Managing Redundancy at Multiple Levels of Motor Control
Jurjen Bosga & Ruud G.J. Meulenbroek

Donders Institute for Brain, Cognition and Behaviour, Centre for Cognition, Radboud University Nijmegen, The Netherlands

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Introduction
In two joint-action studies we addressed how subject pairs (dyads) manage the excess of resources in their motor systems which allows them to perform a shared motor task in multiple ways. In both studies we exploited a rocking board task to investigate intraindividual and interindividual movement control when people perform lateral swinging movements while being mechanically coupled.

Method
Twelve dyads performed side-to-side rocking movements on a board in nine conditions covering three amplitudes (8, 18 and 28 degrees) and three frequencies (0.4, 0.6 and 0.8 Hz). The instructed and realized amplitude-frequency combinations were presented real-time on computer displays in the form of rotating bars.

Experimental setup (Top view )

Parameter changes
- Single
- Double (Intentional)
- Quasi-double (Biomechanical)

Realized Amplitude (deg)
Coordination

Results

Joint Action	SD\(\phi\)\(^{1}\)	SD\(\phi\)\(^{2}\)
Heads	-	73.87 [4.63]
Shoulders	63.75 [11.17]	73.28 [5.82]
Hips	58.48 [12.77]	56.86 [14.64]
Knees	42.02 [13.95]	34.93 [17.10]
Ankles	63.29 [13.46]	59.61 [13.70]

Conclusion
Exploitation of biomechanics in goal-directed task performance is a prominent motor control mechanism that operates independently of the modalities people use to monitor the perceptual consequences of the generated motion patterns.

Study 1.
In this study we examined the key role the visual modality is assumed to play in interindividual movement coordination and we scrutinized the way in which dyads control the combined amplitude/frequency constraints of the task.

Research
Amplitude-Frequency relationships (Kay, Kelso, Saltzman & Schöner, 1987)

Movement frequency ↑ - Amplitude ↓
Movement frequency ↓ - Amplitude ↑

Research question
What will happen when people perform a repetitive motor task with two movement parameters of equal importance to attend to?
(see Bosga, Meulenbroek & Rosenbaum, 2005)

Experimental setup (Side view )

1 vis-a-vis
2 back-to-back
3 solo

Study 2.
In this study we tested the generality of the Leading Joint Hypothesis (LJH) in a kinematic analysis of the joint-coordination patterns that dyads display when they need to manipulate a rocking board along a prescribed angle and at an imposed frequency.

Research
Prior research has shown that joints of a multi-articular limb play different roles in movement production according to their mechanical subdivision in the joint linkage (LJH; Dounskaia, 2005).

Research question
How do two mechanically linked persons coordinate their movements while performing a repetitive motor task?

Experimental variables
Three-dimensional Intrinsic Body Angles (deg)
Continuous relative phase (deg)
- mean (M\(\phi\))
- standard deviation (SD\(\phi\))
Cross correlations with associated time-lag (ms)

Results

References