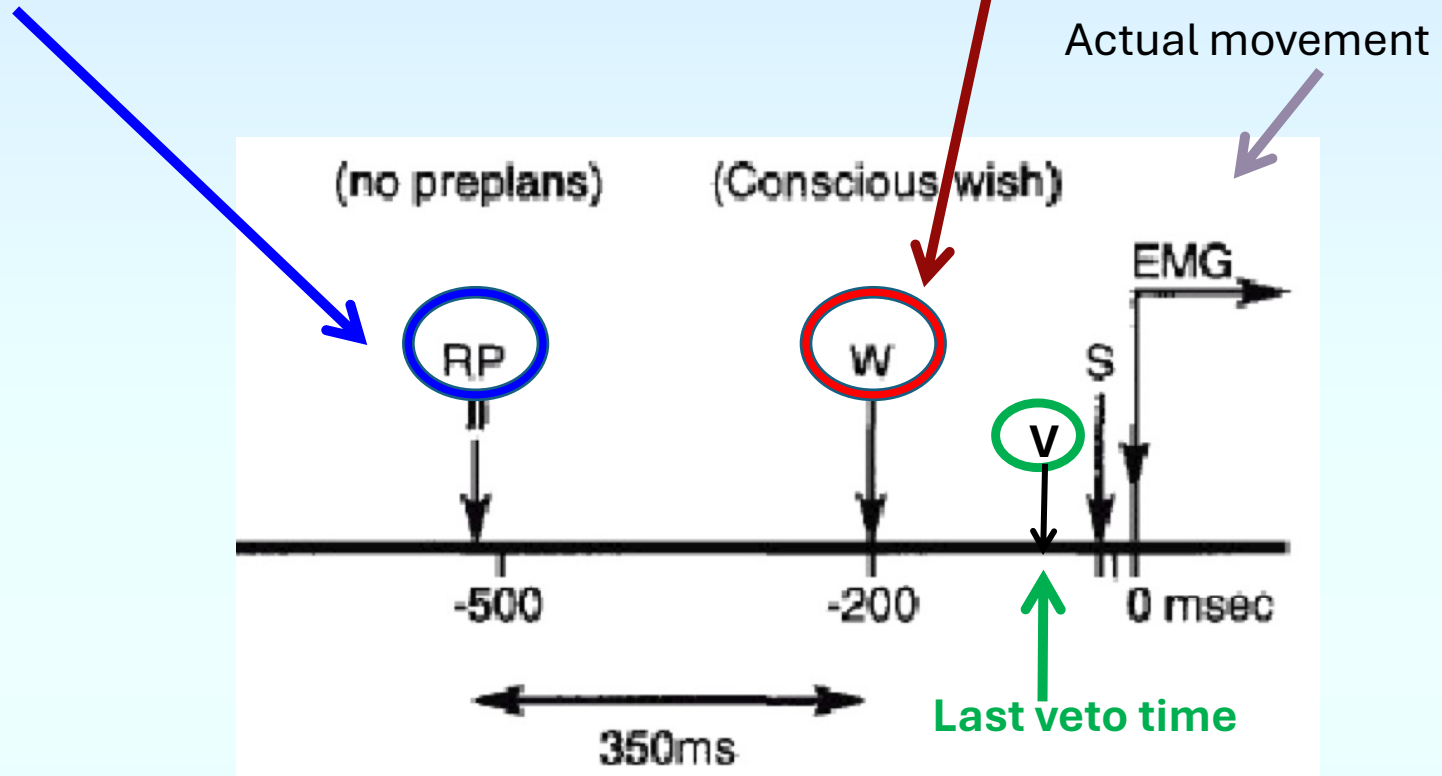
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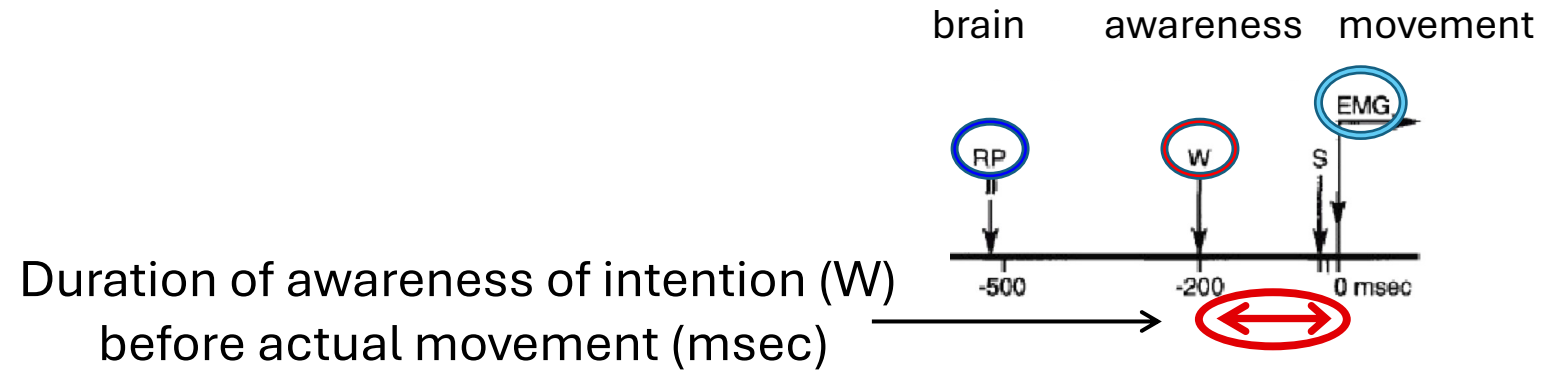
But, awareness of intention to move was reported
>300 ms after their brain began to generate the action.

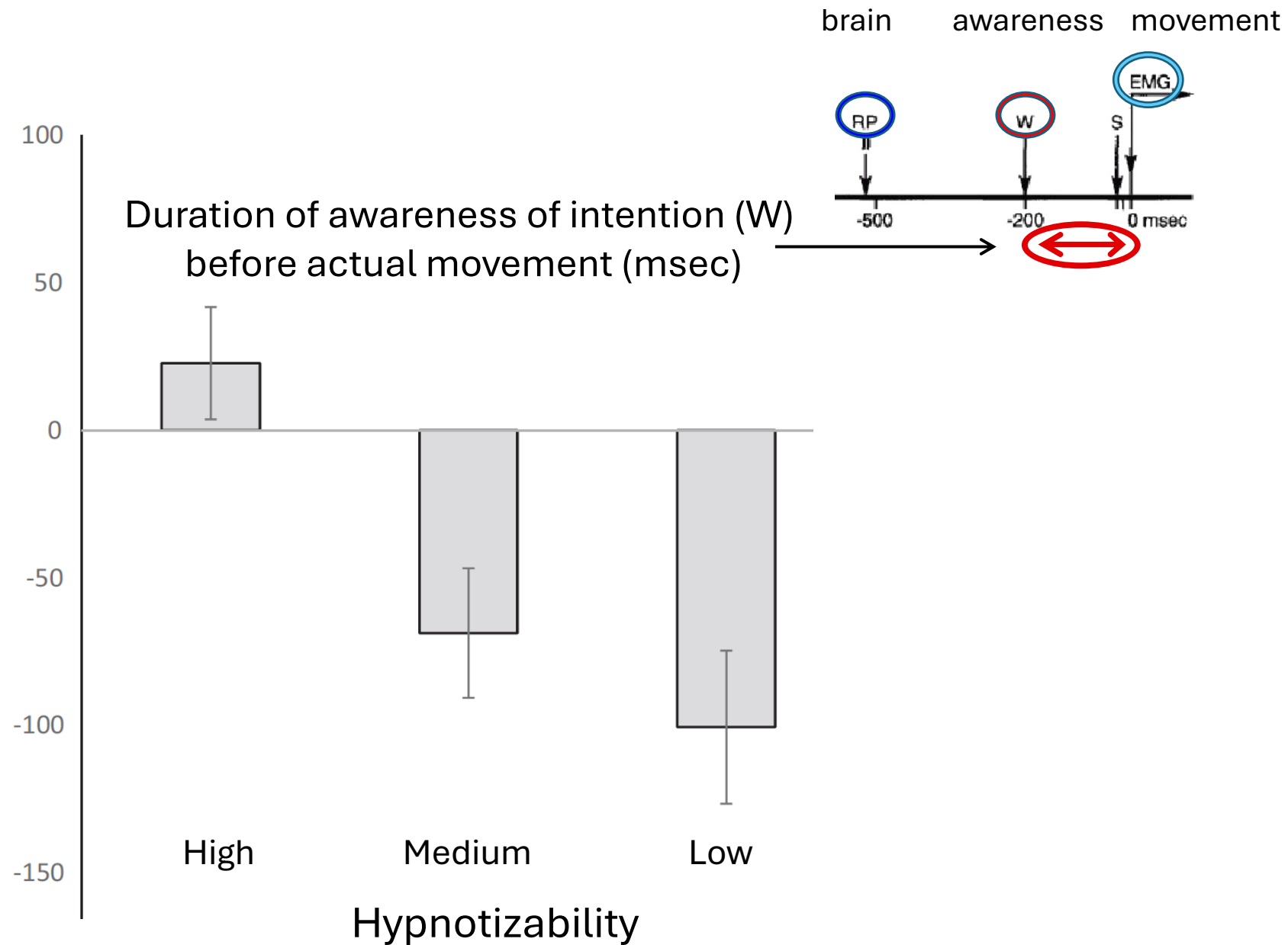
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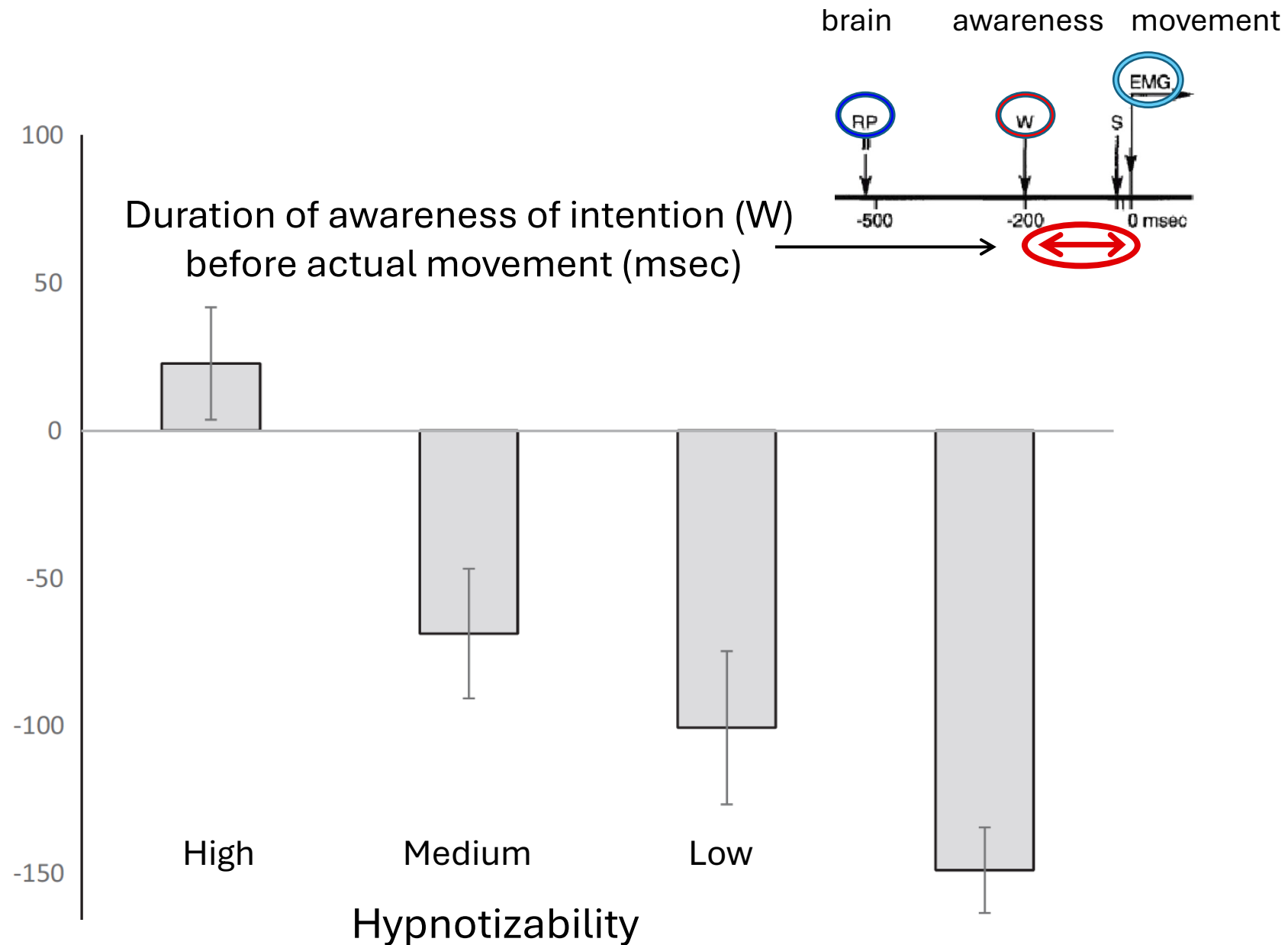


Subjects could still “veto” the movement up to about 75 msec before the movement occurred





Lush et al. 2016a



Lush et al. 2016a

Meditators

Please silently name the color of the font
with which each word is written.

green

red

yellow

green

blue

blue

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yellow

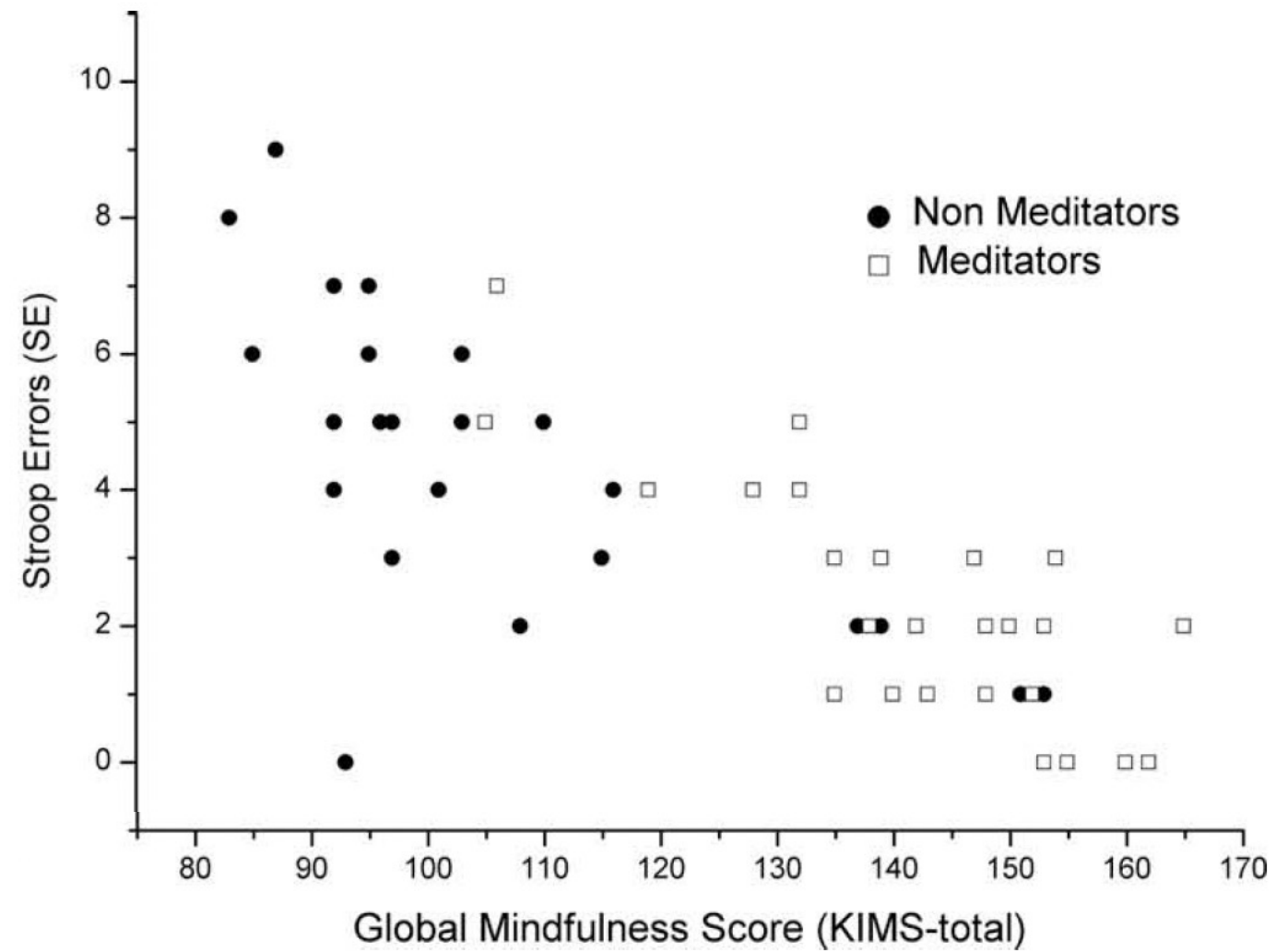
red

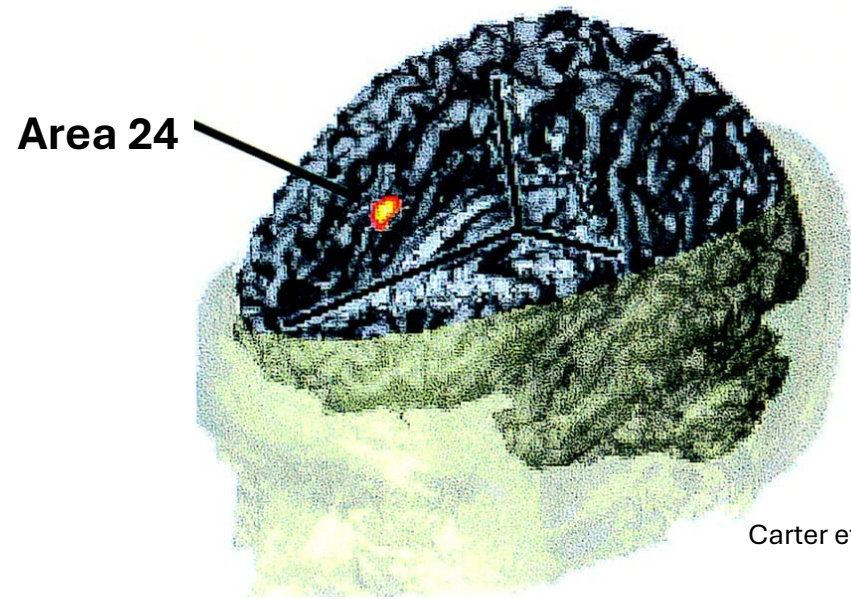
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green

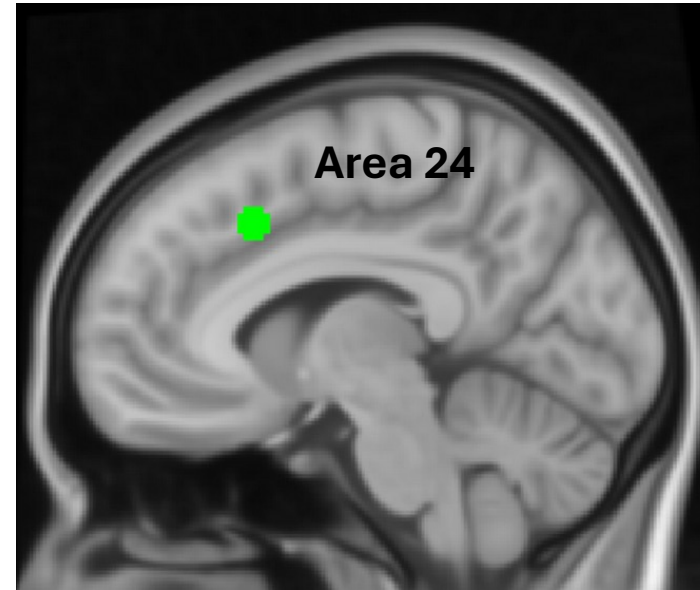
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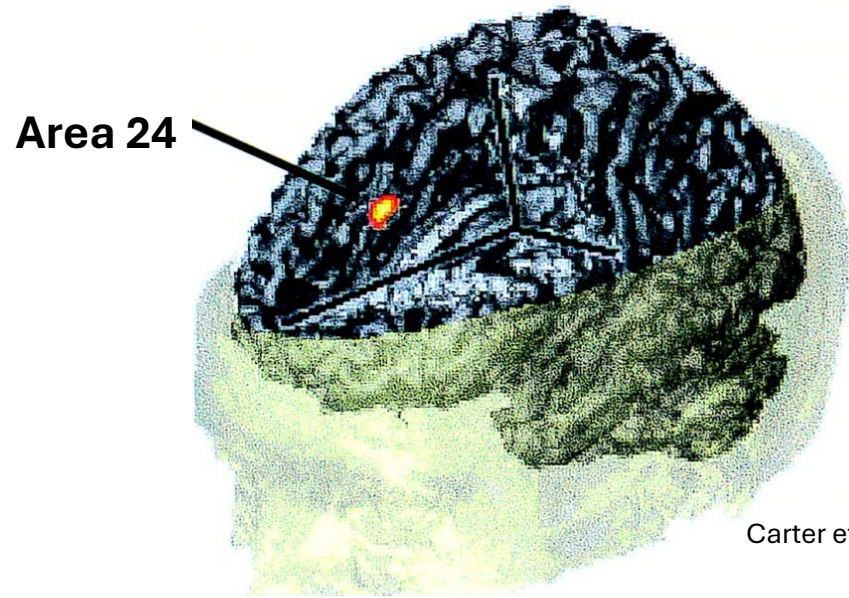


Carter et al. PNAS, 1998

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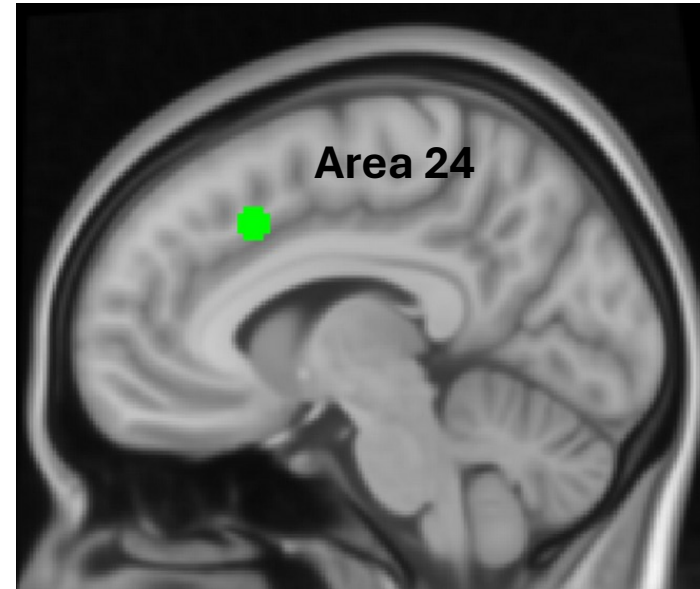


Murray et al. 2022



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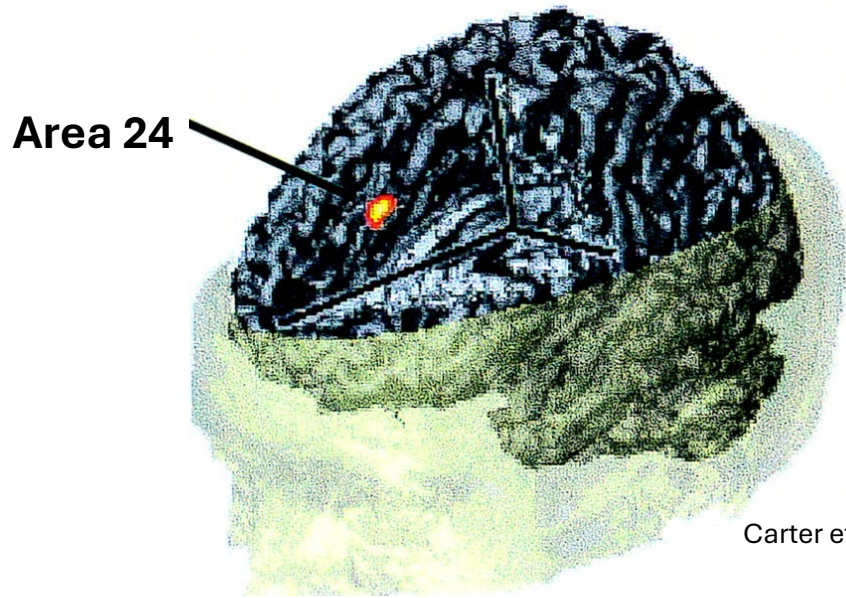


Murray et al. 2022

More
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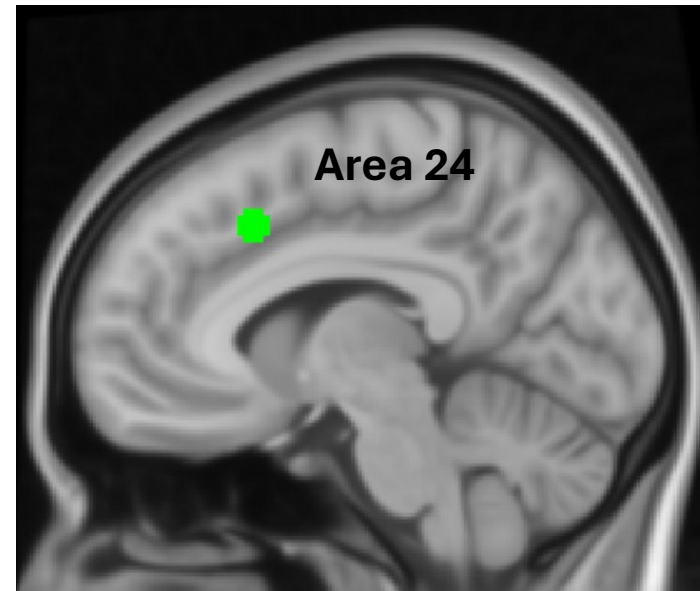


Meta-analysis, Fox et al. 2014
Meditators vs. Non-meditators



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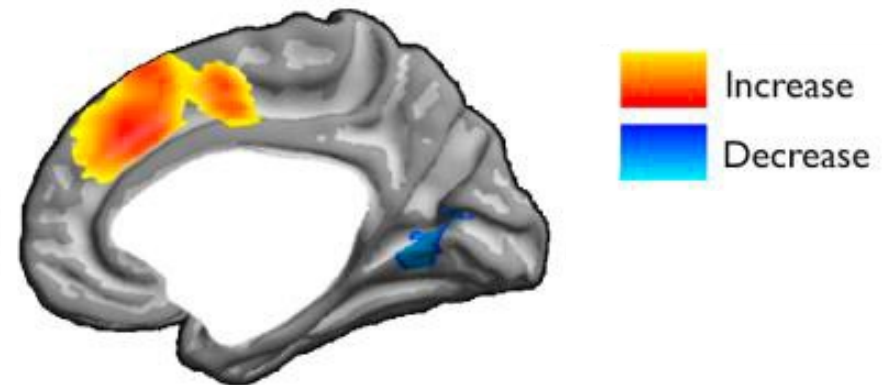
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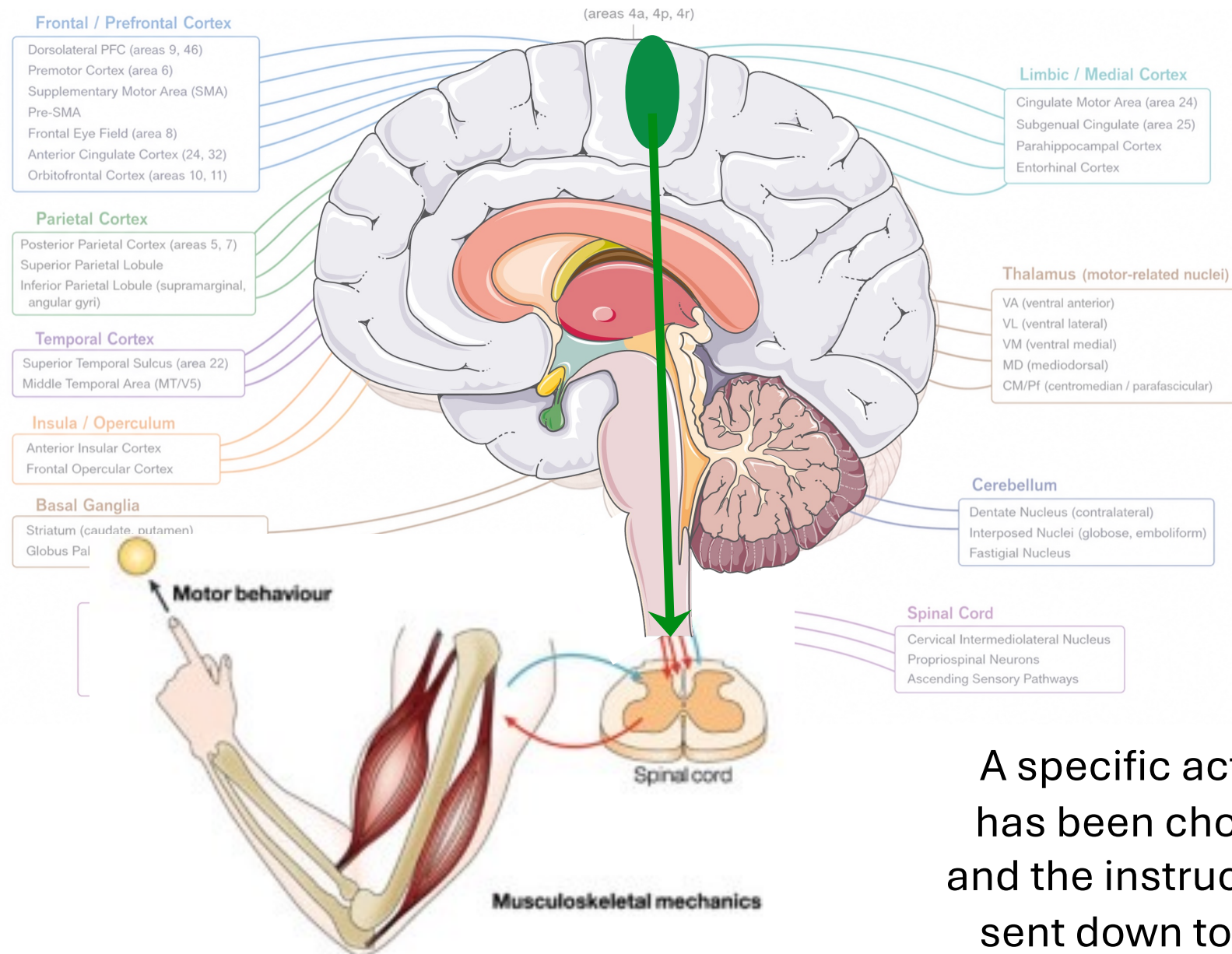


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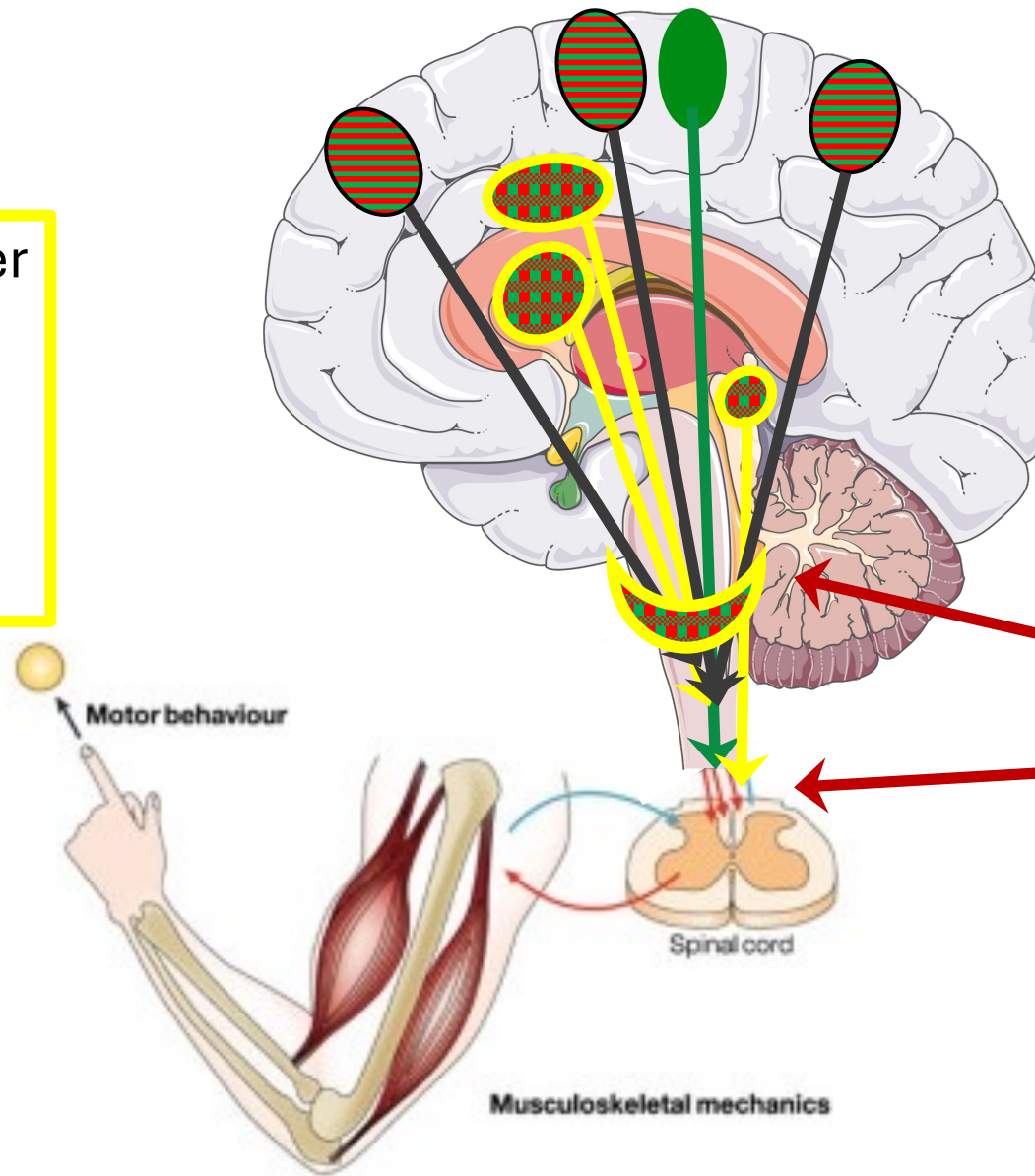


Valk et al. 2016, large, well-designed,
before and after 9-month meditation training



A specific action has been chosen and the instructions sent down to the spinal cord.

Some of these gate-keeper regions also generate feeling tone (vedana), which helps enable awareness of intentions.



A motor cortex volley specifies an action to be carried out.

Many other regions constantly regulate the brainstem & spinal cord to either enhance or suppress actions.

Caveat:

This practice is not intended to be effortful or self-judging, more of an attunement to the intentions that naturally arise and a remembering of our most basic values & insights.

Self-judgment will make it harder to simply be aware of the way things are.



What brings preconscious experiences of response preparation into awareness?

Deliberate attention- a skill that grows with clear comprehension as part of mindfulness practice.

A mindset of pausing before acting- which allows time for intentions to reach awareness

Attunement to vedana- which can signal intentions that may warrant deliberate supervision