The Neural Basis of Dance Movement and Partnering
Is Dance “The Next Wave” in Cognitive Neuroscience?

Dancing stimulates the brain in interesting ways.

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In the last 10 years, music's status within cognitive neuroscience has moved from being a fringe area to a topic of central interest to neuroscientists. Dance seems poised to be "the next wave" in cognitive neuroscience. And, in fact, dance takes advantage of many of the strides made by music research and combines them with notions of motor control and sensorimotor coupling that have already attracted great interest in neuroscience.
The 4 P’s of Dance

Pattern

Partnering

Pacing

Person
The Neural Basis of Human Dance

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1) spatial patterning of movement

2) meter = rhythmicity

3) entrainment (synchronization)
Subjects

• amateur tango dancers

• minimal musical experience
The step was taught in advance of the PET scan. No learning occurred during scanning session. Eyes were closed in all scans.
Dance condition
I. Spatial Patterning of Movement

Dance vs. Contractions alone

muscle contractions

but no movement
Dance – Contractions

Superior parietal (BA 5/7)

(precuneus)
II. Meter

Dance vs. Non-Rhythmic Dance

- regular and predictable
- irregular and unpredictable
Non-Rhythmic Dance condition
III. Entrainment

Dance vs. Self-Paced Dance

externally-paced
(= entrained)

self-paced
(no entrainment)
Dance – Self-Paced
Meta-analysis of finger-tapping
(43 published studies)

Summary

1) spatial patterning of movement
   superior parietal (precuneus)

2) meter = rhythmicity
   putamen (basal ganglia)

3) entrainment
   vermis of cerebellum
Leading: goal-directed movement planning of movements navigation transmission of force to partner

Following: stimulus-directed movement receptivity to signals from leader
But how can we study partnering in an MRI scanner?
Conditions

• partnering: Leading (improv)
• partnering: Following (improv)
• partnering: Mutual (pre-learned)
• solo (improv)
• solo (pre-learned)
Partnered > Solo

z = 45

MCC
SI

z = 17

Insula
SII/aIPL
TPJ
Tactile V5

Bar graph showing the performance of different conditions.
- Follow: High performance (0.5)
- Mutual: Mid-level performance (0.3)
- Lead: Moderate performance (0.2)
- Solo: Performance at the lowest level (0.1)

* indicates a significant difference.
Being moved by someone

![Bar chart showing comparison of 'Follow', 'Mutual', 'Lead', and 'Solo' conditions. The 'Follow' condition has the highest value, followed by 'Mutual', 'Lead', and 'Solo'. There is a significant difference (*) between the 'Follow' and 'Lead' conditions.](chart.png)
Partnering

1) leading
   motor planning, navigation

2) following
   somatosensory areas, tactile V5

3) mutual
   mentalizing areas (cooperation)
The 4 P’s of Dance

- Pattern
- Partnering
- Pacing
- Person
Bi morali vsi študija ples.