Shatter the Mirror: Usability Evaluation of Kinect-Based System for Ballet Movements, Super Mirror (SM)

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Introduction: Ballet & the Mirror

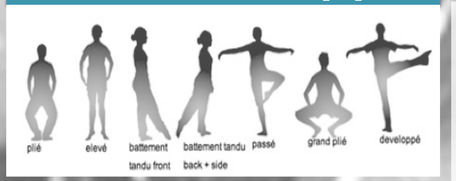
- Instructions take place in a studio with a barre, specialized flooring & mirror(s)
- Similar environments since 18th century [1]
- Mirrors become focus of dancer's attention
- Mirrors become portrayal of dancer's success in technique [3]
- New methodology - **Super Mirror (SM) [2]** that "Combines the functionality of studio mirrors and prescriptive images to provide the user with instructional feedback in real-time" [2]
- Focus was not on benchmarking the system to the expertise of ballet teachers
- ***Purpose***: To evaluate the effectiveness and efficiency of the feedback received from the SM on pre-professional dancers.

Can a system prove to be as accurate as a ballet teacher in assessing the quality of dancers' movements?

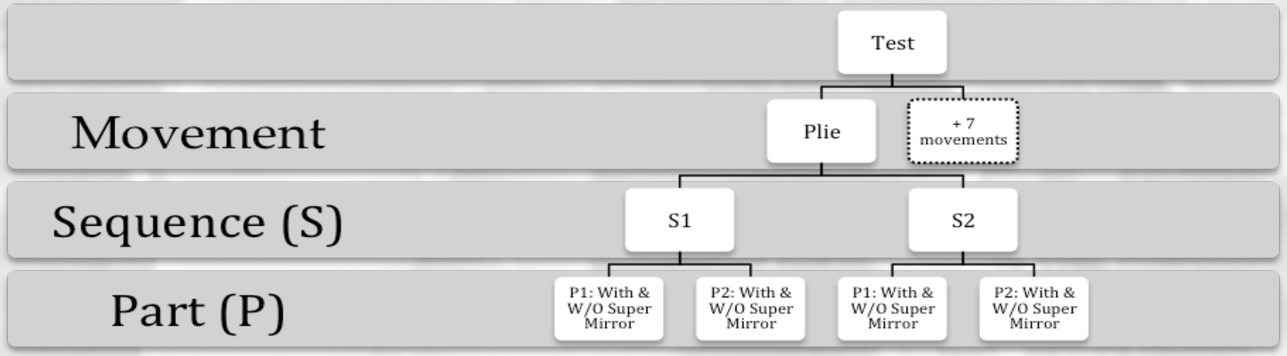
Method

- Controlled study was conducted using pre-professional ballet dancers to compare the SM's assessment of movements, an embedded reference system, to the evaluation of a ballet teacher, the control
- Total of 5 ballet students ages 16-18 with average of 8.8 years of ballet training

Movements [2]



Procedure



Conclusion

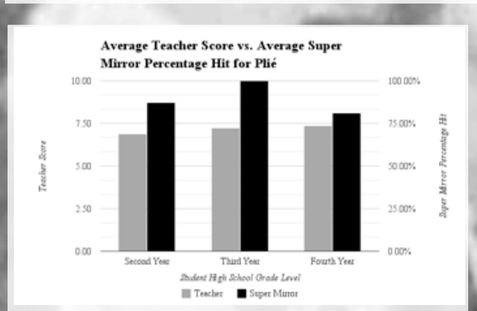
SM is only capable to assess the partial complexity of ballet movements.

Following improvements are suggested:

1. Improve the SM reference model to included fast tuning capability
2. Expand SM to include assessment criteria of the subject-matter expert, such as detecting if the weight is distributed equally between both feet, or if arms are synchronized with legs
3. More advanced SM would include assessment of movement speed, correlation between the movement and the music, etc.

Results and Discussion

Results concentrated on three specific movements, plié, élevé and tendu front. Further investigation is needed to accurately calibrate the reference template to the specificity of each dancer. Adequately, the possibility for comparison between the SM and the teacher was impossible.



Teacher graded higher level students with higher scores for plié movements. SM does not show the same trend and its score is higher than teacher's score. SM score complexity is much lower than the teacher's. SM cannot evaluate the dancer's technique as a whole as teachers do, which contributes to inaccurate results.

For eleve teacher graded higher level students with higher scores. SM score is lower than the teacher's score. SM does not detect joint angles for eleve as well as for plié movements.

Tendu is the most complex of three movements. Teacher graded higher level students with higher scores following the same pattern. SM was not able to successfully detect joint angles which is particularly visible for the 2nd year students.

System Usability Scale

- Mean score of 57 for the students
- Mean score of 43.5 for the teacher
- Both scores indicated a below average result
- Score of above 68 would be considered as above as presented by Usability.gov [4]

References

[1] Foster, S.L.: Dancing Bodies. Meaning in Motion: New Cultural Studies of Dance. Jane Desmond, Durham, Duke University Press, pp. 235-257 (1997)

[2] Marquardt, Z., Beira, J., Em, N., Paiva, I., Kox, S: Super Mirror: A Kinect Interface for Ballet Dancers. In: CHI '12 Extended Abstracts on Human Factors in Computing Systems, pp. 1619-1624. ACM (2012)

[3] Radell, S.A.: Mirrors in Dance Class: Help or Hindrance?. In International Association for Dance Medicine & Science. (2013)

[4] U.S. Dept. of Health and Human Services. The Research-Based Web Design & Usability Guidelines, Enlarged/Expanded edition. Washington: U.S. Government Printing Office, (2006)

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Further Information