3D Static Strength Prediction Program (3DSSPP)

Occupational Health Clinics for Ontario Workers Inc.
Centres de santé des travailleurs (ses) de l'Ontario Inc.

Why use 3DSSPP?

- To analyze a single lift, push or pull
- To estimate strength requirements
- To estimate back compression forces
- To evaluate reach or posture requirements
- To evaluate worker balance
- To evaluate floor traction requirements

What does the program require?

- Manipulation of a body segment
- Knowledge of the load lifted, push, pulled, etc.
- Can place a picture in the background to mimic a posture for a particular job.

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File Task-Input Display 3-Views Oblique-View Reports About

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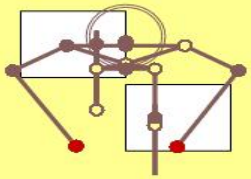

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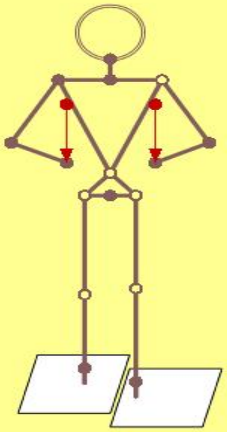

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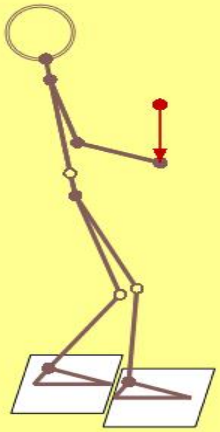

Untitled Task

Status - Untitled Task

Anthropometry
Gender: Male, Percentile: 50th
Ht (in): 69.1, Wt (lb): 176.4

Hand Forces (lb)
Left: 10 Right: 10

Hand Locations (in)

	Left	Right
Horizontal:	9.8	9.6
Vertical:	39.7	39.7
Lateral:	-6.2	6.0

3D Low back Compression (lb):

L4/L5: 135

Strength Percent Capable (%)

Elbow:	99
Shoulder:	99
Torso:	99
Hip:	96
Knee:	84
Ankle:	99

Balance: Acceptable
Coef. of Friction: ---

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Ready

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Proper lifting

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File Task-Input Display 3-Views Oblique-View Reports About

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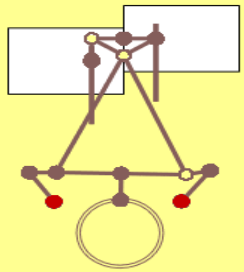

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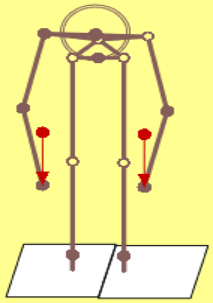

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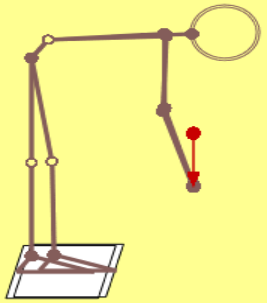


Untitled Task

Status - Untitled Task

Anthropometry
Gender: Male, Percentile: Data Entry
Ht (cm): 193.0, Wt (Kg): 99.8

Hand Forces (N)
Left: 66.7 Right: 66.7

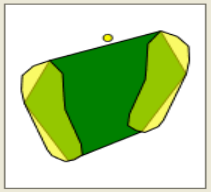
Hand Locations (cm)

	Left	Right
Horizontal:	57.3	57.4
Vertical:	40.1	41.1
Lateral:	-17.5	21.2

3D Low back Compression (N):
L4/L5: 3804

Strength Percent Capable (%)

Elbow:	99
Shoulder:	99
Torso:	83
Hip:	56
Knee:	29
Ankle:	30



Balance: Unacceptable
Coef. of Friction: ---

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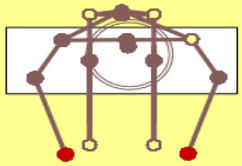

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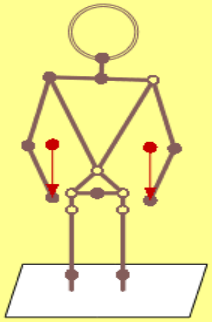

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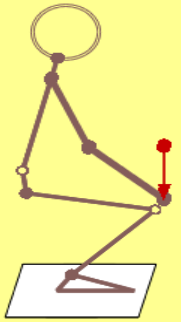

Untitled Task

Status - Untitled Task

Anthropometry
Gender: Male, Percentile: Data Entry
Ht (cm): 193.0, Wt (Kg): 99.8

Hand Forces (N)
Left: 66.7 Right: 66.7

Hand Locations (cm)

	Left	Right
Horizontal:	35.0	35.3
Vertical:	42.6	43.9
Lateral:	-20.1	17.0

3D Low back Compression (N):
L4/L5: 2784

Strength Percent Capable (%)

Elbow:	99
Shoulder:	98
Torso:	98
Hip:	95
Knee:	16
Ankle:	99

Balance: Acceptable
Coef. of Friction: ---

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File Task-Input Display 3-Views Oblique-View Reports About

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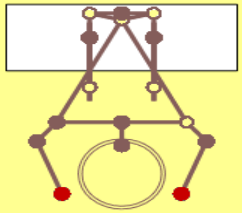

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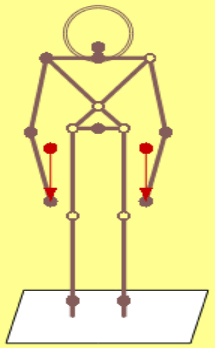

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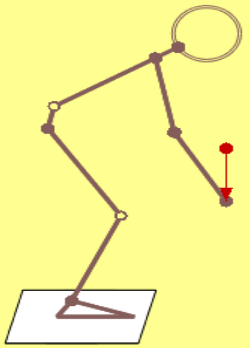

Untitled Task

Status - Untitled Task

Anthropometry
Gender: Male, Percentile: Data Entry
Ht (cm): 193.0, Wt (Kg): 99.8

Hand Forces (N)
Left: 66.7 Right: 66.7

Hand Locations (cm)

	Left	Right
Horizontal:	58.8	58.8
Vertical:	54.4	54.4
Lateral:	-18.1	18.1

3D Low back Compression (N):
L4/L5: 4079

Strength Percent Capable (%)

Elbow:	99
Shoulder:	99
Torso:	86
Hip:	79
Knee:	99
Ankle:	83

Balance: Acceptable
Coef. of Friction: ---

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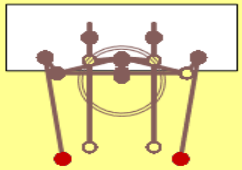

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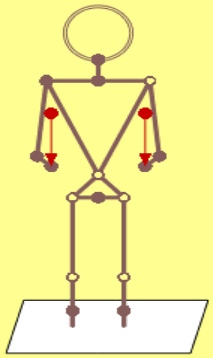

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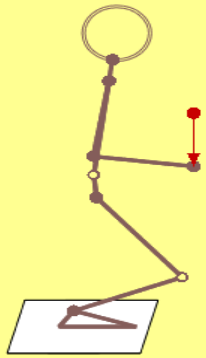

Untitled Task

Status - Untitled Task

Anthropometry
Gender: Male, Percentile: Data Entry
Ht (cm): 193.0, Wt (Kg): 99.8

Hand Forces (N)
Left: 66.7 Right: 66.7

Hand Locations (cm)

	Left	Right
Horizontal:	45.6	45.6
Vertical:	75.6	75.6
Lateral:	-17.9	17.9

3D Low back Compression (N):
L4/L5: 1678

Strength Percent Capable (%)

Elbow:	99
Shoulder:	99
Torso:	99
Hip:	97
Knee:	74
Ankle:	91

Balance: Acceptable
Coef. of Friction: ---

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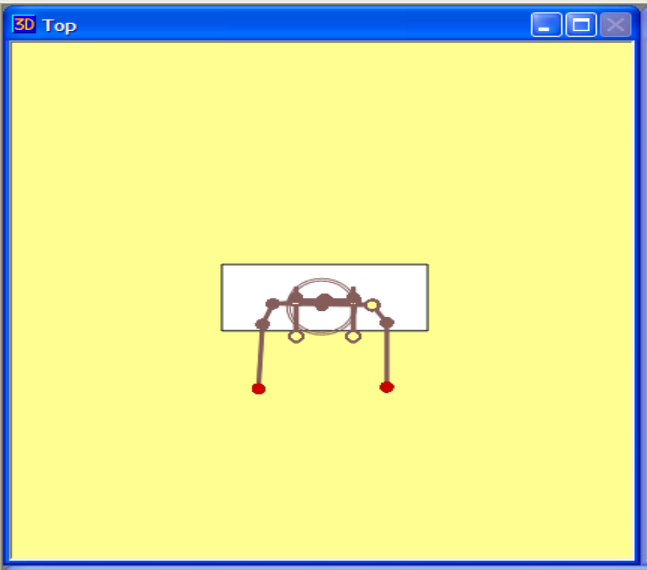
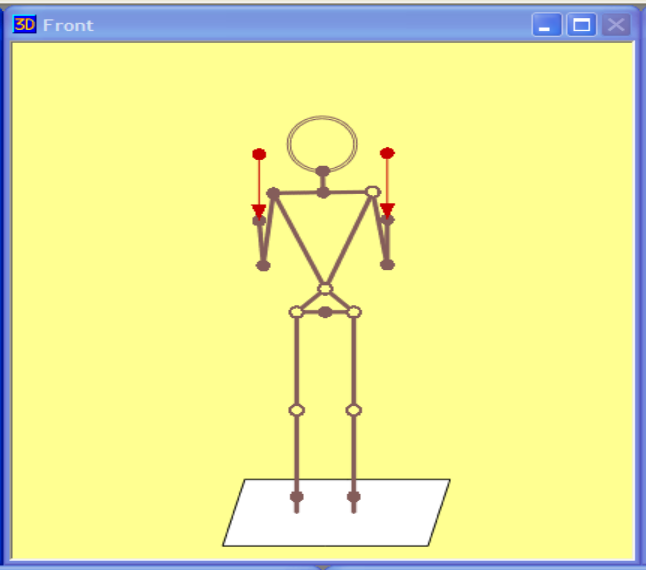
Individual Case

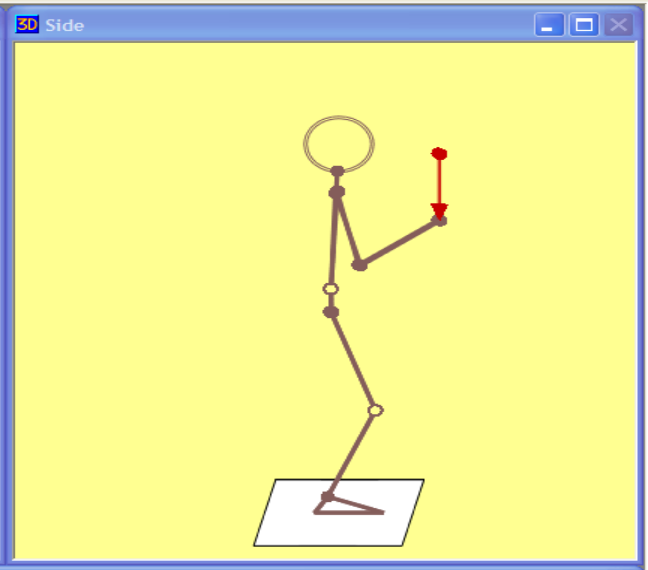
- 63 year old woman
- Previous history of back pain and has degenerative disc disease in the lumbar spine with spondylolisthesis
- Injury: Lifting a large pot from a stove to a walk in cooler (to the floor)
  - Weight: 36 lbs (~16.4 kg)
  - Distance of 18 feet (~7 m)

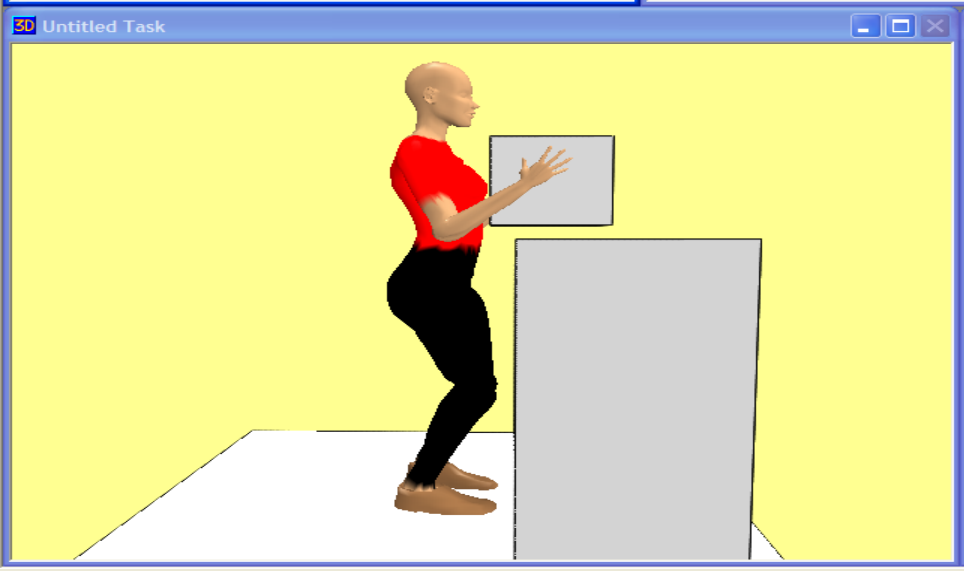
Univ. of Michigan's 3DSSPP 5.0.6 - Mrs. P - lifting pot off stove.tsk*

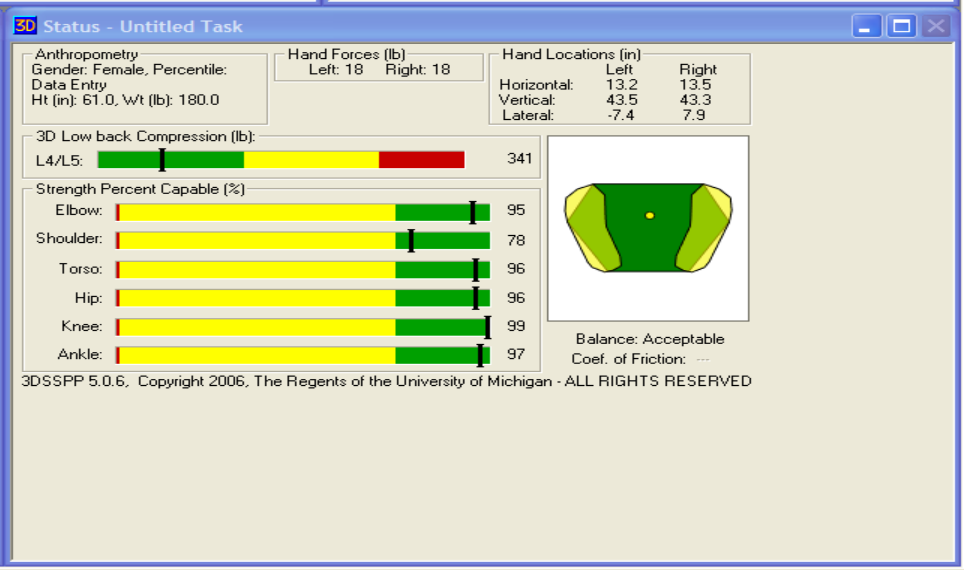
File Task-Input Display 3-Views Oblique-View Reports About











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Univ. of Michigan's 3DSSPP 5.0.6 - Mrs. P - lifting pot to floor 2.tsk*

File Task-Input Display 3-Views Oblique-View Reports About

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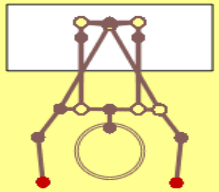

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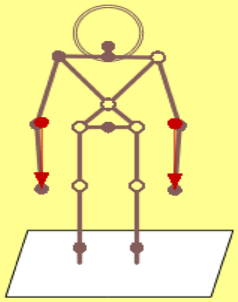

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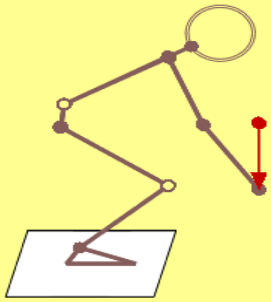

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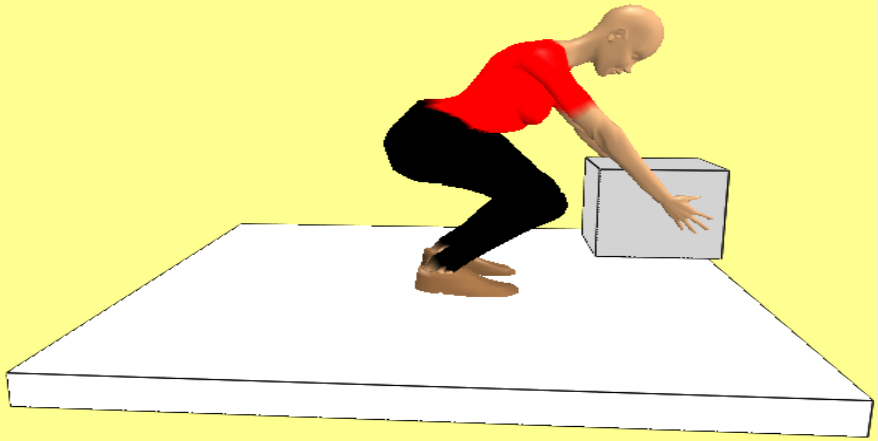

Status - Untitled Task

Anthropometry
Gender: Female, Percentile: Data Entry
Ht (cm): 154.9, Wt (Kg): 81.6

Hand Forces (N)
Left: 80.07 Right: 80.07

Hand Locations (cm)

	Left	Right
Horizontal:	54.6	54.4
Vertical:	27.8	28.3
Lateral:	-20.3	20.3

3D Low back Compression (N):
L4/L5: 4084

Strength Percent Capable (%)

Elbow:	99
Shoulder:	86
Torso:	82
Hip:	66
Knee:	98
Ankle:	67

Balance: Unacceptable
Coef. of Friction: ---

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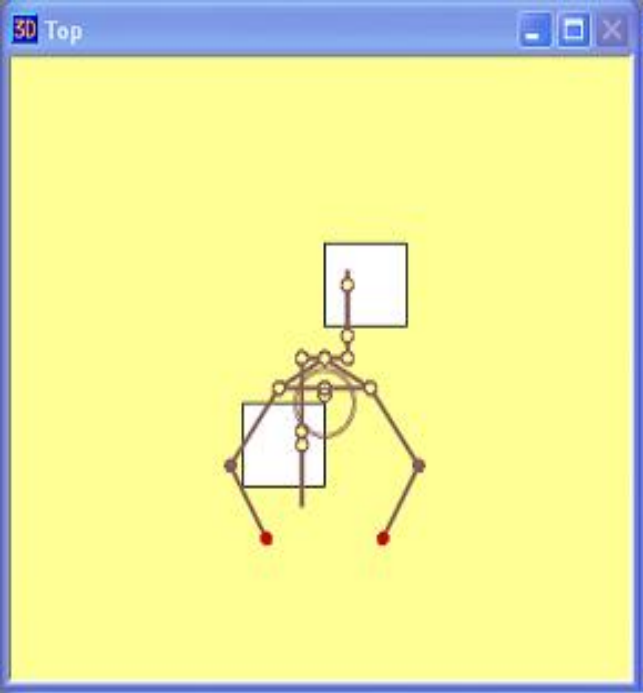
Ready

Shoulder Pain

- 55 year old man
- Shoulder strain
- Lifting 51 lbs overhead for majority of day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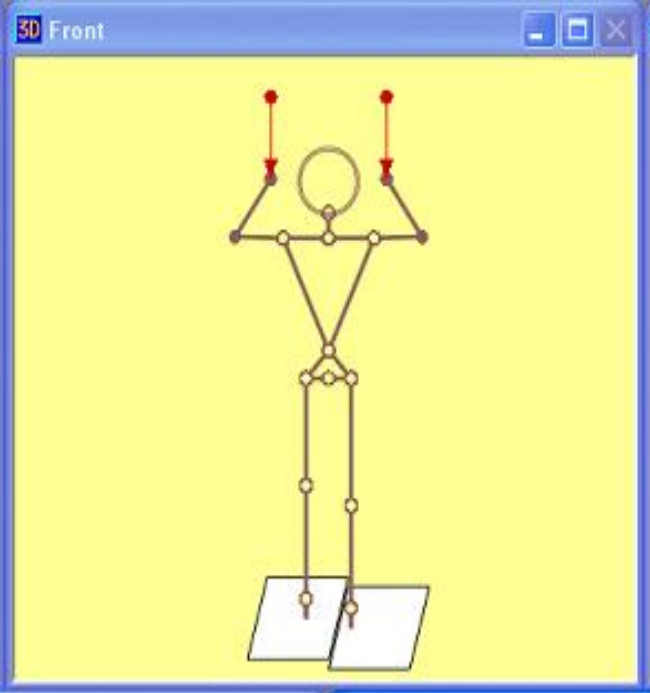
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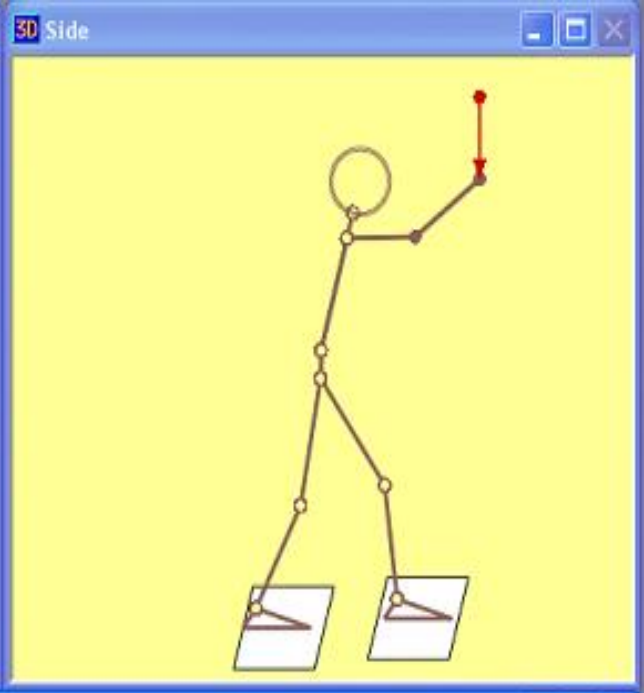
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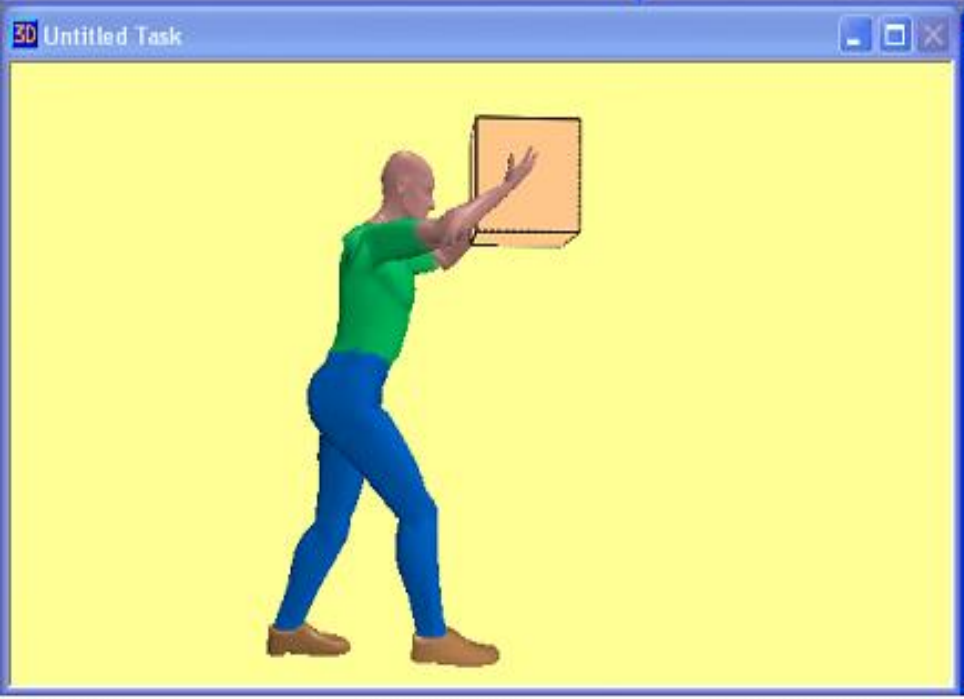
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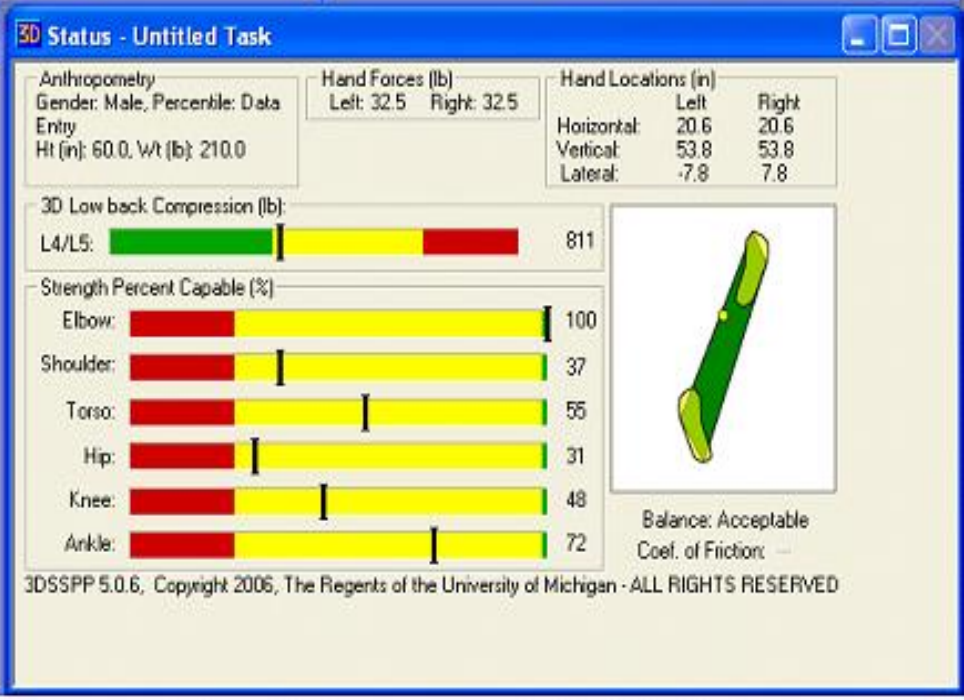
Status - Untitled Task
Anthropometry
Gender: Male, Percentile: Data Entry
Ht (in): 60.0, Wt (lb): 210.0
Hand Forces (lb)
Left: 32.5 Right: 32.5
Hand Locations (in)
Left Right
Horizontal: 20.6 20.6
Vertical: 53.8 53.8
Lateral: -7.8 7.8
3D Low back Compression (lb):
L4/L5: 811
Strength Percent Capable (%)
Elbow: 100
Shoulder: 37
Torso: 55
Hip: 31
Knee: 48
Ankle: 72
Balance: Acceptable
Coef. of Friction:
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Prevention

- Can be used to assess lifting tasks and the effect on the back or other body segments

Assumed Posture															
Weight Lifted	80 lbs	60 lbs	40 lbs	80 lbs	60 lbs	40 lbs	80 lbs	60 lbs	40 lbs	80 lbs	60 lbs	40 lbs	80 lbs	60 lbs	40 lbs
% Capable	8	43	85	18	58	90	21	61	91	11	48	87	26	66	93

Occupational Health Clinics for Ontario Workers Inc.

Centres de santé des travailleurs (ses) de l'Ontario Inc.

Positive Aspects

- Risk of back injury quantified from a single number (compression or moment)
- Strength requirements at all major body joints estimated
- TLVs based on measured human tissue tolerance
- Versatile in type of tasks analyse (i.e. lifting, lowering, pushing, pulling):
- Consider effects of
  - Direction and magnitude of the external force
  - Asymmetrical postures
  - Worker can be partially supported (e.g. Leaning on table – Note: you need to measure this force)
  - Specific to weight, height, sex of worker or to a specific population percentile
  - Accounts for twist and lateral bending
  - Predicts values which can be compared to NIOSH standards

Limitations

- Static assumption is used, therefore dynamic movement is not considered.
- Single acute not repetitive lifts. Fatigue not accounted for in this approach.
- TLVs for disc compression same for men and women.
- Can only be used on static positions
- Disc failure is the major component in establishing TLV
- Tissue load tolerance data sparse