



Movement Time, Range of Motion, and Timing Accuracy

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INTRODUCTION

- It has been commonly observed that players have the ability to trade off speed for spatial accuracy (e.g., shot placement, racquet-ball contact location, etc.) and accuracy for speed in performing various strokes and other tennis related skills.
- However, it has only been recently recognized that by increasing movement speed an individual also tends to increase timing errors. Because most skills require both timing and spatial accuracy, the selection and performance of an appropriate movement speed appears to lead to a compromise between spatial for timing accuracy.
- While past research looking at these various factors have come to different conclusions, they all appear to agree that movement time, movement speeds, and timing accuracy are intertwined.
- Furthermore, the use of the principles related to response time/speeds and accuracy may have important implications for teaching and practicing timing and anticipation skills.

PURPOSE

- The purpose of this study was to understand the relationship between movement time, range of motion and timing accuracy by examining the effects of controlling the speed and/or duration of a forehand stroke in response to balls traveling at various speeds and durations.

SAMPLE

- Participants for this study were 24 right-handed females with an average age of 23 years.
- The women swung a tennis racquet through a range of motion of 60 degrees, 105 degrees, or 150 degrees over three separate sessions.
- Participants were also assigned to one of four experimental groups:
 - The first group swung the racquet at their preferred speed
 - The second group swung at maximal speed
 - The third group swung 20% faster than their minimal speed
 - The fourth group swung 40% faster than their minimum forehand speed.

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METHOD

After practicing the stroke at their assigned speeds, the women attempted to execute their strokes so that their racquet head passed through an infrared beam at the moment that a stimulus (series of lights that progressive flashed down a ramp toward the participant) stopped.



RESULTS

- Overall, the results of the study indicated that timing accuracy of a simulated tennis forehand was maximized by:
 - Responding, or swinging, with a shorter movement time or faster movement speed
 - A better ability to match one's movement time to the stimulus (e.g., ball) speed.
 - This does not hold true for slower swings.
 - Decreasing the range of motion of one's swing.



RECOMMENDATIONS

- Overall, the results of this study support the idea that faster and shorter strokes result in a greater capacity to accurately time one's swing with a moving target (e.g., an opponent's serve or other drive across the court).

These findings suggest the following may be true:

- Players producing shorter movement times are better able to control and replicate the timing of swings that lead to better anticipation.
- Shorter movement times allow players to wait on the stimulus (e.g., ball), allowing it to travel further, which provides the player with more information about the stimulus' speed, trajectory, etc. before a response must be executed.
- Shorter times to complete a movement or task are easier to estimate and replicate, which would lead to more successful executions of the skill.
- It is also important to understand that there was little difference in the timing accuracy between the participants who performed at their maximal speed and those who performed at their preferred speed.
 - It is tempting to believe that players will perform their best when left to decide for themselves what speeds to execute given tennis strokes.
 - However, it must also be known that while players who selected their preferred speeds were able to develop an optimal movement time/speed for the forehand drive, but they did so less consistently than those who performed at their maximum speed for all trials.
- Because this study was held in a laboratory setting (as opposed to a tennis court) with a simulated tennis scenario these results must be considered and applied with your players with some caution.
 - More research conducted with tennis players in their natural settings is needed to be able to make more accurate and legitimate recommendations for coaching practices.

REFERENCES/ RESOURCES

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