

## **Final - PAMA Research Presentation Abstract**

Complete all sections below. You are allowed a maximum of two pages. Do not change formatting. Final abstracts **MUST** be received by May 31, 2017.

**Title of Presentation:** Gaze behaviour in dance – the relevance of spotting in pirouettes

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**Background** (*what informs your study*): Pirouettes are among the most complex movements in dance, in general and specifically, in ballet technique. Ballet dancers perform rotations about the vertical axis, either in place or travelling through space. Central to such rotation is spotting – a dance-specific gaze technique. As the body rotates, the head and gaze remain fixed to one spot. When the fixation can no longer be sustained, the head quickly rotates, overtaking the body to return to the same spot. Although crucial to every turn, there is a lack of scientific insight into why dancers spot.

**Purpose(s)/Aim(s)** (*The purpose/aim of this study was...*): to investigate dancers' gaze behaviour during the double pirouettes. Specifically, we assessed to what extent spotting depends on the visual environment and whether balance in the pirouette is related to head stability and spotting duration.

**Methods** (*how you conducted the study*): Sixteen intermediate dancers performed double pirouettes to both sides in the following randomized visual conditions in a dim room: 1.) no visual anchor, 2.) four illuminated dots in the periphery, 3.) a grid with 35 small illuminated dots, and 4.) an illuminated dot at eye height. Dancers' whole-body motion was measured with a three-dimensional motion capture system (Vicon-T20). Following measures were calculated as an index for balance: 1.) 95% ellipse area of an estimated centre-of-mass (COM), 2.) the topple angle, and 3.) total degrees of rotation; and as an index for spotting behaviour: 1.) middle spot duration, 2.) spot ratio (spot duration/time of head to return to the front), and 3.) an anchoring index of head on shoulders.

**Results** (*what data or findings you obtained*): A four (visual conditions) by two (sides) repeated measures ANOVA did not reveal any statistically significant main effects/interactions for any of the balance and spotting measures. We found no correlations between the spotting and balance measures. Therefore, we performed a post hoc median split based on the total degrees of rotation. The group completing more 'degrees of rotation' before leaving their passé position was assumed to be more proficient in pirouettes. Interestingly, there was a significant difference in the spot ratio of the strong turners ( $M=2.87$ ,  $SD=0.49$ ) as compared to the weak turners ( $M=2.31$ ,  $SD=0.443$ ) in the four peripheral dot condition ( $t(14)=2.46$ ,  $p=0.028$ ). In all other conditions, we found similar trends (grid:  $p=.058$ , one dot:  $p=.075$ , no visual anchor:  $p=.144$ ). Figure 1 presents the coordination of the head, shoulder and hip rotation in a double pirouette over time. The head movement momentarily plateaus – indicating the stable spot to the front – after one revolution, whereas the shoulder and hip continuously rotate.

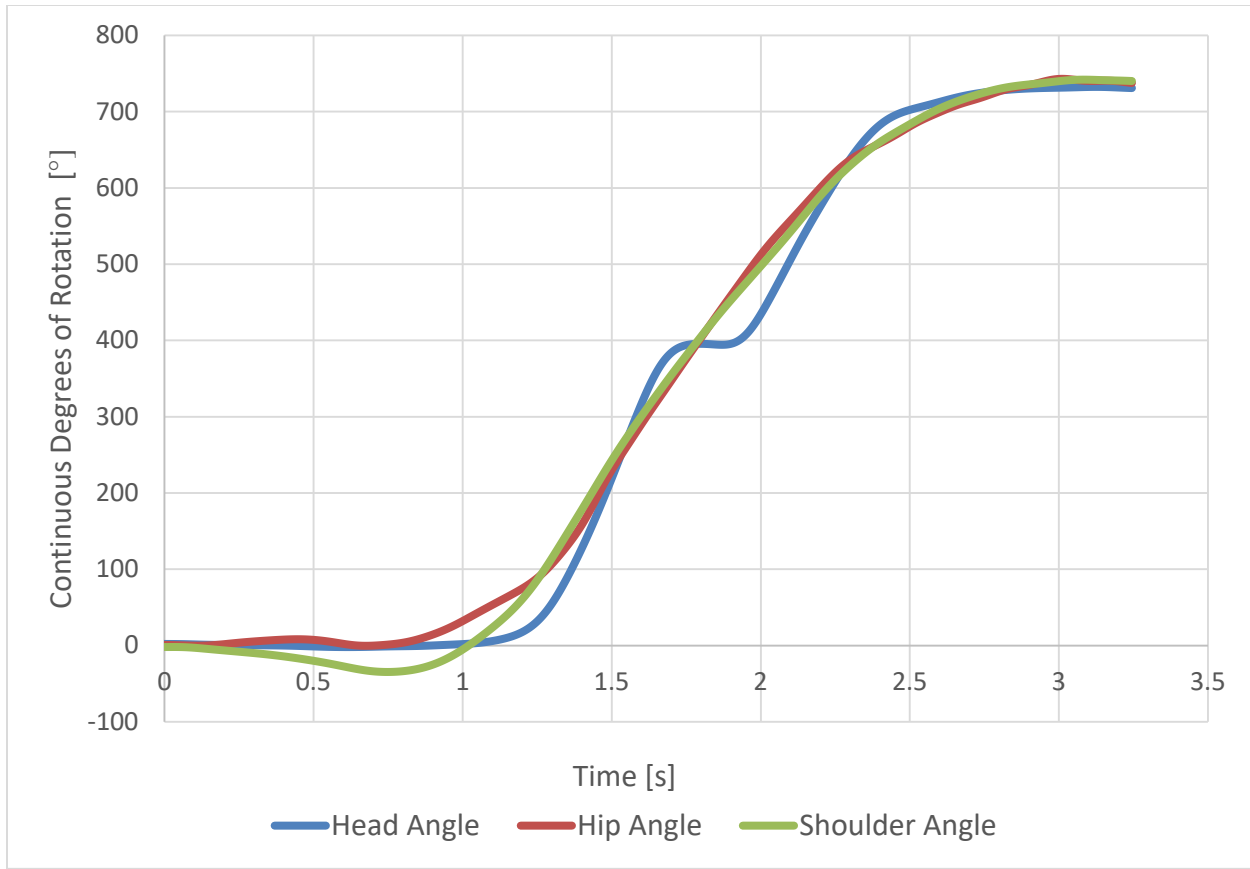


Figure 1 Head, hip and shoulder coordination

**Conclusions and Practical Relevance:** Stronger turners appear to keep their head to the front longer than weaker turners. This strengthens the assumption that spotting indeed plays a role in successful pirouettes. The coordination between the head, shoulder and hip seems to suggest the use of a head-stabilisation-in-space strategy, which might be beneficial for balance control in pirouettes. As we failed to manipulate the spotting behaviour of intermediate dancers with our chosen visual conditions, we are conducting a follow-up study with professional ballet dancers in more ecological visual environments, such as a dance studio or a stage with and without moving objects. Insights into dancers' spotting technique and its influence on turning success will inform both dancers and dance teachers about their training and teaching strategies.

**Key References (optional):** dance, pirouettes, spotting, balance, gaze, postural stability

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