BrainSigns is a spin-off company of the Sapienza University of Rome. The company, starting from a solid scientific knowledge in the analysis of signals produced by the functioning of the brain, has developed innovative applications in different fields: Neuromarketing, evaluation of the impact of the Human Factor in operational and everyday contexts, Neuroergonomics and testing of prosthetic medical devices. BrainSigns has also been working on road safety for several years and recently completed a study on cognitive attention, assessing the level of attention and comprehension of driving school students during a theory lesson, comparing the in-person and remote modes.

We meet BrainSigns' scientific director, Professor Fabio Babiloni of the Sapienza University of Rome.

Professor Babiloni, could you briefly describe the study?

We had the pleasure of conducting this study, which involved 40 students of a classroom to obtain the type B driving licence. The aim was to assess how didactics in the classroom and in remote mode could be "experienced" differently, and in particular whether the latter (remote mode) could anyway affect the educational effectiveness of the lesson. Therefore, the students were asked to wear a "band" with 4 sensors for brain activity (electroencephalography) and a bracelet similar to a modern smartwatch to measure heart activity and skin sweating. In fact, variations in both brain activity and these other physiological parameters now allow us to use the latest neuroscientific techniques to obtain information about the cognitive and emotional aspects experienced by a person while, for example, watching TV, visiting a museum, driving a car or attending a lecture, as in our case. The students attended a one-hour lesson, given by the same lecturer, of great importance for driving safety, i.e. road junctions and their signage on rights of way. Half of the lesson was attended in person, the other half was attended remotely via one of the usual videoconferencing platforms.

Can you give us some advance information on the results?

From a neurophysiological point of view, we saw that the involvement of the students was initially similar, but while the in-presence students maintained a constant level of attention and mental engagement until the end, the remote students showed signs of inattention after about 20 minutes. Another interesting result was that the remote students initially showed increased stress, which then decreased along with the loss of attention. This effect may be attributable to the different interaction between student and teacher, which may not always be easy and immediate when there is a

monitor in the way, compared to the situation in the classroom that certainly favours communication.

In addition, one third of all students made more mistakes when answering questions about the topics learned remotely.

Interesting results but perhaps not surprising. So what is the added value of the neuroscientific approach you use?

Obviously, neuroscientific techniques are not intended to say things that are 'different' from what we normally learn through traditional research, but to open up new perspectives and shed light on the causes of certain human behaviours. As in this case, it is therefore crucial not to demonstrate that a remote lesson might be less effective, but to understand why, for example by discovering that students might initially be well disposed but then technical difficulties can cause a loss of interest and attention.

Driving school trainers believe that road safety topics should be compulsorily taught in driving schools, otherwise there is a risk that learners will focus only on passing the test but not understand why they should do one thing rather than another. How is the situation with distance learning in universities? Are you satisfied?

The context certainly changes, but there are many similarities between what happens in driving schools and universities. A professor generally devotes a great deal of effort to adding value to the lesson, with a series of examples and moments of interaction that can arouse the student's interest and thus encourage active and constructive learning. Needless to say, my experience is that distance learning makes this more difficult, does not encourage interaction and very often induces the student to adopt a passive attitude aimed solely at learning the knowledge needed to pass the exam. As this study has shown.

In the area of driver training, don't you think that more studies could be done, for example on the perception of ADAS use by experienced or elderly drivers.

Absolutely, I am firmly convinced of that! We were recently involved in a study in which we showed that ADAS naïve drivers are apparently enthusiastic and convinced that their driving performance will benefit from it, but in fact mentally they are much more demanded and inattentive towards the road infrastructure, as they focus more on checking the dashboard and the correct functioning of the instrumentation (a problem due to the need to gain 'faith' in automation), rather than checking the road. We live in times when the role of humans is changing radically, automation and technology are invading our daily lives, and it is therefore crucial to consider how to help humans in adapting to this new context.