2.1 Motor perception

2.1.1 Perception and its theories

Perception: Construction

Perception provides a great quantity of conflicting theories. Let's remember that the task of perception is the unification of an object for consciousness, in which the influence of past experiences, relationships with similar information on other objects and associated emotions all come into play.

Neural correlates for the phenomenon of perception have been identified. For example, in area 17, neurons have been identified for each of the individual features of an object: neurons that are activated according to the spectrum of visible waves, as well as neurons for lines at different angles (then, through a creative process, we complete what is missing in order to finishing perceiving an object). In the temporal area for hearing as well as in the visual areas, individual neurons have been identified that react to specific features of the object.

Perception remains a mystery as far as how our brains combine the information, integrate it, and construct a unified object for consciousness. The problem of unifying everything we perceive is that there is no part of the brain in which all information converges to be integrated and thus create an object for consciousness (despite there being hypotheses such as 40-Hz of Koch and Crick).

Perception is more trainable than sensation. The act of perceiving in and of itself is an act of muscle activation. The discovery of mirror neurons caught the attention of many on how the primate's primary motor cortex generated activation of columns that then, by way of the corticospinal tract, innervated the specific muscles that were acting in the moving object. So, the primate activated muscles by seeing a movement, without moving. When we see a movement, even if we do not move, we activate the same muscles as the subject who is moving. The act of perceiving is a neuromotor activation and this justifies what is referred to as training by representation. When we improve the quality of observation, we learn to discard irrelevant points and thus we are able to direct our visual attention to some very specific features of human movement. This way, we can facilitate or pre-activate the neural pathways that will later coordinate. The **act of perceiving** is an act to facilitate neural paths that regulate motor action; therefore, we can also train by means of observation complementing other solutions to refine the quality of our movement skills. This is a very important skill together with representation and verbalization of the observation. Before, these were

a few interesting guidelines in terms of how we can train motor observation to take advantage of the neural subsystems that facilitate the nervous system. When we talk about neural facilitation, we are talking about sensitization of the postsynaptic membrane of the neurons that form these paths. Therefore, there is more accessibility for activation of these same paths due to this pre-facilitation after this process.

2.1.2 The problem of integration

Sensory systems have the potential to be trained. Sensation gives information to the central nervous system to then make the object of consciousness, at which point the phenomenon of perception starts to form or take on a predominant role. Sensation and perception are both trainable, but the difference is that perception is a **creative and constructive phenomenon** that requires more trainability compared to the phenomenon of sensation.

Let's remember that sensation does not yield errors. It reaches the cerebral cortex just as it was in the primary cortices, i.e. just as it was commuted in the relevant centers. However, the phenomenon of perception can yield errors because the subject's interpretation of the object comes into play.

There is an interesting anecdote if we think about Rene Descartes' Discourse on the Method. Understanding that perception could lead to error, he doubted the outside world which, without precise information, is therefore object of doubt. When we put a metal bar in a river, for example, we see it broken, changed, bent. Our sensation provides precise, specific, and error-free data; however, we create the representation of the bar as broken in the perceptual process.

Perception and sensation are both trainable phenomena. We will concentrate on general teaching, on large non-specific global resources that we can use to train our athletes or subjects through the sensory system.

2.1.3 Hypothesis and neural correlates

From the moment when, after the thalamic relay in the different lateral geniculate nuclei of the thalamus, the information starts to follow a processing route in layers 2 and 4 of the cerebral cortex (external granular layer and internal granular layer), depending on its content, this message will promote the activation of very specific neurons that react to the information traits yielded by the object we are grasping with our senses. This phenomenon of sensation that has to do with the differentiation of different features of the objects occurs in those areas with specific short-axon neurons that are activated according to the traits of each object.

This information goes from Brodman area 17 to area 18 (this area contains even more differentiating sections). Here, different specialized neurons will activate to react to those particular traits of the object in question.

Consistent with the differentiation of the grasped object's details happening in area 18, the frontal lobe (through corticocortical projections) receives information from this process and starts to create conjectures or hypotheses regarding what the object is, fragments of which are being grasped by the primary and secondary projection area.

This process of conjecturing the 'what is it?' 'what is it about?' is chiefly carried out in **area 18.** From the short-axon neurons, it creates a communication with other areas of the cerebral cortex in which the processing of information from similar situations has already been registered.

In this way, we can see that there is a relationship between perception and past experiences regarding the object, unlike sensations, where history does not play any relevant role. Past experiences we have had with the object, accelerate the time it takes to confirm or reject hypotheses that we had been able to create based on our perception.

At the time when this hypothesis is created, all this information comes together in some part of the brain (an unknown part as of yet). From there, we reject or confirm the hypothesis and conclude the act of perception with the identification and recognition of the object, ultimately with the attribution of a name. That means that perception concludes when we can name what we have in front of us.

Perception is a process that demands corticocortical connection, frontal lobe, and language. In the phenomenon of perception, motor dimensions interact to incorporate more information from the object, since sensations involve motor function and perception depends on the movement of sensations.

Perception therefore involves mental tasks in order to deal with situations to recognize objects. Training sensations would entail exercises to open up channels, that is, multiplying possibilities for stimulation. Everything we can do to set out tasks that require a greater mental load and mental activity relative to an object, stimulates perceptual processes. (Di Santo, 2016)

2.1.4 Observation and perception in sports

The first distinction that we will make is between perception and observation. Some authors suggest this difference when referring to perception as the potential to grasp information related to a situation in our body and changes therein, and observation as the grasping of my body and another person's movement.