Pupils are really small

Your pupil, the opening at the center of your eyes, allows you to collect information from the world around you. But a lesser fact known to the student is that examining strictly as it builds (becomes smaller) and spelled (it becomes bigger) in response to certain stimuli, scientists can get crucial intuitions on what is happening in the brain. When the environment is bright, the pupil builds, and when he is dim, the pupil dilates. But environmental responses - like the response to light ... are just the tip of the iceberg. The students also respond when people deceit some drugs, when they feel strong emotions, when they recover a memory, or when they are focusing or thinking about something. In this article, we will discuss how students work, as environmental stimulus responds and how their reactions are reflective of cognitive processing - ie, internal work and current calculations in the mind. As you will discover, the small opening at the center of your eyes can tell us a lot of what is happening in your brain! The opening at the center of your eye allows the light to enter, allowing you to collect information about the world around you, but even the opposite is true, even the intuitions can be acquired on what is happening in your brain based on the behavior of the Your students. The student is the opening in the center of the eye that appears as a black spot surrounded by the colored side of the eye, the iris. The iris is a muscle in the eyes that works like the diaphragm of a camera (see figure 1). The iris responds to the quantity of light that enters the eye by adjusting the size and diameter of the pupil (the opening), in order to allow the appropriate amount of light in the eyes (the camera). Light travels through the liquid in the eyes and is therefore absorbed on the back of the eye, in an area known as the retina. The retina is covered by specialized cells called photoreceptor (think of this part of the eye as a movie of a camera in which the image is captured). Photorectors collect information from light and send it to the brain to be processed in the image you see. Figure 1: An analogy can be made between a camera and the eye. The iris (shown in green in the front of the eye, surrounding the pupil) is similar to the diaphragm of the camera (shown in green in the front of the camera lens) and the student (the small opening in the center of the center of the EYE) is similar to the camera opening (the black opening in the center of the camera lens that allows mild). The IRIS / Aperture adjusts the size of the pupil / opening to allow the appropriate light into the eye / camera. The light is absorbed / captured on the back of the eye / camera from the retina / film (shown in purple on the back of the eye, and in purple on the camera, behind the lens). How does the student? When the lighting is bright, the IRIS responds confusing (flessando) - making it the smallest pupil and therefore allowing less light in the eye. When the lighting is dim, the iris responds expansion (relaxing) - making it the largest student for situations where more light is needed to see. This is called the pupillary light reflex [1]. The autonomic nervous system - the part of the nervous system responsible for involuntary and unconscious processes, which are processes that we can not control consciously, such as heart rate and digestion - is also responsible for the pupillary light reflex. The pupillarie answers, then, may be partly understood as physical responses involuntary or unconscious on the lighting conditions, but this is in fact only the tip of the iceberg! (See figure 2). Figure 2 - In this figure, see the pupil of the same person in three different states. The photos were Using an eye-tracker; Blue coloring indicates the position and size of the student. In the central panel, see the pupil of the resting person, after being exposed to normal interior lighting conditions. In the left panel, see the student forced (decreased in in After exposure to a luminous torch. In the right panel, you see the dilated pupil (increase in size) after a period when the person sat in a dark room. The pupillaria response as described above is a background process. We can think of bass outward processing as a processing information (ie, light, sound, pressure, heat or chemicals) from the body Ã ¢ â,¬ Å "UPÃ ¢ â,¬ to the brain. In the lower processing, the information enter the body through the sensory organs (eyes, ears, skin, mouth, nose): Ã ¢ â,¬ Å "the bottom. The information is then resumed and processed in the brain, Ã â,¬ å "the top, Ã ¢ â,¬ to create an interpretation (ie a perception) of information, a memory of it or other higher level thinking. The Pupiliarie Answers in Light are considered processing from the bottom upwards because it derives from the external stimulus (a certain intensity of the light that enters the eye) is processed in the brain and therefore perceived (the intensity of light is perceived as a brightness). From there, the brain sends signals to the iris, causing the contract or expand, depending on the brightness of light [2]. It seems to make sense, therefore, that the student should respond only to lighting conditions because checking the amount of light seems to be the main purpose of the Puppen. Surprisingly, this is not completely true. Studying pupillaries answers, now we know that pupils can talk to us about a much more complex activity that is happening in the brain. Pupils tell us more than the brightness of the pupilometry is a method used to study Pupilry replies by measuring the changes in the size of the unit in response to various types of stimulation. Pupillometry has revealed a further top-down relationship between Pupilry replies and several mental operations that are sometimes rather complex [1]. Top-down processing can be designed as higher level information from the brain that is sent Ã ¢ â,¬ Å "Down" to the body. In the rest of this article, we will talk about the exciting and unexpected relationship between the opening of yours Eye and the internal operation of your mind: specifically, perception, emotional responses and cognitive load. Perception: thinking about light surprisingly, scientists have recently found that students also respond to stimuli that involve a lighting condition in the same way they do When we experience real changes in lighting conditions. Simply put, even when there is no change in the actual brightness of a stimulus, a person's pupils can respond forcing because this stimulus usually tells us that there are conditions of Brilliant lighting. For example, Binda et al. [3] showed participants equally bright images of the sun and the The moon, which we know are typically bright or excuses and encryptioned images that seemed nothing specific. The images that seemed nothing specific were nor Ã ¢ â,¬ Å "Sean luminance" or "scale phase", - unlike the images of the sun and the moon, were destined to lose meaning so that any pupillante response To them was due to their brightness alone, and not because implicit (or suggested) a lighting condition. The average luminance images were of uniform color and combined the brightness and color of the general average of the entire image of the sun. The stage encrypted images can be designed as a puzzle, with all the mixed pieces. The stage scrambled images were also the same general general brightness of the original sun images, but the pieces of the image have been encrypted so that The image was no longer similar to an image of the sun. In this way, the four types of images differed in their significance but Of their brightness, therefore any difference in the expansion of the observed pupil should have derived from something different from the differences in brightness. Researchers found that individual students reacted to sun images (which is normally rather bright) contracting. However, the images of the moon and the images that didn't seem anything specific no no Participants have the students contract, even though they were just as bright as the image of the sun! Similarly, MathÃƒ'T et al. [4] Found that participants' students contracted when they were presented with words (both spoken and visual) that have simply transmitted the concept of light, and that their students dilated for words that transmit obscurity. It seems that the understanding or thought of light or darkness concepts can sometimes be enough to cause the same response in the students like real light and the cause of darkness. This tells us that students can respond not only to environmental information, from below down, but can also be stimulated by top-down processes or information from the brain instead of the environment. Emotion: You can see it in your brain facilities of eyes involved in higher level processes, such as emotion and cognition (thought), are also known to stimulate pupillarica activity. Activities in the regions of the brain that help us feel emotions can also increase pupil dilation. Things in the environment that cause us to have emotional, positive or negative answers, can cause pupil expansion. For example, partially and Surakka [5] presented participants with a series of sounds and monitored the participants, the students are listened to. After each presentation, the participants evaluated sounds as emotionally positive, negative or neutral. The sounds that have been evaluated as positive (like a child who laughs) or negative (like a crying child or a pair of fights) have led to increases in pupil expansion compared to neutral sounds (such as bottom office noise) , which have had little size pupil effect. Knife: think hard experiences If you try to do something different, something you didn't do before, you need more mental effort to run that task, which means you have to think stronger. The increase in pupillar expansion is also from this increase in mental effort, which is often referred to as cognitive load. When the increase in cognitive load lasts for a while, the expansion of the students lasts even for a while, reporting that the person continues to think about the difficult task and pay attention to it. An increase in cognitive load is thought to be associated with areas of the brain responsible for continuing attention, located in the frontal lobe of the brain (behind the forehead). This model of greater pupil expansion resulting from an increase in cognitive load is seen when individuals perform difficult tasks. Activities How to make difficult math problems, store large groups of information or counting backwards with seven increases due to an increase in cognitive load and therefore produce greater pupiling expansion [2] .1 Use of pupil expansion as an increase indicator of the Cognitive load, memory studies found that cognitive load increases when storing, remembering and recognizing information and cognitive load is greater for more difficult content. For example, Papesh et al. [6] Found that cognitive load is significantly increased when participants were asked to store and recover inventable words (as Ã ¢ â,¬ Å "GarpÃ ¢ â,¬) from memory, compared to real words. Researchers have discovered that when it was used more mental effort to store information, which information has been better remembered later. Even more important, this was also reflected in pupillaria dilation; Stronger is the memory, the most dilated pupils in the unit tended to be. These results also apply to children's ability to use short-term memory - the memory system used when to remember the information for a short period of time. Imagine, for example, that you feel like a truck of ice cream and offer generously to buy three of your friends a snack. If you try to remember what kind of dealing with each of which you want, so you can run it and buy it for them, you are using short-term memory to contain this information. Johnson et al. [7] He studied short-term memory using a business in which the participants stored the long number sequences and e He reported them back. The researchers observed the students of the participants - â,¬ â "¢ for a increased and sustained expansion, which told them when the participants were memorizing the information and when they weren't. After memorizing six numbers, children's students are typically started to force, but adult students have remained dilated. This has indicated that, at six numbers, children affect their memory limit and have stopped memorizing, but adults no. This Pupillometry study confirmed that children have a smaller short-term memory than adults. What is different from the pupiliaries responses that take place during cognitive load and pupillar replies that happen during perception and emotion is that it is the contraction of the pupil and the expansion result from the cognitive load. Dealed students when the information is processed or remembered, as both are cognitively challenging tasks. The students are often built on the reporting of information, since the cognitive load decreases once the information has been successfully remembered. Finally, the size of the pupil returns to intermediate dimensions when mental processing is complete [2]. The monitoring of pupil expansion, therefore, is useful for monitoring when we are putting more effort in thinking, since we start the processing of information when in the end they report information. Conclusion The dilation of the pupil is, perhaps, an unusual way to understand the human mind, but it is clearly useful. This method could also be potentially used to study different populations, such as newborns, children, individuals with mental disorders, or those with difficulty that communicate. Studying the student allows us to take advantage of the fact that the eye is an extension of the brain. How it put Eckard Hess [8], Ã ¢ â,¬ "It's almost as if a part of the brain was in a simple view for the psychologist for Peer at.Ã ¢ â,¬ Glossary Student: Ã ¢ â € œ Opening in the center of the iris This allows the light to enter the eye. Pupillometry: Ã ¢ â € the study and measurement of the diameter of the pupil and as reacts to environmental stimuli and mental processes. Cognitive load: Ã ¢ â € â € â € 'The quantity of mental effort used during information processing. dilation: Ã ¢ â € a relaxation of muscles in the iris that causes the student to become larger than a diameter. Contraction: Ã ¢ â € â € a tightness of Muscles in the iris that causes the student to become smaller than a diameter. Conflict of interest Contacts The authors declare that the research was conducted in the absence of commercial or financial relations that could be interpreted as potential conflicts of interest. Notes to more ¨ of page [1] Ã ¢ â € you can test all this p er you: having a friend agrees to keep visual contact with you (this could be the most demanding part, as it is a bit embarrassing), then asking for a mathematics easy questions (what is 2 + 2, 1 + 1 Ã ¢ â,¬ |?). You should not see a change of expansion. Now, ask a difficult mathematics (how, what is 53 * 87?), And you may notice a sudden increase in expansion. If your friend can understand the problem or stop trying to solve it, you may notice that his students will return to the normality. [1] Ã ¢ â € œIs Sirois, S. and Brisson, J. 2014. Pernymometria. Wiley interdiscip. Rev. Cogn. Skiing. 5: 679 Ã ¢ â,¬ "92. doi: 10.1002 / WCS.1323 [2] Ã, â € Steinhauer, SR, Siegle, GJ, Condray, R. and Pless, M. 2004. Nice and parasimpatial innervation of Pupillary dilation during sustained processing. Int. J. PSYCHOFISTO. 52: 77 Ã ¢ â,¬ "86. Doi: 10.1016 / j.ijpsycho.2003.12.005 [3] ã, â € 'Binda, P., Pereverzeva, M. and Murray, S. O. 2013. Student Constritions at photographs of the sun. J. Vis. 13: 8. doi: 10.1167 / 13.6.8 [4] Ã ¢ 'MathÃƒ'T, S., Grainger, J. and Stijkers, K. 2017. Pupiliarie answers to words that transmit a sense of brightness or obscurity. Psychol. Skiing. 28: 1116 - 24. doi: 10.1177 / 0956797617702699 [5] ã, â €thala, T. and Surakka, V. 2003. Variation in the size of the pupil as an indication of affective elaboration. Int. J. Hum. Computer. Pin. 59: 185 Ã ¢ â,¬ "98. doi: 10.1016 / s1071-5819 (03) 00017-x [6] ã, â € papesh, M. H., Goldinger, Goldinger, D. and Hout, M. C. 2012. Resistance to memory and specifically revealed by pupilometry. Int. J. PSICOFISTO. 83: 56 - 64. doi: 10.1016 / j.ijpsyo.2011.10.002 [7] Ã, â € Johnson, El, Miller Singley, at, Peckham, Ad, Johnson, SL and Bunge, SA 2014. The evoked pupilometry From activity provides a window in the development of short-term memory capacity. Front. Psychol. 5: 218. doi: 10.3389 / fpsyg.2014.00218 [8] Ã ¢ â € Hess, E. H. 1965. Attitude and size of the student. Skiing. I am. 212: 46 - 54. doi: 10,1038 / scientificamerican0465-46 torres a and hout m (2019) students: a window in the mind. Front. Young minds 7: 3. doi: 10.3389 / frym.2019.00003 presented: 17 June 2018; Accepted: 4 January 2019; Published Online: 6 February 2019