Muscle synergies can be observed in the absence of a brain or spinal cord, and are not necessary to simplify control

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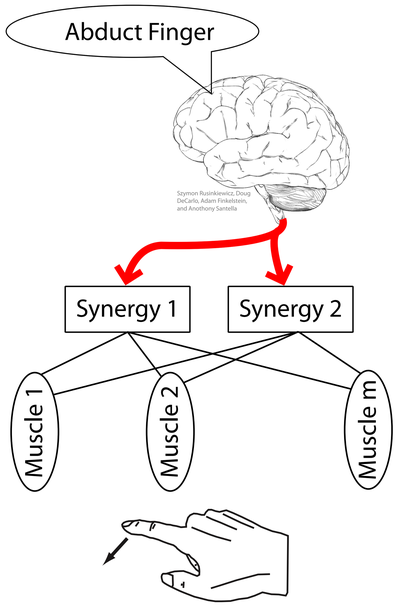
1. Are muscle synergies neural links?

Synergy hypothesis:
Brain interacts with synergies, not muscles[1,2,3]

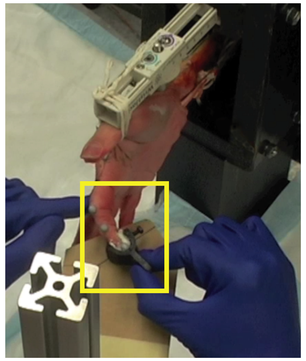
Supporting evidence:
Muscle activity does not vary independently[1,3]

Grounds for skepticism:
Task constraints may produce the appearance of muscle synergies, even without neural links[4,5]

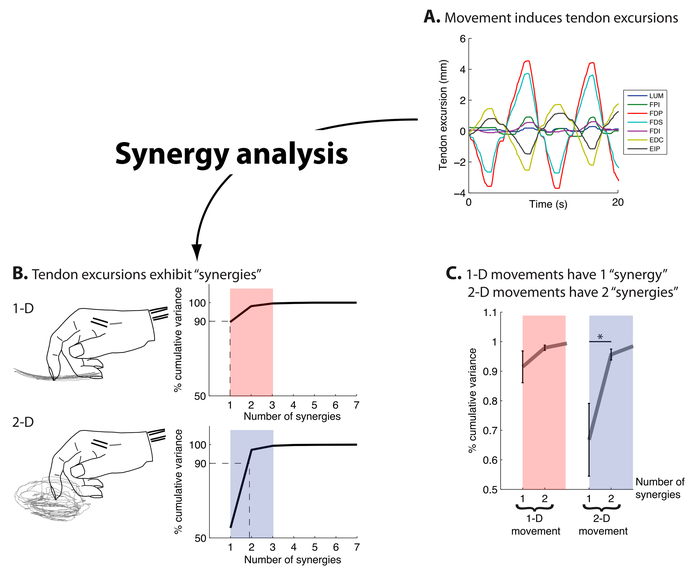


2. Disconnecting the brain from the body

Experimenter induces movement in a cadaver finger, while tendon excursions are measured



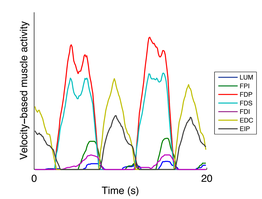
3. Movement induces muscle synergies

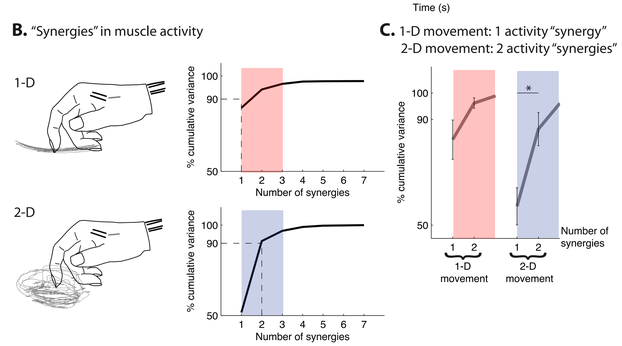


4. How do excursions relate to muscle activity?

No direct transformation, but if
- No eccentric contractions
- Activity proportional to shortening velocity

then synergies are still observed in muscle activity even though there are no neural links amongv muscles





5. Conclusion

The structural characteristics of the limb alone can explain the detection of muscle synergies.

These covariances in muscle activity, traditionally attributed to neural constraints, can arise from the biomechanical structure even when exploring the full workspace.

Acknowldegements
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References

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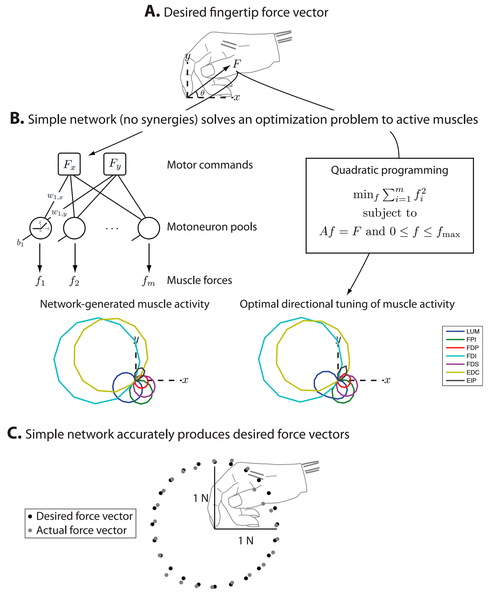
6. Why simplify when you can optimize?