Size-Weight Illusion: A Proof of Concept

Christopher Danford, Katie Jacobson, Peter Valentine, Mark Gumtang, Claire Schumock

Research Advisor: Andrew Meszaros,
Robin Dorociak

Size weight illusion (SWI)

- A person’s estimate of object weight changes from being size-based (anticipatory) to mass/density-based (experiential) after repeatedly lifting the object
- motor function adapts/corrects *independent* of conscious perception
- implications for rehab/task training

Hypotheses

- SWI will be present in full body squat with more force being produced through the lower extremity on the side that has the larger cube initially, with more vertical displacement of the large cube side as well
- Pre lift predictions will bias the larger cube, while post predictions will bias the smaller cube
- We also anticipate a larger vertical displacement on the side with the larger box following the fatigue protocol

Methods & Procedures

- **Consent of non-disclosure**

- **Variables that will be measured for each group include:**
    - Pre vs. post: left/right bar weight estimate (with VAS Box)
    - Max anterior and posterior excursion, max medial & lateral excursion, & total excursion
    - Trial #1 vs. #8: center of mass excursion
    - Trial #1 vs. #8: ground reaction force (left plate, right plate)
    - Trial #1 vs. #8: bar angle deviation from rest: max, at full stance, total accumulated during trial [when bar v = 0, then bar is at peak = change in rep cycle].

- **Assign squat pin height**

- **Emphasize importance of follow timing/rhythm of squat sequence & keep the bar level on the way up-and-down**

Pin Height #	Actual Height Range
7	5-2” to 5-6”
6	5-6” to 5-10”
5	5-10” to 6-2”
4	6-2” to 6-6”
3	6-6” to 6-10”

Squat Procedure

- Subject arrives and signs waiver, not told which group they are in (primed, unprimed, unprimed and fatigued)
- Reflective biomarkers applied to anatomical landmarks and subject is asked which box they believe is heavier if either using a visual analog sliding scale
- Subject squats with bar keeping a specific pre-instructed tempo and data is collected using motion capture technology
- “Keep looking straight forward at the target the entire time. Your goal is to keep the bar as level as possible and keep time with the metronome: 1 second up, pause for 1 second at the top, 2 seconds down, pause for 1 second and open your hands at the bottom to unweight the bar.”

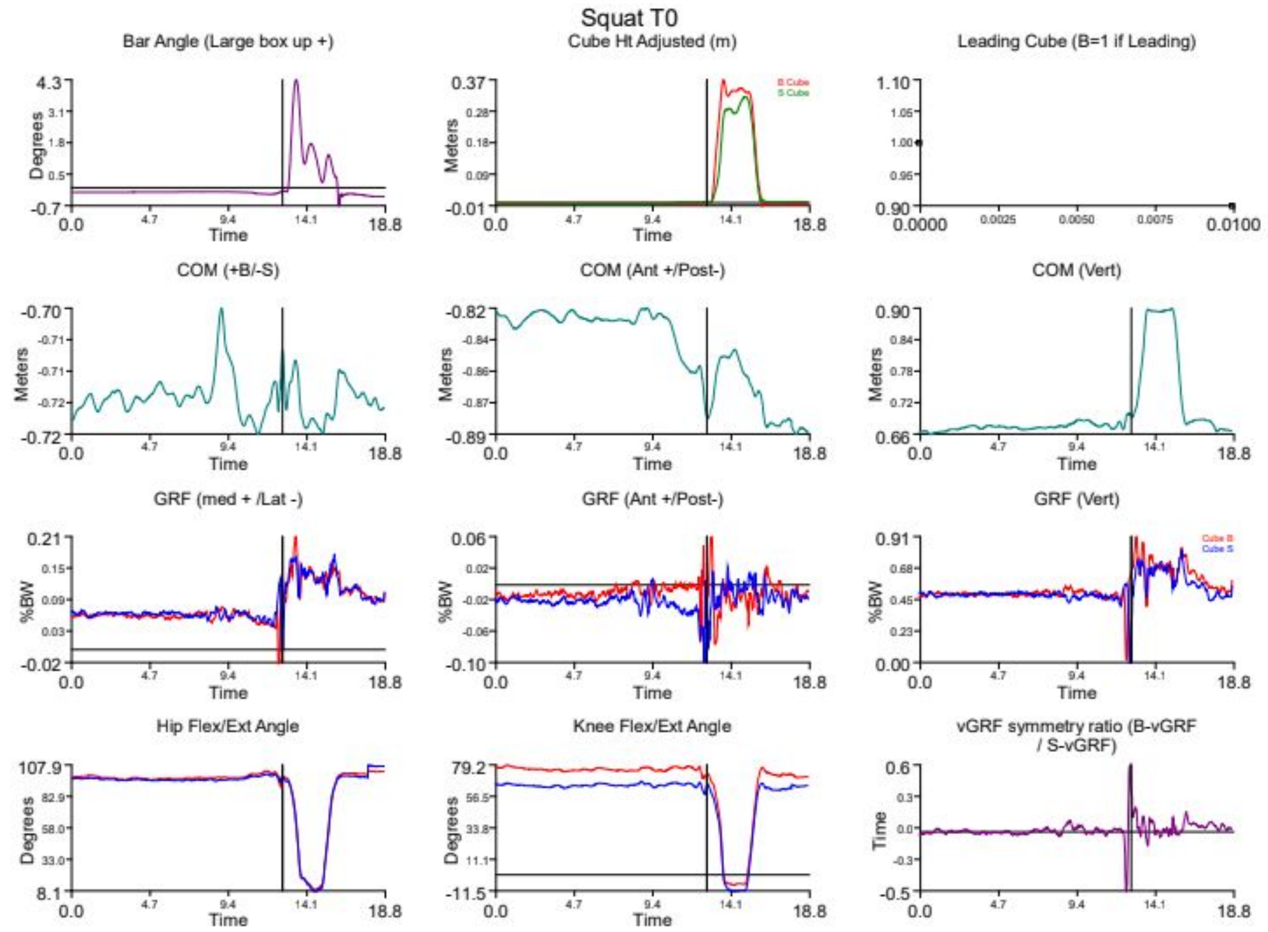
Fatigue Procedure

- "You will be doing leg extensions with your right leg following a metronome at a 1 second up, 1 second down tempo. You will do as many repetitions as possible until I tell you to stop."
- Weight: 20% of participants' bodyweight
- Stopping Criteria:
  1. 3 repetitions in a row with participants demonstrating inability to fully extend the right knee.

  OR

  2. 3 repetitions in a row with participants demonstrating inability to maintain metronome cadence.

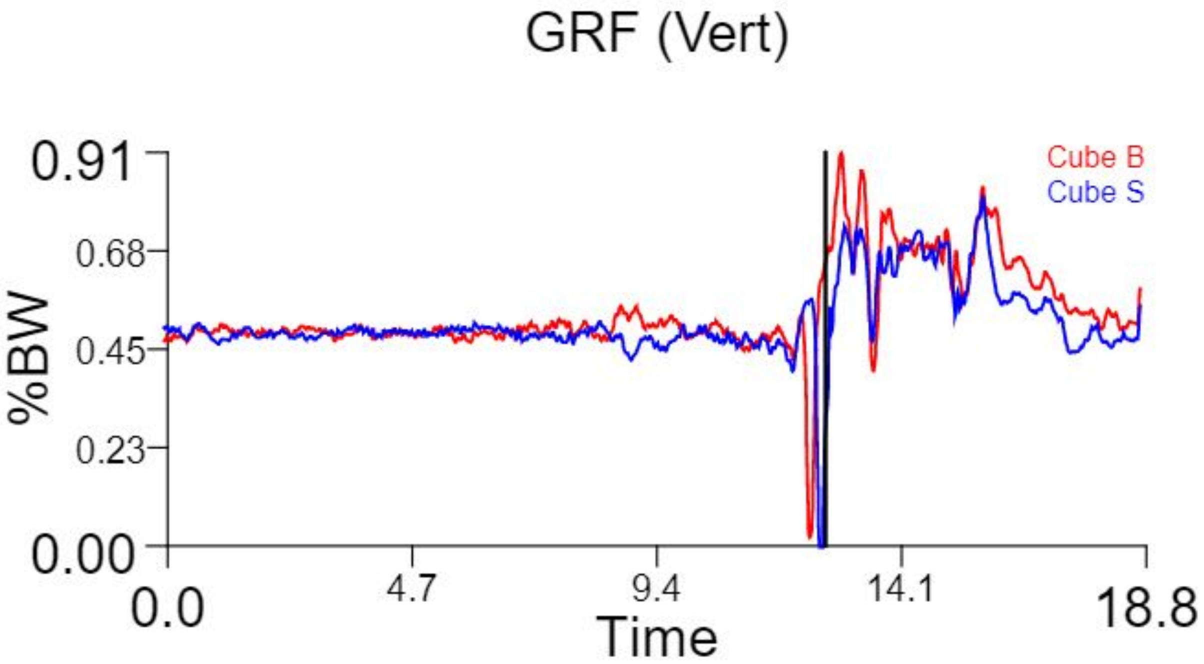
Results!



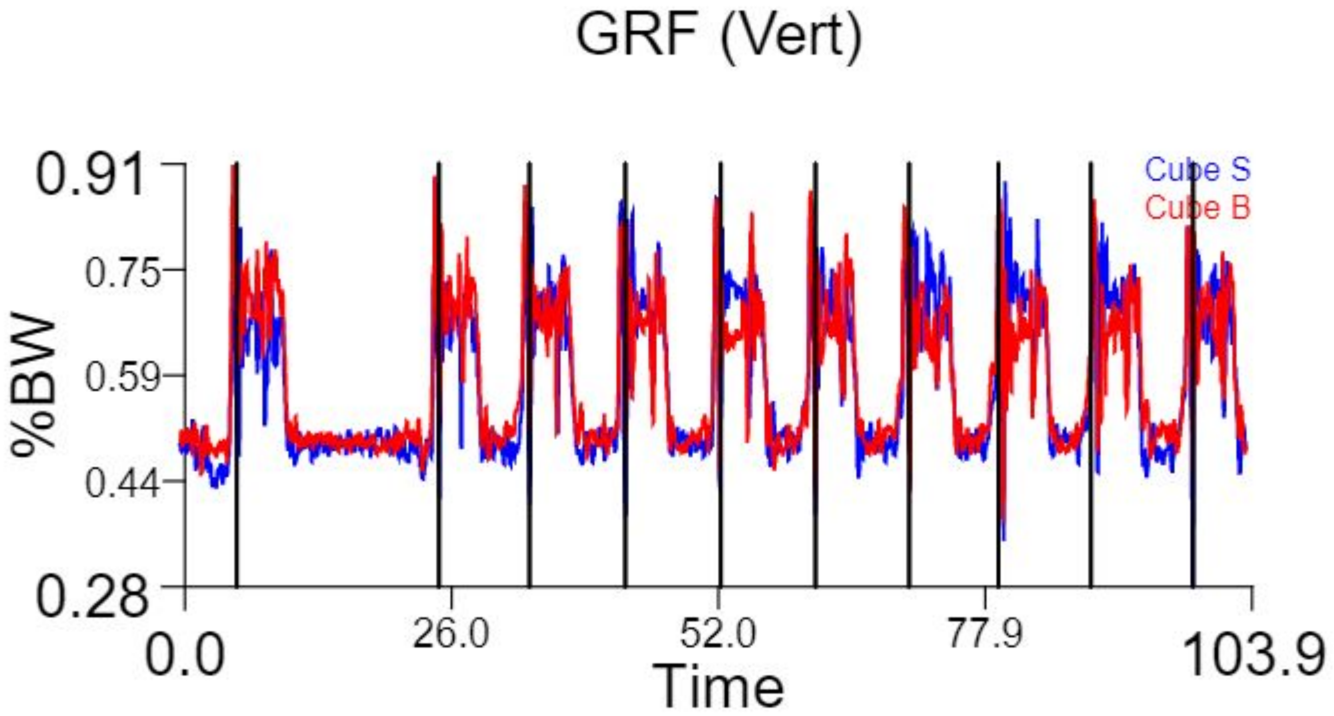
Squat T0
Bar Angle (Large box up +)
Cube Ht Adjusted (m)
Leading Cube (B=1 if Leading)
COM (+B/-S)
COM (Ant +/Post-)
COM (Vert)
GRF (med + /Lat -)
GRF (Ant +/Post-)
GRF (Vert)
Hip Flex/Ext Angle
Knee Flex/Ext Angle
vGRF symmetry ratio (B-vGRF / S-vGRF)
Degrees
Meters
%BW
Time

Preliminary data

(Single Trial)



Repeated Trial



Resources

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Questions ?