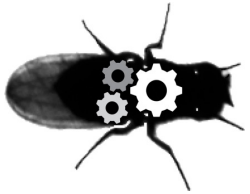
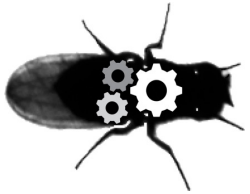
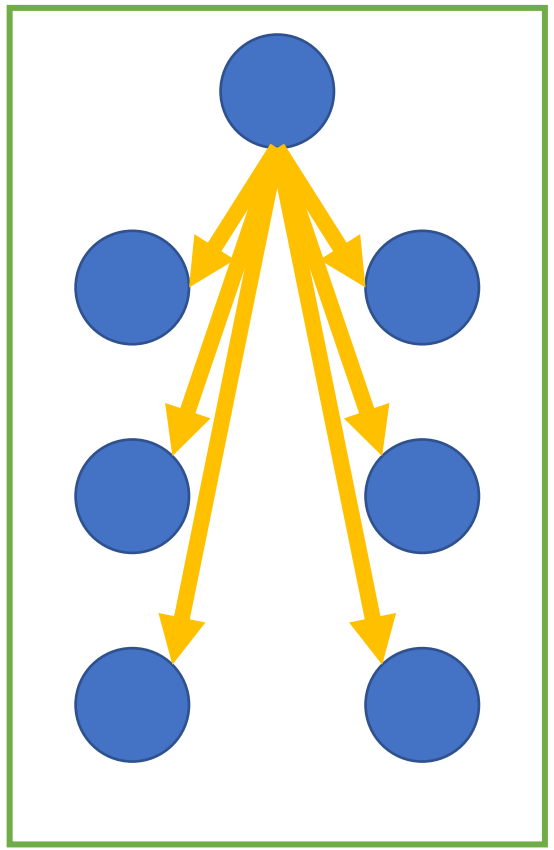
EPFL



Introduction to decentralized control

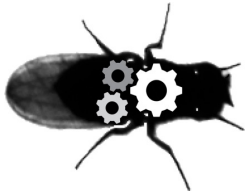


Decentralized or centralized ?

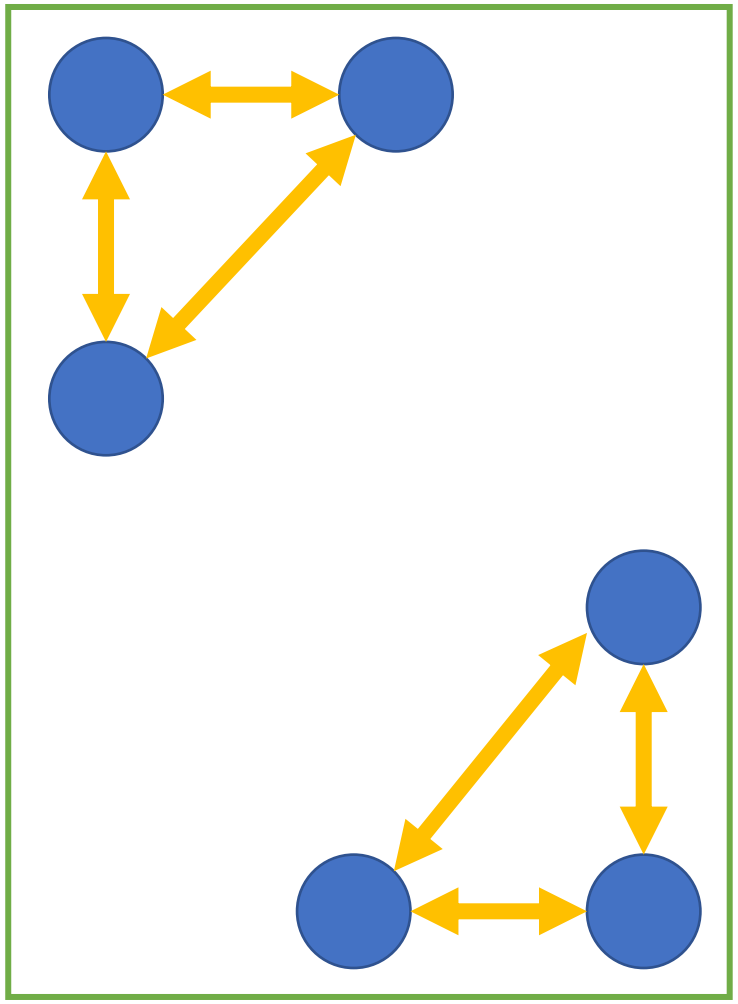


Trafic management system on delay

https://globalhealthnow.org/object/traffic-light



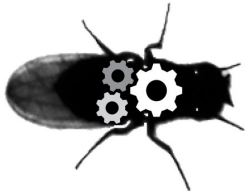
Decentralized or centralized ?



(a) From Nouyan et al. (2009), reprinted with permission.

Brambilla et al. Swarm Intelligence (2013)

Sumpter DJT, *Philosophical Transactions* 2006



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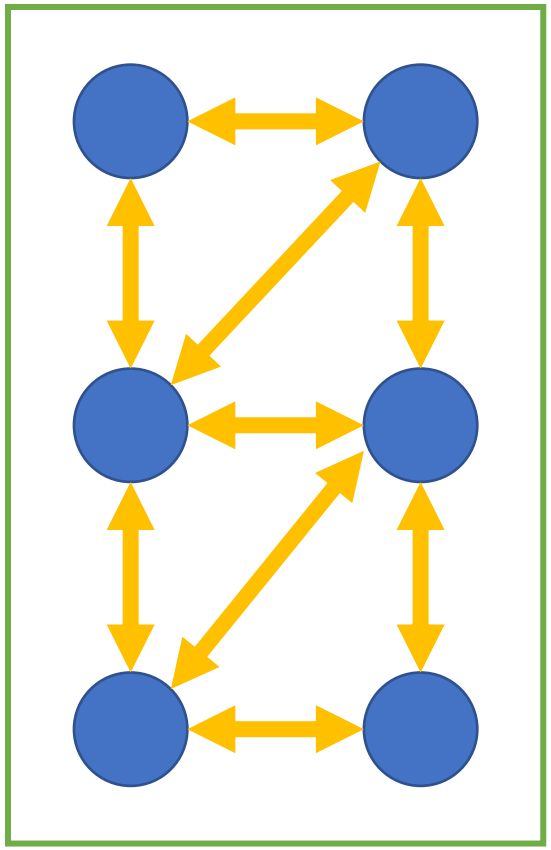
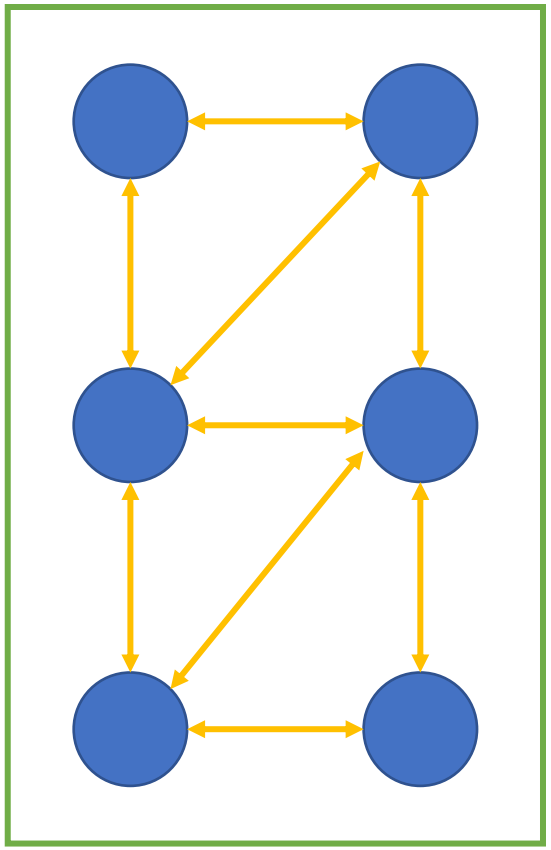
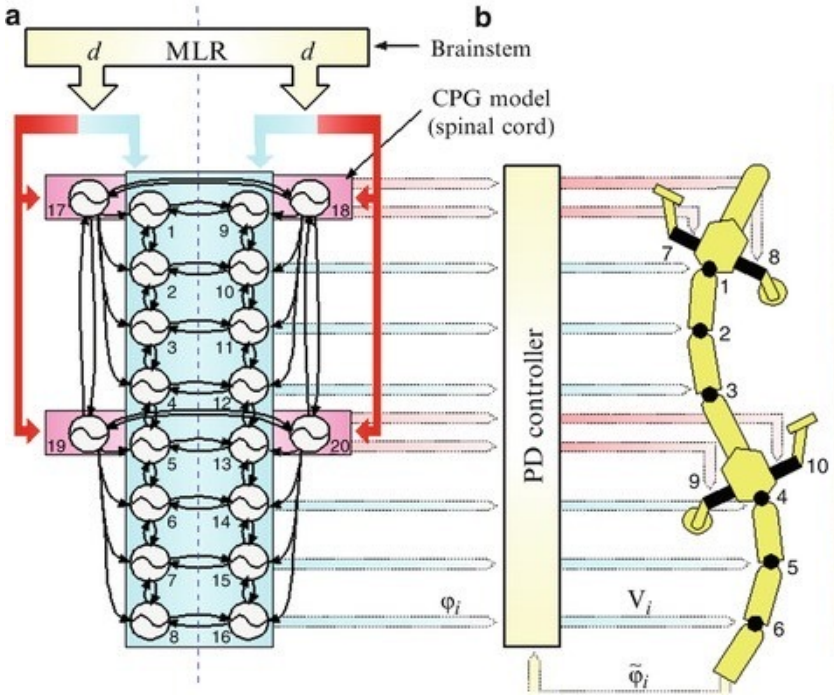
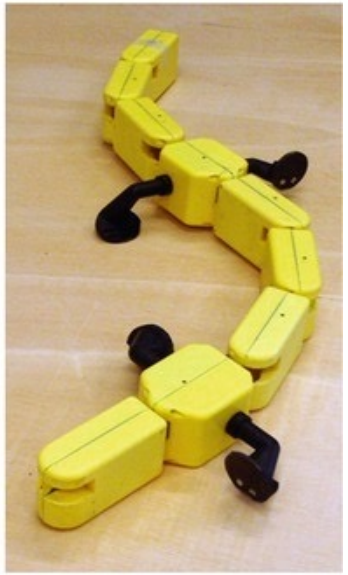
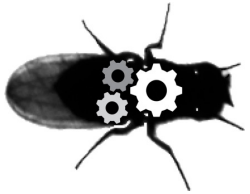






Ijspeert et al. Science (2007)





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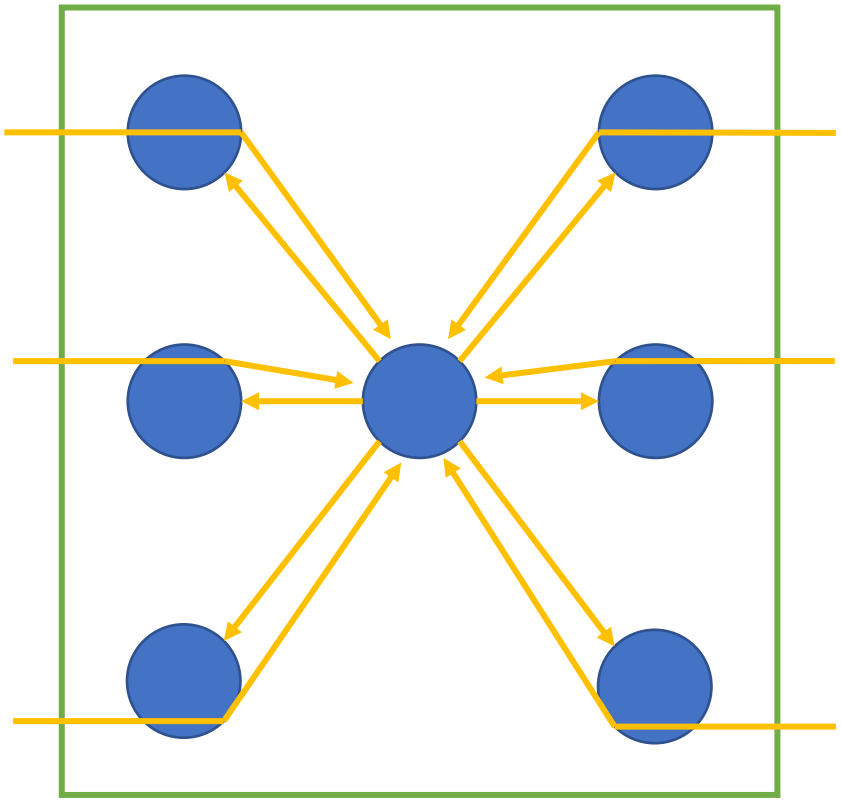
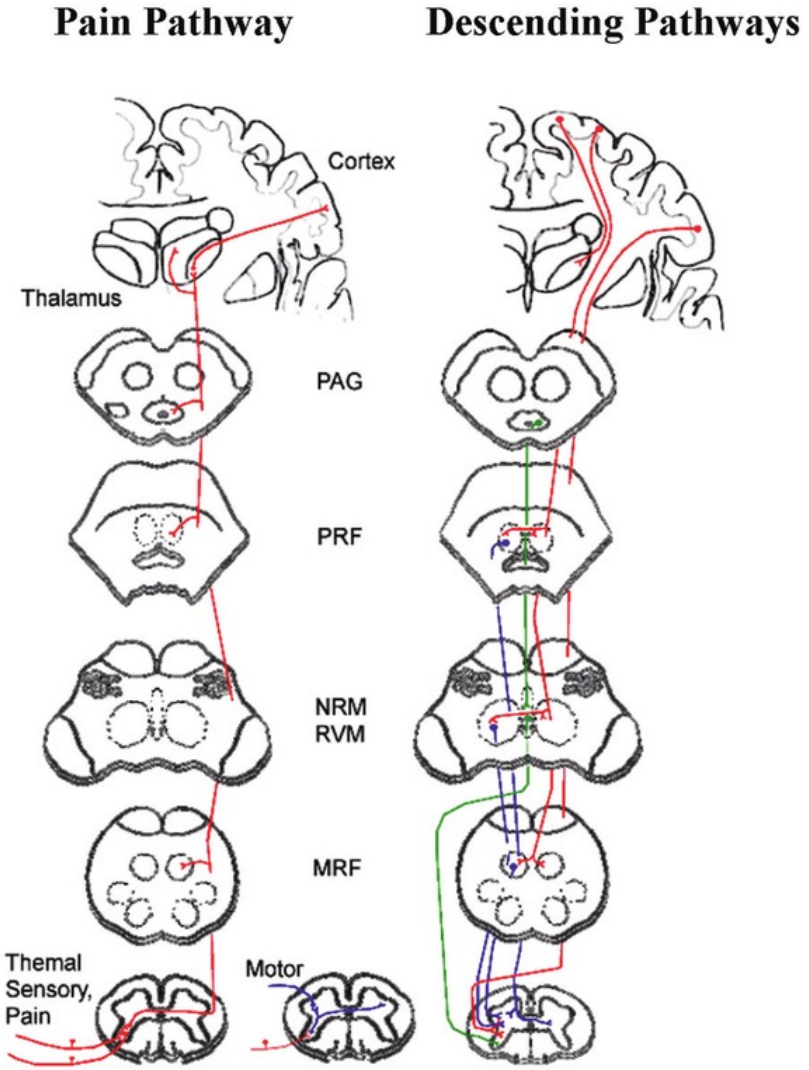
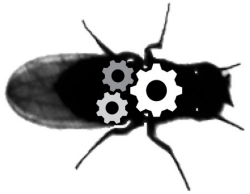


NASA - http://photojournal.jpl.nasa.gov/catalog/PIA19920



Ghazni et al. American Journal of Neuroradiology (2009)



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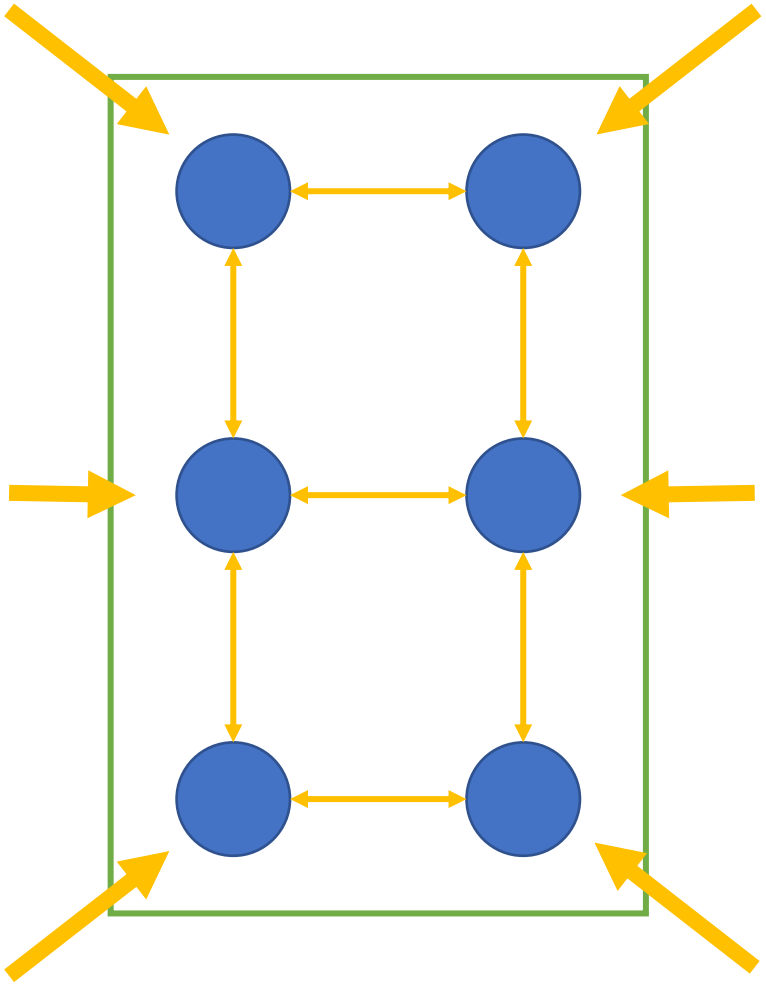
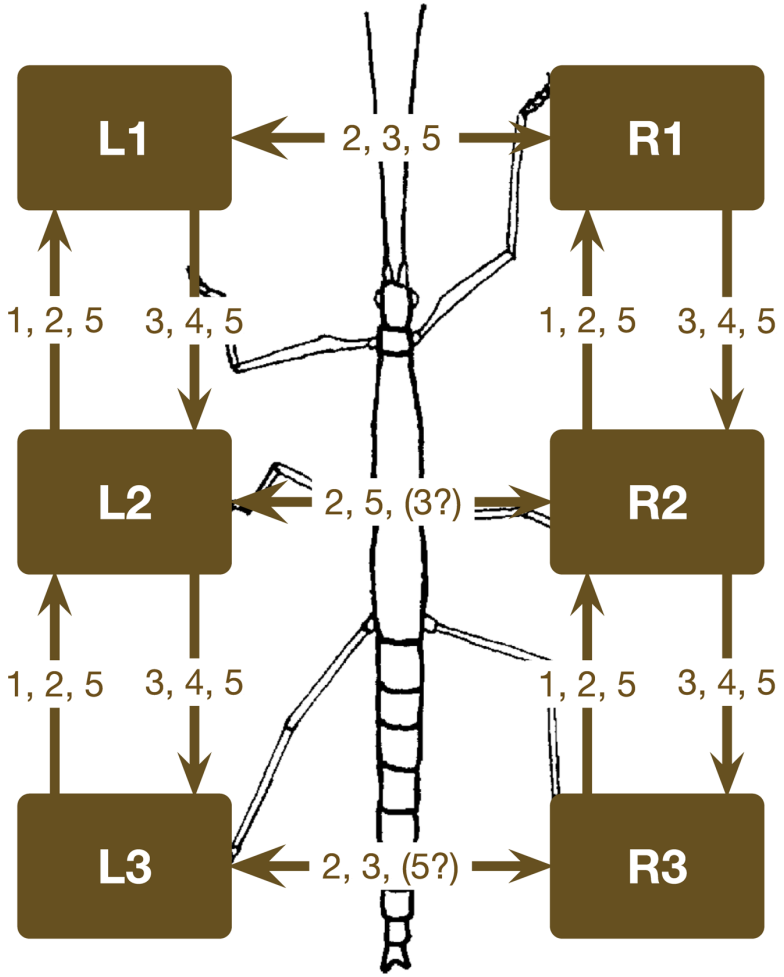


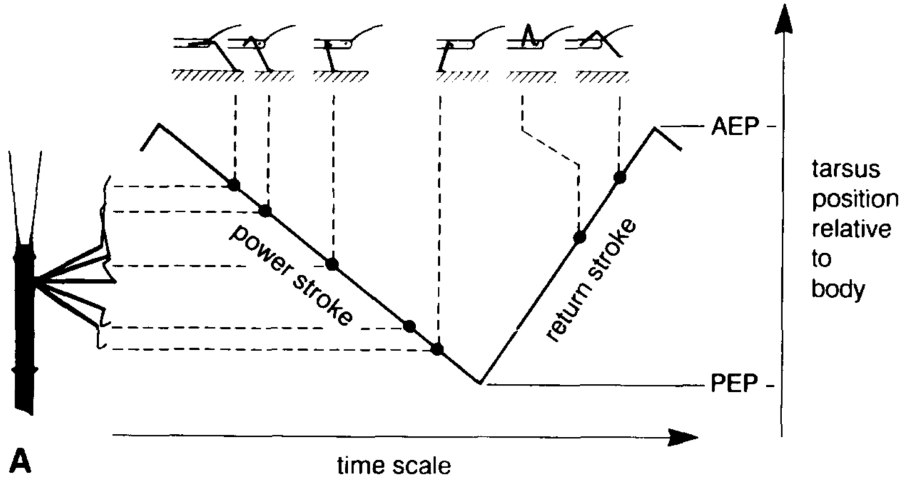


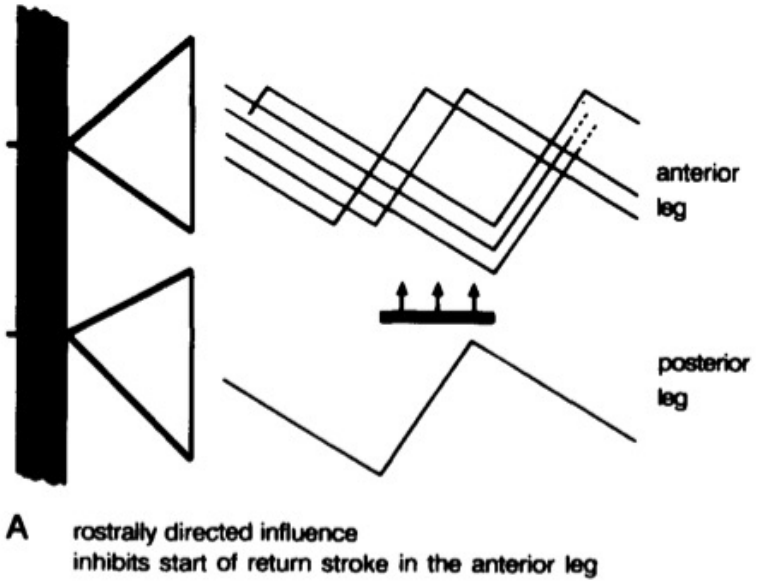
1. Return stroke inhibits start of return stroke
2. Start of power stroke excites start of return stroke
3. Caudal positions excite start of return stroke
4. Position influences position at end of return stroke ("targeting")

5a. Increased resistance increases force ("coactivation")

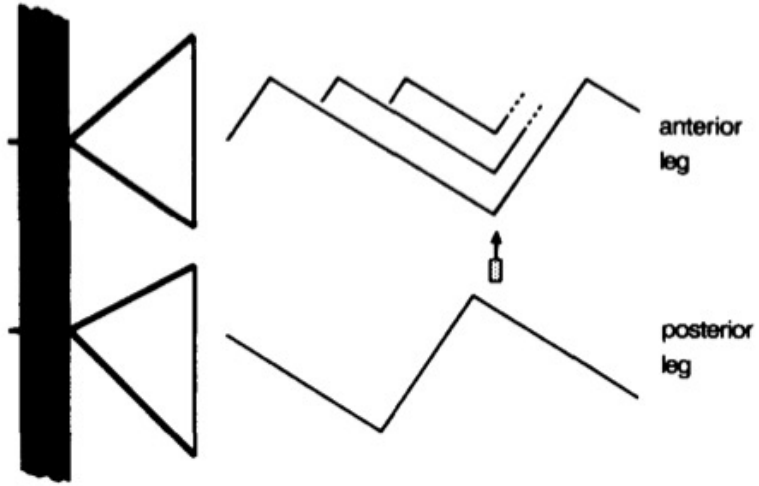
M. Schiling et al. PLOS computational biology (2020)

Cruse et al. observations on arthropod locomotion

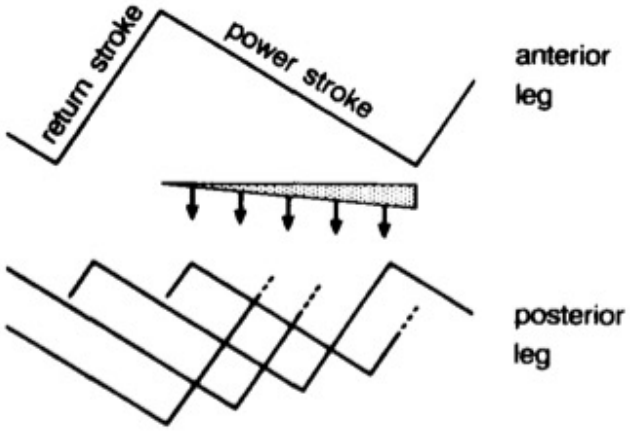




A rostrally directed influence inhibits start of return stroke in the anterior leg

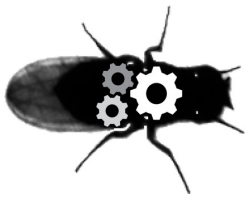


B rostrally directed influence excites start of return stroke in the anterior leg



C caudally directed influence excites start of return stroke in the posterior leg

H.Cruse et al Trends in Neuroscience 1990



Centralization from an information theory point of view

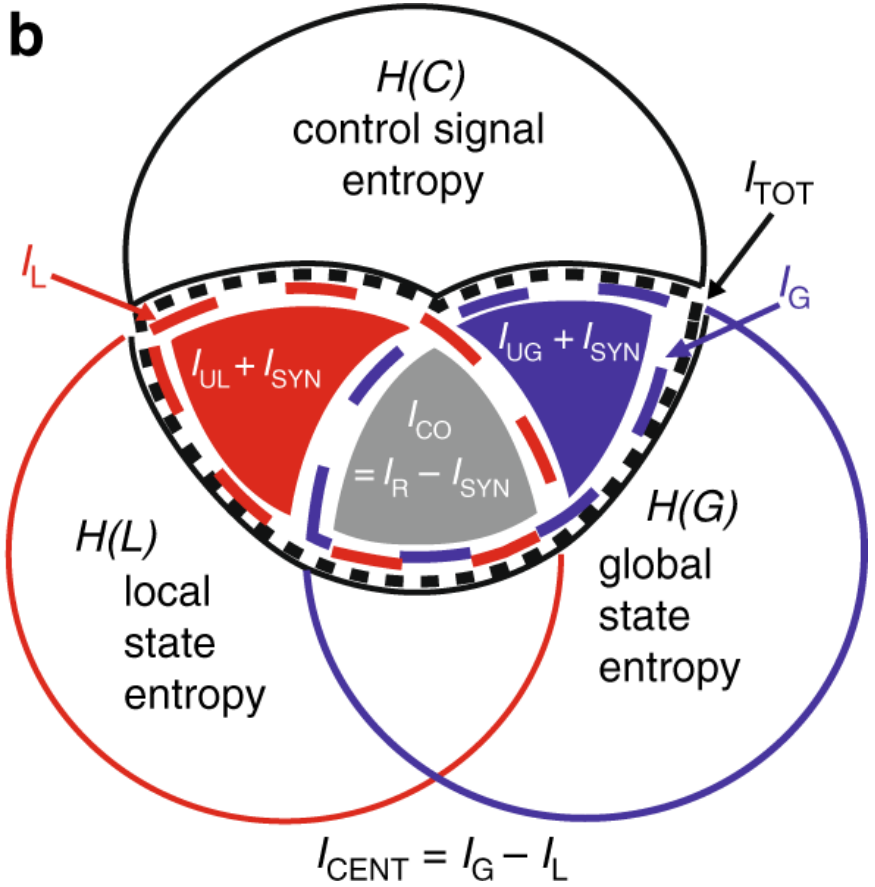
I_{UL} unique local mutual information

I_{UG} unique global mutual information

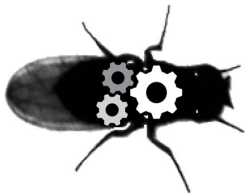
I_{SYN} synergist mutual information

I_R redondant mutual information

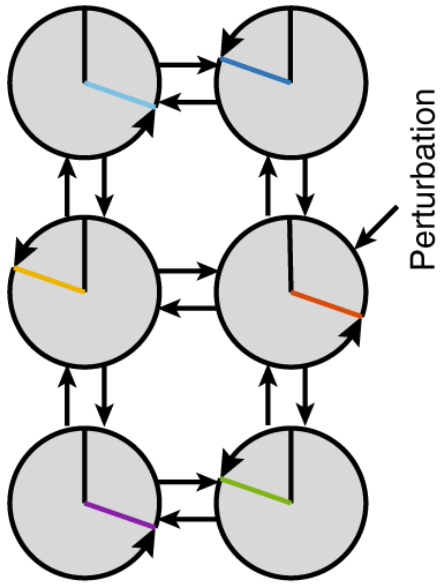
$I_{CENT} = I_G - I_L = I_{UG} - I_{UL}$

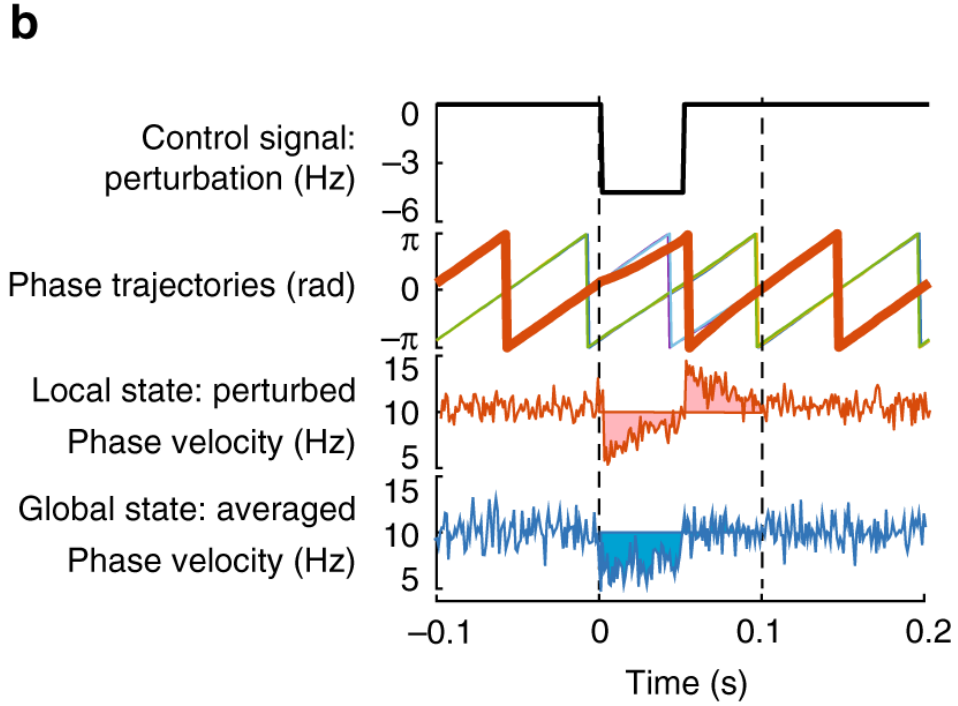


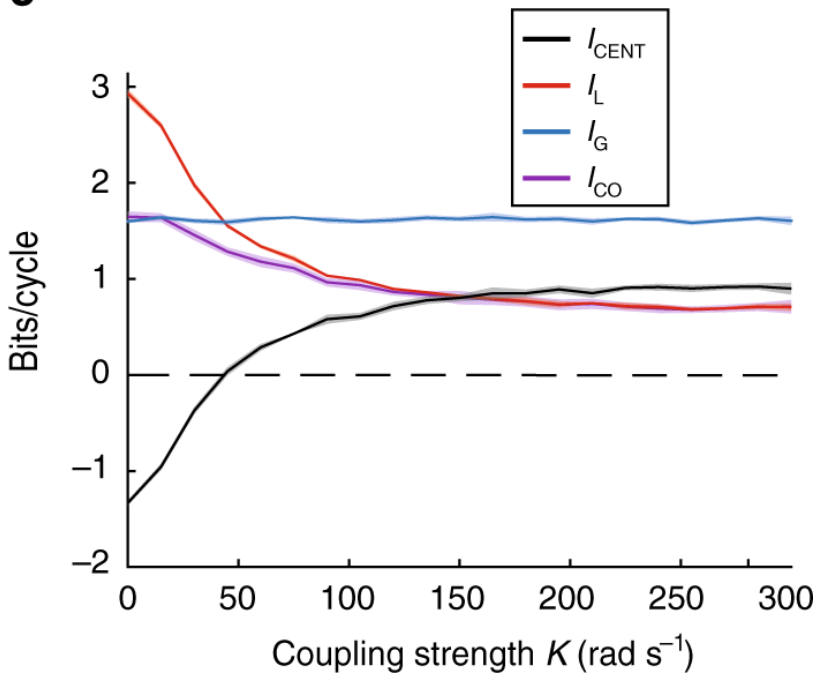
I.D. Neveln et al. Nature Communications (2019)



Centralization in a network of coupled oscilators:

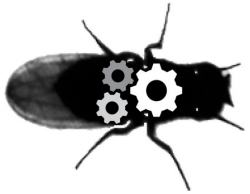




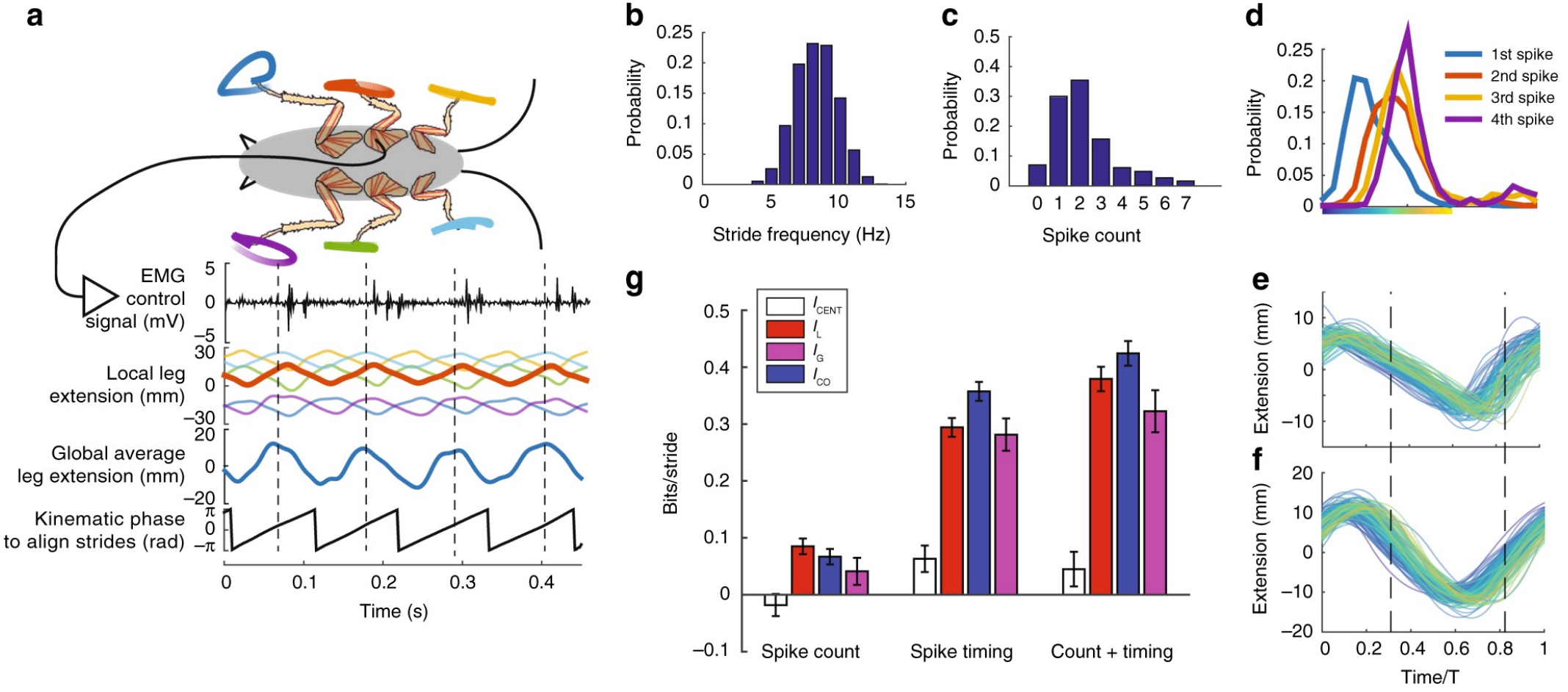


I.D. Neveln et al. Nature Communications (2019)

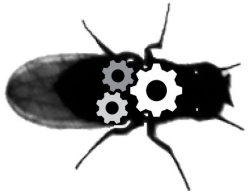
EPFL



Centralization in cockroach locomotion:



I.D. Neveln et al. Nature Communications (2019)



Centralized decentralized comparison

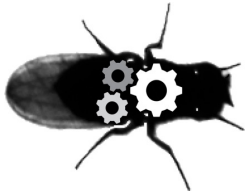
Centralized:

- Fast
- Simpler

Decentralized:

- Robustness/Redundancy
- Adaptability/Flexibility
- Modularity

EPFL



Todays tutorial: Principle

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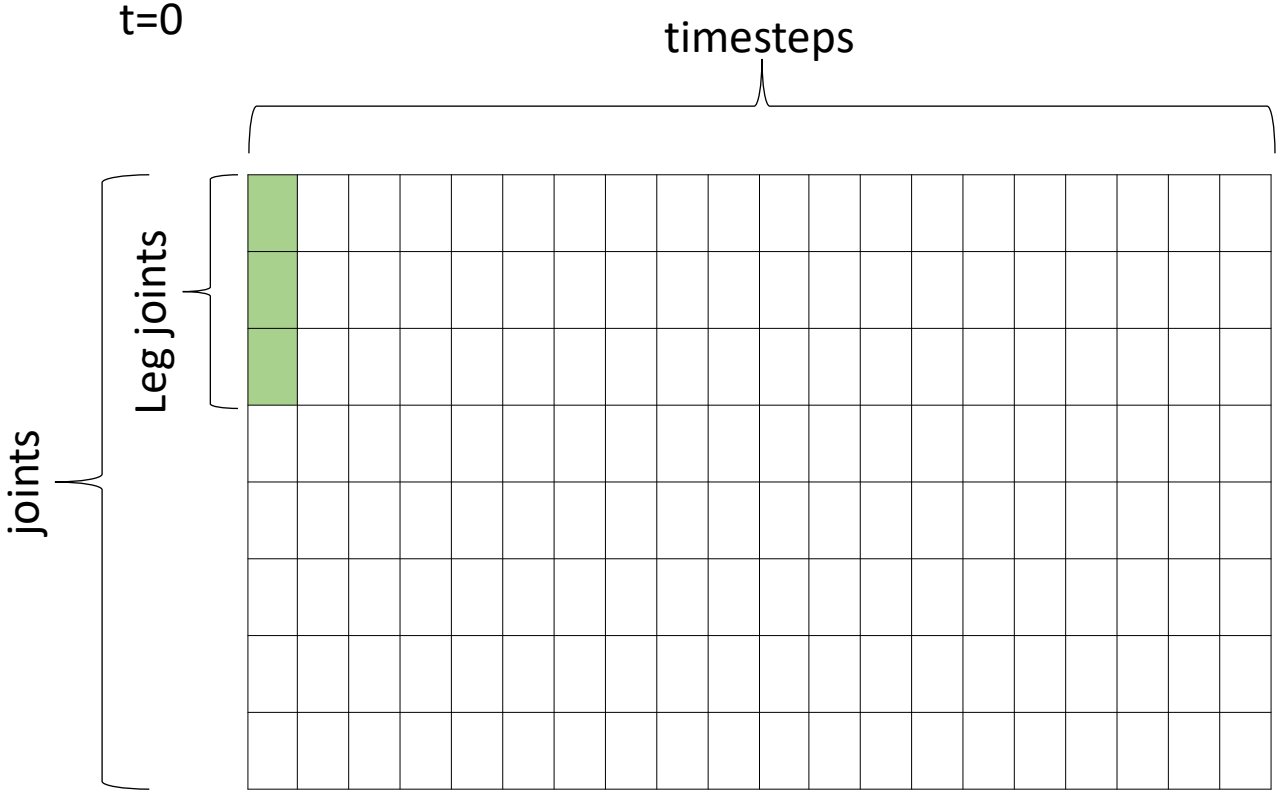

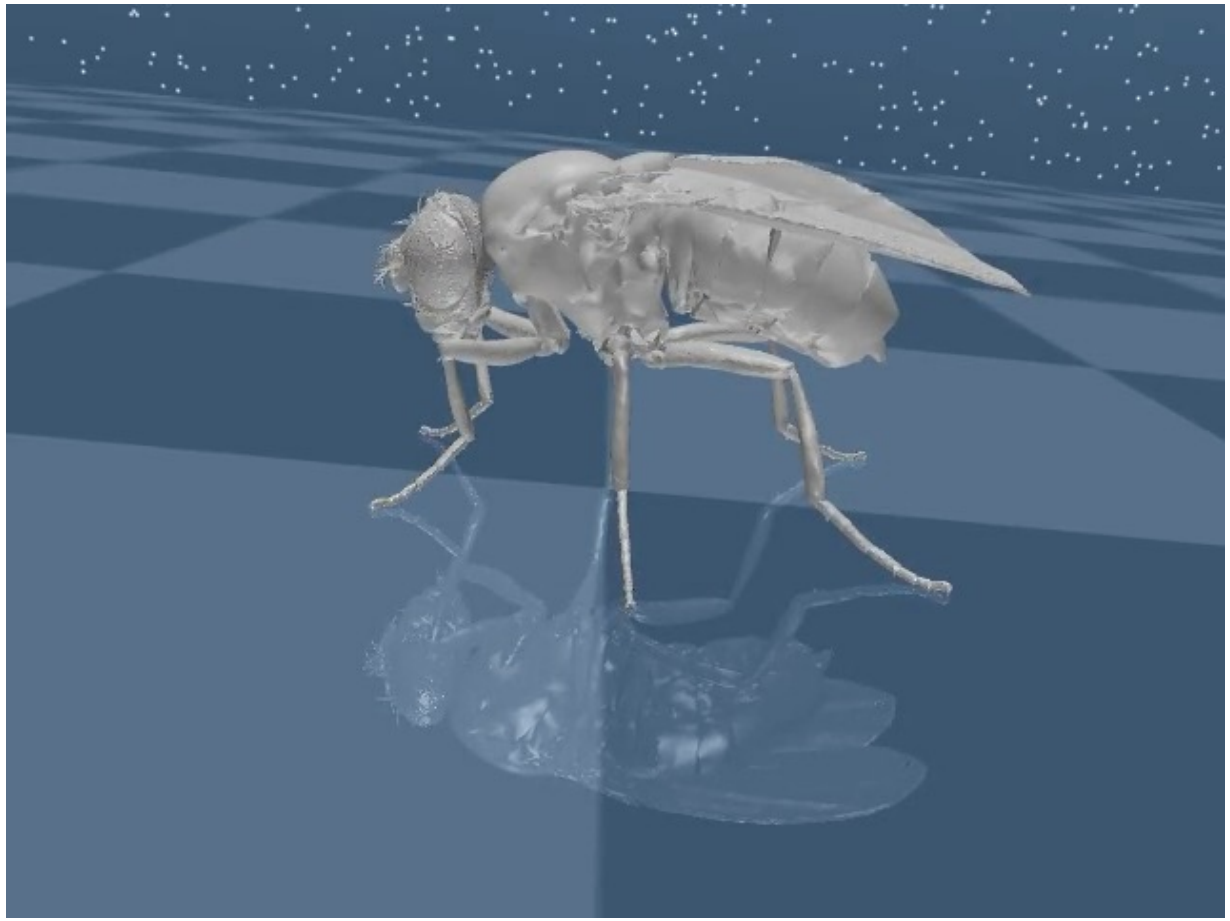

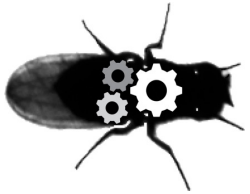

Todays tutorial: Principle

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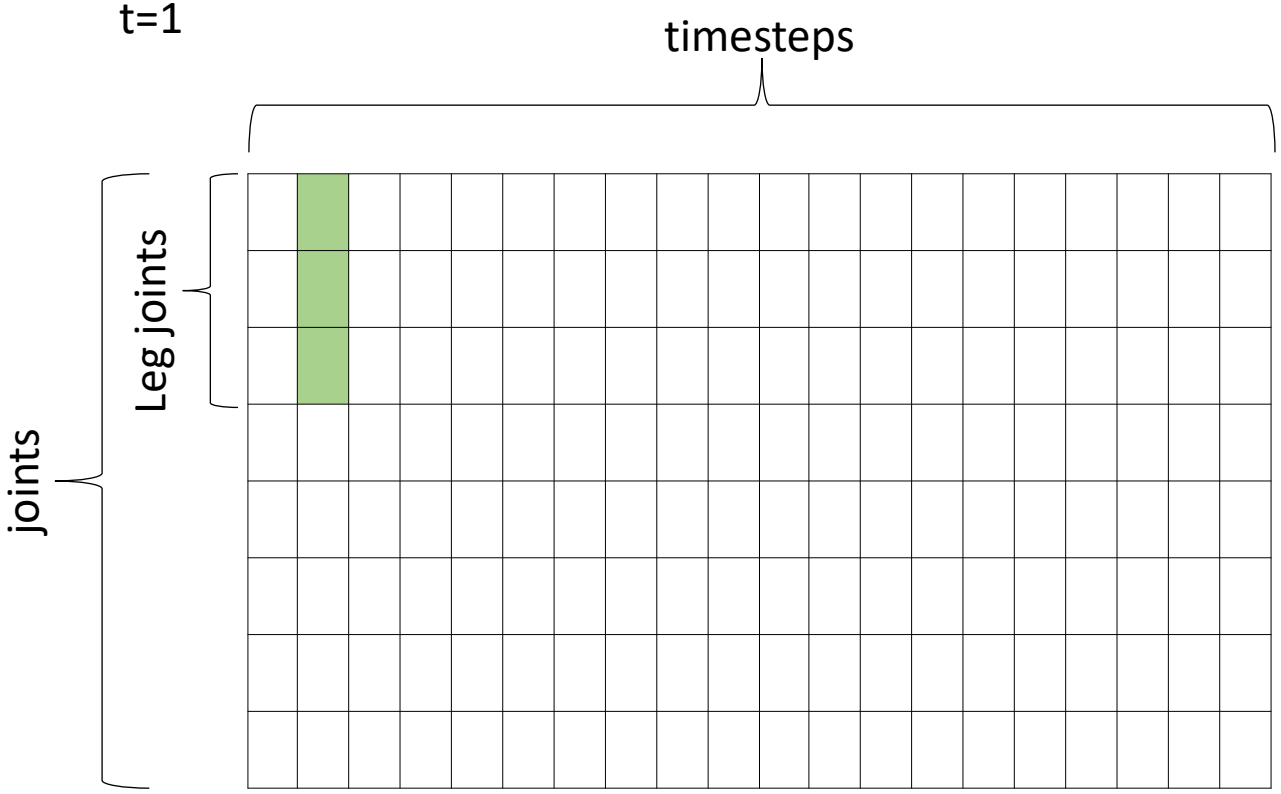

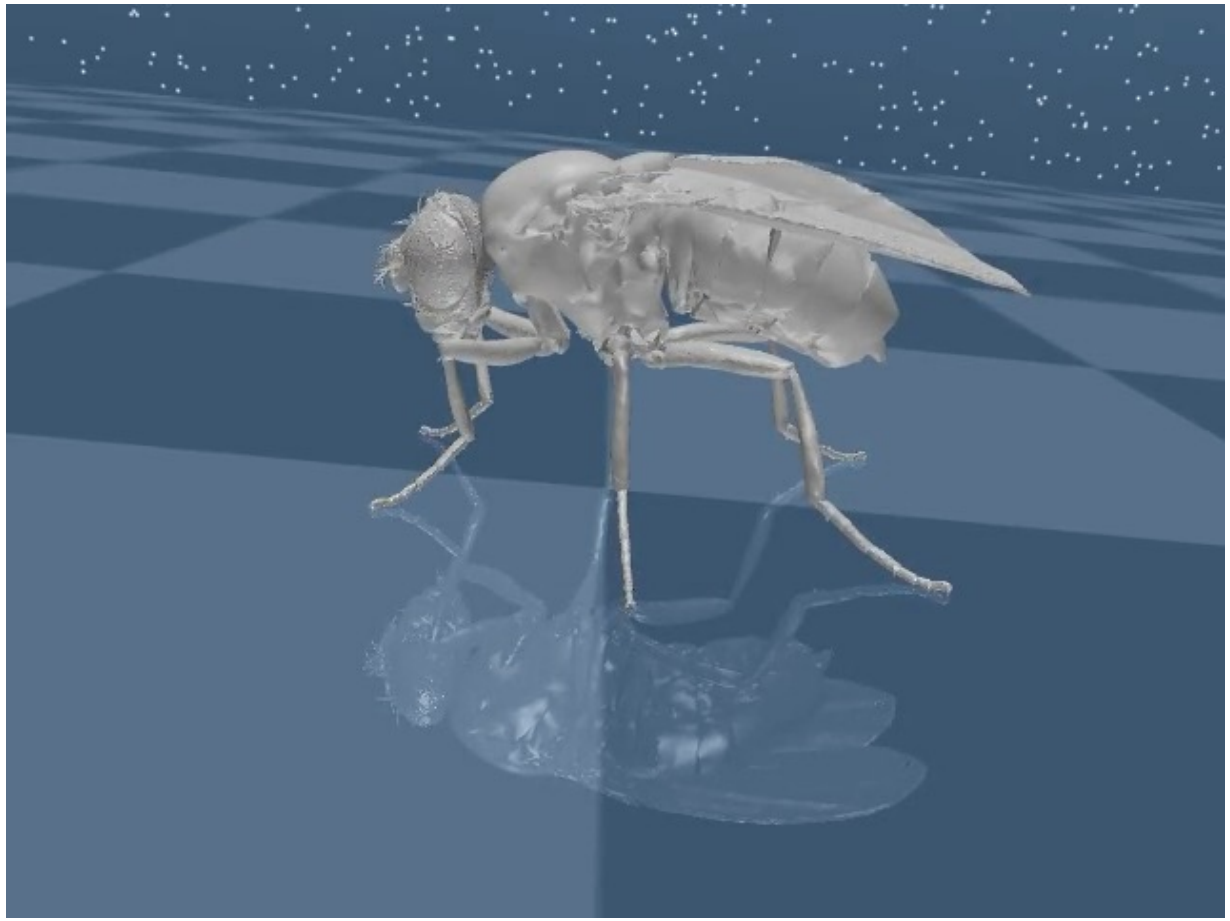

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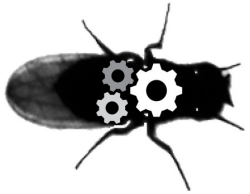

Todays tutorial: Principle

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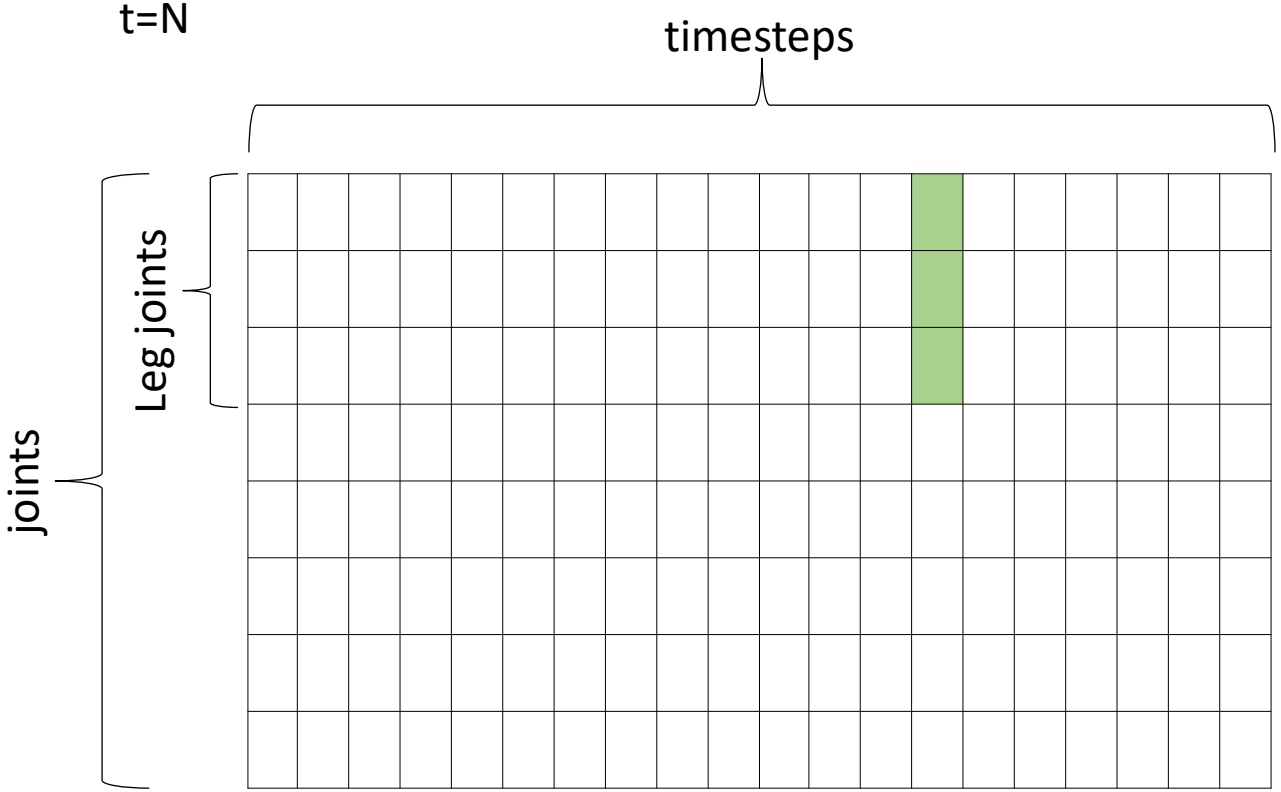
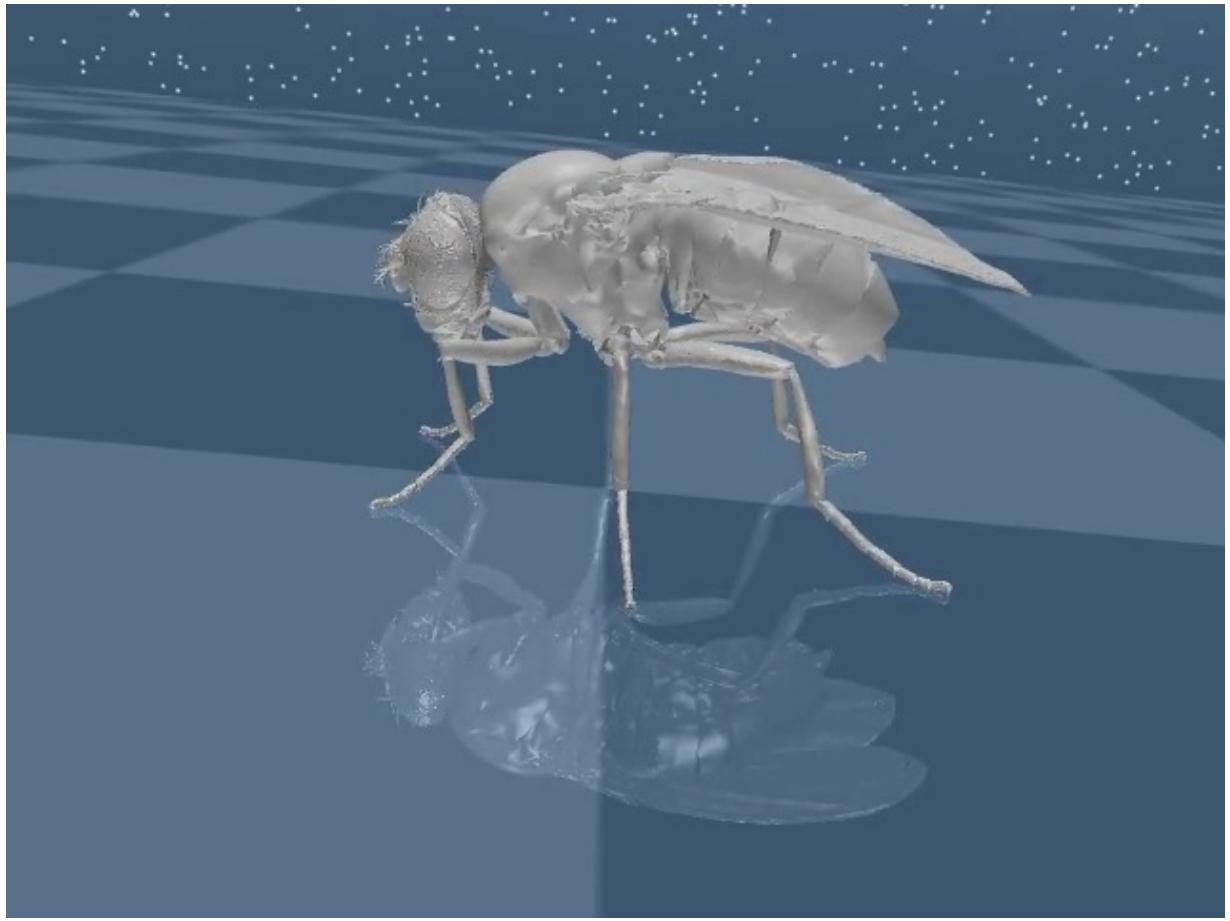
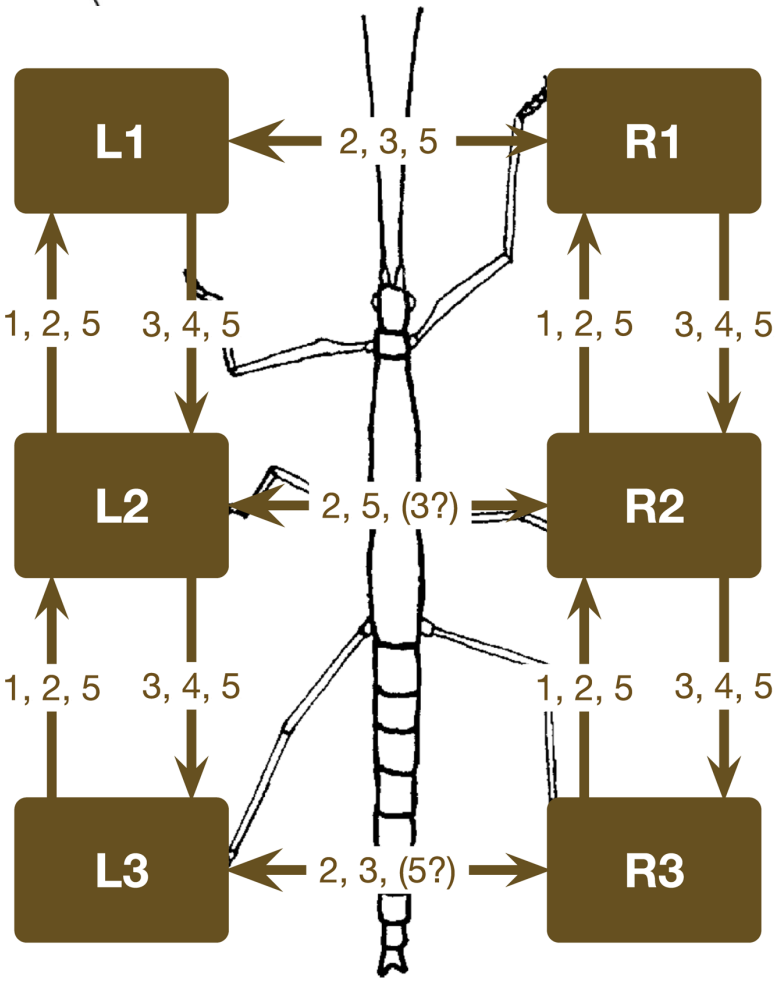




Todays tutorial: Principle



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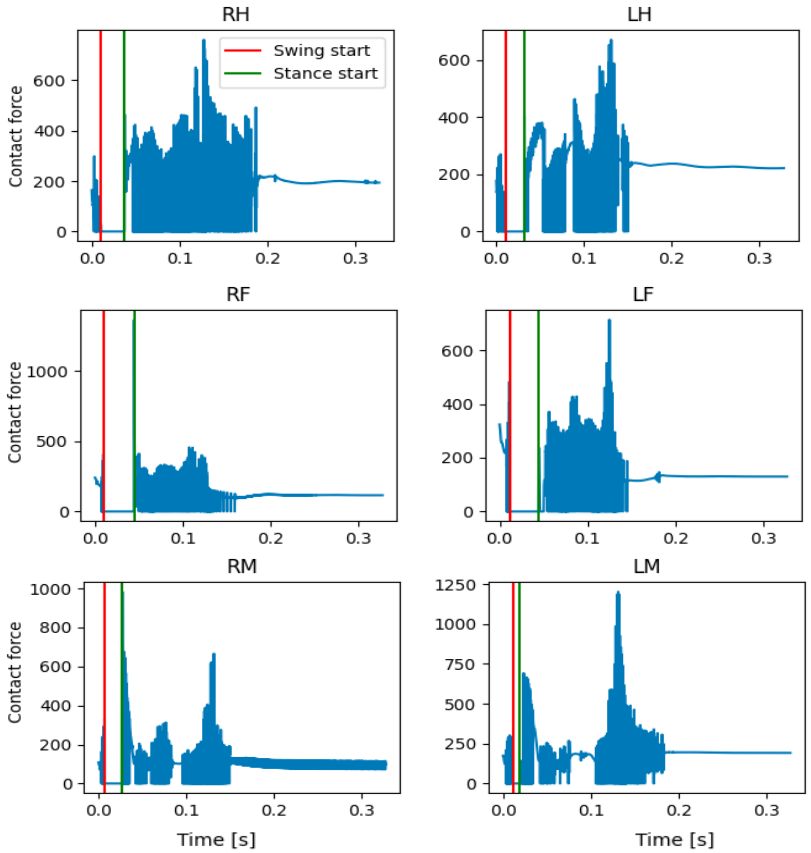

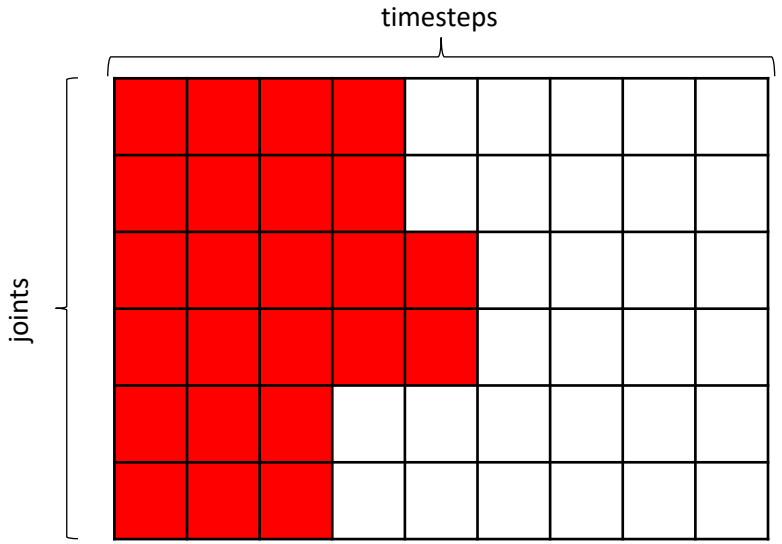

SWING INDEXES