Where to Look? How to Look?
by Giancarlo Toràn

From the early fencing treatises the authors have faced this question: where is best to look during a duel?

There are several different opinions: some suggest looking at the tip of the sword, some at the weapon hand, some like **Marcelli** (1686) *"... in faccia, e ne gl'occhi; perchè questi avendo corrispondenza con l'interno, sono spie del cuore." (…at the face and straight in the eyes; because they connect with the inside and are the heart's spy.)*

Few years before Marcelli, in his *Gorin No Sho* (The Book of Five Rings) in 1645, the famous **Miyamoto Musashi** wrote something similar but added something more: *"...it's not enough to know how to look. One must know how to perceive and feel. To perceive is more important than to see...one must see far away things as if they were close and things that are close as if they were far away. It is essential to know how to discern the tactics of our adversary armed with a sword without letting insignificant movements of the blade distract us… One must be able to see on both sides without ever moving the pupils… But when one fixates his eyes on a single point one loses the global picture and becomes disoriented… Knowing the way of Hejo one can assess even without looking the distance and the speed of the opponent and can pry inside his heart."*

But to *'pry inside one's heart'* is not exactly an example of the specific language cognitive sciences have gotten us used to appreciate. We must translate our intuitions into something more easily manageable, understandable, and if possible measurable.

Before continuing I must be clear: I am a professional in the field of fencing but in the area of cognitive science even with my scientific background, I still remain an amateur. I beg for your forgiveness for the inevitable approximations when I try to convey my ideas and intuitions on this subject, and for some simplifications which we can better explain during our discussion if necessary.

My starting point is my experience: with myself and with the students with whom I worked and continue to work.

I can look in the eyes of an interlocutor at my left and talk to him, while someone else at my right tries to take away with a swift motion the glove I hold between my fingers. I can take the glove away—foiling his attempt—just as well, and maybe better, than if I watch directly the other person as long as he is not totally outside my field of vision. I explain this with the higher specialization of the peripheral area of the retina, the part which detects movement.

I can verify this in several ways. One of the most convincing proofs is that of **retinal fusion frequency (RFF)**.

Years ago the FIS funded some research, one being the measurement of the fencers' RFF during a competition. Fencers were asked to look at an array of LEDs whose flashing frequency was progressively increased until the flicker could no longer be detected. The RFF

changed, *i.e.*, increased during the competition as if it were correlated with a higher cerebral activity.

I built therefore an apparatus—which I still have—capable of doing the same thing. The first thing I discovered was that the RFF is different for different colors.

The most interest thing was that the RFF itself varies if I look at the LED out of the corner of my eye. Doing so I could still detect the lights flickering (as in the case of the old type TV screen) but when I looked straight at them they appeared to be steady (not flickering).

But let's go back to the attention.

We can keep our attention toward a point in space even if we are looking elsewhere: this is called ***"undercover attention."***

This is not very easy to do. Our visual system is highly dominant because of its multiple connections with very many areas in the brain. We know that we can pay attention to other sensations even with our eyes closed. But if we open our eyes and even more if we stare at something our attention tends to be captivated by what we see.

We can train ourselves to control this aspect of focusing our attention as well. But why should this represent an advantage?

The explanation I found and which today seems to me to be the most convincing starts from far away. For a long time I used to think that it was always useful to load on information: the more information you have the better you'll be able to decide what to do.

But this is not always true.

In fencing, just like in other fields in life, the factor **time** is the decisive one. It is not enough to decide: you must do it quickly, very quickly, and right.

You must choose among all the information and quickly eliminate the part which isn't very useful. The more information you keep, the higher the cost in terms of time of the elaboration process, and the increase is exponential.

Apparently our brain is very well aware of this and has been aware for a long time. The brain is very skilled in erasing already at the preliminary stage that information which is not useful. Would you like to have some examples?

Try to stare in rapid succession different points in your room. The world remains steady even if your eyes move.

But if you look at the screen of a video cam in operation, while you move it at the same speed towards the same points, everything will appear to you as if it were in motion preventing you to distinguish the details.

The eye which moves in a succession of discontinuous individual movements (**saccades**) "sees" only when the focus is on; everything esle is cancelled. It seems hard to believe but this is how it is.

The ***fovea centralis*** is the part of the retina responsible for sharp central vision, which is necessary in humans for any activity where visual detail is of primary importance. The retina is complex, layered structure with several layers of neurons. The only neurons that are directly sensitive to light are the ***photoreceptor cells***. They are mainly of two types: the ***rods*** (concentrated on the outer regions of the retina and used in peripheral vision) and the ***cones*** (concentrated in the center of the retina and used for the perception of color, can perceive finer detail and more rapid changes in images). Extremely complex and connected to the brain via the optical nerve, the retina is capable to do the preliminary elaborations on the visual stimuli, sending the result to the brain through paths which are slower or faster, depending on the minor or major biological relevance of the result. In other words, if the information is significant related to our immediate survival, it follows the faster paths and connects with the emotional circuits.

The distance between us and a potential enemy, or a predator, is a typical example. I really believe that the sense of distance (***measure***) follows this path and skips paths of evaluation which are slower.

We don't need to be proxemics specialists to "feel" discomfort if our interlocutor gets too close to us beyond a certain comfort limit.

Furthermore, we know that this "feel" changes if we use, or the other uses an instrument (a sword, for example) which becomes our or his extension.

Let's go back to the eye and how we see.

The ***parvocellular (PC) pathway*** (the slow one) of the visual system, responsible for the fine vision and colors, receives input almost only from the cones which are concentrated on the fovea and which are in a large number.

Less numerous but distributed in a much larger zone of the retina which is served by a lesser number of neural fibers are the rods responsible for the perception of movement through the ***magnocellular (MC) pathway*** (the fast one).

The rapid, small, and frequent eye movements, called ***saccades***, move the eye, hence the fovea, on various fixation points in subsequent times giving us an apparent vision of the whole and producing also curious optical illusions like those used so artfully by Escher in his drawings.

To stare at precise point, *i.e.*, concentrating your attention on it—all students are well aware that one can stare at something on the page and let the brain drift elsewhere—means to activate several neural fibers which originate from the fovea, and also to overload the processing system with a lot of information of several kinds. In such situation, to take a decision which ought to result in a motory action requires time—too long in the case of fencing. As Musashi said, *"But when you fix your eyes on a single spot you lose the vision of the whole and you get disoriented."*

We could say: when you stare at a point our processing system, which has a limited capacity, does not have sufficient resources to perform quickly and handle at the same time also other tasks like the management of the distance.

So what should one look at? Everything and nothing: the glance moves rapidly over everything but does not focus on anything. Primarily, it goes to the center, towards the torso but does not focus on the hand or the weapon or the eyes. He sees them but does not focus on them. Better, he does not attempt to put them in focus. But this is still not enough.

The feel for the measure, as the old Maestri always said, is the most important precondition for the successful outcome of a fencing action.

However, measure is not something static, nor measurable with a yardstick. It is the ability to predict the potential of an action, ours and our opponent's together, with a dynamic context.

When I move towards him, will he stay, move forward or back, and at what speed?

Measure therefore, is determined also by the ***rhythm*** of an action: a rhythm that involves both fencers in a dialog, a ballet which is called the fencing "phrase" when hits are exchanged. This is a clear reference to language, to communication.

Ditto for the dialog without words between fencers which takes place on the strip and follows the general rules of communication. In this case also, to understand one another and find ourselves in contact with the blade or the target, we must first be on the same wavelength, enter in syntony, move "together." Only then one can try to break successfully the syntony and place the winning touch.

Alternatively, we can resist to the attempt to break by the opponent and maintain the control, the syntony, up until the end: for example to parry and then riposte.

We can now summarize our advice: **don't focus on anything, yet look at everything and search for, initially, the synchronism with the opponent**.

To explain how to do this I borrow from **NLP** (Neuro Linguistic Programming) the ***mirroring and matching technique*** of the interlocutor. In our case we must adapt to his rhythms: speed, posture, direction.

I asked a good student of mine how he felt about this system which he had used for some time. His answer: *"Very well, and sometime I can perfectly execute instinctive actions, not thought out, because I feel the measure perfectly. Then, when I am very tired and things don't work any longer I realize that I regress to focusing on specific areas just like I used."*

How can someone train to do well all this?

The easiest part which we can do in the drills for measure is to mirror and match: follow the other's movements until we assimilate his rhythm. To improve, we must train and identify the opponent's characteristics (it is very helpful to talk with the maestro or your team mates) and learn how to broaden the focus of our attention. We must focus totally on the opponent and on his movements: move just like him, feel just like him, become him. Our concentration must be alert but relaxed, be intense on what we are doing and only on that.

The oriental Masters say: ***be here and now***. This is something we can train for quite effectively any time during the day, even outside the fencing salle.

The most difficult part is that which is related on **how** to look.

First, to free the pupil from the need to look, make the student perform several drills with closed eyes (blindfolded). For example, all the ceding parries followed by a riposte, against a right handed and a left handed fencer, on *fili* (glides) or after *trasporti* (transports).

Then, you repeat everything with open eyes to lead the student to trust gradually his own sense of measure and his peripheral vision. Just make sure that he hits without staring at the target or the opponent's weapon hand. He can do it by looking at the coach's eyes or at the coach's unarmed hand which moves here and there. Other times the coach may even engage him in a distracting conversation during a series of hits.

After an initial period of discomfort things start to work out and the precision does not suffer that much.

Then, after the student has gained the necessary trust with the coach, you put him against an opponent but always under the monitoring eye of the Maestro. When the improvement becomes evident, the new behavior of where to look and how to look becomes assimilated and established.