

Dynamic Time Warping: A Novel Metric for Evaluating Piano Performance

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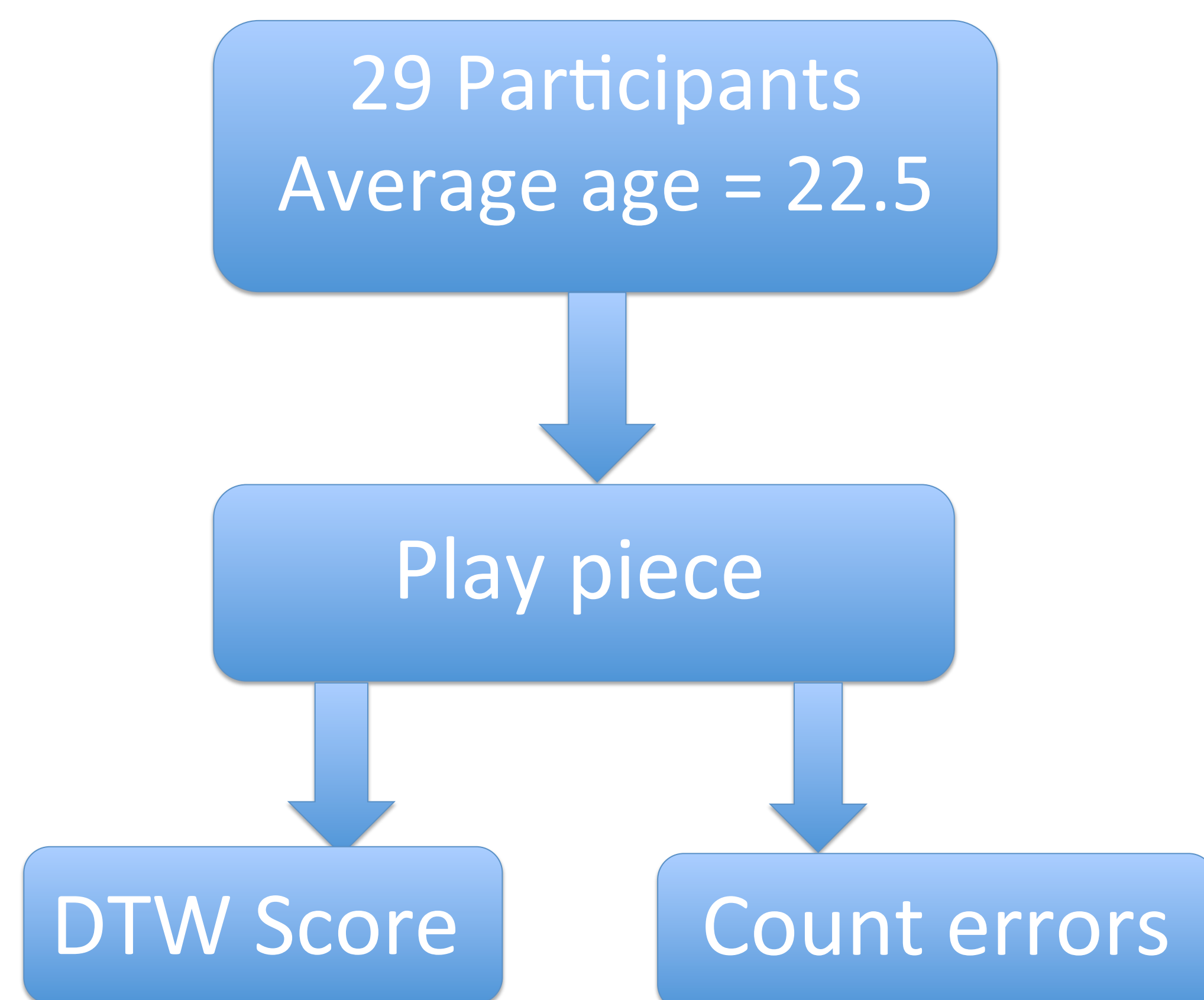
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INTRODUCTION

Quantifying musical performance is time-consuming, especially because there are few objective, automatable methods to implement this analysis. Dynamic time warping (DTW) is an algorithm for measuring similarity between two temporal sequences that can vary in length or speed. Because DTW can determine the similarity between two temporal sequences regardless of length, it is often used to analyze motor movements with a stereotyped pattern.

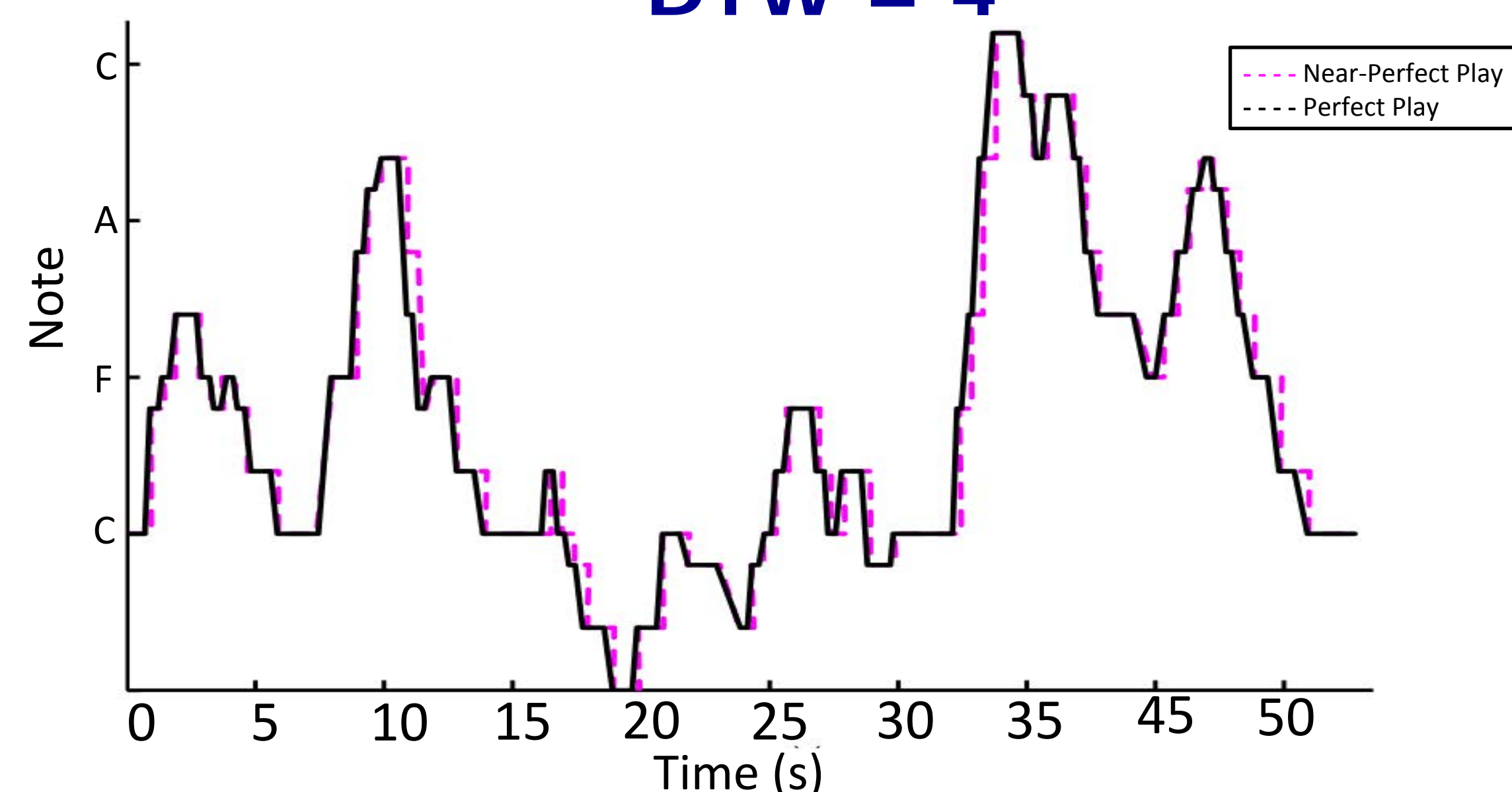
In the experiment below, we apply DTW to trace the acquisition of a novel piano piece. Studies evaluating piano performance traditionally employ qualitative metrics that are time consuming to execute. DTW presents an objective, time-effective method of quantifying proficiency by comparing each performance of the piece to an “ideal” template.

STUDY OVERVIEW



EXPERIMENT

Near-Perfect Play of the Piece, DTW = 4



The DTW algorithm compares each performance of the piece to an ideal template.

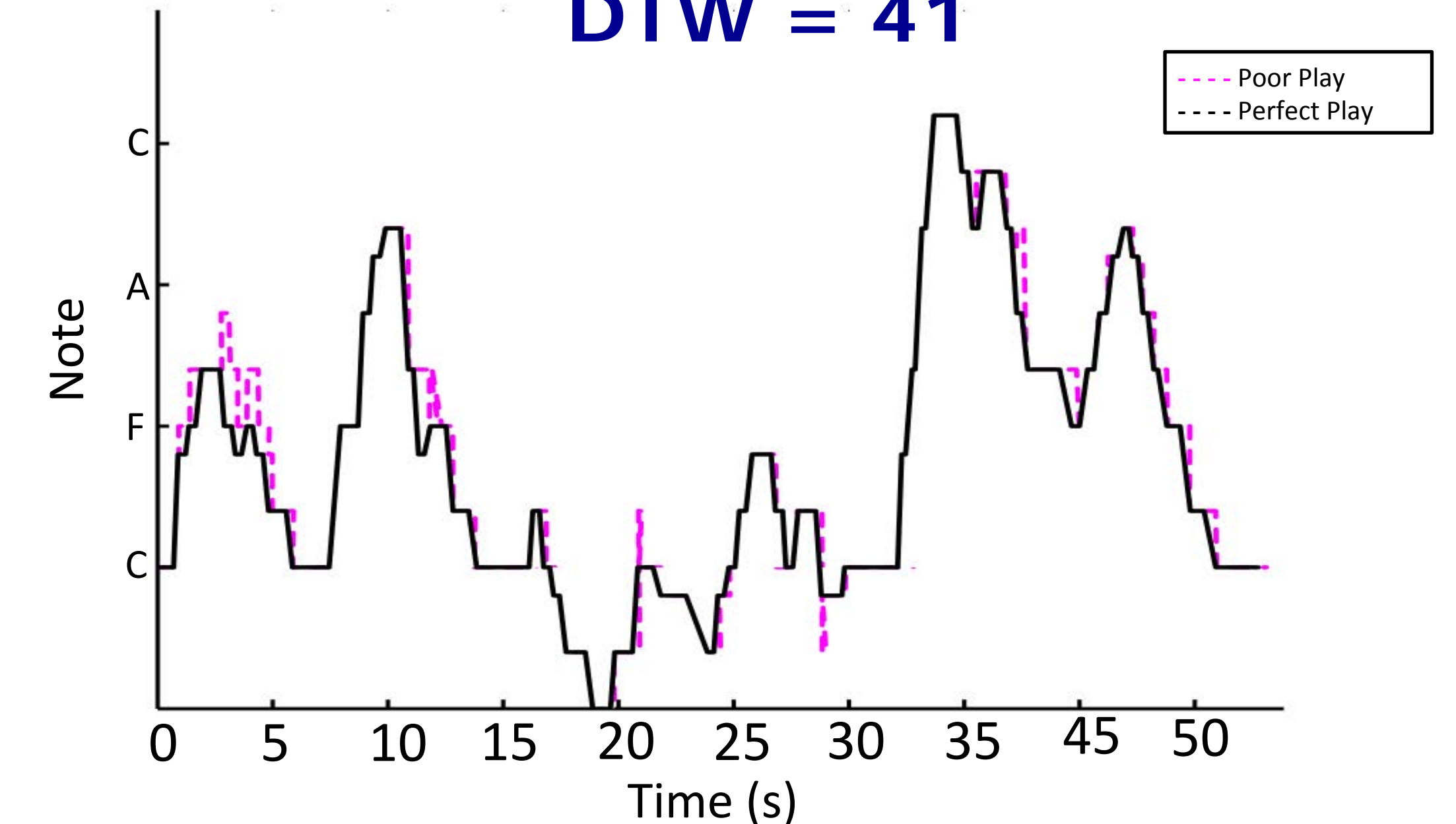


Participants played a novel piece presented digitally.

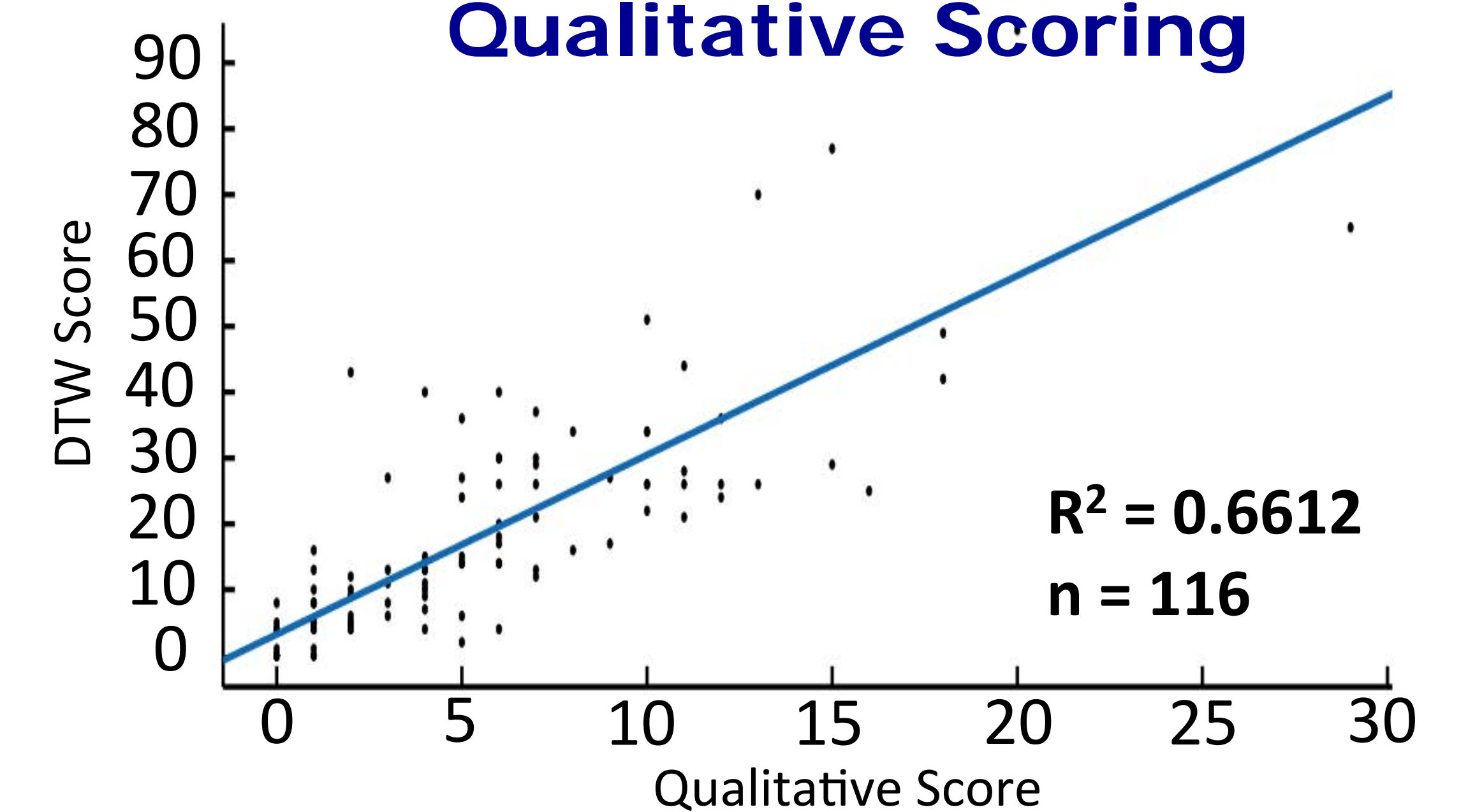
CONCLUSIONS

We found a strong correlation between DTW score and number of errors qualitatively determined, suggesting that DTW is a reliable metric for quantifying proficiency in piano performance. It is also time-efficient – more than 1000 pieces can be scored through DTW in the average time taken to score a single piece (48 seconds long) qualitatively.

Poor Play of the Piece, DTW = 41



DTW Score Against Qualitative Scoring



DTW score was plotted against the number of errors.

ACKNOWLEDGEMENTS

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