ANALIZA IN RAZVOJ TENIŠKI GIBANJ

Temeljne kompetence

Razumeti biomehanske in tehnične zahteve tenisa ter povečati učinkovitost teniških gibanj.

Cilji

1. Spoznati študije o zahtevah teniške igre z vidika gibanj,
2. Spoznati dejavnike, ki vplivajo na učinkovitost gibanj,
3. Oblikovati vaje za razvoj gibalnih vzorcev ter povečanje učinkovitosti gibanj teniških igralcev.

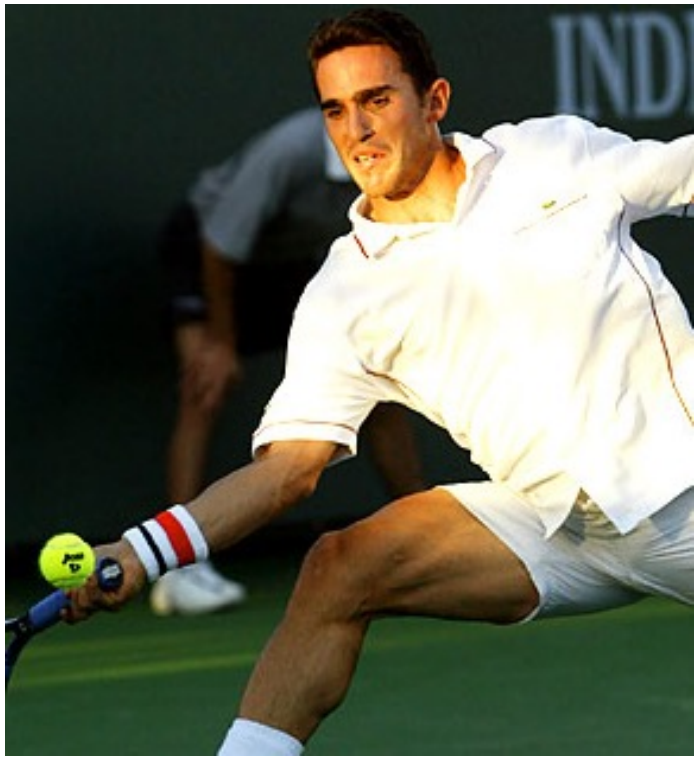
Hitrost v športu

- Hitrost, ki jo zahteva določen šport
- Glavne komponente:
  - Linearna/premočrtna hitrost
  - Lateralna hitrost & agilnost (sposobnost lateralnega gibanja in hitrega spreminjanja smeri)
  - Intervalna hitrosti (sposobnost ponoviti šprinte v kratkih časovnih obdobjih)
  - Hitrost v času utrujenosti (sposobnost doseči maksimalno hitrost v vseh fazah igre).

Tenis – analiza in zahteve

- Povprečno trajanje točke: 10 s
- Povprečno število točk: 5 (70% točk se konča po 4 udarcih)
- Število točk v dvoboju: 100 – 400
- Število sprememb smeri: 300 – 1000 (povprečno 4.5)
- Najdaljša pretečena razdalja: okrog 12 metrov
- Visoka intenzivnost gibanja pred, med in po pripravljaljnem poskoku
- Visok pomen zaznavanja, reakcijske hitrosti in anticipacije.

Analiza teniških gibanj



Vpliv podlage

Povrečno trajane točke

Ženske posamezno = 7.1 sek.

Moški posamezno = 5.2 sek.

Pesek = 10 sek.

Trda podlaga = 5.2 sek.

Trava = 2.8 sek.

Delež izmenjav na osnovni črti

French Open 51%

Australian Open 46%

US Open 35%

Wimbledon 19%

→ Različne strategije gibanja

O'Donoghue & Ingram (2001)

Odgovor v obrambnih situacijah

30 % udarcev je odigranih pod časovnim pritikskom.

Grosser, Kraft and Schönborn (2000)

Dinamično ravnotežje

"Sprinti, pospeševanja, zaustavljanja, počepi, poskoki, spremembe smeri...

4m za vsak udarec

4 spremembe smeri v vsaki izmenjavi

Središče mase

Ženske - 55% TV

Moški – 57% TV

Težišče telesa

Se spreminja med gibanjem.

Študije o teniških gibanjih

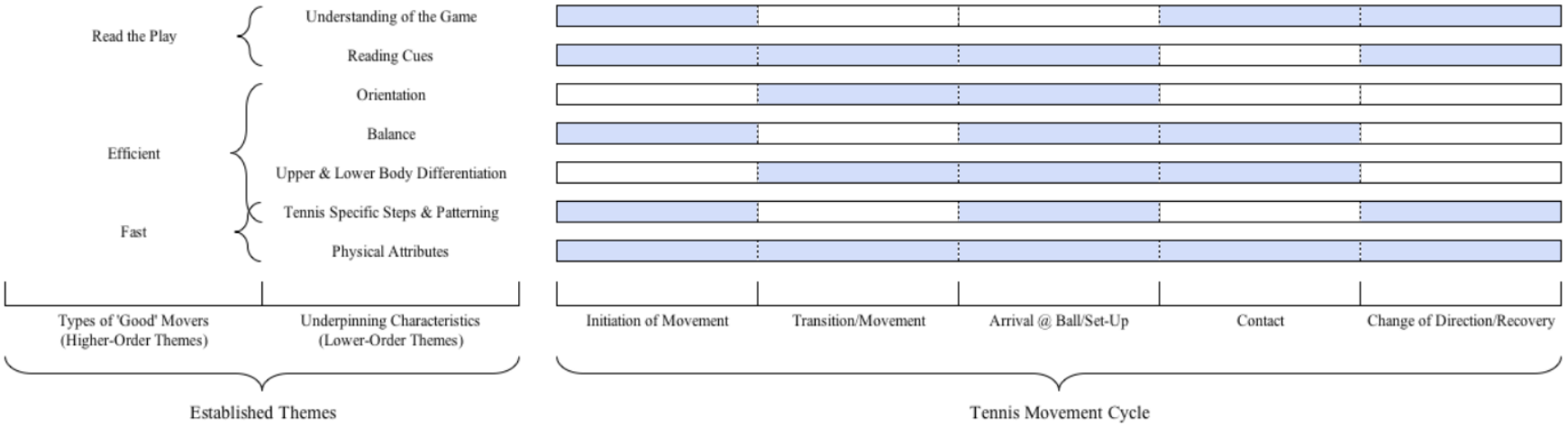


Figure 3.1. The figure presents a framework for coaches and strength and conditioning experts to interpret the established higher-order themes representing 'good' tennis movement and the subsequent underpinning lower-order themes (characteristics) which contribute to these movement styles. The styles of 'good' tennis movers established in this study are presented alongside their underpinning characteristics and then referenced in relation to how they are utilised during the tennis movement cycle.

Shane, 2020.

AO (2016-2018), m=84, f=93

Table 7.1 Descriptive statistics at the point, game, set and match levels

	Male				Female			
	Point	Game	Set	Match	Point	Game	Set	Match
	Mean (95% CI)	*Mean (95% CI)*	*Mean (95% CI)*	*Mean (95% CI)*	*Mean (95% CI)*	*Mean (95% CI)*	*Mean (95% CI)*	*Mean (95% CI)*
Ball in Play Time (s)	4.65 (4.45 – 4.86)	30.46 (28.13 – 32.79)	293.18 (271.21 – 315.16)	1101.79 (1023.86 – 1179.72)	5.03 (4.83 – 5.23)*	38.59 (36.30 – 40.88)***	351.32 (328.38 – 374.25)***	841.56 (765.29 – 917.83)
Peak Ball in Play Time (s)	66.32	230.08	896.00	3726.72	48.84	223.40	915.80	2016.96
Distance Covered (m)	8.11 (7.75 – 8.47)	53.32 (49.37 – 57.28)	513.59 (475.58 – 551.59)	1938.15 (1805.05 – 2071.24)	7.71 (7.36 – 8.05)	59.29 (55.40 – 63.18)*	540.75 (501.23 – 580.28)	1296.96 (1166.70 – 1427.22)
Peak Distance Covered (m)	122.09	392.83	1532.21	6428.61	83.22	479.96	1517.67	3286.43
Shots	2.29 (2.19 – 2.39)	14.60 (13.83 – 15.38)	140.31 (132.25 – 148.37)	522.34 (491.66 – 553.02)	2.25 (2.15 – 2.34)	16.81 (16.03 – 17.58)***	152.66 (144.13 – 161.19)*	364.94 (334.90 – 394.99)
Peak Shots	22	94	347	1423	16	100	336	752
Distance Covered per Shot (m)	3.23 (3.14 – 3.32)	3.49 (3.37 – 3.60)	3.51 (3.40 – 3.63)	3.58 (3.47 – 3.68)	3.01 (2.92 – 3.10)***	3.37 (3.25 – 3.48)	3.35 (3.24 – 3.47)*	3.39 (3.29 – 3.49)
Changes of Direction	1.62 (1.53 – 1.72)	10.81 (9.80 – 11.82)	104.69 (94.99 – 114.39)	396.09 (363.14 – 429.03)	1.56 (1.46 – 1.65)	12.09 (11.10 – 13.07)	110.31 (100.37 – 120.26)	264.70 (232.60 – 296.80)
Peak Changes of Direction	39	82	409	1205	28	121	384	785
Distance Covered per Change (m)	4.83 (4.67 – 5.00)	5.99 (5.72 – 6.26)	5.28 (5.08 – 5.48)	5.18 (4.99 – 5.37)	4.82 (4.66 – 4.98)	5.98 (5.72 – 6.25)	5.37 (5.17 – 5.57)	5.32 (5.13 – 5.50)
Ball in Play Time per Change (s)	2.73 (2.62 – 2.84)	3.54 (3.33 – 3.76)	3.07 (2.91 – 3.23)	2.99 (2.84 – 3.14)	3.12 (3.01 – 3.23) ***	4.11 (3.90 – 4.33)***	3.63 (3.47 – 3.79)***	3.58 (3.43 – 3.73)
Shots per Change	1.32 (1.26 – 1.39)	1.90 (1.78 – 2.01)	1.58 (1.47 – 1.69)	1.50 (1.42 – 1.59)	1.36 (1.29 – 1.42)	1.98 (1.86 – 2.09)	1.72 (1.61 – 1.83)	1.65 (1.56 – 1.73)

Pearson's Chi Square test – significant difference from male scores; <0.05* & <0.001***. No match level comparisons were conducted due to differences in number of sets played.

Shane, 2020.

AO (2016-2018), m=84, f=93

Table 7.2 Descriptive statistics of change of direction movements

	Male	Female
Breakdown of Changes per Point		
No COD	42.4%	44.2%
1-2 COD	34.5%	33.1%
3-4 COD	12.5%	12.7%
5-6 COD	5.4%	5.6%
7+ COD	5.2%	4.4%
Distance Between Changes Breakdown		
< 2 m	35.8%	36.9%
2-4 m	33.0%	31.8%
4-6 m	14.5%	14.7%
6-8 m	9.1%	9.1%
> 8 m	7.6%	7.5%
Movement Direction into Change		
Left	44.6%	45.1%
Right	43.7%	45.4%
Forward	5.9%	4.7%
Backward	5.8%	4.8%

Shane, 2020.

Razlike med moškimi in ženskami

	moški	ženske
Trajanje izmenjave (s)	4,65	5,03
Pretečena razdalja v izmenjavi (m)	8,11	7,71
Število udarcev v izmenjavi	2,29	2,25
Pretečena razdalja na udarec (m)	3,23	3,01
Pretečena razdalja za spremembo smeri (m)	4,83	4,82
Čas med spremembama smeri (s)	2,73	3,12
Število udarcev na spremembo	1,32	1,36

AO (2016-2018), m=84, f=93

Table 7.3 Characteristics of medium intensity changes of direction

	Male *Mean (95% CI)*	Female *Mean (95% CI)*	*Sig*
Medium Intensity Change Characteristics			
Medium COD per Point	1.43 (1.35 – 1.52)	1.46 (1.38 – 1.55)	.654
Peak Medium COD per Point	35	27	
Degree of COD (°)	118.38 (117.03 – 119.74)	122.79 (121.46 – 124.12)	< .001
Velocity In (ms^{-1})	1.54 (1.52 – 1.55)	1.43 (1.41 – 1.45)	< .001
Acceleration In (ms^{-2})	-2.30 (-2.36 - -2.25)	-2.20 (-2.25 - -2.15)	.005
Velocity Out (ms^{-1})	1.55 (1.54 – 1.57)	1.45 (1.43 – 1.47)	< . 001
Acceleration Out (ms^{-2})	2.25 (2.19 – 2.31)	2.21 (2.15 – 2.27)	.347
Distance per COD (m)	5.37 (5.20 – 5.53)	5.11 (4.94 – 5.27)	.029
Time per COD (s)	2.99 (2.88 – 3.10)	3.26 (3.16 – 3.37)	< .001
Shots per COD	1.42 (1.36 – 1.49)	1.41 (1.35 – 1.47)	.721
Movement Direction into Change			
Left	44.8%	45.2%	
Right	43.7%	45.4%	
Forward	5.7%	4.7%	
Backward	5.8%	4.7%	

Shane, 2020.

AO (2016-2018), m=84, f=93

Breakdown of Changes by Degree

< 45°	*Percentage of Medium COD*	6.8%	5.2%	
	Velocity In (ms^{-1})	2.13 (2.1 - 2.17)	2.01 (1.97 - 2.05)	< .001
	Acceleration In (ms^{-2})	0.29 (0.2 - 0.39)	0.47 (0.37 - 0.58)	.014
	Velocity Out (ms^{-1})	2.3 (2.27 - 2.34)	2.23 (2.19 - 2.27)	.005
	Acceleration Out (ms^{-2})	0.31 (0.23 - 0.39)	0.25 (0.15 - 0.35)	.354
45° - 75°	*Percentage of Medium COD*	13.7%	11.2%	
	Velocity In (ms^{-1})	1.57 (1.55 - 1.59)	1.45 (1.43 - 1.48)	< .001
	Acceleration In (ms^{-2})	-0.67 (-0.75 - -0.59)	-0.5 (-0.58 - -0.41)	.003
	Velocity Out (ms^{-1})	1.54 (1.52 - 1.57)	1.44 (1.41 - 1.47)	< .001
	Acceleration Out (ms^{-2})	0.29 (0.2 - 0.39)	0.22 (0.12 - 0.32)	.306
75° - 105°	*Percentage of Medium COD*	17.1%	16.0%	
	Velocity In (ms^{-1})	1.46 (1.44 - 1.48)	1.36 (1.34 - 1.38)	< .001
	Acceleration In (ms^{-2})	-1.83 (-1.88 - -1.77)	-1.62 (-1.68 - -1.56)	< .001
	Velocity Out (ms^{-1})	1.4 (1.38 - 1.43)	1.29 (1.27 - 1.32)	< .001
	Acceleration Out (ms^{-2})	1.41 (1.34 - 1.48)	1.18 (1.11 - 1.25)	< .001
105° - 135°	*Percentage of Medium COD*	22.0%	22.8%	
	Velocity In (ms^{-1})	1.44 (1.42 - 1.46)	1.35 (1.33 - 1.37)	< .001
	Acceleration In (ms^{-2})	-2.59 (-2.64 - -2.53)	-2.35 (-2.4 - -2.29)	< .001
	Velocity Out (ms^{-1})	1.44 (1.42 - 1.46)	1.36 (1.34 - 1.38)	< .001
	Acceleration Out (ms^{-2})	2.45 (2.39 - 2.51)	2.28 (2.22 - 2.34)	< .001
135° - 165°	*Percentage of Medium COD*	23.1%	25.9%	
	Velocity In (ms^{-1})	1.48 (1.46 - 1.5)	1.4 (1.38 - 1.42)	< .001
	Acceleration In (ms^{-2})	-3.14 (-3.21 - -3.07)	-2.92 (-2.98 - -2.85)	< .001
	Velocity Out (ms^{-1})	1.54 (1.52 - 1.56)	1.43 (1.41 - 1.46)	< .001
	Acceleration Out (ms^{-2})	3.32 (3.25 - 3.39)	3.05 (2.98 - 3.12)	< .001
> 165°	*Percentage of Medium COD*	17.3%	18.9%	
	Velocity In (ms^{-1})	1.54 (1.51 - 1.56)	1.43 (1.4 - 1.46)	< .001
	Acceleration In (ms^{-2})	-3.68 (-3.79 - -3.57)	-3.38 (-3.49 - -3.27)	< .001
	Velocity Out (ms^{-1})	1.57 (1.54 - 1.61)	1.51 (1.48 - 1.54)	.004
	Acceleration Out (ms^{-2})	3.76 (3.61 - 3.9)	3.68 (3.53 - 3.82)	.432

Sig - Significance of differences in Pearson's Chi Square test

Shane, 2020.

AO (2016-2018), m=84, f=93

Table 7.4 Characteristics of high intensity changes of direction

	Male *Mean (95% CI)*	Female *Mean (95% CI)*	*Sig*
High Intensity Change Characteristics			
High COD per Point	0.19 (0.17 – 0.21)	0.10 (0.08 – 0.11)	< .001
Peak High COD per Point	9	7	
Degree of COD (°)	101.31 (96.20 – 106.41)	106 (101.14 – 112.08)	.166
Velocity In (ms^{-1})	2.87 (2.82 – 2.93)	2.80 (2.74 – 2.86)	.060
Acceleration In (ms^{-2})	-3.15 (-3.35 - -2.96)	-3.31 (-3.54 - -3.08)	.300
Velocity Out (ms^{-1})	2.57 (2.51 – 2.62)	2.43 (2.36 – 2.50)	.002
Acceleration Out (ms^{-2})	2.52 (2.31 – 2.73)	2.53 (2.27 – 2.80)	.937
Distance per COD (m)	16.02 (15.44 – 16.59)	18.56 (17.89 – 19.23)	< .001
Time per COD (s)	7.75 (7.43 – 8.07)	9.56 (9.19 – 9.93)	< .001
Shots per COD	3.24 (3.11 – 3.38)	3.61 (3.46 – 3.76)	< .001
Movement Direction into Change			
Left	43.4%	44.9%	
Right	43.7%	44.5%	
Forward	6.8%	4.9%	
Backward	6.1%	5.7%	

Shane, 2020.

AO (2016-2018), m=84, f=93

Breakdown of Changes by Degree

< 45°	*Percentage of High COD*	28.1%	25.2%	
	Velocity In (ms^{-1})	3.68 (3.64 - 3.73)	3.5 (3.44 - 3.57)	< .001
	Acceleration In (ms^{-2})	-0.23 (-0.36 - -0.11)	-0.27 (-0.48 - -0.07)	.747
	Velocity Out (ms^{-1})	3.53 (3.47 - 3.59)	3.33 (3.23 - 3.42)	< .001
	Acceleration Out (ms^{-2})	-0.23 (-0.38 - -0.09)	-0.25 (-0.47 - -0.03)	.916
45° - 75°	*Percentage of High COD*	6.0%	5.1%	
	Velocity In (ms^{-1})	3.05 (2.92 - 3.17)	2.94 (2.75 - 3.13)	.335
	Acceleration In (ms^{-2})	-1.82 (-2.32 - -1.31)	-2.36 (-3.14 - -1.58)	.244
	Velocity Out (ms^{-1})	2.51 (2.33 - 2.69)	2.29 (2.03 - 2.56)	.175
	Acceleration Out (ms^{-2})	0.47 (0 - 0.95)	0.49 (-0.28 - 1.26)	.968
75° - 105°	*Percentage of High COD*	7.3%	6.0%	
	Velocity In (ms^{-1})	2.35 (2.24 - 2.46)	2.5 (2.33 - 2.67)	.135
	Acceleration In (ms^{-2})	-2.83 (-3.13 - -2.53)	-3.18 (-3.65 - -2.71)	.213
	Velocity Out (ms^{-1})	1.96 (1.88 - 2.04)	1.9 (1.77 - 2.03)	.448
	Acceleration Out (ms^{-2})	1.48 (1.15 - 1.82)	1.27 (0.71 - 1.83)	.514
105° - 135°	*Percentage of High COD*	13.7%	11.2%	
	Velocity In (ms^{-1})	2.36 (2.29 - 2.43)	2.44 (2.33 - 2.54)	.259
	Acceleration In (ms^{-2})	-3.83 (-3.99 - -3.66)	-4.03 (-4.29 - -3.77)	.188
	Velocity Out (ms^{-1})	2.03 (1.98 - 2.07)	1.99 (1.9 - 2.08)	.542
	Acceleration Out (ms^{-2})	2.83 (2.56 - 3.1)	2.85 (2.41 - 3.29)	.939
135° - 165°	*Percentage of High COD*	23.3%	27.1%	
	Velocity In (ms^{-1})	2.48 (2.43 - 2.54)	2.48 (2.41 - 2.55)	.929
	Acceleration In (ms^{-2})	-5.1 (-5.26 - -4.94)	-4.92 (-5.14 - -4.7)	.199
	Velocity Out (ms^{-1})	2.16 (2.09 - 2.23)	2.08 (1.99 - 2.17)	.149
	Acceleration Out (ms^{-2})	4.64 (4.39 - 4.88)	4.33 (3.98 - 4.68)	.156
> 165°	*Percentage of High COD*	21.6%	25.4%	
	Velocity In (ms^{-1})	2.52 (2.46 - 2.59)	2.49 (2.4 - 2.58)	.509
	Acceleration In (ms^{-2})	-5.8 (-6.03 - -5.56)	-5.28 (-5.63 - -4.94)	.015
	Velocity Out (ms^{-1})	2.2 (2.13 - 2.27)	2.08 (1.98 - 2.18)	.051
	Acceleration Out (ms^{-2})	5.48 (5.2 - 5.77)	4.81 (4.41 - 5.22)	.008

Sig - Significance of differences in Pearson's Chi Square test

Shane, 2020.

AO (2016-2018), m=84

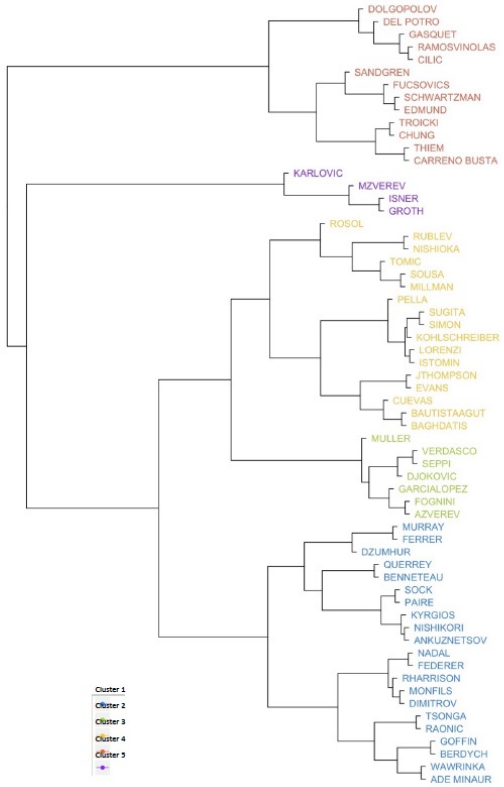


Figure 8.2 Dendrogram of men's COD profiles for players with whom played a minimum of 3 matches at the Australian Open Grand Slam event from 2016 to 2018. Final profiles used in the analysis consisted of 13 categorical and time-motion descriptors of COD performance. Dissimilarity was measured with a Euclidean distance and players were clustered using Ward's minimum variance method.

Shane, 2020.

AO (2016-2018), m=84

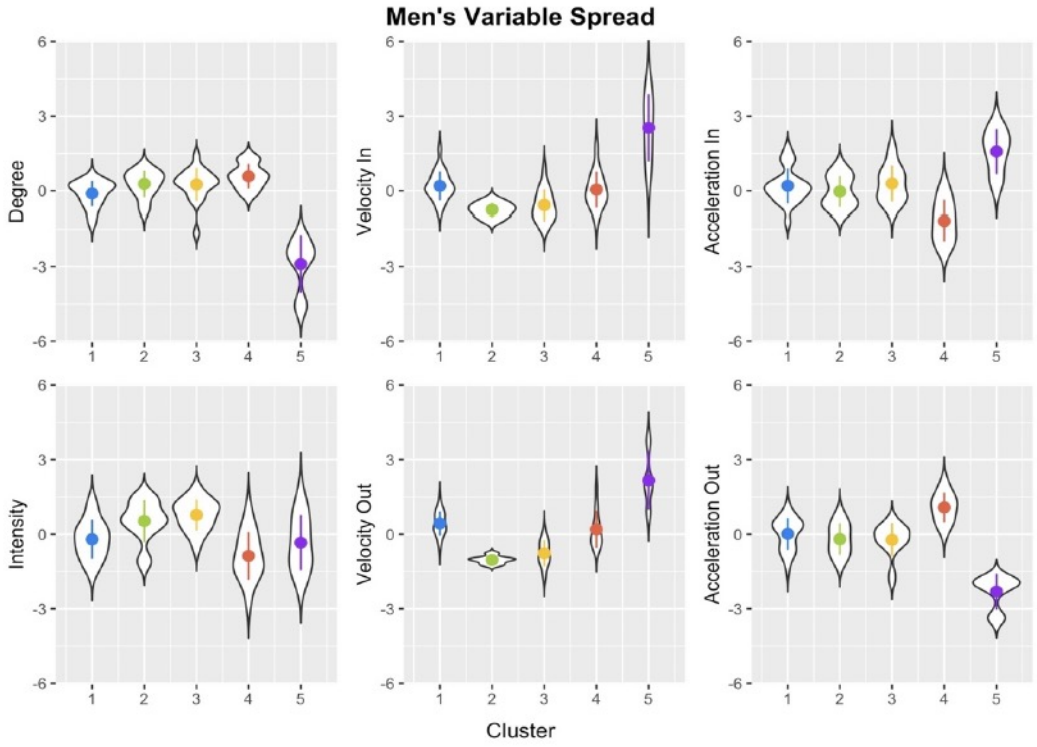


Figure 8.4 Violin plots of the six COD variables of interest for the men's COD profiles. Plots visualize the spread of the standardized player-specific random effects by cluster for each variable.

Shane, 2020.

AO (2016-2018), f=93

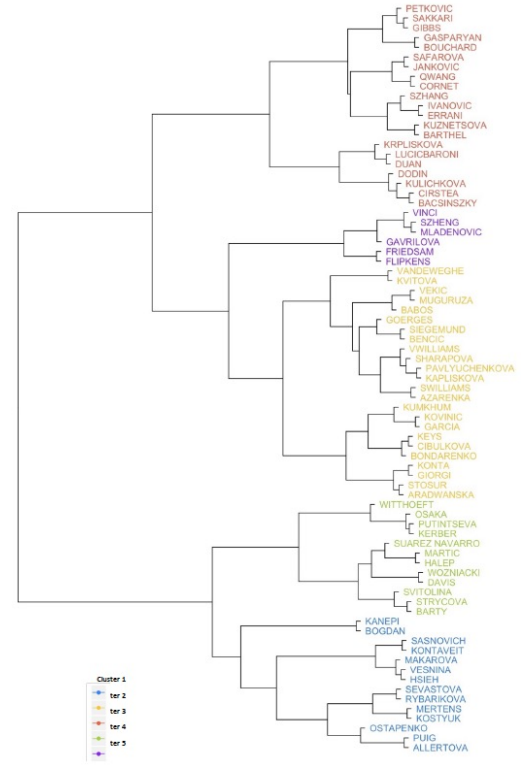


Figure 8.3 Dendrogram of women's COD profiles for players with whom played a minimum of 3 matches at the Australian Open Grand Slam event from 2016 to 2018. Final profiles used in the analysis consisted of 16 categorical and time-motion descriptors of COD performance. Dissimilarity was measured with a Euclidean distance and players were clustered using Ward's minimum variance method.

Shane, 2020.

AO (2016-2018), f=93

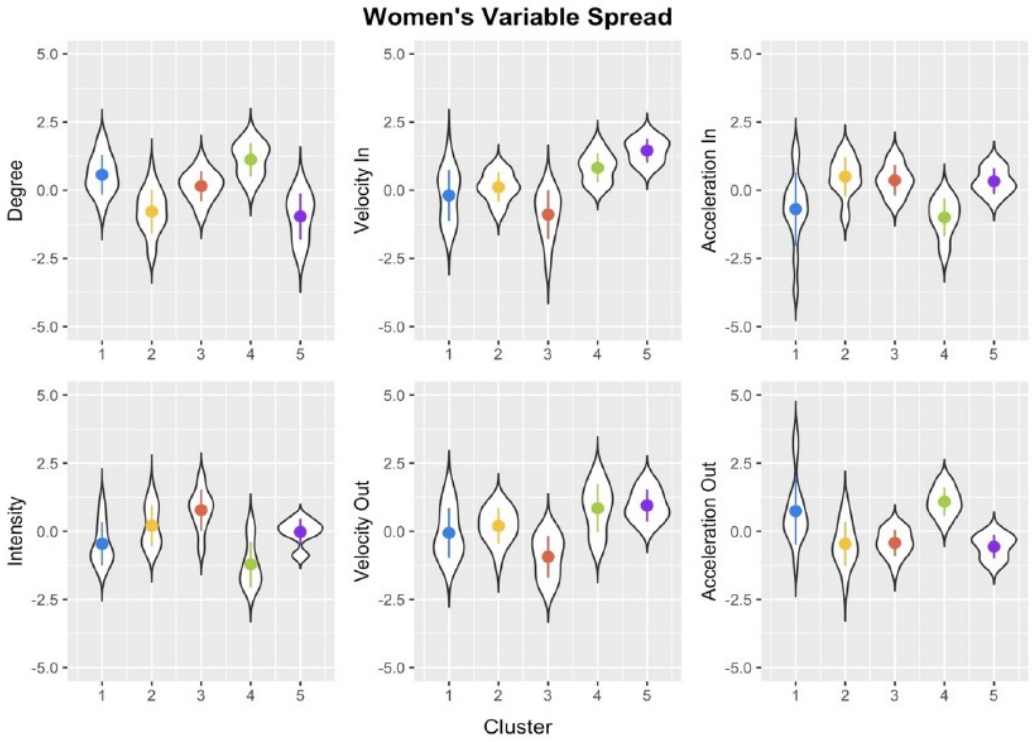


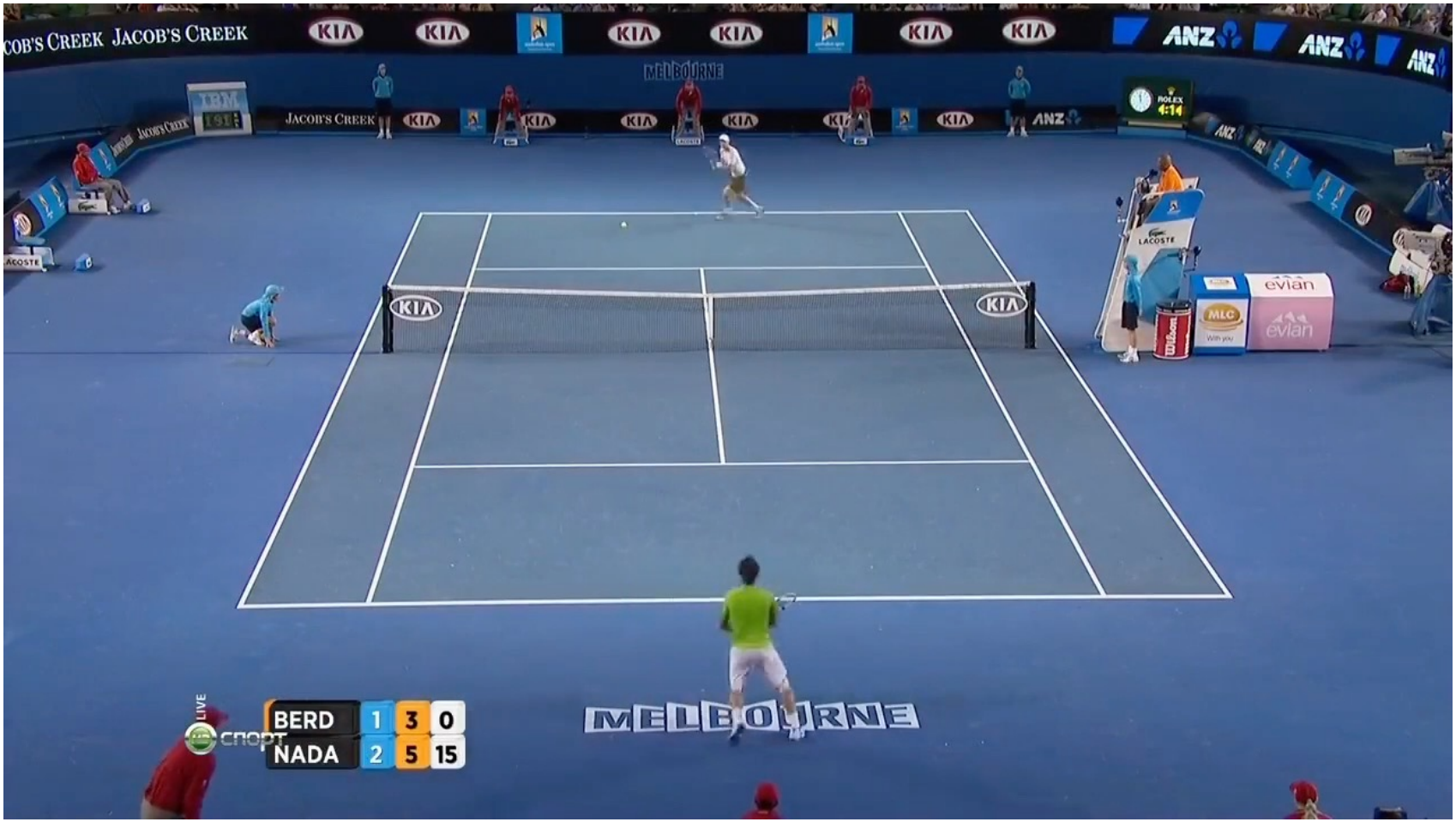
Figure 8.5 Violin plots of the six COD variables of interest for the women's COD profiles. Plots visualize the spread of the standardized player-specific random effects by cluster for each variable.

Shane, 2020.

Hitrost gibanja med udarcem

- Ko hitrost prihoda na udarec preseže 14 km/h se izrazito zmanjša hitrost loparja,
- Na hitrost loparja pozitivno vpliva povečanje moči trupa zgornjega dela telesa,
- Izvajanje treninga udarcev in gibanja ločeno ne pripomore k gibalni učinkovitosti igralcev,
- Udarce in gibanja je potrebno izvajati skupaj.

Hiter začetek gibanja



Hitro gibanje – tehnične osnove

Odzivnost stopal	Za hiter začetek gibanja igralec, uporabi nasprotno silo – gibanje proti podlagi.
Stabilnost	Impulz sile se bo učinkovito prenesel na zgornji del telesa samo v primeru, če ima igralec ustrezno stabilnost trupa.
Uporaba prostih telesnih segmentov	Ekonomičnost pri različnih udarcih in gibanjih bo dosežena s pravilno uporabo prostih telesnih segmentov.

Odzivnost stopal

Definicija:

1. Sposobnost stopala, da prenese silo s pomočjo upogibanja in pronacije
2. Sposobnost močno iztegniti/raztegniti stopalo, da bi povzročili odriv.

Odzivnost stopal lahko izboljšamo z:

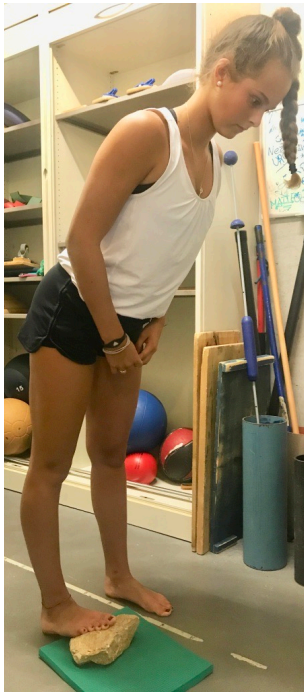
1. Proprioceptivnimi vajami
2. Vajami koordinacije (različne drže/položaji stopal)
3. Vaje za krepitev gležnjev.

Pomen odzivnosti stopal

Pomen odzivnosti stopal

Med prilagajanjem na žogo

Razvoj mobilnosti stopal



Razvoj jakosti stopal

Trening brez obutve mora biti vključen v ogrevanje in trening hitre moči.

Stabilnost trupa

Pomembnost:

- Pripomore pri prenosu moči/sile med zgornjim in spodnjim delom telesa

Značilnosti:

- Zaklene“ (pričvrsti) medenico z dobrim nadzorom nad ledveno-trebušnimi mišicami.

Prosti telesni segmenti

Povezava med hitrostjo in koordinacijo:

- Prosti telesni segmenti so vključeni v izvedbo udarca (aktivna vloga) ali jo podpirajo (pasivna vloga - ravnotežje).

Gibalni vzorci in položaji

Načrtovanje treninga hitrosti

Faze	Značilnosti
5-12 let	Osredotočenje na živčno-mišični razvoj z uporabo vaj za reakcijski čas (štartni signali) in hitrost gibanja (meti, zelo kratki šprinti, frekvenca korakov). Te vaje morajo biti naučene pred dokončno dozorelostjo centralnega živčnega sistema.
13-16 let	Ohranjanje reakcijske hitrosti, razvoj alaktatno-anaerobnega energijskega sistema in postopna uvedba ustreznih programov treninga za krepitev mišic. Pripomore k razvoju splošne in specifične tehnike teka, ki ustreza morfološkim spremembam športnika.
17+ let	Igralci morajo biti sposobni ustrezno uporabiti svojo splošno hitrost med igro. Razvoj anaerobne vzdržljivosti. V tej fazi se splošna hitrost lahko minimalno izboljša z ustreznim treningom moči.

Agilnost - definicija

- Agilnost lahko definiramo kot gibalno sposobnost učinkovitega izvajanja gibov s pospeševanjem ali upočasnjevanjem, vključno s spremembami smeri. Nedavno je bila agilnost definirana kot »hitro gibanje celega telesa s spremembo hitrosti ali smeri kot odziv na dražljaj« (Sheppard & Young, 2006). Ta definicija priznava vključitev kognitivnih veščin pri določanju učinkovitosti gibanja.

Agilnost

Definicija: sposobnost izvedbe gibalnih nalog z maksimalno učinkovitostjo.

V katerih situacijah teniški igralci potrebujejo agilnost?

1. Ob izvedbi udarcev pri veliki hitrosti gibanja
2. Pri spreminjanju smeri po izvedbi enega udarca in pripravi na drugega
3. Pri natančnem postavljanju na udarcev
4. Pri izvajanju več zaporednih udarcev
5. …

Pradet, 1996.

Nespecifičen trening na teniškem igrišču

Tek nazaj

Lateralno / sprememba smeri / linearno

Trening agilnosti na teniškem igrišču

Manj kompleksno

Razvoj gibalnih vzorcev:
→ osredotočenost na aktivnost stopal,
→ izvedba prvega koraka,
→ koordinacijske aktivnosti.

Bolj kompleksno

Vprašanja?

Specifičen trening na teniškem igrišču

Dostop do video gradiv:

Tennis Fitness & Conditioning

Delavnica

Razvoj tipičnih gibalnih vzorcev za:

- Serviranje,
- Reterniranje,
- Igro na osnovni črti,
- Igro pri mreži,
- Obrambne situacije.