

2.2 Didactic proposals for the training of sensory-perceptual functions

2.2.1 Tactile and haptic proprioceptive training

Introductory Concepts

Let's go back to the idea that these dimensions are trainable. Processing this information at high quality and in the least amount of time possible makes all the difference in performance. In this context, it should be clarified that:

- The **proprioceptive sense** is what offers the clearest chances of training, configuring clear and convergent dimensions of approach.
- **Tactile and haptic senses** can improve over the course of a lifetime and what happens with subjects that lose their vision is a clear example of this adaptation.
- The **vestibular sense** presents a methodological challenge, with equal chances for improvement as other mechanoreceptive dimensions.

The mechanoreceptive system is one of the most important systems, kinesthetically speaking, as it provides the most relevant information for motor imagery, as well as for neuromotor programming. Let's consider that sports practice is a specific training in itself, and its general and additional approaches are important (especially in sports that do not depend much on visual analyzers).

Tactile and Haptic Proprioceptive Training Objectives:

- Improving equilibrium.
- Improving posture.
- Prevention and correction.
- Preventing falls.
- Improving gait.
- Detecting abnormalities.

What Can I Train? Estimates:

Refers to the capacity to detect and evaluate variables related to motor control itself. Deals with training motor control variable recognition skills. Perhaps it is the proprioceptors' truest function. We have still not found any methodological proposal to target this skill. What can we estimate? Joint positions, stretches and lengths, force or activations.

- *Joint positions*: refers to the possibility of estimating the position of a joint at a given moment or the path created from one angle to another. We come across two possibilities, namely: static and dynamic.
- *Stretches or lengths*: refers to the detection of muscle length and its changes at specific velocities. It is key to prevent injuries. It takes into account two variables: stretch ratio and stretch speed.
- *Force estimation*: related to estimating the main components in force movements.
- *We come across two possibilities: speed - force ratio and force ratio: dynamic - static.*
- *Static*: takes into account two dimensions, namely: the passive dimension, which estimates the weight of the weights or elements; and the active dimension, in which the dynamometric force is contracted and registered.

Training Variables. Joint Positions:

Deals with training variables for estimation skills, of which there are 6:

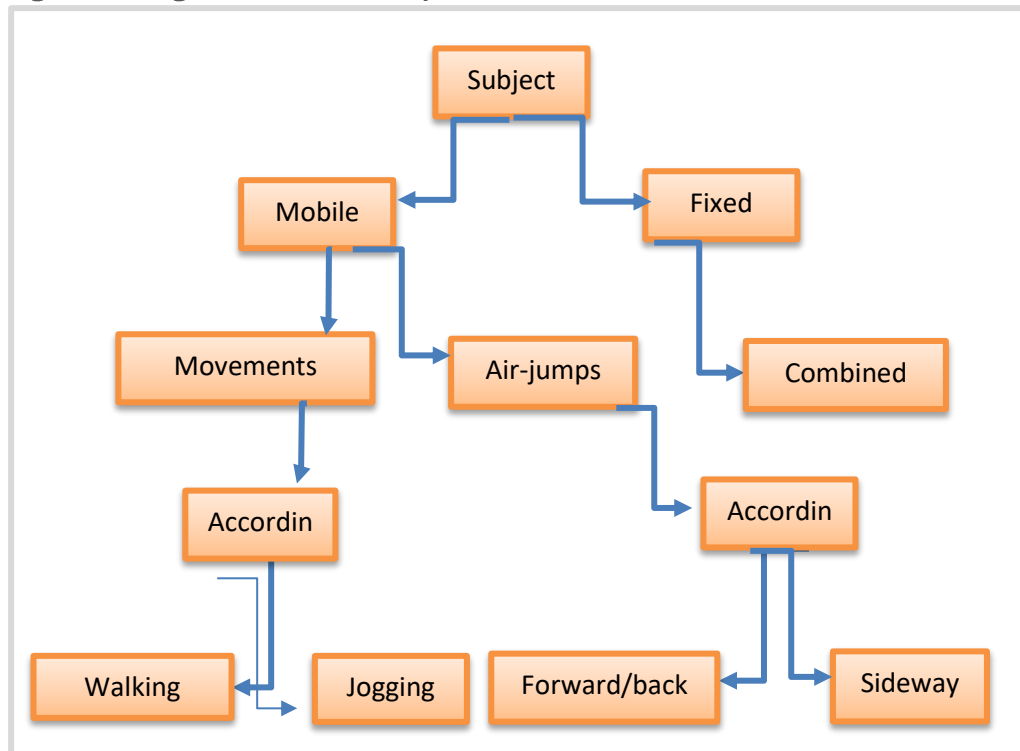
- *Planes*

One or simple: we can work in only one plane, horizontal, frontal, or sagittal. Drawing from a combination of these, one can change between the sagittal-frontal, sagittal-horizontal, and frontal-horizontal planes.

- *Subject's state*

The subject can be in either a mobile or fixed position. As an example, if the subject is mobile, there can be combined (air-jump) movements. Movements can be grouped according to types and directions. Types: in this category we can find walking or jogging-running. Direction: here we find various movements, for example, forward, backward, and sideways.

Figure 1: Integrative Chart of Subject's State



Source: prepared by the author(s).

- *Other Analyzers*
Hearing and touch are also added as possible constraints.
 - High complexity: to perform exercises with a high degree of complexity, we can decrease analyzers, like for example, closing both eyes.
 - Medium-high complexity: to reduce the complexity a little, we could leave only one eye open, in this case the non-dominant eye.
 - Medium-low complexity: to facilitate the previous task, we can propose activities with the dominant eye open.
 - Low complexity: the simplest way of performing a task would be with both visual analyzers open.
- *Number of Joints*
 - Only one (the lowest level of difficult would be if we only involved one joint in the performance of a task.)
 - Two or more (as more joints are added, the more difficult proprioceptive estimation will be).
- *Starting Position:*
An individual should be able to process proprioceptive information in any starting position.
We can differentiate between primary positions (like supine, prone, lateral) and derivative positions (for example kneeling, seated, standing).
- *Hemibody and/or Trains*
 - Only one (here we can perform activities using either the left or right hemibody; or the upper or lower hemibody)

- Both (we can differentiate between symmetric and asymmetric). Symmetry refers to performing the same movements with each hemibody, at the same time; while asymmetric means each hemibody carries out different movements.
- Complex: this category can encompass those activities in which activities in different hemibodies or limbs are mixed, with different functions.

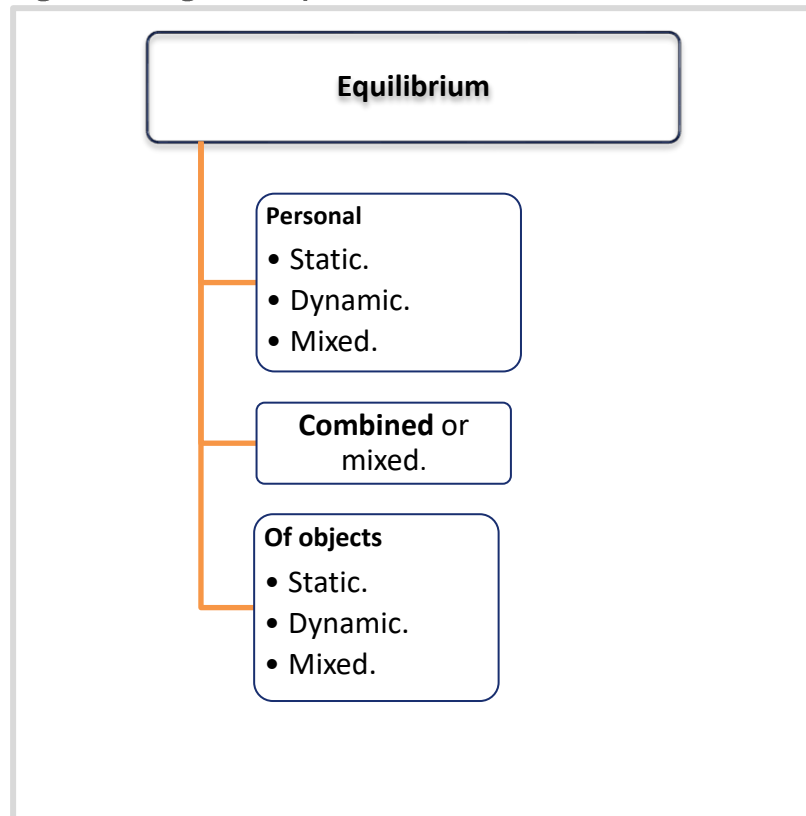
Equilibrium

Equilibrium, ultimately, puts all sensory systems into play, but when canceling out the visual sense, we boost proprioceptive involvement. Maintaining equilibrium not only puts proprioception into play, but also the whole set of mechanoreceptors integrated with the rest of the interoceptors and exteroceptors. Equilibrium training calls for systematization and should be granted the same importance as other motor skills, not only in old age.

To clarify: it should not be confused with proprioceptive training, as it often happens, seeing subjects grappling with and on unstable surfaces, especially planks.

Classifications: there are as many classificatory possibilities as there are authors, and countless examples present themselves wherein we find ourselves in situations that are impossible to include in any one category. The variables detailed below may be just as important as these considerations.

Figure 2: Integrative Equilibrium Chart



Source: Prepared by the author(s).

Variables

Equilibrium training: we can identify at least 10 training variables to configure specific progresses, namely:

- 1) Relationship between CG and BS (center of gravity and base of support).
- 2) Starting position.
- 3) Exclusion of other analyzers.
- 4) Subject's state.
- 5) Limb activity.
- 6) Devices.
- 7) Inclusion of other objects.
- 8) Body part that is emphasized for support and control.
- 9) Quantity of supports.
- 10) Type of movement.

1) The relationship between the center of gravity and the base of support (CG-BS) takes three possibilities into account:

- Stable.
- Irrelevant.
- Unstable.

(We can also consider combined forms: the classic example is unstable with hanging objects).

- 1) Starting position: the individual who trains should be able to challenge his or her balance in any starting position. As explained earlier, there are primary and derivative positions (supine, prone, lateral, kneeling, seated, and standing).
- 2) The exclusion/restriction of analyzers refers to the fact that the more dependent we are on the mechanoreceptors, the more difficult it will be to stay balanced. The idea of this work is to cancel, change, or restrict said analyzers.

4. The subject's state can be any one of the following three:

- Dynamic.
- Static.
- Mixed: here we find different movements with changes of direction or taking on weight.

5. The activities performed by the limbs will influence the task being performed, and these activities can be divided into four categories:

- Stationary (motionless).
- Active (including limb movements).
- Specific activities.
- Non-specific activities.

(Limb activities allow the possibility of including only lower, upper, or both).

6. The use of devices is another way of influencing activities for working on equilibrium. We can identify two different types of activities:

- Without devices: these make up the basic and elementary form of maintaining equilibrium.
- With devices: entails greater complexity and level of difficulty for maintaining equilibrium. When we talk about devices, we can identify the following:
 - Supports: these can be compliant or non-compliant.
 - Suspension: for example, devices like the TRX®.
 - Exogenous: here we can identify elements like traction tape.
 - Weights: one alternative is to work with weights and other unstable objects.

7. Inclusion of other objects: this category involves an ability to control not only one's own equilibrium, but also that of other objects, which can either be in motion or fixed.

- Objects in motion: the movement can either be non-specific motions or specific techniques (juggling, for example).
- Fixed objects: as an example, we can use an activity in which we need to keep a book on top of our head without letting it fall.

8. Body part to support and control: refers to the body part that we use to support body weight and control equilibrium.

- Simple: refers to the main body parts: feet, knees, sit bones, trunk, hands.
- Combined: the main combinations are: head-feet; hands-feet; torso-hands; trunk-feet; sit bones-feet; sit bones-hands.

9. Number of supports: four or more, three supports, two supports, a single support (monopodal). The greater the number of supports, the easier it is to maintain equilibrium.

10. Types of movement:

- Stationary: this category refers to activities that only entail maintaining a position.
- Active: these can be movements or minor pressures and relaxations.
- Use: we can use these variations for the shoulder girdle.

Tactile Training

The first thing we can say on the topic is that we have not found methodological proposals for systematically targeting tactile training itself, meaning the training of thermal and/or proprioceptive receptors (just like with proprioception) in any source. Therefore, what follows is entirely personal, from the physiological analysis of the sense of touch.

The goals of this training are to improve final motor adjustments in countless activities in daily life and in sport motions, encouraging proper applications of force in holding and gripping activities and improving the recognition of shapes and textures in order to adjust object-manipulation tasks.

We understand that tactile training methodology does not differ much from the tactile sense, simply because it is impossible to train the tactile sense without movement and parallel proprioceptive stimulation.

We draw a distinction between two large variables:

1. Body Parts

- Hand-foot: deals with parts of our body with a high density of tactile receptors and their function is crucial.
- Other limbs: in this case, we are talking about a low density of receptors, thus, their treatment could be interesting as well.
- Head-face: highly sensitive areas, therefore they have great possibilities for training and discerning subtlety.
- Trunk: just like in the case of the limbs (except for the hands and feet), the low density of receptors implies a challenge from a methodological perspective.

2. Detection Possibilities

- Contours and lines: refers to the detection of the surface of objects and their distinctive textures, just like lines or drawings on our skin.
- Shapes: puts stress on recognizing objects themselves, which includes mass and not just contours.
- Pressures: surface and intensity of pressure or pressures that are applied on parts of the subject without the visual analyzer.

Figure 3: Tactile Training Variables



Source: prepared by the author(s)

Examples of Exercises

- Someone draws on the palm of my hand, I do not look at the lines, and I simultaneously use my other hand to draw what I feel on a piece of paper. I mark on a piece of paper the estimated intensity and surface of pressure as force is applied on me.
- The same exercises can be done on other parts of the body, like the back or legs for example.
- We can close our eyes and recognize cardboard letters or deeply traced letters in wood or other textures.
- We can close our eyes and recognize the objects that are placed on our hands.
- We can lay out 5 pieces of sandpaper, touch them, and organize them according to the level of roughness and coarseness without looking at them.
- We can organize 6 buttons according to size, without looking at them.

Haptic Training

We are constantly using the haptic sense, like for example, when we touch our faces countless times a day.

Let's remember that this implies the integration of touch and proprioception and that, therefore, the majority of human actions demand this sense.

As far as methodology, we did not find systematic methodological proposals in the bibliography. Its training does not differ much from the proposal for the tactile sense.

Recognizing Shapes through Movement.

Perhaps this is the main way to train the haptic sense, that is, touching, thinking, feeling contours, textures, always in motion.

2.2.2 Visual-motor training

Visual Training

Visual processing speed makes a significant difference not only in sports performance, but also in the majority of DLA (daily living activities): they can define whether or not an athlete wins, or can be life-saving in specific situations in big cities.

Visual processing is, almost in its entirety, highly trainable and can be improved at all developmental stages. The general bibliography presents many exercises, but little systematization. Our challenge over the course of the years has been to create a methodological proposal.

There are three main pillars of visual training methodology, which we will explore below:

- *Contents*: refers to the types of vision we choose to train and the specific aspects of each one.
- *Exercises*: refers to the many examples of tasks and activities that we can develop and that are transferable to different sports or DLAs.
- *Variables*: refers to the possibilities of systematically increasing the difficulty of exercises, or simplifying them, so that they will be accessible to all.

We propose:

- Concentrating on the nature of the specific visual processing of the sport in question: central and peripheral objects, interferences, backgrounds, etcetera.
- Selecting a sample situation for that sport and taking on the task of designing a set of exercises specifically adapted for the visual function.
- Trying to systematize a rational progression based on the different variables mentioned earlier and which we will analyze below.

Types of vision:

- *Peripheral*:
- *Central*: central vision can deal with tracking or detection of objects.

As far as central vision goes, the most important activities are visual tracking and detection. Peripheral vision is defined in relation to central vision and its training is crucial for sports and DLAs. The most viable possibility for peripheral vision is detection and the potential to train the vestibulo-ocular reflex or VOR.

Central Visual Tracking.

Basis to train the vestibulo-ocular reflex.

- Fixed head - mobile object.
- Fixed object - mobile head.
- Mobile head and object.

Clarifications:

- *Fixed head and mobile object:* they can be carried out in two dimensions, where the object can move down, up, to the sides. Or in three dimensions, involving the previous movements, as well as forward and backward movements.
- *Fixed object and mobile head:* I move my head in different directions and at different speeds while trying to read or simply look at a still object. Can incorporate other movements, not just those of the neck.
- *Mobile head and object:* I try to visually keep track of an object that is moving while also moving myself. Implies combining the previous conditions.

Detection and Central Location

Seeks speed and precision with regard to detection and central location. These perceptual processes can be stimulated by activities such as:

- Locating specific subjects.
- Locating words in a paragraph or in the dictionary.
- Finding errors in images or drawings.
- Reading by skipping lines.
- Working with activities like Where's Waldo?
- Working with drawings, numbers and figures (Toulouse-Pieron).

Peripheral Vision

Key in decision-making in most sports actions. Its processes are completely trainable.



Exercises:

- Speed reaction exercises or starting at signal detections.
- Exercises to name numbers or colors seen through different types of vision.
- Exercises to perform specific motions for a sport, mainly passes to peripheral subjects while looking at a central object, or passing to a central object according to a peripheral signal.
- Exercises to monitor and detect the preceding; in general, with conditions that increase in difficulty.

Examples:

- Reaction exercises: the classic example is "races or squeezes" in which the stimulus can be central or peripheral, but both are always present.
- Enunciation exercises: in accordance with performing a relatively complex motor task, I enunciate objects or numbers grasped through different visions.
- Specific motion exercises: as I fix my gaze at central objects and in relation to peripheral objects, I carry out specific motions of the sport.
- Tracking exercises: refers to activities that consist of immediately grasping objects in the visual field and/or tracking them despite other disturbances.

The visual training variables to keep in mind are:

- 1) Number of objects.
- 2) Mobility of the object.
- 3) Mobility of the subject.
- 4) Speed.
- 5) Angle.
- 6) Background.
- 7) Head position.
- 8) Eyes and ocular dominance.
- 9) The objects.
- 10) Interferences and obstacles.
- 11) Rotations.
- 12) Presence of other stimuli.
- 13) Fatigue.
- 14) The motor motion itself.
- 15) Other motor skills.
- 16) Memory.
- 17) Other situations and contexts.

1. Number of objects: the more objects there are, the more difficult it will be. We can divide the objects into four types:

- Central.
- Peripheral.
- Technical control.
- Background.

2. Mobility of the object: both central and peripheral objects can be fixed or mobile. Mobility entails added difficulty. The mobile object should move throughout the visual field. Fixed objects, both central and peripheral, assume simplicity. Mobility get more complicated, so two mobile objects would be the highest difficult.

3. Mobility of the subject: refers to the state of the subject, which can be still or moving, or even jumping. Main possibilities:

- Stable (fixed-still)
- Unstable.
- Jumps.
- Movements.

4. Speed: There are two main agents at play in regards to speed:

Central and peripheral objects can move:

- Slowly.
- Quickly.

Instead of being still, the subject is in motion, and this motion can be:

- Slow.
- Fast.

5. Angle: we refer to the angle between the central and peripheral objects. The greater the angle, the more difficult it will be. We could divide these angles into three types:

- Angles smaller than 90° .
- Angles between 90° and 135° .
- Angles between 135° and 180° .

6. Background: this can be clear (without objects) or hazy and confusing (crowded with objects), that are either fixed or mobile. The references are:

- Clear - without object.



- Simple hazy - fixed object.
- Medium hazy - mobile with fixed object.
- Complex hazy - mobile object.

7. Head position: can be normal sagittal or rotated-altered. The normal position is simple sagittal. Rotated or altered positions are itemized according to difficulty:

- Transverse rotation.
- Lengthwise rotation.
- Medial rotation.

8. Eyes and ocular dominance: covering an eye implies an additional obstacle, and even more so if we block the dominant eye. We can divide up our task possibilities according to greater or lesser complexity:

- Covering both eyes.
- Covering only the dominant eye.
- Covering only the non-dominant eye.

9. The objects and their composition: the three main values are *shape*, *size*, and *color* (other possibilities, like lights and shadows can also be taken into account). The composition of the objects itself can modify the process, whether they are central or peripheral.

Shapes can be varied, namely, either a specific object (more or less familiar to the subject) or unspecific (with totally distinct characteristics).

Colors, depending on their uniformity or diversity, can complicate or simplify the task.

10. Other stimuli: the presence of other disruptive stimuli appears in the majority of situations, both in sports and in DLAs. The stimuli can be:

- *Only visual*: this section refers to those disruptive stimuli that are only visual in nature, without interferences or complications from other present stimuli.
- *With the disruptive presence of other stimuli*: auditory, tactile, and any other type of stimuli can be added to visual disturbances.

11. Interferences or obstacles: these obstacles can be between the subject and the central object, the peripheral object or both; likewise, there may be no obstacles, which would allow absolute clarity between the subject and the central and peripheral objects.

- *Fixed obstacles*: a prime example is the boundary in team sports like soccer, in which there are non-moving objects between the subject and other objects.
- *Mobile obstacles*: refers to mobile objects that interfere with the subject's vision. This happens in the majority of team sports.

12. Previous rotations:

- *Whole body*: these situations can happen after performing a lateral or frontal roll, for example, or another skill that involves rotation.
- *Only the neck*: rotating my neck around a single axis or multiple axes.
- *Only the eyes*: Keeping the eyes still or moving them.

13. Fatigue: this section focuses on the necessity of training the visual functions in conditions of fatigue. Let's remember that at more than 120 ppm (FC) vision is no longer the same. It refers to adapting training to the specific conditions of fatigue, both aerobic and anaerobic.

14. The motor motion itself: this can be specific or non-specific to the sport. We can outline the following motions:

- Movements.
- Passing-receiving.
- Throws-kicks.
- Tracking of the element in motion,
- Tracking of the element on foot.
- Other actions (batting, blocks).

15. Other motor skills: the idea that frames this category is that of being able to express a given motor skill while also performing additional tasks.

Among tasks we could perform, these skills should be included:

- Strength.
- Flexibility.
- Equilibrium.
- Speed.
- Resistance.
- Power.
- Multitasking.

16. Memory:

- *Explicit memory*: refers to everything that is not movement, like faces, word sequences, or numbers.

- *Implicit memory*: refers to everything in the motor process, like steps, stair exercises, or other movements.

17. Other situations and contexts:

- Natural light.
- Artificial light.
- Hypoxia.
- Altitude.
- Vibrations.

2.2.3 Vestibular training

Vestibular Training

We have not found a specific systematization in any bibliography regarding this topic, either, except for therapy and always for ocular movements.

We did not find proposals for people without disorders. In this respect, for individuals with disorders, we looked for the following objectives:

- 1) Reducing the sensation of dizziness.
- 2) Increasing confidence in one's own equilibrium.
- 3) Reducing the risk of falling.
- 4) Improving the vestibulo-ocular reflex function.
- 5) Improving gait.
- 6) Reducing dependence on exteroceptors for equilibrium and gait.
- 7) Reducing anxiety.
- 8) Increasing motor function.

Possibilities for Training

We clearly discern at least three possibilities that we will introduce below. All of these options refer to functions, as well. The option with the greatest therapeutic power is vestibulo-ocular reflex work; however, the other two offer interesting methodological alternatives and possibilities:

- Accelerations.
- Rotation-turns.
- Vestibulo-ocular reflexes.

Accelerations

There are numerous training possibilities for accelerations and the devices constructed specially for them simplify the approach. A classic example is the roller coaster: a comprehensive device for vestibular training. Possibilities also multiply in vehicles.

Exercises can be varied:

- 1) Estimate when the car will stop accelerating and will stabilize.
- 2) Using routes with pre-established changes of speed.
- 3) Estimate the variations in the car's speed.
- 4) Detecting the start of the whole-body movement.
- 5) Detecting the end of the whole-body movement.

Rotations and Turns

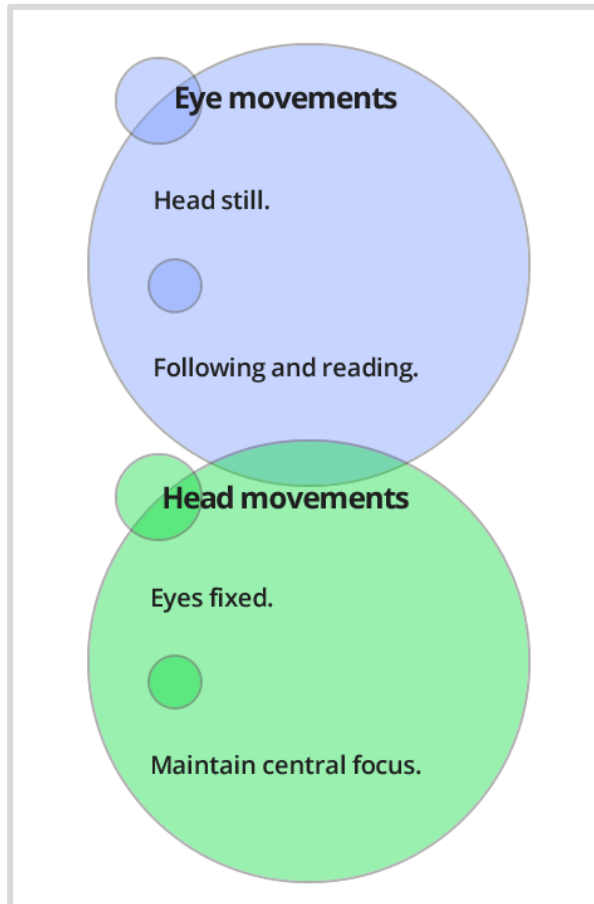
An interesting way of stimulating the vestibular system is physical exercise itself, just like disciplines like diving or figure skating. These are activities in which the rotational sense is trained from an early age and when rotations are complex in one position, we can facilitate their learning from other positions.

Vestibulo-Ocular Reflex (VOR) Training

Variables:

- 1) Starting position (seated, standing, lying down).
- 2) Subject's state (static or dynamic).
- 3) Exteroceptive constraint (two eyes or only one eye).
- 4) Limb activities (inactive or performing other movements).
- 5) Additional tasks (with or without).

Figure 4: Possibilities of V.O.R. Training



Source: prepared by the author(s)

Contributions, Creative Ideas and Reflections

Interesting: Roller Coaster on Film

On film you can have the same sensations of vertigo that are actually present when you are on a roller coaster, without sitting in a little "seat." The visual information sets off, without vestibular variation, the same reactions as when the stimulation is included in the changes of the labyrinth.

2.2.4 Integrative aspects of perceptual training

Now we will explore didactic tools for greater training of the sensoperceptual functions. We have a target of approximately 12 activities that can serve this goal. We have divided them into 12 groups or subgroups for didactic simplicity, which does not mean they cannot be changed, and takes into account the expansion through the trainer's creative potential to change it.

- Repetitive exercise with cognitive, verbal, evaluative and rational task.
- Implementation with modified speed (ultra-slow).
- Sensation intensifications.
- Reduction or constraint of sensations.
- Interaction with objective sources.
- Detection of errors in other's implementations.
- Personal graphic resources (drawings).
- Molding work.
- Calculation and estimation tasks.
- Imitation or mirror exercises.
- Sensory register exercises (leaving marks or stains).
- Other resources.

We designate the first group as: **Repetitive Cognitive Exercise Tasks** This set of activities consists of stimulating the perceptual function using tasks of attention steering and parallel reasoning. We can attribute the idea to Rubinstein, who became famous at the time for opposing the automatic reflex model proposed by Pavlov. Rubinstein coined the phrase "repeating without repeating," in stark opposition to the idea of "repeating for the sake of repeating." Repeating without repeating means doing a movement (repetitions) while introducing parallel rational attentional tasks to the subject that is exercising, that is, that there are motives to mentally work on the task between repetitions. Among these forms of mental work on movement, we have:

- *Tasks related to movement evaluation*, in which we can establish a progression so that the subject learns to evaluate it. An example could be nominally distinguishing a movement between good and bad, and later ordinally grading it (bad, regular, very good, excellent), until being able to rate the movement on a scale of 0 to 10. Then, we should break up said movement into parts, and give a grade to each of these parts. It is very important that in this movement evaluation task, we always demand a rationale, that is, I am grading it as good or bad for such and such reason, it was regular because of this or that, I understand that the subject failed for these reasons. Overall, the task of probably inductive inference is important to train this movement evaluation skill.
- Within this type we also have what are called *sensations questioning*, in which the teacher continually asks about what the subject felt, or observed in the other person's movement. To give an example: How did you know that it was your knee? How did your elbow feel? How did your lumbo-pelvic control feel? Did you watch the head? How was it positioned? Did you see how he had it positioned? Did you watch the subject's knee extension? In other

words, it means asking about one's own sensations and about what the other person is doing. Even the use of conditional propositions is very interesting to train these movement evaluation functions. This can be done using expressions like "if," and "then". As an example: "if you feel that such and such a body part is relaxed, then try to pay attention to it." This conditional statement enables a whole set of subjects, not just one, to direct their attention to improvement of perception, and therefore of decision-making as well.

- The second group is what we call **ultra-slow implementation**, which not only serves to train proprioceptive systems, but also exteroceptive sensory systems. There are two things to keep in mind about this: first, that it enables the creation of patterns for cortico-cortical balance to be able to correct those movements, which, in real game situations, are performed so rapidly that we fail to receive and interpret proprioceptive signals before they are done. Basically, the objective is to successfully consolidate engramatic parameters for cortico-cortical ratio and balance when the speed of ballistic movement does not allow for the correction of information grasped from peripheral receptors. Obviously, the use of speed modification, moving from fast to ultra-slow implementations, also demonstrates that we can try the movement at normal speed.
- A third group of activities is called **sensation intensifications**. The idea is to increase information flow grasped and transmitted by a particular sensory system. For example: the intensification of proprioceptive information has very clear examples in the correction of swimming mistakes, in which the use of mittens through water resistance can stimulate even more proprioceptive receptors in the wrist and hand joint so that this way, the swimmer can become aware of information that usually does not reach consciousness. The increase of visual information by using mirrors, or the increase of auditory information by using of amplifiers for ball-hitting actions are also resources that we can use to boost senso-perceptual functions.
- The fourth group (in contrast to the previous group) is what is called **reduction or constraint of sensations** and consists in that, to be able to increase the amount of information that a sensory system processes, another system needs to be restricted or canceled out. This can be applied in different ways: restricting the visual function or canceling it out to become aware of proprioceptive information that consciousness usually does not retain. Visual information can be restricted by covering the non-dominant or dominant eye, and auditory information can be restricted, so as not to hear the sound of the ping pong ball on the table and to improve the quality of motor response based on visual information, etcetera. So, we have many examples wherein, by restricting or canceling out a particular source, we have no alternative but to increase the amount of



information that we collect from a different source. This type of activity is really very interesting, and we use it a lot when a person limits the access of information from another sensory system, either by not using it, or by being unaware that he or she could use it much more effectively. So, restricting access from one source helps boost information from another source.

- Another very important resource to increase sensorperceptual information is what is called **interaction with objective sources**. In this regard, we are talking about providing information through technology, like for example: photographs, film frames, or videos, which also have strategies for their use, optimal moments in which one can observe oneself after having been filmed and, therefore, correct oneself on the spot while information is captured from the movement that, from one's own supply of introceptive information, we either fail to notice, or correcting different mistakes that we do not perceive. A moderate use of objective sources, always in combination with evaluation, reasoning and other resources, can boost the sensorperceptual function, while collecting information that is usually not grasped by them.
- Another very important tool to train the sensorperceptual function in athletes and non-athletes is requesting **finding errors in other's executions**, detecting the mistake and also being able to reason the cause that brought about the other's weak point. This task of detecting errors in others sharpens the sensorperceptual function, steering the attention towards what is relevant and, of course, helping in making decisions with respect to where I need to be to detect a particular type of errors in certain movements. At our center, we perform many exercises of this type that have to do with detecting differences between one figure and another. This refers to the famous game of 7 errors with figures: while the subject performs a certain activity (equilibrium, strength, flexibility), there are two figures and he must try to spot the differences between them.
- **Use of Graphic Drawings:** In rhythmic gymnastics, when we practice a type of jump in which the participants need to extend at least 180° after jumping in the sagittal plane, they are asked to draw how they should be in the neutral phase of the jump at the moment when we register maximal leg width. After having drawn how they understood they should be (which reinforces motor imagery), they are asked to jump again and, after having jumped, they are asked as well to draw how they perceived that they were. This refers to drawing the movement as it was carried out and asking them the reasons for the differences, why they believe that the movement, as it was performed, failed to produce or was different from the movement that was supposed to be done. The first drawing allows to verifying if the quality of the movement is good, and the second drawing reinforces attention to very accurate aspects of performance. For example, when we taught handstands to the

faculty of Physical Education, we used this tool a lot. They would draw the handstand like they thought it should be, they would do a handstand, and then they would draw again what they had done in the first position. From there, they would try to reason out why there were differences between the first and second drawing. It is, in short, a very interesting resource that fundamentally serves to better capture attention in this critical phase. Within the same type of activities, we also have the task of completing critical phases. For example, we show a photo of movement to an athlete in which we cover in the photo, in the critical phase, half of the body, and the athlete's task here is to complete the correct position of the part of the body that is covered by the paper, trying to draw on the paper, as exactly as possible, how this critical phase should be continued, which affords not only an improvement in the quality of motor imagery, but also to reinforce attention to those critical points of movement.

- We call the eighth group of activities **molding tasks**, which are not only for the proprioceptive function, but also for the visual function. They are exercises for the person to guide his or her sensorperceptual function, crucially the joint positions that need to be respected in movement. We can imagine a human statue and the training task here would be to mold the subject with the movement that should be performed. This task also enables capturing the attention of perception itself, reinforcing the quality of motor imagery, locating the joints at the exact point that they need to be in the exact moment of movement. This molding task is even fun; for example, making me mold myself, as I am the performer, taking apart this position and then later trying to recreate the position they molded me in (with eyes closed, which once again allows reinforcing the sensorperceptual information provided by the proprioceptive system).
- **Calculation and estimation tasks:** In this regard, we have many calculation tasks to which we can draw our trainee's attention. For example, we can work on estimating distances in meters (or feet) between two subjects (with both subjects fixed), or estimating distances between two subjects, with one fixed and one mobile. Another option to deal with estimating distances between two subjects is proposing activities in which people not only estimate distances by experiencing movement, but also estimate distances when observing other people's movements on film. Another variation can be when we are looking at the playing field while we are following a soccer match, and drawing from that, asking that they estimate the distances between teammates, and between teammates and opponents. Estimation of movement time can also be studied, which consists in performing serialized activities and trying to estimate how many seconds this serialized activity takes. Another valid example to explain estimation would be performing zig-zag jumps, coordinative movements on stairs and also trying to

estimate how many seconds this movement takes. Each time I estimate time, distance, weights, or heights, I am differentially training my senso-perceptual systems.

- This group is what we call **imitation or mirror tasks**. This is when I try to imitate the movement of my teammate who is ahead and in the same plane, in such a way that reinforces my inherent attention at the start and the tracking of the actions done by subjects in front of me. Another possibility is that a subject who is in front of me, but facing me, not with his back to me, also tries to imitate his activities either on the same hemibody as the teammate who is showing me his movements, or on the opposite hemibody, which would mean that if we are face to face, we would be doing the same movements in the same section. These imitation tasks greatly reinforce the training of visual sensoperceptual functions, because we have to do positions at the start of actions in the other person's movements, even when we use mirrors to start the action. It is a very interesting resource that complicates the difficulty of the task.
- **Sensory registry**: has to do with using marks and interpreting them to be able to reinforce attention to what we are doing. For example, a person who is learning to do a somersault is asked to leave marks on the floor to be able to increase perception of where the supports need to be, so she covers her hands with chalk to be able to leave marks according to where she placed her supports. Using the resource of signaling or leaving marks of the performance strengthens the quality of information from particular sensory systems.
- **Various resources**, where we fuse other types of sensory system training activities. We will cite below some tasks that help us with the improvement of these functions.
 - *Photographic ordering*: refers to presenting the athlete with a series of photographs of a specific movement (long jump) out of order, and the task is to put the photographs in order according to the temporal sequence of the movement. This reinforces attention in the sensoperceptual function. We can also use what we call puzzles, that is, cutting the photograph or breaking it into fragments so that the trainee fits the pieces into the correct places, which contributes to the improvement of perception. Hazy or contrasting background exercises can also be included (such as Where's Waldo?) in which, with the detection of a particular object made harder by the quantity of information we place in the background, I need to sharpen my detection for this type of information. "Where's Waldo?" can help from a visual as well as a perceptual point of view. Detecting a sound when there is a lot of troublesome background noise, or detecting a specific object when there are a lot of confusing similar objects in the background, increases the senso-perceptual and auditory functions.



- Exercises that have to do with *identifying the other person's laterality* are also taken into account, which reinforce the quality of visual sensorimotor information, that is, detecting when the subject moves the right or left hemibody. This detection of another person's side, which can be altered according to the position of the other person relative to my own body, is a very interesting tool for training. Within this type of activities, there is a requirement to choose an adequate location to observe the other person's movement or even one's own movement. The trainer should know where to place the observer to detect particular information, as choosing the adequate location is extremely important to improve quality.
- Another resource that I personally use a lot to improve the quality of capturing information is *intentionally incorrect performance*: when a person learns a movement, to be sure that they perform it well, we ask them to perform it wrong deliberately. If the subject is in a position to perform it poorly and well whenever he wants, this means that he has integrated the information correctly and understands the movement: "now that you understood it and can do it right, do it wrong."
- Another resource could be *flashes in limited time*, which is: presenting a large quantity of information in a short amount of time and trying to remember, for example, aspects that showed up: How many times did you see the person with the red shirt? Overall, it means that when I show you a sequence of many people over the course of 10 seconds, you tell me how many times you saw the person, or I could read you a paragraph and you tell me how many times you heard such and such word.

Conclusions

What we have seen is a general comprehensive teaching to train perception. The sensory systems that provide information and their integration through the act that we call perception provide quality information for trainable representation with many didactic resources. They form part of what is called the movement anticipation mechanism, functions that happen in the occipital parietal lobe and temporal lobe and that can improve the quality of information collection to process said information and the quality of performance, programming, and final motor adjustments.

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