

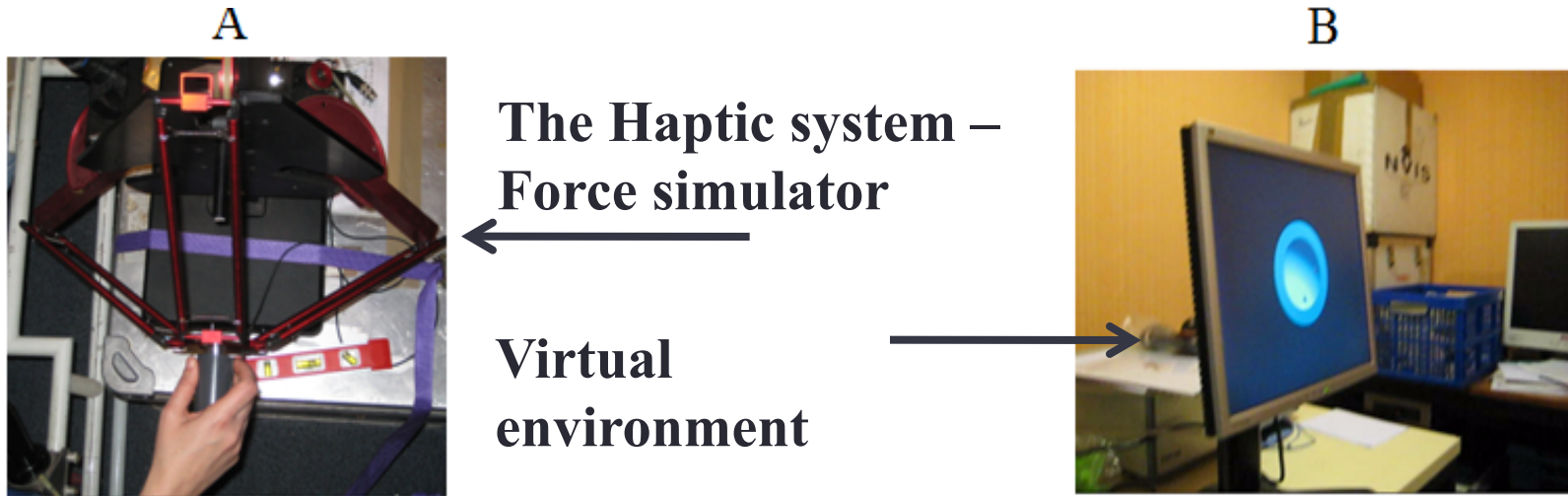
UNDERSTANDING HUMAN SKILLS

Joe McIntyre

Health Division

Tecnalia Research and Innovation

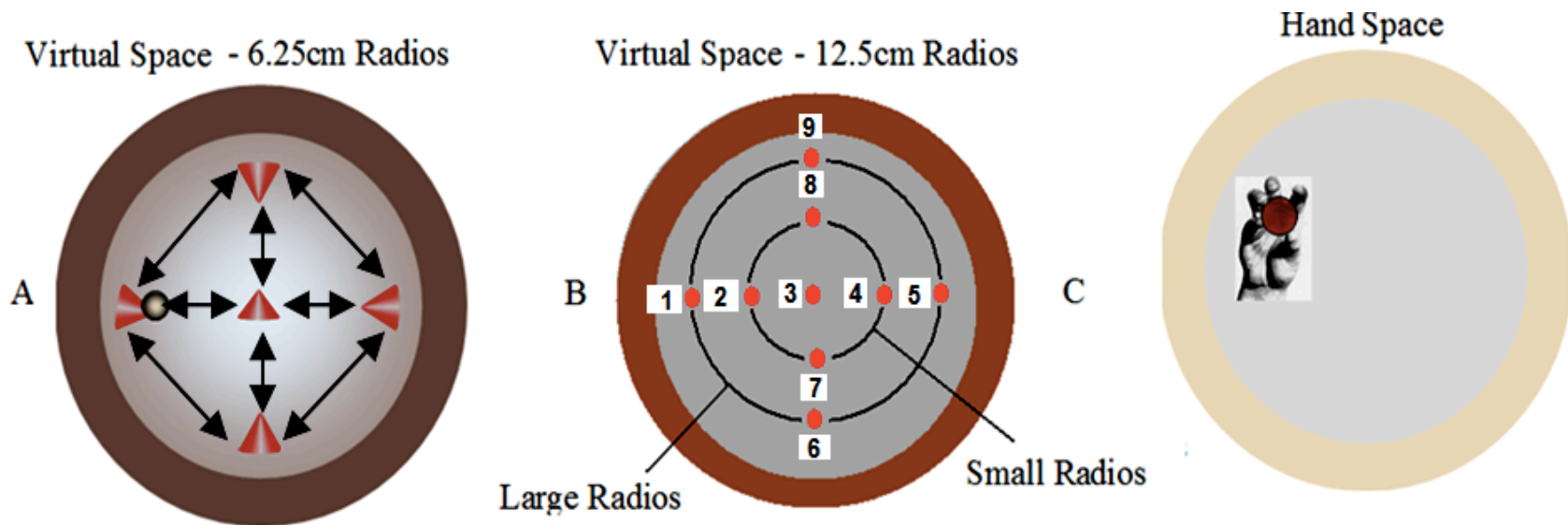
Constrained Motion on Curved Surfaces



- 11 subjects, aged 23-55.
- A total of **3300** movements were recorded.

Constrained Motion on Curved Surfaces

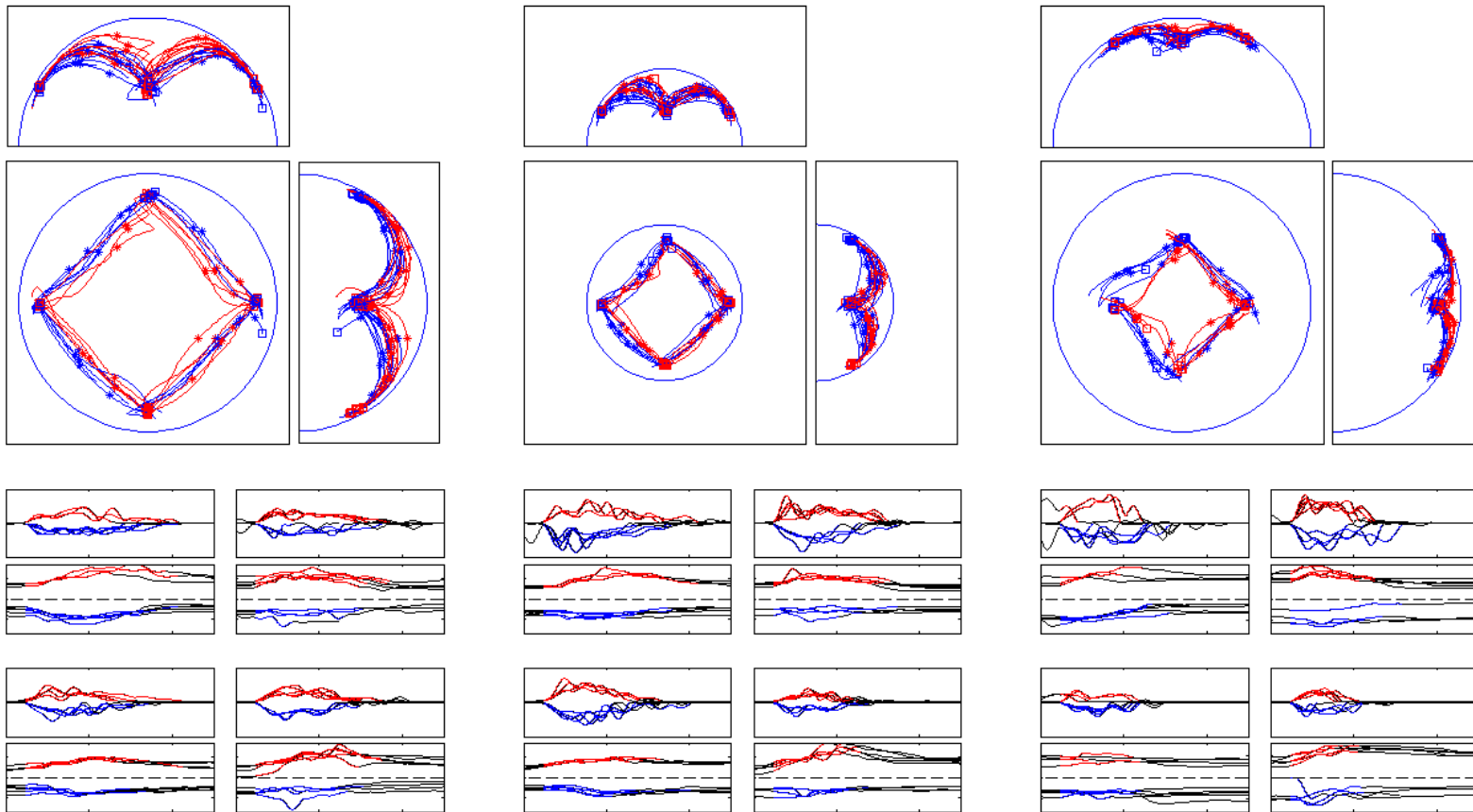
Task Description



Berman, S., Liebermann, D. G., & McIntyre, J. (2014).
 Constrained motion control on a hemispherical surface: path planning.
Journal of Neurophysiology, 111(5), 954-968.

Constrained Motion on Curved Surfaces

Results

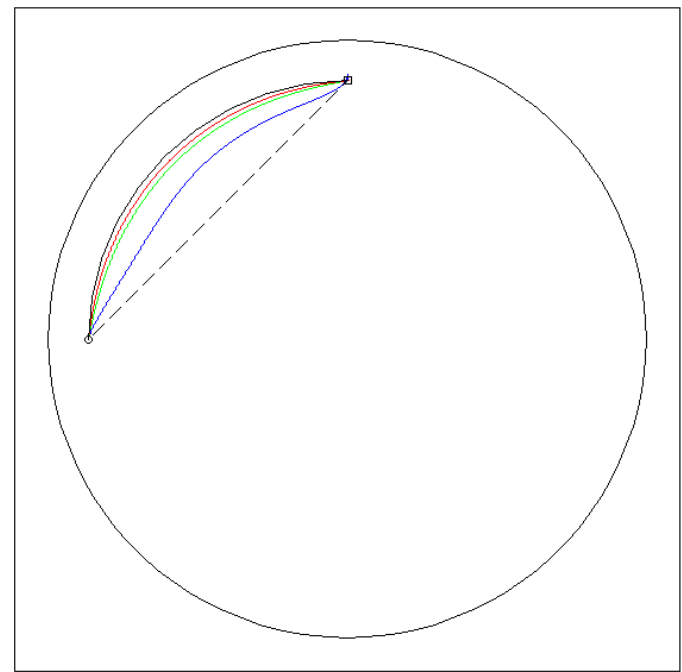


Constrained Motion on Curved Surfaces

Hypothetical Control Policy

- Straight line in visual space
- Hybrid control
- Incorrect estimate of surface normal (aligned in depth)

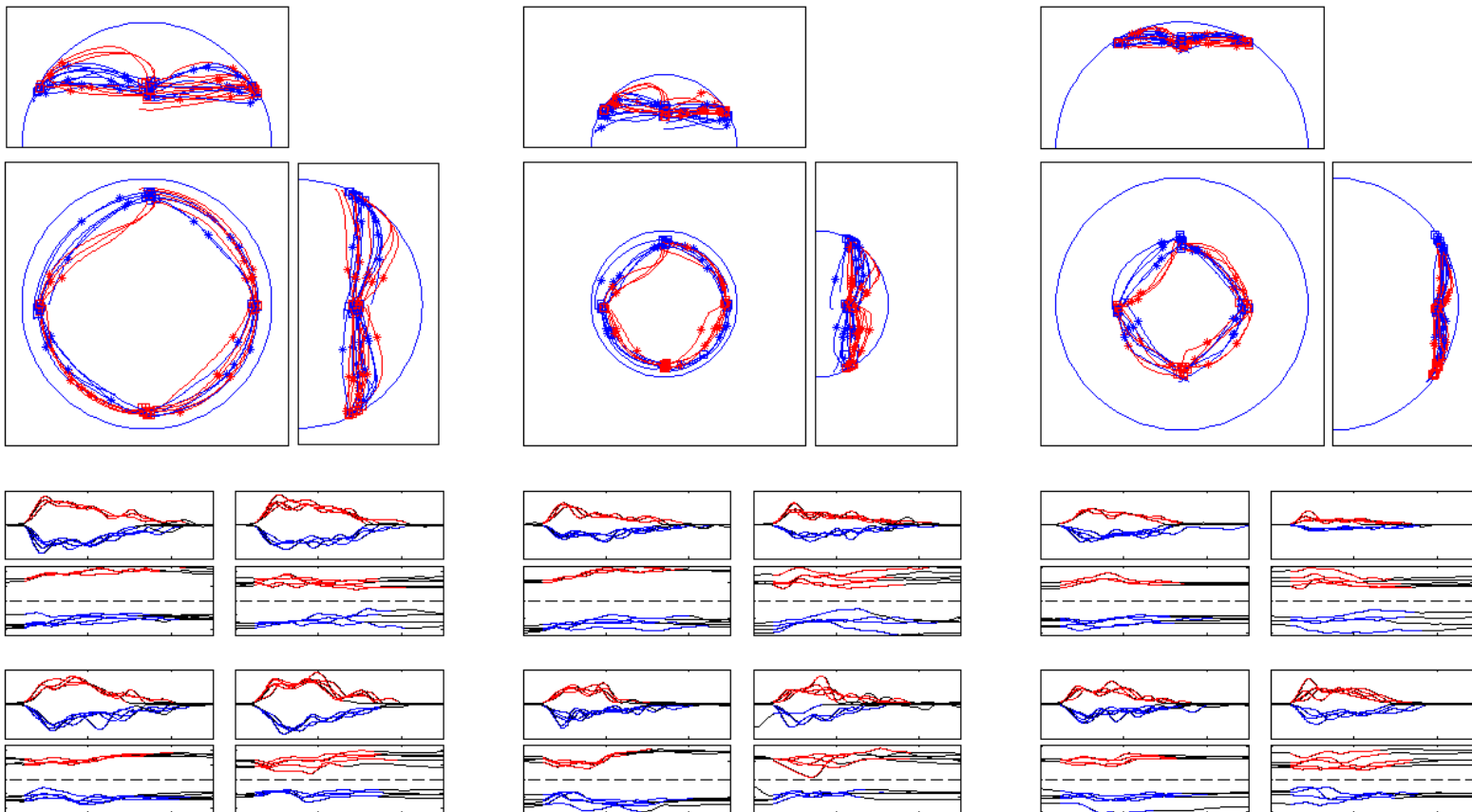
Simulations



Berman, S., Liebermann, D. G., & McIntyre, J. (2014). Constrained motion control on a hemispherical surface: path planning. *Journal of Neurophysiology*, 111(5), 954-968.

Constrained Motion on Curved Surfaces

Results



Provocation ...

- It is already difficult to characterize ***human behavior***.
 - Humans are highly adaptive.
 - Humans are highly variable.
- It is impossible to characterize ***control policies***.
 - You can see trajectories.
 - You can measure forces.
 - You cannot see or measure “control”.
- You haven't go a prayer ...

Encouragement ...

- It is difficult to characterize human behavior.
 - Humans are highly adaptive.
 - Humans are highly variable.
- Humans are highly robust.
 - High variability, but high success rate
- Don't teach ***what*** to do, teach ***how*** to do it.
 - Impedance control, model-based learning
 - Infer control from inter-trial ***variability***, rather than inter-trial ***constancy***.
 - But ...
 - Does high precision = high impedance?
 - Does high precision = high compliance and external constraint?
 - Teach the robot learn what is ***important!***
- Don't give up!