




Dynamic Stability in Healthy Elderly

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Falling Is Bad...

- 1/3rd (~12 million) elderly fall each year
 - (Fuller '00; www.census.gov)
- Primary cause of death and contribute to 90% of all hip fractures in the elderly
 - (Fuller '00; Sterling '01)
- The costs of fall-related injuries could reach **\$44 billion** by 2020 (in the US)
 - (Englander '96; Rizzo '98; www.cdc.gov/ncipc/)

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What Contributes To Falls?...

- Elderly often walk slow... This may predict fall risk
 - (Alexander et al '96; Luukinen et al '95; Bergland et al '03)
- Possibly due to loss of strength or flexibility?
 - (Burnfield et al '00; DeVita & Hortobagyi '00; Kerrigan et al '01)
- Possibly a pro-active strategy to *improve* stability?
 - (Shkuratova et al '04; Dingwell et al '00 & '06; England & Granata '07)
- Walking faster increases risk of tripping / falling:
 - (Berg et al '97; Pavol et al '99; van den Bogert et al '02)

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Questions:

- Are elderly more locally and/or orbitally unstable than healthy young adults?
 - (Hurmuzlu '96; Dingwell & Cusumano '00)
- How does this depend on walking speed?
 - (Dingwell & Marin '06; England & Granata '07)
- Are differences predicted by loss of strength and/or flexibility in the elderly?
 - (Burnfield et al '00; Kerrigan et al '01)

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Subjects:

	Young Adults	Older Adults	p-value
Gender (M/F)	12 / 5	12 / 6	0.80
Age (years)	23.3 ± 2.6	72.1 ± 6.0	<0.0001
Height (m)	1.73 ± 0.094	1.70 ± 0.104	0.36
Body Mass (kg)	71.1 ± 9.86	73.2 ± 12.3	0.58
Body Mass Index (BMI)	23.5 ± 1.7	25.4 ± 3.2	0.07
Composite Strength score	3.07 ± 3.71	-4.29 ± 2.35	<0.0001
Composite ROM score	1.89 ± 1.81	-2.03 ± 2.78	<0.0001
Preferred Walking Speed (m/s)	1.30 ± 0.10	1.29 ± 0.15	0.86

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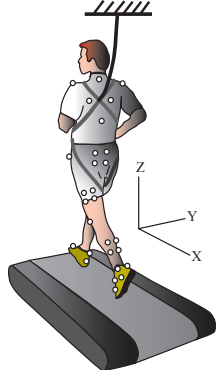


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Experiment:


- Subjects walked at 5 speeds:
 - 80% × PWS
 - 90% × PWS
 - 100% × Preferred Walking Speed (PWS)
 - 110% × PWS
 - 120% × PWS
- Two 5-min trials @ each speed
- Trunk & leg kinematics recorded using Vicon 612

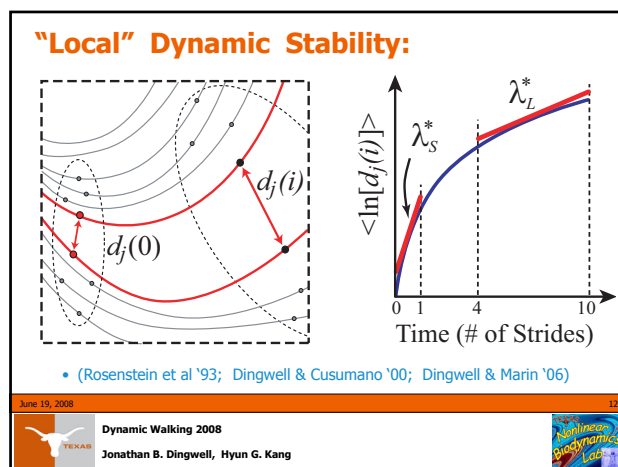
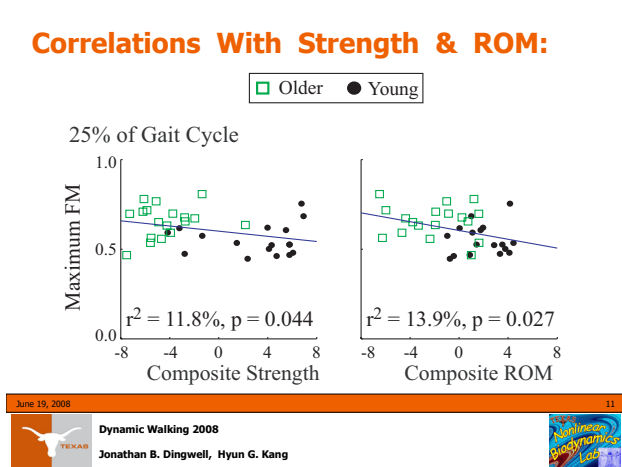
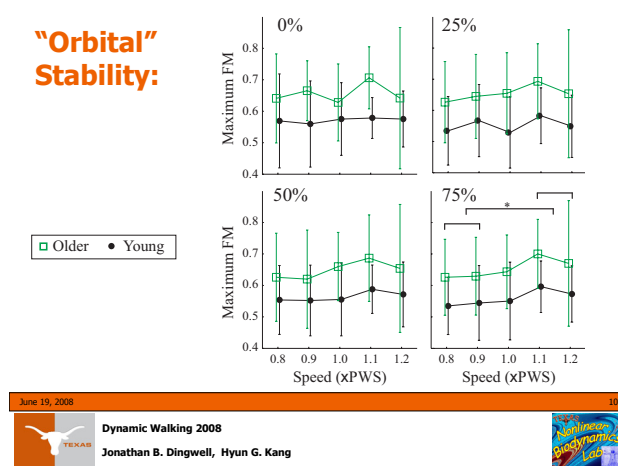
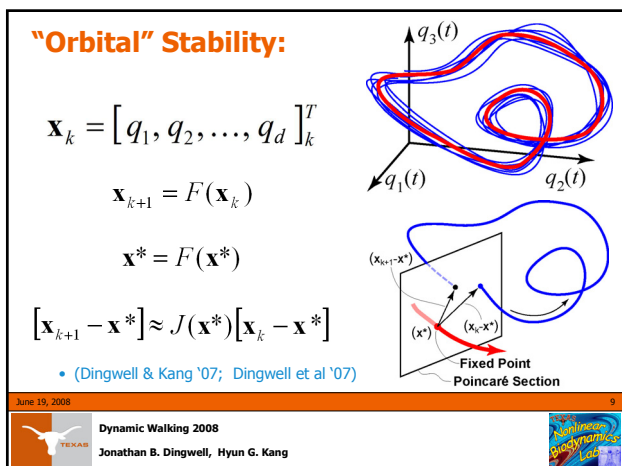
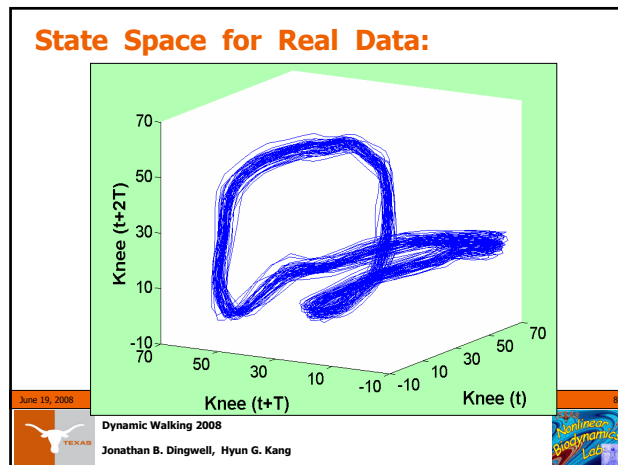
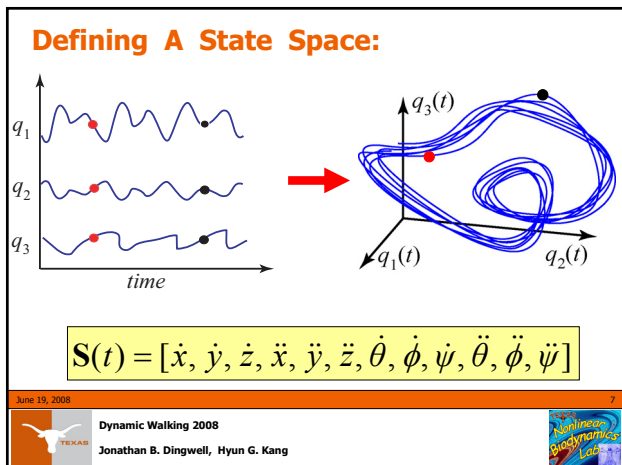


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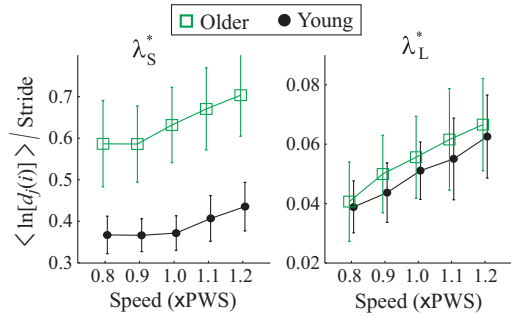


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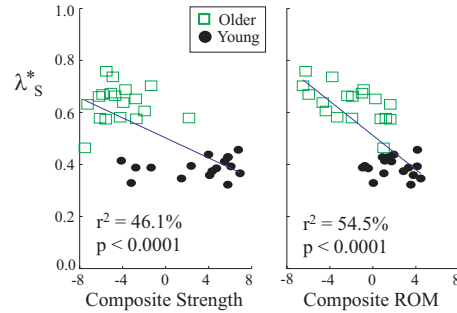


"Local" Dynamic Stability:



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Correlations With Strength & ROM:



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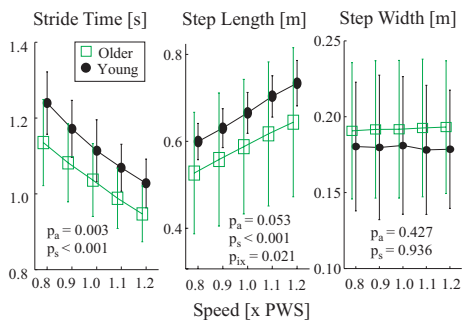
Summary / Conclusions...

- Elderly were more locally *and* orbitally unstable, regardless of walking speed...
- Slower walking speeds led to decreased instability in both groups, despite increased variability...
- Differences remained, even after accounting for differences in strength and ROM...
- **Go see Patrisha McAndrew's Poster !!**

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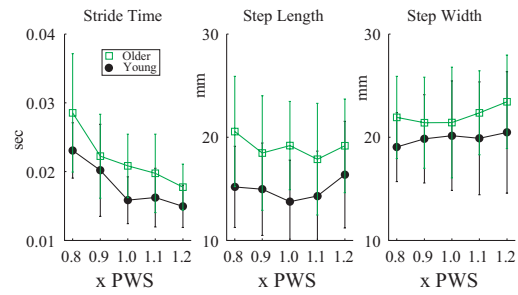


Basic Stride Parameters:



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Variability in Stride Parameters:



• (Dingwell & Kang, *Gait & Posture*, 2008)

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