USING PHYSICAL ABILITIES
TO PREDICT FUTURE PERFORMANCES IN TENNIS.

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KEY WORDS
abilities, task analysis, performance criterion, talent detection.

INTRODUCTION.
The detection of future high level athletes constitutes a determining challenge for sports federations. Early success in sports rarely confirm high level results in the future. This observation is particularly true in tennis even when players are taken care by the tennis federation. The fundamental question is to identify steady patterns that may lead to the highest level of practice.
The paradigm of abilities developed by Fleishman seems to constitute a very heuristic chart likely to corroborate the judgment of coaches in detecting future talents.
This chart puts aside the level of abilities and allows to identify steady patterns that enable to achieve performances.
This form of communication has several goals :
- to show the inefficiency at predicting the influence the initial performance has on the final one.
- to examine the stability of the physical abilities measured through a chosen category of tennismen.
- finally, to prove the real predictive power of these abilities after 4 years of practice with various performance records.

METHOD AND PROCEDURES.
52 tennismen (mean age 13) were involved in the experiment which take place in the detection program organised in I.N.S.E.P. psychological department. During four years. 9 tests chosen by 12 federation expert coaches in the EUROFIT battery for their importance in high level tennis practice are used to measure 7 physical abilities (Fleishman's indirect task
analysis method): legs dynamic and explosive strength, arms dynamic and explosive strength, trunk strength, stamina and extent flexibility.

The dependant variable is the French method ranking in one hand, and the following performances clues in the other issued from a task analysis regarding to required abilities: points won on serve, points won after long exchanges, points won with the speed of the ball, points won at net and points won regarding to the player's moving efficiency. These subperformances were identify with the same French expert federation coaches.

Several experiments have been conducted:
- First, correlations between federal ranking performances across four years have been calculated to show the predictive power limitation of the initial performance on the final one for the age of 16.
- Then, the predicting power of the required abilities is examined according to their stability in order to know at what age this prediction can be pronounced.
- Finally, correlations between performances and abilities were also calculated in order to identify predictive power of tests at the age of 13 regarding to the final 16 year performances.

**RESULTS.**

**a- Predictive Power of Federal Association over 4 years**

<table>
<thead>
<tr>
<th></th>
<th>FFR 13</th>
<th>FFR 14</th>
<th>FFR 15</th>
</tr>
</thead>
<tbody>
<tr>
<td>FFR 14</td>
<td>0.757**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FFR 15</td>
<td>0.288*</td>
<td>0.533**</td>
<td></td>
</tr>
<tr>
<td>FFR 16</td>
<td>-0.063</td>
<td>0.212</td>
<td>0.620*.</td>
</tr>
</tbody>
</table>

*TABLE 1: Correlation matrix between French ranking performances (* correlations are significant at \( p < .05, \) ** \( p < .01 \)). FFR: French federal ranking.*

The correlation matrix show a typical quasi-simplex profile and a gradual drift of the predictive power can be observed over time: -.063 for the age of 16 (FFR 16) considering initial 13 years performance (FFR 13).

**b) Stability of Aptitudes.**

All the tests recorded by the French Tennis Federation prove to be stable from one year to the other from the age of 13 with the exception of three of them: legs dynamic (30m running speed test), explosive strength (long jump) and extent flexibility that become stable only at the age of 14.
TABLE 2. Correlation between tested abilities over time
(* correlations are significant at p < .05, **p < .01).

c) Correlation between Abilities Tests and Federal Ranking
Table 3 shows that no significant correlation appears between the French Federal Ranking and the performances achieved during the 4 years both tests and tennis practice.

TABLE 3. Correlations between tests and each year performance

d) Relationship between Performance Sub Criteria from Task Analysis
Significant correlations were round between service performance, speed given to the ball and points won at net in one hand. On the other, performance obtained in player's moving accuracy marks relationships with points won after long ex changes.
### TABLE 4. Correlation matrix between performance subcriteria at the age of 16 (** correlations are significant at p < .01). Performance criteria: A points won on serve, B. points won with the speed of the ball, C. points won after long exchanges, D points won regarding to the player's moving efficiency, E points won at net.

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
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<tbody>
<tr>
<td>B</td>
<td>.777**</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>C</td>
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</tr>
<tr>
<td>D</td>
<td>-.359**</td>
<td>-.138</td>
<td>.534**</td>
<td></td>
<td></td>
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<tr>
<td>E</td>
<td>.656**</td>
<td>.583**</td>
<td>-408**</td>
<td>-207</td>
<td></td>
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</tbody>
</table>

### TABLE 5: Correlations between abilities tests and performances criteria. (** correlations are significant at p < .01). Tests: 1. trunk strength, 2. legs explosive strength (long jump), 3. arms dynamic strength, 4. legs explosive strength (Sargent test), 5. legs dynamic strength (10x5m shuttle run), 6. arms explosive strength, 7. legs dynamic strength (30m running speed), 8. stamina, 9. extent flexibility. Performance criteria: A. points won on serve, B. points won with the speed of the ball, C. points won after long exchanges, D. points won regarding to the player's moving efficiency, E points won at net.

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
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<th>D</th>
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<tbody>
<tr>
<td>1</td>
<td>-.174</td>
<td>.069</td>
<td>-.065</td>
<td>.497**</td>
<td>-.045</td>
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<tr>
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<td>.22</td>
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<td>-.210</td>
<td>-.02</td>
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<tr>
<td>3</td>
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<td>.479**</td>
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<td>.365**</td>
<td>-.197</td>
<td>-.108</td>
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<td>.396**</td>
<td>.170</td>
<td>.153</td>
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<tr>
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<td>.497**</td>
<td>.124</td>
<td>.190</td>
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<td>.301</td>
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<td>.046</td>
<td>.357**</td>
<td>.213</td>
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<td>.178</td>
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<tr>
<td>9</td>
<td>.153</td>
<td>.081</td>
<td>-.223</td>
<td>-.127</td>
<td>-.075</td>
</tr>
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</table>

The correlation matrix shows very interesting links between the tested abilities and the fields of performances: significant correlations were found between service performance, legs dynamic (.43) and explosive strength (.50) and arms explosive strength (.37). Speed given to the ball with legs dynamic (.40) and (.36) explosive strength. Performance obtained in player's moving accuracy marks relationships with trunk strength (.50), arms dynamic strength (.48) and legs dynamic strength (.36). Points won at net can be predicted with legs dynamic strength (.43). These results are more significant than correlations between the first and the last ranking federal performance (-.06).
DISCUSSION AND CONCLUSIONS

The French type of ranking doesn't allow the prediction of performances by the fourth year of training (16 years old players).

On the other hand, the physical abilities used for this study are much more stable and can be predicted for the 16 years old from the scores on tests recorded at the age of 13 with the exception of three of them whose performance could not be predicted before the age of 14.

Nevertheless these abilities have no relationship with the performance represented by the French federal ranking.

According to these results, it seems possible to conclude that, in tennis, the ranking is not restricted to only physical abilities but it also calls on other resources like perception and decision taking which are very much in demand.

The performance criteria issued from task analysis are by far more exploitative.

- Service performance can be predicted by legs dynamic and explosive strength and arms explosive strength recorded on tests at the age of 13. These links are not surprising and show that dynamic strength from both arms and legs are necessary in showing the differences on this type of tasks.

- Speed given to the ball can be predicted by legs dynamic and explosive strength. This result evokes an additional evidence on the role the leg movement plays in the acceleration of the ball.

- Performance obtained in player's moving accuracy marks relationships with trunk strength, arms dynamic strength and legs dynamic strength. We can suppose that this pattern can be linked to some ball returns in extreme situations when the work of the lower limbs compensates the upper limbs, especially when the player stretches to reach the ball or when the body is in rotational movement.

- The performance in scoring while volleying at the net seems to be more related to the dynamic strength of the lower limbs, that is to say, to the players running speed. But this observation is not really a surprise.

It is to be quoted that the performance that consists in winning a long rally has nothing to do with any physical ability previously tested in this study, nor with cardiovascular endurance as expected. Perhaps this kind of performance constitutes a clue which has not been studied accurately enough and which should be re-examined.

Correlations made between performance criteria allow to observe two archetypal style of players: the player at the net with better performances in points won at serve, points won with speed given to the ball and points won at net and the player at the back with better performances obtained in moving accuracy and points won after long exchanges.

This study shows that performances can only be predicted regarding abilities with criteria issued from the task analysis. Many experiments have encountered difficulties in discovering abilities that predict individual differences at highly level of performance (Fleishman, 1972) because of insufficient performance data (for a review, see Ackermann, 1990).
REFERENCES.


