2.1 Cognitive elements of the player

Introduction

The following module will analyze the development and application of decision making from the point of view of different fields of knowledge. The intention is to illustrate experiences and the theoretical framework in this course with concrete facts.

The professional areas where decision making is present are so wide and diverse that they must be explored in order to discover how decisions are approached. Psychology, physiology, neurology, professional and youth coaches, along with high-performance athletes, are all sources of knowledge that play a role in decision making and can enrich our study with their experiences.

Decisions are inherent to life. We continuously have to make decisions, whether they're simple day-to-day decisions or complex decisions that lead to major change.

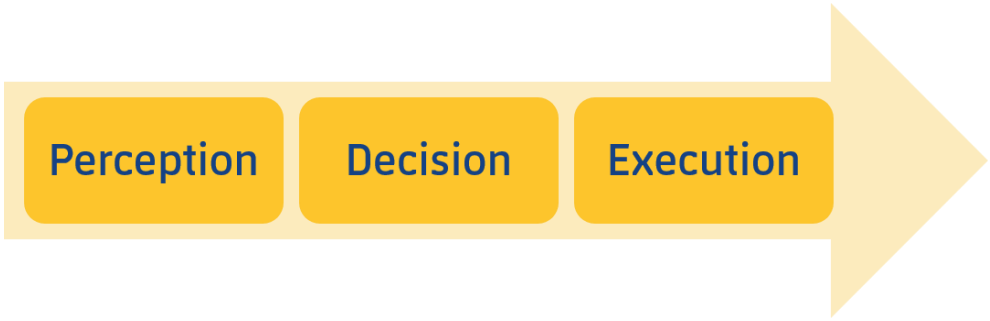
We make so many decisions that few of them are actually made consciously. The majority of our day-to-day decisions are unconscious. This decision-making mechanism is based on energy optimization. It is not energetically convenient to think consciously about all the choices we make daily, from the clothes we wear, the way to get to work, how we greet people, how we brush our teeth each morning, and so on. There are so many decisions to make on a daily basis that our brain cannot store all the information on a conscious level due to the amount of energy that would use. The neuronal energy saving strategy is a result of the variables we encounter.

One issue we want to highlight concerns the emotional plane. Emotions are considered the basis of all decisions we make. Each one of them goes through our emotional filter. In a sport as complex and emotionally charged as soccer, understanding the emotional dynamic is very important due to how emotions influence decision making.

During a soccer game, so many decisions are made that it is not possible to keep track of them. For this reason, we must develop methodological strategies and optimization tools to improve players' decision-making

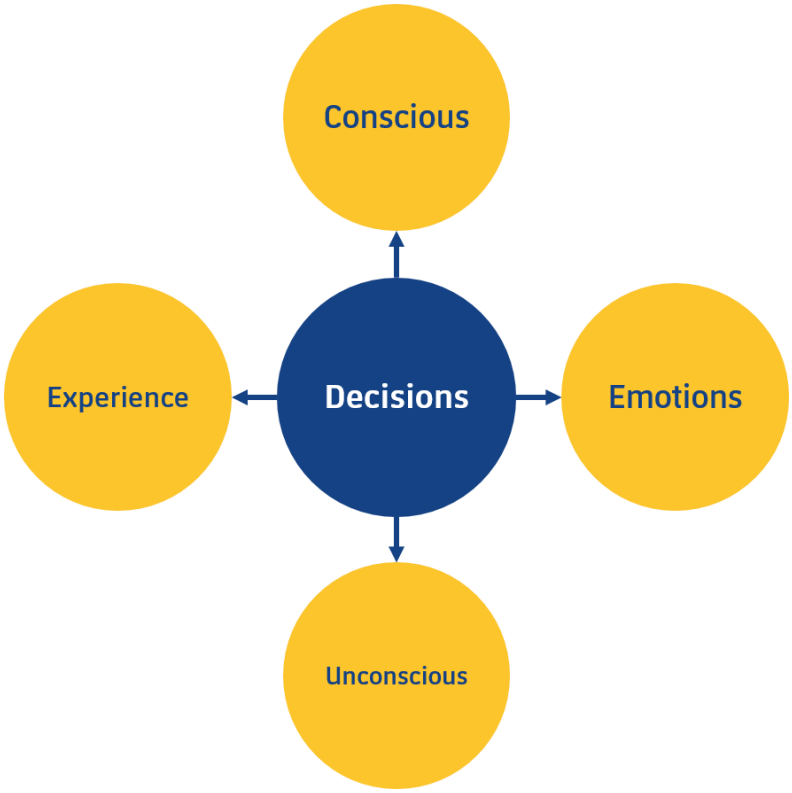
process, with the aim of being able to make better decisions faster. According to Guindos (2015), "the methodology we must use educates and trains the unconscious in a pragmatic way and applied to our sport" (p. 90). As configurating elements are developed in exercises, habits will form in the unconscious that enable agile responses, once assimilated during the training process.

Figure 1. Traditional decision-making process



Source: Guindos, 2015, p. 89.

Figure 2. Current decision-making process



Source: Guindos, 2015, p. 91.

To better understand the decision-making process, it is important to begin by studying the **cognitive structure**, **perceptual memory** and **attention/concentration**.

The decision-making process is highly complex as a result of the number of elements to consider in the process. If you look at a player's actions in detail, you can see that his/her behavior is divided into two different moments: the moment he/she perceives the information, and the moment he/she executes his/her action plan. This is known as the perception-action cycle.

When the action that needs to be executed is recognized quickly, the player is said to use an automatic tactical-perceptive approach. Otherwise, if he/she does not have a repertoire of perceived situations in his/her memory, cognitive perceptive abilities will be in charge of running a filter so that the decision-making mechanism is not too demanding.

During the decision-making process, the incoming information is compared to that of previously experienced and resolved scenarios. If similarities are found, previously successful responses are used. If the intervention scenarios are new, a response is given based on information obtained from playing experiences in similar contexts.

Actions that are carried out to resolve situations are not done in an isolated way. They are linked to each other in a short amount of time and some are even carried out simultaneously. Experienced players, while performing certain actions, are already thinking about and analyzing their surroundings to decide what the next intervention will be. Of the many stimuli a player must attend to, two can be distinguished as the most important: his/her teammate's actions and those of his/her opponents. This is where the idea of **strategy** comes from.

It is well-known that the most important information for athletes is obtained through the sense of sight. Through our central field of vision (stereoscopic view), we have a narrow angle of vision and receive little information, but the quality of this information is very high, and we can see every detail of the situation. Through our peripheral field of vision, or monoscopic view, we have a wide angle of vision and receive a lot of information, but the quality is poor since it doesn't include details (Espar, 2017).

Table 1. Field of vision characteristics

Peripheral	Central
• Wide view. • A lot of information. • Poor-quality information. • There are fewer details.	• Narrow view. • Little information. • High-quality information. • All the details can be seen.

Source: Espar in Seirul·lo, 2017, p. 252.

Cognitive structure

This structure allows the athlete to understand the characteristics of his/her surroundings better, grasp stimuli and process them, with the intention of determining their importance and significance in each particular situation, in order to make decisions.

Team sports are characterized by the situational and changing dynamics of the environment, which require the athlete to adapt permanently to changes based on decision making.

We will discuss some characteristics of information processing to understand how it produces declarative learning.

Information processing

We will look at memory systems for declarative learning. Later on we will discuss motor learning. Declarative learning is important to understand the game, but not to act on it, because when a player participates in an action he/she does not have time to reason.

We will highlight 3 aspects: sensory information storage, short-term memory and long-term memory.

Sensory information storage: This storage system may contain large amounts of sensory information for a short period of time before it is lost. Archived sensory information quickly disappears and can be stored for only half a second.

Short-term memory (STM): the center of information processing. Information recorded as short-term memory from sensory storage is generally new. If this information is not repeated and memorized instantly, it is very likely to be forgotten. If a person succeeds in repeating new information for 20-30 seconds in the STM, they can learn it and transfer it to long-term memory (LTM). STM can be referred to as working

memory. In line with its dynamic nature, it saves information that is relevant to the present moment only.

Long-term memory: information stored in this memory is generally permanent. With STM, long-term memory information can be updated, reorganized and strengthened.

Remember that motor learning does not normally use this approach. Instead, based on the perception-action cycle, the athlete carries out the actions he/she deems optimal based on context and his/her experience. The actions he/she carries out are increasingly optimized and adapted to context.

Selective attention

It is critical for athletes to be able to ignore irrelevant sensory information so that they can use selective attention for the most important information in a given situation. The ability to selectively attend to stimuli is based on the correct distribution of neurochemicals in the brain (Cox, 1987). Changes in the balanced distribution of dopamine and noradrenaline is associated with the impossibility of selectively attending to a stimulus (Cox, 1987). This ability to distinguish between relevant and irrelevant information can be trained and will depend on the athlete's experiences.

Narrowed attention

An athlete's ability to focus on the appropriate stimuli during the game is called focus of attention. The focus of attention includes the athlete's ability to increase or decrease his/her attention when needed. As Easterbrook (1959) says, the environment provides us with the information we need to deliver a skillful performance. In certain situations a narrow attention eliminates all irrelevant stimuli and only the most relevant ones remain. These conditions, as mentioned above, are trained.

We will study four areas of the cognitive structure.

- Perceptual memory.
- Attention/concentration.
- Sensors.
- Stimuli.

Stimuli

Perceived stimuli are responsible for triggering a series of events, which are captured and processed by different areas. Training athletes to distinguish stimuli is very important.

Stimuli, in general, refers to everything that happens around a person. Everything he/she feels, interprets through the sensory organs, perceives in a certain way and acts accordingly, correctly or incorrectly based on past experience.

In line with the degree of importance attributed to the stimuli, it is important to understand how perceived information is processed in order to design a training approach and exercises according to the type of stimuli that need to be trained.

Stimuli differentiation according to Damunt and Guerrero (2013):

Depending on time:

- Duration: Triggers/of concentration.
- Speed.
- Differences in speed.
- Prediction of events.

Depending on location:

- Distance
- Trajectory.
- Orientation.
- Organizational.

According to their nature:

- Significant stimuli: provide relevant information to the receptor, who chooses the best option according to his/her goal. These stimuli are subdivided into animate/inanimate, specific/unspecific, proximal/distal, interoceptive/exteroceptive.
- Insignificant stimuli

On the field, specific significant stimuli are the ones that best transfer to real game situations due to the similarities of the exercises. In this case, perceptual memory, which we'll study later, comes into play during the competition if it was previously trained with highly specific stimuli.

Sensors

These are divided into four categories:

- Visual
- Auditory.
- Kinesthetic/tactile.
- Vestibulo-ocular.

In training exercises, sensors can be distinguished by the player's holistic view, although it is not appropriate to do so as a rule of training. They can be trained according to desired objectives in a given session.

Sensors are the organs through which we receive information from perceived stimuli. It is important to emphasize that the objective, in this case, is to know how to **grasp and understand**. Sensors grasp stimuli and, through perceptual memory and attention/concentration, we understand what is happening, enabling optimal decision making.

Visual sensor

Here, four levels are differentiated, each one limiting the next.

- Orientation of the body: it is important at the coordination level and at the cognitive level to be able to interpret as many stimuli in your field of vision as a result of the correct positioning of your body. The body's orientation allows you to assess the area around you.
- Orientation of the head: Players who play on the inside pick up a lot of stimuli. It is fundamental to orient your head towards where the stimuli are generated.
- Orientation of the eyes: this orientation is more limited because, most of the time, the movement of the eyes is accompanied by the movement of the head.
- Range of vision/peripheral vision: consists of the ability to identify objects around the point of focus. It determines the range of one's field of vision.

Auditory sensor

As far as soccer is concerned, the auditory sensor is secondary. According to Damunt and Guerrero (2013), this is true for two reasons:

- Most of the auditory information that reaches the athlete has already been received visually.

- Generally, information from auditory sensors does not allow for anticipation. What the athlete does is react. If the goal is to optimize the decision-making process, anticipation is more important than reaction.

Kinesthetic/tactile sensors

- Reference points: locate the rival.
- Be aware of the changes in one's own posture and movements, as well as information regarding fatigue, pain, etc.

Vestibulo-ocular sensors

They're part of what goes on unconciously. These sensors are responsible for managing the body's balance. In soccer, many situations generate postural imbalances, so it's recommended to training these types of sensors.

After grasping the stimuli that come from the environment through the sensors, the next step is to understand them. Perceptual memory and attention/concentration come into play here.

Perceptual memory

This memory refers to all the information that surrounds someone regarding the perceived stimuli.

In a child's first reaction to a stimulus, the child does not know if it is significant or not, nor does the child know its meaning. This is the moment when you begin to form your experience, while investigating stimuli that provide information.

Perceptual memory plays a role when helping athletes learn know how to identify stimuli in the environment that are truly significant, storing them in their memory and later applying appropriate motor responses.

Development of perceptual memory

During a soccer game, a player constantly receives hundreds of stimuli, all in the form of perceptions. The goal of developing perceptual memory is to gain the knowledge to distinguish and process all the information received.

The extent to which a young player masters the internal logic of the game, the tactical culture of the team, the playing model, and how well

he/she controls his/her motor resources, is determined by how much he/she has optimized his/her perceptive-motor skills during practice, and will translate to a better performance on the field.

Perceptual memory is influenced by two variables. Emotional markers and mindsets As mentioned above, emotions are the filter through which all decisions pass. The decision to carry out a motor action in any given situation is determined by emotions. Mindsets help the brain to solve and manage complex problems.

Optimizing perceptual memory

A chain of events ranging from the repetition of stimuli, the use of specific stimuli, and storage in short and long-term memory.

Repetition of stimuli - specificity of stimuli - storage in memory.

The goal is to create situations where the athlete can interpret the similarities between stimuli and associate them with previous learning, based on experience. This generates a repetition of the stimulus, specific to the playing context. The brain synthesizes proteins when forming a memory. If a memory is stimulated the right way, it is then stored in the long-term memory.

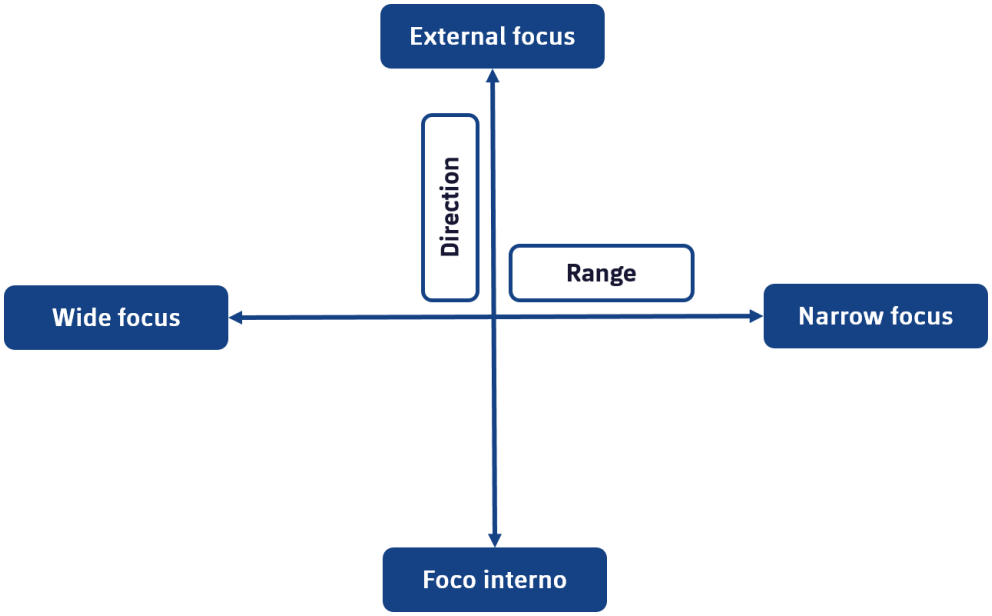
Perceptual memory, attention/concentration.

Attention, contact with the most relevant stimuli.

Concentration, focusing and maintaining attention on a specific task.

Nideffer (1976) argues that attentional processes have two independent dimensions. The first is called **range** and the second is called **direction**.

Figure 3. The focus of attention varies according to range and direction.



Source: Prepared by the authors.

The range of the athlete's attention span ranges from narrow to wide, while the direction varies from internal to external.

Attention Models

In recent years, the variables attention and concentration have been increasingly recognized as critical to an athlete or team's success in the world of high performance sports. This is increasingly being studied by coaches, physical trainers and sports psychologists. Sports teams understand that distractions (loss of attention) are common during training sessions and even more so during games or competitions. Athletes experience many variables as distracting agents, whether external or internal, that threaten the focus of attention.

When an athlete has good technical capacity - physical and tactical, it can enhance his/her ability as an athlete if he/she also manages to train and develop his/her **attention** and **concentration**. It provides greater problem-solving capacity in the face of any given exercise.

During a soccer game, a player must process a large number of stimuli from teammates, rivals, fans, his/her own internal emotions, the role he/she must play at each moment and according to the situation of the

game, and so on. All this means that athletes must develop the ability to direct their attention to the game at all times and to nothing else.

According to Dosil (2004), "the ability to control one's attention and concentration must be one of the goals in any sports training program and a skill that must be perfected by both athletes and coaches". (p. 177).

Nideffer (1976) identifies two dimensions of attention: **range**, which is wide or narrow, and **direction**, which is external or internal.

Range refers to everything the athlete can process at any given time. If the athlete finds a lot of information to process, then the range is wide. Conversely, if there is little information, the range is narrow. Such information is important for both types of range. (Nideffer, 1976).

Direction refers to where the focus of attention is directed. We can have external or internal direction. When the athlete begins to focus information from his/her surroundings, whether it's the fans, the weather, the coach, the rivals, etc., his/her focus has an external direction. When he/she begins to focus on emotions and thoughts related to the game, the focus has an internal direction.

The two dimensions, range and direction, can be combined to form four attentional styles. These are the ways in which athletes perceive information about their surroundings.

1- Wide-external: a lot of information is processed immediately. Enables a quick and concrete assessment of the surroundings.
2- Wide-internal: the player can analyze the situation perceived as well as plan his/her internal motor resources. Past information and possible future interventions are reviewed.
3- Narrow-internal: uses mental trial prior to motor execution. It allows the athlete to review his/her psychological variables.
4- Narrow-external: attention is directed at a previously determined objective or a specific external situation.

The objective for our athletes is to train and develop the four dimensions of attention. That way, they will be able to identify the information in their surroundings based on the most relevant dimension and adapt to a different focus.

This can be trained and carried out successfully to the extent that the athlete knows all the particularities of his/her sporting discipline and discovers his/her attentional skills.

Motor memory

Motor memories of strategic intentions, playing models, etc., are part of a previous emotional filtering. Remember that it is through the perception-action cycle where the player uses this "motor memory" (if you can call it that) implicitly to make the motor action emerge. Motor memory includes the following variables:

- Procedural knowledge of coordination skills.
- Innate movements (genetics).
- Movements learned through practice.
- Implicit/explicit movements.

In a soccer game, decision making will be carried out in different ways. It will depend on the player's location on the field and the situation, and whether or not it is essential.

To clarify what has been said, we can refer to Torrents, Pol, Seirul·lo and Balagué (2014) when they say that:

> Although they integrate volitional processes, humans' motor actions and sports actions, in particular, are regulated mainly in subcortical areas and do not require the existence of previously stored programs in the brain or consciously elaborated motor decisions. (p. 65).

On the other hand, Seirul·lo (1987) explains:

> Decision making cannot be understood only as a conscious process, although on certain occasions it may be (e.g., when a goalkeeper intentionally decides to throw himself in a certain direction to block a penalty). In most cases, during an interaction between opponents, there is a constant flow of highly effective actions (fake outs, feints, attempts, changes of direction, etc.) that do not require the combination of intention-action or instruction-action. For this reason, it seems advisable to reduce the instructions usually given in training sessions and replace them with situations that favor certain practices and avoid or

limit others, as is the case with preferential simulating situations (p. 66).

In short, when designing training tasks, a large number of configurating elements must be taken into account to bring athletes closer to their contextual reality, i.e. the game. Create tasks in which players must pay attention for optimal decision making.

Table 2. Configuring elements in decision making

Opponents	• Direct • A teammate's • Their intentions.
Teammates	• Situation. • Intentions.
Space	• Field (the whole field). • Playing and space nearby (observe teammates and opponents).
Time	• Of the game. • Of the specific action (pace, right moment, etc.).
Regulations	• Of the game. • Of the competition.
A player's own abilities	• Technical. • Physical. • Strategic.
Ball	• Location. • Danger.
Referee intervention	• Know the refereeing characteristics.

Source: Espar en Seirul·lo, 2017, p. 256.

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