EXPLORING THE CEREBRAL ACTIVITY THROUGH MUSIC AND VISUALS.

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SUMMARY

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2.1 visual cortex

The region of the brain that is in charge of recibing, processing and interpretate the information that arrives trough our eyes is called visual region. As seen in Figure 1, the main structure for that is the visual cortex, placed on the back of the brain, in the occipital lobe. The light enters trough the eyes going trough the retina. In the retina, there are special cells (cones and rods) that transform the light into electrical signals. Those signals travel trough the optic nerve to a station called the thalamus (specifically to the lateral geniculate nucleus). Finally, the information arrive to the visual cortex.

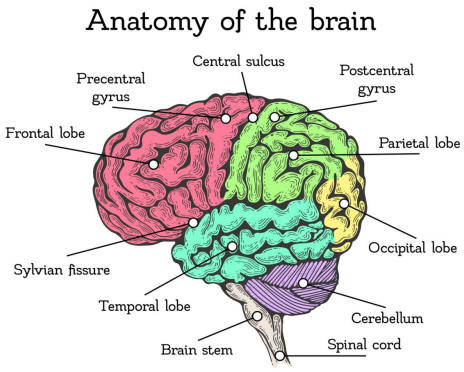

Figure 1: Areas of the brain, by CogniFit Blog. *Three main parts of the human brain*, 2015

As it is explained in the first chapter of the book *Neuroanatomy, Visual Cortex* [1] the visual cortex is divided into five different areas (V1 to V5). As shown in Figure 2, those areas are classified according to their functional and structural characteristics. As information moves through the different areas, it becomes increasingly more specific. Neurons in the visual cortex are typically activated by stimuli within a specific receptive field. Each area contains neurons that are sensitive to different types of stimuli.

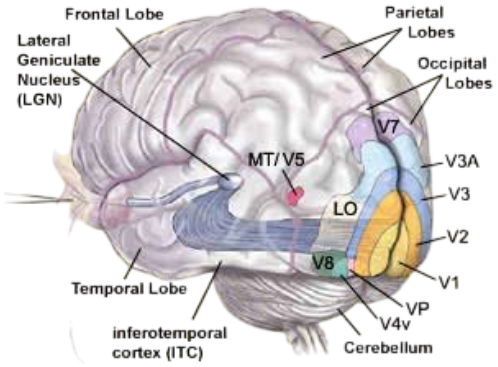

Figure 2: Areas of the visual cortex, by Leonard J. Press, O.D., FAAO, FCOVD. *The Visual Centers of the Brain*, 2018

- **V1 - Primal visual cortex:** V1 is located around the calcarine sulcus. It consists of a laminar organization of six layers with a columnar architecture of marked ocular dominance and orientation.
  This area is the first cortical receptor of the retino-genicular cortical pathway. It receives information from the thalamus in layer 4 and sends projections to section V2 and other areas where all the information captured by V1 will be processed.
  The main function of this area is to break down the image into its most basic concepts. It is responsible for detecting retinotopic positions, edge orientation, contrasts, spatial phases, and direction of movement. It also has a very precise retinotopy with very small and well-defined receptive fields, along with a fairly high spatial resolution.

- **V2 - Secondary Visual Area:** This region surrounds V1 and acts as an interface between V1 and other extrastriate areas. It continues to maintain rhinotopy, but its columns show a rather different organization from the previous region. It receives information from layers 2 and 3 of the V1 region and sends projections to V3, V4, and V5, as well as returning information to V1 for feedback.
  This area is essential for the grouping of elements and the differentiation of figure and background. The main function of V2 is to integrate the output of V1. This area has larger receptive fields that allow it to reflect more complex

properties than those detected previously, especially with the detection of textures, edges, color contrasts, and spatial frequency. Some types of cells in V2 participate in the detection of figures and boundaries. In addition, V2 participates in routing to the dorsal and ventral pathways.

- **V3 - Visual Area 3:** Region V3 is located next to V2, on the dorsolateral surface of the occipital lobe. It receives signals from V1 and V2 and projects them to intermediate dorsal and ventral areas. This region has even larger receptive fields than the first two and is responsible for deciphering and processing very complex spatial patterns that the other two areas are unable to process. It does not have a specific role or a fully designated function, but rather acts as an intermediate node for processing and transmitting complex information to the following areas. It is the area responsible for transmitting information to the following more specialized areas.

- **V4 - Colour specialized area:** The V4 region is located on the ventral and lateral surface of the occipital lobe. It is responsible for receiving inputs from V1, V2, and V3 and projects them to more ventral temporal areas.
  This region is responsible for color recognition, not only detecting the wavelength of the signal, but also registering color constancy under variations in lighting. By detecting and processing this information, it ensures that the brain reacts to colors according to the information detected in this region. It also has neurons that respond to curved shapes, corners, and combinations of lines and textures. It is responsible for visual attention. This part of the brain modulates strongly according to attention. It increases when attention is paid to a stimulus within the receptive field.

- **V5 - Movement Specialized area:** V5, also known as MT (middle temporal), is located in the lateral/dorsal temporal region and is responsible for receiving information from areas V1, V2, and V3 and sending it to regions of the dorsal parietal pathway. This region is responsible for detecting

the direction and speed of movement, as its neurons are highly selective for this. It integrates local signals to encode global movement, an essential parameter for visual tracking and motion perception.

- **V8 - High level Color Processing:** This area, also called V4 plus, is located in the ventral region of the occipital lobe and was recently discovered through fMRI studies, when an area was observed that became highly active when color was perceived and analyzed.
  V8 is heavily involved in interpreting color, but in a much more complex way than V4. It specializes above all in achieving color constancy. It ensures that even if the intensity of the color changes, we can still identify the actual color being perceived. This ability requires complex calculations that depend not only on the information entering the retina, but also on spatial and contextual comparisons. It is a region that contributes to the identification of complex color patterns and boundaries defined by color differences.

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CONCLUSIONS

3.1 **conclusions**

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