PERCEPTION:
A TENNIS SUPERPOWER

What is 'Direct Perception' and what does it mean for coaches?

Watching professional tennis matches is always awe-inspiring. Players are so skilled, it often looks deceptively easy. There are the obvious physical skills of athleticism, but there are also what are referred to as 'unseen skills'. These are what distinguish players as successful performers (at every age and level).

In this series, we will look at a number of these tennis superpowers, which include:

- Problem solving
- Perception
- Decision-making
- Technical Adaptability
- Performing under pressure

Although every coach wants their players to have these abilities, the typical practice design often ignores or even hinders their development.

Like all the other superpowers, this one flows from the premise that tennis primarily uses Open Skills, and specifically, uses 'Perceptual Motor Skills', meaning that these skills must adapt to the environment.
(For an article on Learning Tennis as an Open Skill, click here)

A change in viewpoint

Several years ago, I started a journey that has changed my view of skill acquisition. In the last few years, it has all come together to the point that I have realized the Ecological Dynamics (ED) paradigm provides a much more effective framework on which to base all my coaching. (I will eventually be updating all my material on acecoach.com accordingly.) (For an introductory article on ED, click here)

There is a lot of great work on ED by Professor Rob Gray of Arizona State University (and one of the 'fathers' of ED), and I have found some good tennis applications from UK coach **Steve Whelan**. I recommend looking up anything they've done.

Skills versus Technique

We need to start by understanding the difference between coaching technique and coaching ***skills***. Coaches typically spend the majority of their time teaching **technique** (which, in most cases, means perfecting a motor pattern that can be repeated when needed). In contrast, we need to see it more as coaching ***skills.*** Professor Gray defines a skill in the ED framework as:

*'A **skill** is the ability to use **information** from the environment to **find & execute** a **movement solution** to realize an **affordance** that will achieve one's **goal/intention.**'*

Skills are not about **technical repeatability** but the ability to use **technical adaptability**.

Skills are:

- Information-driven and coupled
- Goal-driven, purposeful and functional
- Involve decision-making (No decision = no skill)

Skills do require repetition, but it is different in an ED approach. Being 'skillful' means being able to perceive the environment and make sound decisions to solve problems, rather than simply repeating a pre-programmed movement. It is about ***repeating the process of finding a solution***, to make the player more skillfully 'attuned', intentional, and adaptable.

For example, imagine a standard BH crosscourt feeding drill that one would see anywhere in the world. A coach feeding a ball to a player (predictable reception) to repeat a BH they are told to hit crosscourt (specified projection) is not developing the ***skill*** of hitting backhands since there is no relevant perception, problem-solving, decision-making or adaptation.

> *"Being 'skillful' means to being able to perceive the environment and make sound decisions to solve problems rather than simply repeating a pre-programmed movement."*

'Direct' Perception

One of the main differences between my previous views and the ED view is the way I formerly viewed perception. Previously, perception for me was a 'step' in the information processing (IP) process.

The analogy that Professor Gray uses is:

"The IP process is like shooting a cannon. All the calculations of where to fire it are 'computed' in one's head, and then the cannon is fired."

All the research has led me to a different view.

Tweaked for tennis, I will phrase it like this: If the racquet were the cannonball, rather than a process where all calculations and predictions of where the ball will be are completed first and then the motor pattern is applied, Dr. Gray would say the racquet is more like a 'guided missile'. Through sensors in the missile, it maintains a constant connection with the target that is constantly updating. That is called ***'Direct Perception'*** in ED.

So what? What does this have to do with coaching? Hopefully, I can make the connections clear as we go, to see how this impacts how we coach and design training.

To develop skillful adaptability, it is important to understand Direct Perception and that all the information we need is contained in the environment. We simply need to connect to it appropriately.

> *"We perceive to move but we also move to perceive."*
> James J Gibson-American Psychologist who identified the concept of Direct Perception

This is not a process unique to humans. Animals (especially mammals) work this way. Here is a link to an interesting video. Although the caption is about how the cheetah uses its tail, notice the cheetah's head and eyes, and how, to make all the incredible moves needed to catch the gazelle, it keeps its perception laser-focused.

https://www.reddit.com/r/natureismetal/comments/gtlket/a_cheetah_using_its_tail_to_minimize_torque_and/

In ED, this is a critical and core concept called ***'Perception-action coupling'.*** The cheetah is not doing internal mental calculations, processing and 'predicting' where the gazelle will be before acting, but all its movements are part of a full-system 'embodied' dance.

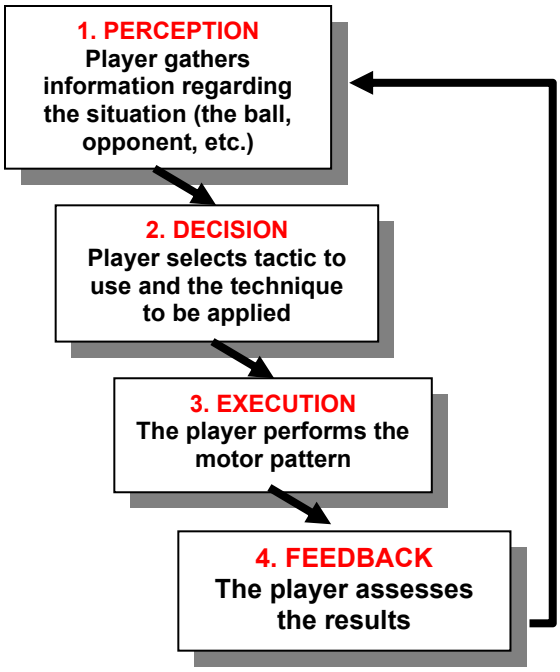
It is the same for us with the opponent and the ball. We perceive to move, but at the same time, we also move to perceive. Our perception and action form an ongoing feedback loop, with perception guiding action and our actions guiding perception. (See the table below)

Perception Guiding action:		Action Guiding Perception:
• **Perceiving 'Affordances':** We perceive what the environment offers a**s** **'**invitations to action'. In ED-speak these invitations are a key concept called 'affordances'. They are goal-relevant and guide our movement choices. E**xample:** *A player has the tactical goal of attacking and pressuring the opponent. If the player receives a short ball, this can be perceived as an 'affordance' to move to the net. (guiding all their footwork and preparation, etc.).* • **Action Capabilities:** The information we perceive is always filtered through our own capabilities. E**xample:** *If a player does not move well, is not adept at volleying, is tired, etc., they may **not** perceive the short ball as an affordance to approach & volley.* (How often have you trained players to approach & volley and wonder why they don't do it when they play?)		• **Creating New Information:** As we move, our bodies generate new information, which allows us to adapt. E**xample:** *The player didn't take the affordance to move all the way into the net, but did move into the court. They also picked up new information that the opponent was hanging back behind the baseline.* • **Feedback Loop:** Each movement provides feedback about the movement itself and generates new information used to adjust subsequent actions. The act of moving allows you to perceive the changing position of the opponent, the trajectory of the ball, etc. E**xample:** *Our player also perceives the ball as low, and, coupled with their location and the opponent's location, provides them with the affordance to hit a slice drop-shot. The cycle continues based on their perception of their changing position, the opponent's position, the ball's trajectory, and so on.*

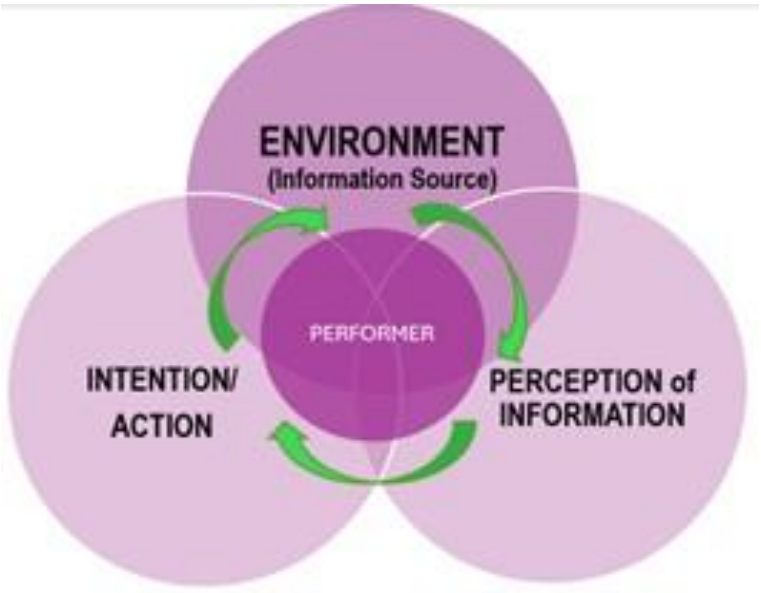
Perception and action are not sequential but simultaneous and interdependent. Therefore, tennis training needs to be about helping players learn to 'attune' to the relevant information and maintain their connection to it rather than memorizing movements and technical positions (E.g. the 'ideal' position to take on a FH groundstroke backswing).

Here is a diagram that depicts the interaction and the difference from my previous view of Information Processing:

Not



But now…



Coaching implications

So, what does all this ED-jargon mean for the coach on the court? How do we train this perception-action coupling to nurture this 'Direct Perception'? Here are a few of the guidelines I have found helpful in the journey:

- **Prioritize training *skills,* not 'technique':**
  Do not misunderstand. Effective biomechanics are important, but the 'form' many coaches teach doesn't lead to playing skillfully. Constantly ask, *'Am I training the **skill** or just my idea of correct technique?'*

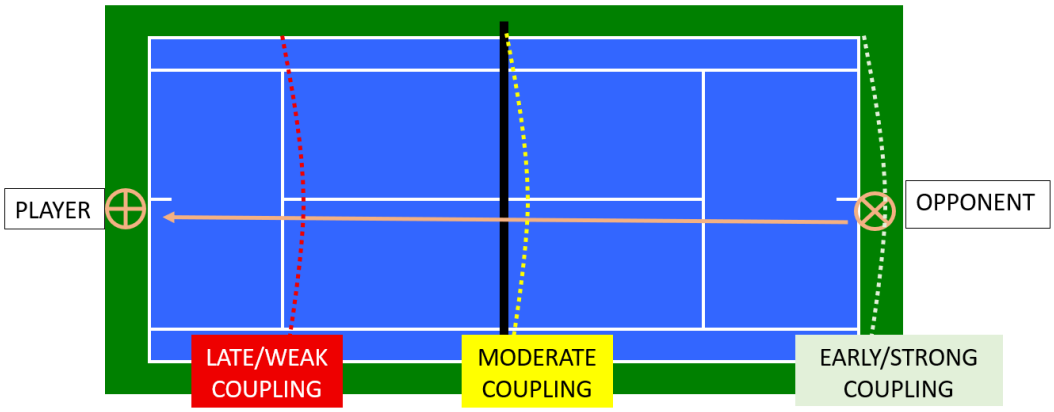
- **Train skills by educating 'Intention':**
  The intention players have for their movement will be a major factor in determining which information is relevant. ***Our whole coordination system is wired to perform tasks.*** A clear tactical goal for every shot will help focus our perception on what is essential to accomplish the task.

  For example, the intention of 'making an opponent stretch' will set off a whole different movement solution than 'pushing them back'. Their intention and the task shape the perception and thereforethe action. Never divorce technique from tactical intention.

- **Prioritize training 'Attention':**
  Years ago, I did an article on perception. Even though it was written from an IP perspective, a tool I created remains useful in an ED context if we 'evolve' it. The goal is to keep in mind that perception is not a 'step' in a 'brain-first' process.

  The tool is what I call your Focus of Attention Range (F.A.R). Your F.A.R. is when/where you couple your actions to the relevant information you need to act. **'Education of attention' is also an essential concept in ED, so players 'attune' to specifying information for their actions.**

  A coach can determine a player's F.A.R. by observing them from behind. When the player hits the ball towards their opponent, note when you see them start to move for the next shot and how 'connected' their movements are. (e.g. not just random 'bouncing'). When they move, take a mental 'snapshot' of where the ball is to get an indication of when/where they begin their coupling process. With training, every player can improve their F.A.R. and couple their actions earlier.



- **Late/Weak Coupling:** The player makes their initial actions when the ball is bouncing on their side of the court. This is typically observed among starter players with no prior experience. They see the approaching ball from the moment the opponent hits it; however, no actions are taken until the ball is about to bounce, at which point they react.

- **Moderate Coupling:** The player takes their initial actions when the approaching ball is around the net. This is typically seen with intermediate players. It is like the ball they see is in a fog. When the ball comes out of the fog, then they begin coupling.

- **Early/Strong Coupling:** These players have a F.A.R. that includes the opponent on the far end of the court. They pick up relevant information from their own shot, moving towards their opponent, their opponent's impact, and the ball coming back towards them.

For performance players, physical trainers spend hours just for minimal gains in speed. Helping players react ***earlier*** can lead to big improvements in play.

Novice players see the same things as advanced players, but advanced players know how to zero in on the information most relevant to guiding their actions. Players can be trained in the relevant information sources:

- Ball-based information: Attuning to the characteristics of the ball, including its height, direction, distance, speed and spin to connect movements to intercepting the ball.
- Player-based information: Seeing the relevance of the opponent's position and location.

Sometimes, it is the shifting of attention that causes a challenge. Players must shift their focus from their impact, to the opponent, and back again repeatedly. Shot quality suffers if this shift is poor.

- **"Here & Where" Activity**
  This is a variation of the classic Timothy Gallwey *"Bounce, Hit"* activity. The player says *'Here'* when they make contact with the ball. To lock in their attention, it is essential to synchronize the saying of the cue word at the exact moment the ball impacts the strings. This is only possible if the player truly has their full attention on the ball at impact. Having them exaggerate the exhale by saying ***'HHHeeere'*** will improve the synchronization.

  Next, immediately after they hit, the player shifts their attention to the far end of the court and the opponent impacting the ball. To do this, they cue themselves by saying ***'Where'*** (Where is the ball? Where is the opponent?). It is helpful to keep saying *'Where'* multiple times as they watch their opponent hit the ball and it approaches them. Using *"Where"* and *"Here"* can help direct their attention.

Improving the Visual System
One of the elements hindering players from tracking the ball is inappropriate head movement and eye tracking. **By improving this, a player's visual system can be fully utilized to couple perception with action.**

Tracking a ball well requires a player's head to remain still and to look forward. They need to track it all the way to the impact. Coaches should look for appropriate head movement when playing.

This is especially important when players are running laterally. If their head turns to the side, they will tend to impact on the side rather than in front.

- **Head Games**
  This is a constraint coaches can use to help players feel balance and head position. Put on a baseball cap. When moving to the side, ensure the cap points toward the net. To help the head stay balanced and still, and avoid bouncing up and down while moving, turn the cap inside out and balance it on the head while playing. Play a small game in one service box (underhand serve). If successful, keep enlarging the area.

Note: Visual stimuli are not the only source of pertinent information. The sound of the ball and even the opponent can also provide information.

- **Prioritize variability for receiving the ball:**
  One of the most effective ways to consistently train perception-action coupling is to ensure players gain experience through varied reception.

  Include neutral, offence and defence in every session and receive balls with varying speeds, trajectories and spins (depending on level). This is in contrast to 'grooving' strokes through 'drills' (a military term for doing the same moves over and over) with pre-prescribed reception & projection. Make it a priority to include decisions on ***every*** repetition.

- **Keep practice activities 'information-rich':**
  The best activities include an opponent. Cones give far less information. By making practice like the actual game (Called 'Representative Learning Design'), players are given real-world problems to solve and learn to focus on the information that is most relevant to calibrate their movements.

Summary

The article discusses the concept of "Direct Perception" within the Ecological Dynamics framework and its relevance to tennis coaching. It distinguishes between coaching technique and coaching skills, emphasizing that skills involve adapting to environmental information to solve problems rather than repeating fixed motor patterns. The article explains how perception and action are coupled in a continuous feedback loop, where players perceive affordances in their environment and adjust their movements accordingly.

It advocates for training that focuses on skill development, intention, attention, and variability in practice, rather than rote technical drills. Practical coaching strategies include educating players on intention, improving visual tracking, and designing information-rich, game-like practice scenarios to enhance players' ability to attune to relevant information and make timely decisions on the court.