



# Different types of variability in tennis practice

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## ABSTRACT

Variability is a term that is gaining traction in the tennis coaching world; traditional approaches which emphasise either a one approach-fits-all 'text-book' model of instruction are being abandoned as a result of the acknowledgement that people have differences and the acknowledgement that even the top players show variability. This article summarises some of the different types of variability that might occur in tennis practice, and gives recommendations for coaches

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## INTRODUCTION

Approaches that emphasise variability are fast gaining support over more traditional approaches to learning and training, which are linear and therefore ultimately (and obviously incorrectly) suggest that the same instruction to a group of players will result the same for all players. Traditional approaches have also sought the reduction of error (variability in a skill) so that the skill corresponds to a putative text-book model. This obviously no longer stands to reason because it is known that top players have varied technique (although they all make use of effective biomechanical concepts). Also, individual differences imply that everyone learns differently. Furthermore, modern tennis training has evolved in a way that makes it more holistic, as this can create more complete players (Crespo, 2009).

At a glance, variability could occur in tennis practice through varying: the incoming ball, tactical situations, technique or shot outcome (height, spin, spin, direction or depth). Drawing from many theories and definitions of variability, which often overlap, this article gives practitioners recommendations and the theoretical grounding that they could use to better their sessions.

## DIFFERENT TYPES OF VARIABILITY

### Variable, varied and random practice

One of the precursors to all other types of variability, Schmidt (1975) suggested that with increased and wider experience, we

develop a generalised motor programme, constantly updating rules of how to recall and use skills better. Similarly, contextual interference (Shea and Morgan, 1979) suggests that by switching skills in a random order (and possibly different variations of skill across different situations), more conscious effort is used to recall the different skills, which in turn leads to better and longer term learning. The result in tennis practice is that coaching should be variable, varied and random as it leads to learning skills faster and more robustly (Reid et al., 2007; Schmidt et al., 2018) but also mimics match conditions (Pankhurst, 2013).

### Recommendation for Coaches:

- Vary the situation in which a skill is practiced (variable practice), i.e. position, incoming ball and possibly shot outcome
- Have players switch between skills in practice (varied practice), and vary the order of practice (random practice).
- Apply these types of variability even when focusing on a specific skill or with beginners, although maybe to a lesser degree in these cases and in closed practice.



### Discovery or guided-discovery learning

Discovery learning involves a learner exploring different solutions in order to find effective solutions usually through the use of task/goal constraints such as targets and then the player testing hypothesis about skills to achieve the desired outcome. Thus variability is encouraged through trial and error. As a teaching methodology it contrasts to the traditional prescriptive method (Reid et al., 2007) and it has been argued that discovery learning is implicit and therefore allows for learning quicker as the learner adapts without as much conscious control or intention as if they were instructed (Liao and Masters, 2001; Masters and Poolton, 2012). This may not be the case fully as discovery learning involves hypothesising about solutions in order to achieve an outcome; however, the joint focus on task as well as solution may make this approach as least semi-implicit, allowing for some of benefits of implicit learning. Whilst discovery learning might imply that the coach should not impart any knowledge onto the learner, this should not be the case (Reid et al., 2007) and coaches should still impart knowledge and direction. Hence the more apt term guided discovery where a coach will guide solutions within effective ranges, biomechanical principles and concepts.

#### Recommendations for Coaches:

- Set tasks which force players to find effective and efficient technical solutions
- Use physical targets, impediments or modifications, i.e. ropes going parallel over the net in order to encourage height.
- Instruct players to force a certain effect on the opponent (i.e. push them back at the baseline or hit a low volley at the net) (Buszard et al., 2013).
- Give players parameters or concepts to work within, e.g. for a player working on an attacking forehand it would be important that the player make use of the BIOMECH principles and have a flatter swing but configurations of the swing may differ player to player within this.



### Dynamical systems and the constraints-based approach (adaptability)

Dynamical systems theory and the constraints-based approach take the discovery learning approach further, suggesting that expert performance can be a direct result of variability and adaptability (Seifert et al., 2013), whereas discovery learning could be taken to suggest that once a correct solution is found, variability is decreased. From a dynamic systems or constraints based approach (Davids et al. 2008; Crespo, 2009) the player has an internal movement pattern landscape based on interacting task (tactics, objectives, etc.), individual (abilities, attitudes, training, etc.) and environmental factors (weather, oncoming ball, etc.), which govern skills and success. In tennis terms, a new situation creates an imbalance in the movement landscape which the player tries to resolve by reorganising the skill components (Sanz and Moreno, 2013). Improvement occurs as the landscape where these factors meet is explored (through practice and variability) and stable states or 'attractors' are developed (states where the different components of the system meet for a successful response). Many movement patterns can be developed, allowing for successful switching between skills and variations of skills, which in turn allows for the creation of more complete players as a player is actively able to adapt better to different or even new conditions.

#### Recommendations for coaches:

- Encourage constant adaptation and variability even when effective solutions are found but also encourage 'attunement' to 'affordances', i.e. awareness of opportunities dictated by the situation (Davids et al., 2008)
- Use targets, goals, court modifications and impediments for drills to force exploration of new solutions
- Use the tactical effects against other players to guide exploration
- Guide solutions within solid biomechanical principles

### Structured task-goal variability

Structured task-goal variability is a newer theory and an offshoot of variable practice and possibly the constraints-based approach, and it involves changing the skill outcome in practice. Research has shown that will allow for more control in a test of changing outcome; however, the individual who practices the same outcome over and over will be better at that constant test (Ranganathan and Newell, 2010; 2013). This might seem simple but it partly contradicts the variability of practice theory posited by Schmidt (1975) because it suggests that practice at one outcome is best for learning if variability is not needed in competition; although, given the need to constantly vary outcomes constantly in tennis, deliberate variability of the outcome in practice seems more suitable than constant practice.

#### Recommendations for coaches:

- Have players actively vary outgoing shot properties such as height, speed, spin, depth and direction (even during practice of a specific situation) as this will allow the player to vary the outcome better under pressure, effectively improving their general accuracy
- Use targets, impediments and goals to induce variation of outgoing ball flight characteristics
- Be aware that this approach may not be best when one specific outcome of shot needs to be practised such as a flat 1st serve

### Differential learning

Differential learning draws on some of the aspects of a dynamic systems approach but emphasises perturbations and disturbances (Sanz and Moreno, 2013) through no repetition or even random instruction, which allows the player to refine their technique unconsciously. This is due to the signal from the noise or the randomness resonating against the signal of the movement pattern, which allows for greater feedback to the player (Schollhorn et al., 2006; 2009) or forces the player to develop their movement dynamics (Sanz and Moreno, 2013). The emphasis here is to bring external noise to a level where it interferes with the internal noisy signal of the skill, thus forcing the player to refine the skill. Beginner players already have this large amount of noise from a lack of a yet developed motor pattern and so this might not be appropriate for them. This type of practice might be better suited in warm-ups or in short coordination exercises given its lack of realism to a match.

#### Recommendations for coaches:

- Coaches should encourage a no-repetition policy in practice, or even add in 'noise' with random instruction
- Set instructions of different body and arm finishing positions for strokes

- Set instructions to never repeat shots exactly
- Tell players to wear temporary sight impairment devices
- Have players use other rackets with different weight, sizes, materials and strings
- Tell players to start facing the other way or run round cones between shots
- Be aware that too much of this type of practice is not very realistic to match situations
- Still ensure players act within the tactical context
- Use this type of practice in warm-ups and for coordination drills only.

### Execution redundancy

Execution redundancy (Ranganathan and Newell, 2010; 2013) refers to changing technique for a given outcome, and is related to differential learning and a dynamic systems approach, and could be seen as another type of perturbation to the dynamic movement system (Sanz and Moreno, 2013) which further develops player's ability to adapt. It has been suggested that execution redundancy in practice might allow for the benefits of finding optimal solutions but also generating more flexibility (Ranganathan and Newell, 2010; 2013). Thinking of the top players, the level of the game dictates that players will need to improvise and hit with control in situations where time and space has been taken away from them; it has been said that experts are more able to do this (Seifert et al., 2013; Unierzyski et al., 2018). In a study of experienced club tennis players, the group asked to vary technique whilst rallying improved in accuracy significantly whereas the group not asked to vary technique, the constant condition, did not (Davis-Higuera, 2018).

#### Recommendations for coaches:

- Encourage players to actively change their technique for a given outcome as this will lead to the player being more flexible as well as refining their skills.
- Ensure technique is still within accepted biomechanically correct ranges
- Ensure that the technique is attuned to the tactical situation
- Vary different swing configurations (grip, contact position/ height, arm angle at contact, swing size, etc.)

## CONCLUSIONS AND FINAL RECOMMENDATIONS FOR COACHES

Variability in tennis practice can develop players who are free of injury, have effective and efficient technical skills, but also

have personalized and adaptable skills, which is likely to allow for more enjoyment, greater success as well as a longer career. A lot of the theories of the different types of variability overlap and are not mutually exclusive in practice, and this is likely to be because they all have similar mechanisms, conceptualised in different ways. Coaches should use common sense, using the level of the player and goals to dictate where variability should take place in practice. All of the types of variability can be used within currently accepted methodologies for conducting sessions, which usually involve (once a warm-up, observation and evaluation has been carried out) picking a technical or tactical aspect to work on, starting from closed practice, and then adding levels of realism until the skill is ready to be tested in match play.

Adding layers of realism to drills with follow up shots or different decisions, naturally adds variability to practice in some ways but coaches should be aware of all the ways that variability could be induced in closed practice when working on a specific skill, situation or intention. Table 1 shows how to introduce the different types of variability for the closed practice of rally neutral baseline groundstroke skills and a wide attacking 1st serve.

| Type of variability   | Considerations for closed practice of baseline groundstroke rally (neutral) skills  | Considerations for closed practice of the 1 <sup>st</sup> serve flat/wide (attack) skill  |
|---|---|---|
| Variable practice – different incoming balls  | Feed to slightly different locations with different speeds,heights/spins  | Player changes side and position they serve from. Player could also change ball toss height   |
| Varied practice - switching between skills  | Players switch between forehands and backhands, even using variations such as slice, topspin and extreme topspin  | Players switch between flat, topspin and slice serves, or even serves in different directions   |
| Random practice – practice another skill  | Mix groundstrokes with attacking groundstrokes or volleys in a multiple ball drill, or work on serves simultaneously  | Mix serves with groundstrokes or volleys in multiple ball drill or working on another skill at same time  |
| Discovery and Guided discovery – show desired result and encourage adaptation         | Put cones down for depth in rally shot, and set up drills which encourage depth and keeping opponent back. For guided discovery, make sure players have an idea of what an effective groundstroke with effective BIOMECH principles is. | Put cones down for direction and speed (2 <sup>nd</sup> bounce target) of wide serve, or set up drills which encourage players to put rafter under pressure and move them off court |
| Dynamic systems and constraints based approaches - link different factors and explore | As above but more exploration of effective technique variations for groundstrokes based on factors. E.g. a shorter player might suit more physicality and spin; wider incoming balls require different footwork                         | As above but more exploration of effective technique variations for serves based on factors. E.g. extreme wide serve requires more spin and less speed                              |
| Task goal structured variability -  | Use targets/instructions to have players hit higher/lower, wide/central, flatter/more spin rally shots  | Have players hit wide fast 1 <sup>st</sup> serves with different amounts of slice/kick, and some wider than others.   |
| Differential learning – add randomness  | Use different types of balls and rackets. Use temporary sight impairing devices. Instructions to touch side line between strokes, hit with different stances or finish stroke with racket over shoulder, arm or just after contact      |   |
| Execution redundancy – diff. techniques for specific outcome                          | Have player hit with different contact positions (higher/lower/more in front/more in hand), slightly different finishing arm positions, different stances, etc.   | Have player change ball toss at different heights, different backswings, slightly different accepted service grips  |

Table 1: Example of different types of variability for the closed practice of groundstroke baseline rally skills and a 1st serve (attack) wide skill

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