Motor Planning and Coordination in Sensory-Motor Decisions

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Findings

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Hypotheses

• Humans make moment-by-moment action choices in order to accomplish behavioral goals
• When an object is within arm’s reach, an infinite number of hip, shoulder, elbow, and wrist angles could satisfy the task demand
• The goal was to provide evidence concerning the extent to which coordination and planning lower energetic costs and increase movement efficiency
• Research focuses on comparing the different movements of a participant as he or she completes a simple physical task
  lifting a jug from one shelf and placing it on another without knowing the weight of the jug
• PhaseSpace Motion capture suit
  → markers on specific body parts: shoulder, hip, hand, & elbow

Methods

VARIABLES
• INDEPENDENT: Weight of the jug & knowledge of the jug’s weight
• DEPENDENT: Body positioning (trajectories) & energetic cost

SUBJECTS
• N = 6

CONDITIONS
• Light Blocked - 10 trials
• Heavy Blocked - 10 trials
• Mixed Planned - 20 trials
• Mixed Unknown - 20 trials

Discussion & Implications

• Planning is demonstrated by the grouping of the blocked and planned conditions and by differing from the unplanned condition
• There was no significant difference of energetic costs across conditions

Background & Relevance

• Data suggests that there is an efficiency difference across conditions
  Further testing:
  - Bigger sample size
• Development of Human Movement Models
• Medical diagnosis and rehabilitation
• Human-Computer Interfaces
• Understanding of how the brain directs sensory-motor behavior

Conclusion

• Planning is demonstrated by the grouping of the blocked and planned conditions and by differing from the unplanned condition
• There was no significant difference of energetic costs across conditions

Energetic cost - Jerk Minimization Model

Both blocked and planned conditions differed in the same way while the unplanned conditions were not different from each other. Lower jerk represents smoother acceleration, thus higher energy efficiency.

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Hand position from beginning to completion of task across six different conditions.