Comparison of Balance Between Pirouettes En Dehors And Pirouettes En Dedans in Dancers

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Background

In ballet, there are two main ways to perform a pirouette, a balanced spin with single-limb support: **en dehors** (outward) where the dancer turns away from the supporting leg, or **en dedans** (inward) where the dancer turns towards the supporting leg. Both employ external rotation of the leg at the hips. The pirouette en dehors is presumably easier to balance as the dancer is externally rotating in the same direction the lead leg is pulling, thus helping to continue rotation. However, in the pirouette en dedans, dancers must work against the lead leg pulling in the opposite direction of the turn to internally rotate, thus making it more difficult to stabilize their foot's Center of Pressure (CoP).

Currently, only one study has measured balance during rotational movement in both en dedans and en dehors pirouettes (Fronczek-Wojciechowska, 2016), but the two measures were not compared between each other.

The aim of this study was to assess differences between these two types of turns in terms of balance, through analyzing CoP displacement and oscillations of the supporting forefoot. Hypothetically, the dancers performing the pirouette en dehors will be more balanced and exhibit limited movement variability and CoP standard deviation (SD) in the x- and y-axes on a pressure plate system.

Methodology

Protocol: Dancers conducted a static and dynamic stretch protocol for 3.5 minutes before testing (similar to Morrin & Redding, 2013). From fourth position, a common ballet preparation, each dancer performed three trials of the pirouette en dehors followed by three trials of the pirouette en dedans, all en demi pointe (barefoot).

Data Collection: The BTS BioEngineering P-WALK pressure plate (675x540x5 mm; 2304 sensors) was used to track the movement of the pirouettes for three seconds. G-STUDIO, the accompanying software, recorded the incoming data at 20 FPS. Each dancer began the turn with their lead (raised) leg off of the plate while keeping their stance (rotating) leg on the plate for the test and were required to land solely with their stance leg back on the plate.

Data Analysis: The start and end of each dancer's pirouette (6 per dancer) was individually analyzed on G-STUDIO software. The start was identified as the moment immediately before rotation of the foot occurred, and the end was the moment immediately after rotation of the foot occurred. These points for the CoP (x, y) were then isolated.

Statistical Analysis: A two-tailed paired samples t-test was used to compared average SD values for the CoP in both the x- and y axes for both pirouettes. A second two-tailed paired samples t-test was conducted to compare the average speed between the pirouettes.

Findings

There was no significant difference in balance or speed between either pirouette. This suggests the dancers had no difficulty shifting and controlling pressure along the medio-lateral axis of their forefoot as they performed each pirouette when compared to the anteroposterior axis of the forefoot. This contradicts other study findings (Fronczek-Wojciechowska, 2016) which reported a significant difference in CoP displacement in the pirouette en dedans. This study's results may be due to the large variance in subject demographic data. Suggestions for future research include testing with a 3D motion capture system and having a larger pressure plate with greater surface area to turn.

Bibliography

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Results

Figure 1. Description of the differences in step movement in the En Dehors v. En Dedans pirouette technique

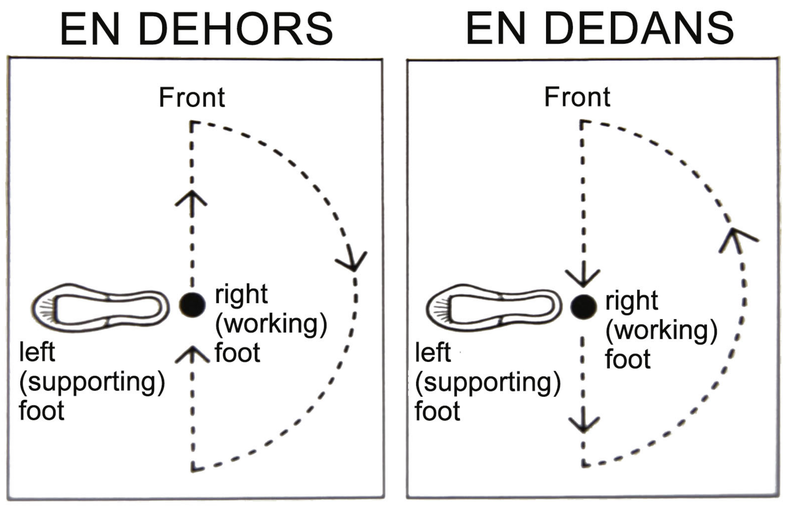

Table 1. Axis Deviation and Mean Speed in En Dehors v. En Dedans

	Mean X Axis Deviation in mm (±SD)	Mean Y Axis Deviation in mm (±SD)	Mean Speed in mm/$^{s-1}$ (±SD)
En Dehors	8.39 (±3.33)	11.54 (±3.73)	81.42 (±29.37)
En Dedans	9.49 (±5.62)	9.00 (±4.58)	81.43 (±31.22)

Figure 2. Average rotational speed among measured pirouette conditions.

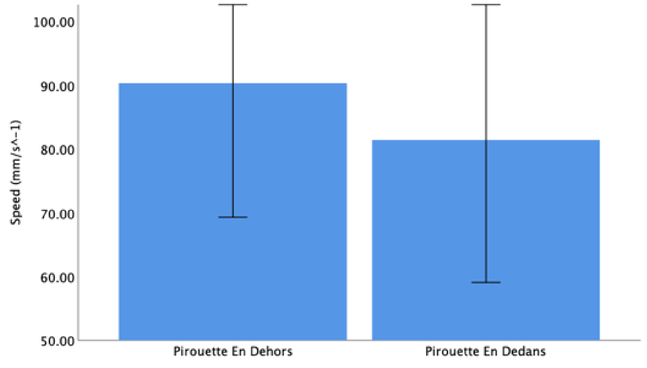

Figure 3. X and Y axis CoP deviation (mm) among measured pirouette conditions.