Court Speeding
Developments in Surface Pace measurement

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Introduction

Presentation outline:
- What is surface pace and how it is measured?
  - Wassing Sestée and visual analogue scales
- Improving the measure
  - Correlations between the science and the perceptions
- Development of the ITF ‘SPRite’
  - Going portable with testing
- Changes to the rules of tennis
  - Davis Cup hits the brakes
Surface pace

What is it?
- A measure of how fast or slow a tennis court surface is
- Brody (1984) published the following equation:

\[ \mu = \frac{v_{ix} - v_{fx}}{v_{iy} + v_{fy}} \]

\[ SPR = 100(1 - \mu) \]
Surface pace
How to measure surface pace...

Wassing Sestée
Tennis ball cannon

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Surface pace

SPR assumes that players associate the pace of the court with the ball/surface friction
- Is this the case...?
- 2003 & 2004 player perception study
- Variety of court types utilised
  - SPR measured with the Sestée
  - Player perception measured with a Visual Analogue Scale (VAS)
Visual Analogue Scales

Court surface: artificial grass

Court surface: green clay
Player perception vs. Surface Pace Rating: the problem...

\[ R^2 = 0.31 \]
Improving the correlation

Least correlated surfaces appear to clay and grass
- Clay perceived slower & grass perceived faster
- COR affects time between successive bounces
  - Time available for player
- Ramping affect of clay ‘kicks’ ball up
- Low stiffness of grass absorbs vertical energy

- Investigate COR and incorporate into definition of SPR

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Improving the correlation

Revised SPR = SPR + $a(b - COR)$  \hspace{1cm} a = 150, \hspace{0.5cm} b = 0.81

Examples:

<table>
<thead>
<tr>
<th>Year</th>
<th>Surface</th>
<th>COR</th>
<th>SPR</th>
<th>Revised SPR</th>
<th>SPR change</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>Outdoor grass</td>
<td>0.76</td>
<td>30.5</td>
<td>38.4</td>
<td>SPR increased</td>
</tr>
<tr>
<td>2003</td>
<td>Outdoor clay</td>
<td>0.90</td>
<td>17.6</td>
<td>4.6</td>
<td>SPR decreased</td>
</tr>
<tr>
<td>2004</td>
<td>Indoor acrylic</td>
<td>0.81</td>
<td>48.9</td>
<td>49.4</td>
<td>SPR unchanged</td>
</tr>
</tbody>
</table>
Improving the correlation

Revised SPR renamed ‘Court Pace Rating’ (CPR) with improved correlation to player perception

\[ R^2 = 0.31 \]

\[ R^2 = 0.62 \]
Project ‘SPRite’

The ITF are the guardians of the game, and one of their roles is to protect the nature of the game.

- To fulfil part of this role, they need to monitor the SPR for tennis surfaces all over the world.
- This is difficult to achieve using only the Sestée as this device is:
  - relatively expensive
  - requires a skilled operator to use
  - difficult to transport.
- Project SPRite
  - develop a low cost, portable system that can be shipped to various locations around the world.
Project ‘SPRite’

Design brief:
- measure CPR to within 5 points of that measured by the Sestée
- require no external power source
- be intuitive to operate so that it can be used with minimal training
- have no user dependency
- be portable

SPRite development:
Project ‘SPRite’

A practical demonstration...
Surface Pace and the Davis Cup

The Davis Cup:
- While 127 nations have entered the Davis Cup for 2008, only 16 countries qualify for the elite World Group each year
- Each tie is held at the chosen home teams court of choice, given a unique flavour to the event
- In 2008, a new rule was introduced to limit the home advantage...
- ...based on findings of a 8 year study into the surface pace of Davis Cup ties
Surface Pace and the Davis Cup

CPR measurements for a selection of Davis Cup ties and ATP events:

Is the home team advantage too great?
Surface Pace and the Davis Cup

CPR for Davis Cup must be no slower than 24 CPR and no faster than 50 CPR*

*natural surfaces exempt
Conclusions

• CPR
  – providing an improved correlation between measured pace and player perception

• The SPRite
  – bringing surface measurements to the masses

• Davis Cup
  – Court speeding but let off with a warning...
Court Speeding
Developments in Surface Pace measurement

The End