MODEL TO DESIGN ACCESSIBLE, SENSORIAL AND COGNITIVE SPACES

METHODOLOGY FOR HEALTHY AND INCLUSIVE DESIGN

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https://seguridadespacialcognitiva.org/

1. GENERAL BACKGROUND

1.1. How and why the model was developed

This model was born twelve years ago as the final project of the Master in Universal Accessibility and Design for All (La Salle University. Madrid. Spain). Previously, I had published works on this topic that I was already beginning to become passionate about. In Spain, the country where I live, until then there was no knowledge about how to design accessible spaces for such complex neurodiverse spectrums, such as sensory and cognitive.

These studies, research and projects focus on architecture and design as important factors for personal and social health: it is the habitat as a determining factor of health. This emphasizes their innovative and participatory nature because they are expressed from the concept of habitat, which is already an unequivocal sign that spaces and cultures are being shared.

From them, arises the need to include in the legal regulations, technical codes and teachings of health and technical careers: engineering, architecture, and design in general, the set of knowledge that must be taught to broaden the view of accessibility universal. These must be part of the teachings that are already provided, surely, on universal accessibility and design for all in technical and specialized health schools and universities.

Based on the knowledge of sensory neurodiversity, perception and cognition, an innovative model is structured to design accessible spaces, a sensory and cognitive spectrum that is novel and of social inclusion. It is a strategic approach that creates in parallel a) inclusive training and design methodologies, b) where knowledge and projects are shared with people with sensory and cognitive disabilities, for a definitive inclusion of neurodivergent people in urban environments and architecture.

This is an approach that leads an unstoppable process, and that in all likelihood in less than ten years (After agenda 2030) will be part of the discussion agenda of states and local governments, because they will talk about “inclusive habitat” without

discrimination of personal conditions.

This will be the phrase of the common agenda: "**We are all, neurodiverse**."

1.2. Development and implementation

Being such a complex and unknown topic in architecture, it has been and still, is necessary to disseminate the need for it, to continue studying and developing as a theoretical set of concepts, projects, and inclusive methodology.

I myself, am an example of advances and innovations: I have been working for several years on all those aspects of neuroscience (neurology of spatial behavior) that can increase its importance within a new way of thinking and doing architecture as neuroarchitecture or neuroscience, architecture, and health.

It is important to say that there are more than fifty projects executed with sensory and cognitive accessibility and many of them are shown in this article.

How to disseminate?

These could include community workshops and talks on these topics about the influence of spatial design and architecture on the health of communities; the need to take this approach into account in public facilities, especially in schools, nursing homes and workplaces. Promote the participation of all people with and without disabilities working together. And the use of the media with its own inclusive strategies and vocabulary with an open approach and clear and inclusive vocabulary.

- Take advantage of the services of Professional Colleges because they offer opportunities to provide information and carry out training in Technical Schools where careers related to engineering, architecture and design are studied that, if they include sensory and cognitive accessibility, become indirect and direct forms of social inclusion.
- Including health professionals in general and, in particular, psychologists and occupational therapists to interact with design professionals and influence the need for projects to focus on design methodologies that consider human neurodiversity.
- Especially considering those specific cases in which, without sensory and cognitive accessibility, social exclusion is generated (schools, residences, parks).

Train architecture and design professionals: improving their ability to offer spaces and activities that are both functional and aesthetic, but especially suitable for providing facilities and positives emotions to all people in society.

2.INNOVATIVE APPROACH: MODEL TO DESIGN HEALTHY AND INCLUSIVES SPACES

The most common approach to accommodate various uses on a plot of land and the most practical for adapting activities within a building is the arrangement of corridors or structuring circuits as elements of a functional relationship for the development of activities – predominant in almost 95% of architectural projects. This model adds new spatial concepts that incorporates a variety of design components for a more sustainable and sensorial use based on spatial relations with courtyards or playgrounds, light, thermal control, and light inside the building, also introducing of its own components as *nodes, circuits, and synapsis*. All components that come together to improve something else that is very important: orientation and sensorial behavioral specificities.

We will talk about these concepts from now on, each of these refers to positive categories of spatial development and adaptation, unblocking difficulties and minimizing efforts: design and architecture as factors of health and quality of life.

- Its consequence is that environments and buildings are legible, understandable and can be easily communicated with people.
- It is an inclusive language: because its origins, its foundation are people in their complex interaction: body, brain, and mind.
- It is from my approach, the "Design model of accessible spaces, sensorial and cognitive spectrum".
- The "Model" has developed its own participatory methodology that includes different users with neurodiversity in evaluation and design.

This model was born for the cognitive spectrum of accessibility, but over time, research and projects, this spectrum was expanded to aspects related to sensory hyper or hypo sensitivity.

2.1. Orientation ad spatial actions

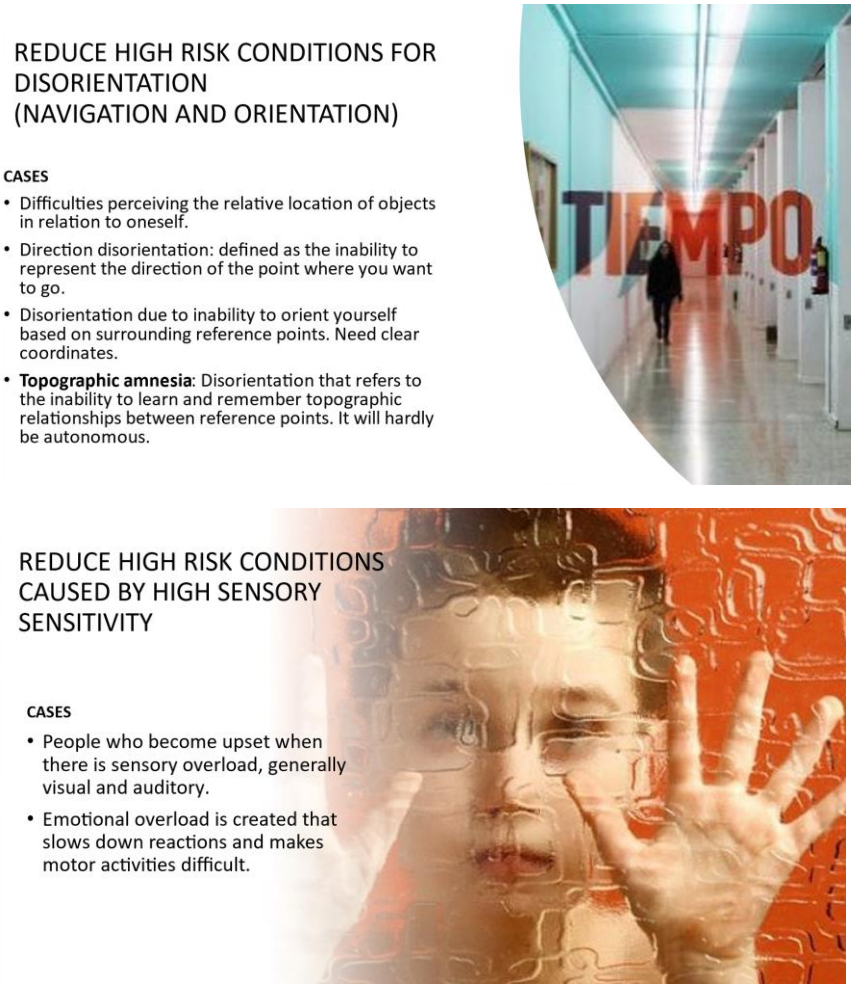
Orientation has always been a measure of personal autonomy. People who can make decisions about how and where to go easily and without having to make complex relationships or use technology have an executive capacity that is related to important mental processes of "monitoring" of the central, autonomic, and peripheral human nervous system.

"There are no specific tests to measure orientation difficulties as a single category, but we can use the Wechsler Intelligence Scale (WISC-IV) or the Wechsler Children's Scale (WPPSI-III), where processes such as working memory, processing speed, perceptual reasoning or oral comprehension are assessed. Or use tests to assess processes directly related to reading, such as the Kaufman K-ABC Test, the Raven's Progressive Matrices

Test, or the Toni-e, to measure verbal and non-verbal intellectual abilities" (Condemarín, Chadwick and Milicic, 1998: 112).

It is the executive functions that make the distinction between ease and difficulty much more than the innate ability that many people have, those who say of themselves: "I have a good sense of direction". Looking and seeing or monitoring, relating, deciding, and then acting can establish that necessary differential value between those who will or will not orient themselves on spatial routes.

We have to remember different definitions of orientation, or in this case it is better to call them "disorientation"."[1],



Figures 1, 2: Spatial orientation/disorientation. Berta Brusilovsky.

this "Model" influences the design so that it is able to "ward off" disorientation, thus proving the enormous importance of the presence of cognitive accessibility indicators (Brusilovsky, 2018). Although nothing is 100% infallible, as disorientation is as diverse as people are, if each of the situations can be "translated" into spatial solutions, most of the difficulties or blockages can be resolved. Perhaps not all the difficulties would be solved, nor would each one of them be solved definitively, but the problems caused by

[1] Brusilovsky Berta. (2018) Index of cognitive of accessibility. Incipit

the inconvenience of moving from one place to another across the length and breadth of a space would be tackled to a large extent.

Cognitive and sensorial accessibility indicators are created to maintain a seamless origin-destination-origin sequence and do away with the labyrinth effect caused by a design without understandable vocabulary. They came to be valued and considered in 2018 (Brusilovsky, 2018: 158) and were seen as decisive for the final result to be considered a good design, adjusted to functional needs, nodal relationships, and through circuits. Enriched with new indicators in Brusilovsky's text (2020) and converted into a support system, they qualify the structures to provide accessibility and safety conditions: none of them is random, they respond to a greater or lesser extent to an aspect of the functioning of the nervous system from which a formal, functional, and aesthetic spatial concept is defined or qualified.

The brain organizes objects according to their shape, function, and even by how they can be manually manipulated. Until now, however, scientists had not been able to prove that color was a relevant factor in the storage of object-re¬lated data in the brain. However, the color effect is also gradually being analyzed as a spatial factor that helps recognize spaces and guide people.

2.2. Principles or postulates of the "Model"

This is one of the most important parts of the model because it constitutes the key to sensory and cognitively accessible design, resulting in a comprehensible spatial vocabulary. They are the structural principles or postulates that provide the necessary consistency to be able to design with sensory and cognitive spatial security. We categorize them as universal and from design because from them, we develop the spatial components of the model as **a comprehensible vocabulary**.

Universal:

- Without them there **is no sensory or cognitive accessibility.**
- They fulfill structural functions in design in **sensory or cognitive accessibility**.

From design:

- They are the parts of the design because they are formal, chromatic, and perceptual structural organizers.
- Its result is architecture with a cognitive accessibility approach.
- Or cognitive accessibility with an architectural approach.

The universal principles

- Neutralize the labyrinth effect or internal confusion of the design, the main barrier to orientation in space: to **break the labyrinth effect**.
- Perfectly match encounters at spatial junctions and crossroads to avoid confusion and disorientation: to **break crossroads**.
- Eliminate design obstacles that prevent focusing attention (working on executive functions), memory, alertness, vigilance.
- Create references with easy texts, graphic signs, and numerical symbols. Adapted **to each place.**
- Fracture-free sequencing of design components without creating crossroads, as fractures in the structure and organization in functional and sensory sequences. To avoid a collapse in executive functions: attentional and emotional.

From design principles

- Create a **threshold effect** in longitudinal spaces with markers or distances **as limits**, to avoid visual and emotional alterations and keep **the information always present** in short-term-operational-memory, which is very short. Markers that can be formal, visual, tactile, chromatic, sound.
- **Grouping-segregation effect**: Introduce this (and others) important phenomenon of visual perception, such as visual organizers.
- Create references with the **semantics of the shapes**. Although design is the result of form-function-imagination-creativity, efforts will be made to ensure that the semantics of forms have an **understandable vocabulary** and serve as a guide.

Architecture becomes a **system of spatial coordinates** to orient, guide, point out, protect, inform, anticipate, calm, and with its formal, functional, and sensory aesthetics: it speaks to people with its own architectural vocabulary.

3-BACKGROUND OF THE "MODEL"

Design, architecture, is the result of organizing and connecting functional and sensory spaces. This is done with different materials and an aesthetic of volumes, shapes, and colors: with a functionality to be used by people. Our brain uses four routes to navigate in space: spatial (by the architectural project and its execution), graphics, lexical and phonological, and symbols; and as a consequence, different parts of the cerebral structure (HNS[2]). To design we should focus on the spatial route: the architectural project. But when the result, once that project has been executed, disorients us, we use the other three to complement its functionality and be able to navigate the spaces.

Shapes: Is a property of space or imagery, defined by its outline, boundaries, colors, texture, and dimensions. The organization of equal or different shapes has direct effects

[2] Human nervous system.

on sensory input, perception, and purposeful action: space is the result of interactions that create this integration – which is not a "sum" – it is a set of parts necessarily assembled so that the result, ready for action, has an overall and global aesthetic.

Perception and action contribute to one another to make visual processing possible: the brain seeks to harness its neural circuits by encoding both through the same neural mechanisms[3].

Research has shown that it is possible for complex connections to exist in the brain despite the distance between the areas of perception and movement (action), allowing movements or tasks (actions) to be executed when what is perceived is familiar, understandable or can be identified (Inferior temporal gyrus).

This has shown that visual search tasks may involve oculomotor activity registers and perceptual processes that also require attention and memory. Therefore, the perception of shapes for action or task execution are not simple acts but require the assembly and effort of a complex web of parts that are set in motion by the visual task that serves as a trigger or inducer for the task.

Stimulus of shapes: humans react to stimulus conditions in the environment, such as combinations of fixed shapes, or the movement of people and objects. There are no simple shapes in the environment since visual stimuli are generally complex. Visual organization becomes even more complex when further stimuli are added, especially if they are moving or if the subject is moving. Simple situations in which a single stimulus triggers a certain behavior are not common and depend on many variables, both contextual and personal, of everyone involved in the experience.

They can be defined as being of prime importance when they are simple, without additions; and of secondary importance when they are the result of the sum of superficial or related conditions, which are superimposed or combined. These alter and change when there are different focuses of attention in the combinations.

Figure-background contrasts: figure-background analysis is fundamental in spatial perception, since the recognition of spaces depends on how the smaller shapes are incorporated into the larger background(s). It often depends on whether or not an object in a space or a space between several spaces is recognized: every surrounded surface tends to become a figure, while the rest will act as a background.

All these expressions respond to complex combinations of visual stimulation that are modified according to the location of the subject, the natural or artificial lighting, and the secondary effects in the resulting compositions.

[3] 8. Department of Psychology, University of Florence, David Burr and Roberto Arrighi, together with Giulia Cartocci, from the *Instituto de Neurocencias del Consejo Nacional de Investigación* (CNR)

Colors: A particular characteristic of colours is that, so far, they can only be perceived through the sense of sight or visual representation (although technology has been used at various times to distinguish between them). They are defined by their hue, tone or chroma (differences in hue); brightness, value, or clarity; and saturation or degree of purity (vivid or dull), which because of its significance is widely recognized as an aspect of vision.

As with most sensory aspects, there are some that disturb, alter, or trigger some discomfort, anxiety, and stress, such as very bright or strong colours like yellow.

Some recent research has addressed the issue, generating findings that have become indications of sensory and cognitive processes and their relationship with reactions to chromatic stimuli among this demographic (Simmons *et al*., 2009). They found (Paron-Wildes, 2005) that rods and cones in the eye showed abnormalities in that they see more intensely than the neurotypical (red and primary colours, seen as fluorescent and vibrant). The use of colors with low saturation was recommended for their calming effect, such as pale pink. Cooler colours such as blue and green would also have a calming undertone, with monochromatic schemes being preferred.

Conditions that should be considered: The use of color can be a valid resource to differentiate areas and to distinguish visual paths. Contrast of the main image with the background: if the background is too intense it could interfere with the image and cause difficulty of perception. Excessive use may distract attention from the overall meaning of the image.

Colors confusion: many factors influence visual ability: blending and other factors hinder the ability to distinguish colours, especially in those with some form of dyschromatopsia (color vision problems). Two colours with a marked contrast, but with similar saturation or illumination, can be confused because the reference that could help to differentiate them is not a reliable reference.

Figure shows how both colours maintain their equality in the greyscale. This fascinating world of colours as a spatial component is expanded on later.

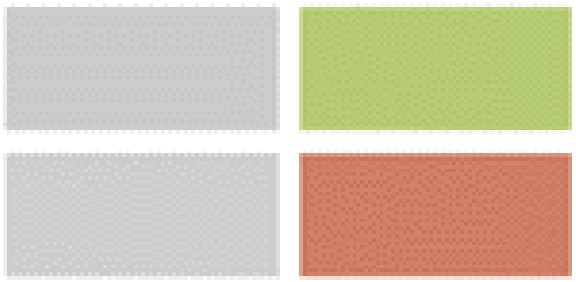


Figure 3. Colors and its relations in terms of grey structure references. Berta Brusilovsky.

As a synthesis "*quality of life*" It is defined as the set of "an individual's perceptions of his or her position in life in the context of the culture and value system in which he or she lives, and in relation to his or her goals, expectations, standards and concerns" (WHO). "The impairment of quality of life is the end result of the interaction of multiple dimensions beyond neurobiological disorders and their symptomatic impact" (Peña Casanova, 2007: 75). The following dimensions, conceived as a whole and responding to each of their realities, bring individuals closer to that much desired way of life.

These are the pathways through which a user communicates with spaces, furniture, objects, and people: *spatial, lexical, and phonological, graphics and with symbols***.**

The ones that are developed are the most important from the point of view of spatiality, but others could be incorporated such as that of touch, which refers to the textures of the materials on horizontal and vertical surfaces.

Figures 4, 5. Volumes, shapes and colors. Day centers of the Madrid city council. Berta Brusilovsky.

The complexity of their use lies in the fact that the brain organizes each of them in different regions in order to integrate them later. As a result, when one is affected, it can use others for communication with the outside world (simplify solutions as much as possible: simple codes should prevail).

4-SPATIAL ROUTE

The spatial route becomes a set of "**spatial coordinates**" that refers to an order or sequence that improves innate aptitudes and reinforces them through the type of learning that only experience, and action can give to human beings: spatial design, not the presence of objects, drives the recognition of scenes and their content (Epstein and Kanwisher, 1998).

This is found fundamentally in the occipital (visual, detecting spatial geometry) and parietal regions, the area of the brain "through which much of the information from the

rest of the regions passes: it organizes the reality that surrounds us" (Eagleman, 2020). Lesions in the parietal lobe would prevent important actions such as getting dressed and spatial orientation from being carried out. Both are key to interacting with everything that surrounds us as human beings.

American and Finnish scientists at the Zuckerman Institute (Columbia University) and Aalto University in Finland have identified the area of the human brain that perceives the geometry of space. Neurons in this region provide a complete view of the environment in just 100 milliseconds. It discovers the places (where) and helps to navigate that space safely, without tripping over the objects present. This new research has determined that the so-called *occipital place area* (OPA) is where one of the stages of cortical processing occurs and is involved in **drawing the geometry of spaces**. The research looked at how the brain areas involved are reorganized to encode spaces where changes have been introduced (a room with or without walls, or with or without a ceiling). When this happens, changes occur in the brain so that it can be perceived in its different circumstances.

Early functional studies have already reported that spatial layout, not the presence of objects, drives the recognition of scenes and their contents (Epstein and Kanwisher, 1998). To move successfully between two points, an individual must first be aware of their own location relative to the environment (starting point) before selecting a route, as the planned response will depend upon the initial position. Orientation perception requires knowledge of two types of information: location and directional heading. From the former, and in order to take a directional course, the basic quality is functional clarity and sequential relationships between activities. This is the first source of formal and functional certainty, essential for good design.

Starting considerations**:**

- The starting point(s) must be completely clear in order to know where one is located, as only then can a route be chosen.
- The destinations of the building or group of buildings must be clearly identifiable through their functional structure and relationships.
- Activities are supported and ordered on the basis of accessible circulatory structures that are readable in the floor plans, sections, and elevations; the design should reflect uses, whether or not specific zones are prioritized. The succession of pathways – corresponding to that of routes or circuits and nodes – may be permanent in formal terms, but are dynamic and relational, and it is much less difficult to interact with them because, colloquially speaking, this is "everyone's property" (Brusilovsky, 2018: 42).
- The sequence should facilitate the identification of any text content as well as continuous multi-graphic features wherever their placement is necessary to guide, direct, and support all or specific destinations.
- The designer's imagination should add the language that he/she feels is most appropriate to provide the necessary conditions for understanding.

- Once *the place* or *starting point (place 0)* is assumed, topological relationships should allow for the identification of directional routes through nodes and circuits.

Figures 6, 7, 8: The sequence should facilitate the identification of any elements and spaces. Day centers of the Madrid city council. Berta Brusilovsky.

Visuospatial aspects can facilitate the resolution of many of the difficulties presented by contingency management, when forewarned of what will be encountered along the way: all these components break the crossroads and the labyrinth effect.

4.1 Organization

While this is always extremely important, organization in this case is also a basic condition for physical and emotional safety. The systematization required for a person with neurodiversity (autism, old people, dementias, mental problems, etc.) should be reflected in the spatial-visual-auditory structure in all its components: structure, function, form, color, and relationships.

The organization of floor plans – horizontally and vertically – that develops a seamless formal and functional sequence will facilitate performance across spaces and result in fewer complications in cognitive spatial security.

It should focus on a sequence that presents minimal details, where the global outweighs the individual and favors a holistic view of the spaces.

The functional organization is based on individual activity areas or spaces that are connected through nodes, circuits, and bridges or links, which are particularly important in this case. The basic condition is the order to be adapted to the spaces in question and the functional requirements of the building, the age groups that are to occupy them and the interest of those who manage these spaces to make appropriate adjustments to the spatial aspects.

Sensory zoning:

The spatial organization or sequence should be coherent from the point of view of activities, in accordance with an activity schedule and, if necessary, with regard to focus, or stimuli. The idea is that it should be feasible – and flexible – to establish a sequence from areas with the greatest potential for action, whether physical or intellectual, to those with the least potential, so that, in the event that the *agenda of activities* (learning, sport, arts, recreation, etc.) involves a certain progression, the internal relationships do not involve distances with labyrinthine routes to allow for such agendas to take place.

Without the need to group them into "high, medium and low stimulation", flexible zoning avoids the consolidation of routines, but should allow for agendas based on potential – in the specific case of schools – to be 'sequenceable'. To avoid the need for zoning according to these action potentials, it is very important that transitional spaces for sensory adaptation are always included.

What has been said above is valid for all kinds of spaces, but sensory zoning is very significant for the systematization of activities in open spaces. It is advisable that playgrounds, dedicated to free and spontaneous activities, have very clear designations so that activities in the more demanding spectrum do not hinder or block the inclusion of those who find it difficult to stay too long at that level of demand.

Rooms:

Rooms or spaces for individualized activities are the basic cells of organization providing a coherent body for the development of human activities. Initially, they are characterized by their dimensions, with the width, length and height ratios being those that mark, in principle, the satisfaction or otherwise, beyond the activity being carried out. Yet it is not a question of doing so with a formula or mathematical algorithm, but of defining qualities based on components of form and movement of the planes that make up the space. And this is much more than mere geometric shapes: it is about prioritizing ones whose simplicity of proportions is associated with the concept of stability and balance, with similar polygonal shapes, such as squares and rectangles. In the case of triangles, it will depend on the dimensions of its sides and the sharpness of its angles. Circles are a complex shape that appear to have no beginning and no end. The curved surfaces of vertical planes should be integrated when the architecture in its overall form and aesthetics can accept them. Addressing this issue should be mediated by the need to facilitate continuity or sequence and not be a purely aesthetic component. The following point, on the qualities of rooms, introduces these shapes as part of dynamic rooms.

In architecture, the floor, ceiling, and vertical planes define the above forms, enclose rooms, and create the desired sensations: the visual characteristics of the room, or basic

cell, link it to very different and opposing sensory experiences. This is important in relation to the different modalities of perception and the experiences they provoke. A quiet room can improve relations with the areas that follow if these are complex. The feeling of tranquility and friendliness is given by the shapes and their dimensions, the furniture, the lighting, and the dominance of the emptiness, for the use and enjoyment of its occupants.

The qualities of rooms: This characterization is based on definitions (Brusilovsky, 2015) [4]that have served to understand how space brings together form, color, and function, and creates emotion, attraction, or rejection. They have experimental origins and correspond to original studies by Jaensch (1911), from his work on the interpretation of impressionist painting, cited by Hesselgren (1954).

- **Impressionistic:** the attention is not fixed on boundaries or objects but moves away from them towards the empty spaces between placed, ordered objects and between supported figures.
- **Haptic:** attention is drawn to objects due to quality, texture, dimension, and quantity, variables that physically and visually reduce emptiness. Such rooms could be physically uncomfortable and visual oppressive.
- **Visual:** an enveloping style, the attention is fixed on surfaces, walls, and textures. The eye is forced to wander from one surface to another without limits as these do not exist. The result of the experience is a loss of contact with the room as a space and the context as a whole. This experience is what might be desired in a painting museum.
- **Dynamic-static rooms:** dominated by axes of movement that alter the real dimensions of the space due to their arrangement. Attention is either drawn away from object to object or is attracted to them in the same way. Attention can be guided by an axis, led from the point where the subject is located to an endpoint.

Innate conditions of space that would fit together rather well with the set of aspects of neurodiversity and its spatial interaction. By combining styles, the experiences become richer, but also more complex. The figure-laden surfaces of a museum, for example, competing with the design of its space, could elicit strong experiences that the visitor would have to overcome in order to appreciate one, the other, or both at the same time. This would be possible by sorting all visual effects by zones or personal and sensory interests. As this is not always possible, there are people who go to see the works in the museum and those who go to appreciate the architecture of the museum. There is a third case, however, who are not going to connect with the mixture and confusion of shapes and content.

[4] Brusilovsky Berta. Model to design accessible spaces, cognitive spectrum (2014-2015) La Ciudad accessible, Granada.

A room can be a communal space or a private room; an enclosed or an open space. But, above all, it provides protection, security, containment, and support to those who go in to use it. On the basis of accepted experiences, some conclusions can be drawn regarding the link between its constitution and its qualities in order to make the experiences comfortable, disengaging the attention from elements that can generate sensations that are not always favorable, or semantically negative. The room, due to its very nature, cannot detach itself from its limits or ignore them. But, above all, it cannot separate itself from the presence of those who walk through it; it cannot separate itself from its form, from the limits provided by its shape, nor from the scale that it measures and the dimensions it has in relation to the observer. Architectural space is a void until the design of its components and scale mold it into architecture.

As on a stage, the experience of the room is linked to its access, limits, proportions, and all of the elements that generate experiences for both the actors and spectators, all of whom are protagonists of the same reality (Brusilovsky, 2015: 137).

***Empty space*:** "The practice of sensory activities takes place in space, a stage, which is recommended to be empty at the beginning of the task, and to be filled by the participants with their needs and with each individual's body, avoiding any interference between them" (Brusilovsky, 2015: 139). The empty spaces allow for a vision of the global as opposed to the individual.

The experience of emptiness represents the lowest point on a scale from least to most active, which helps to calm the emotions and the beating of the heart.

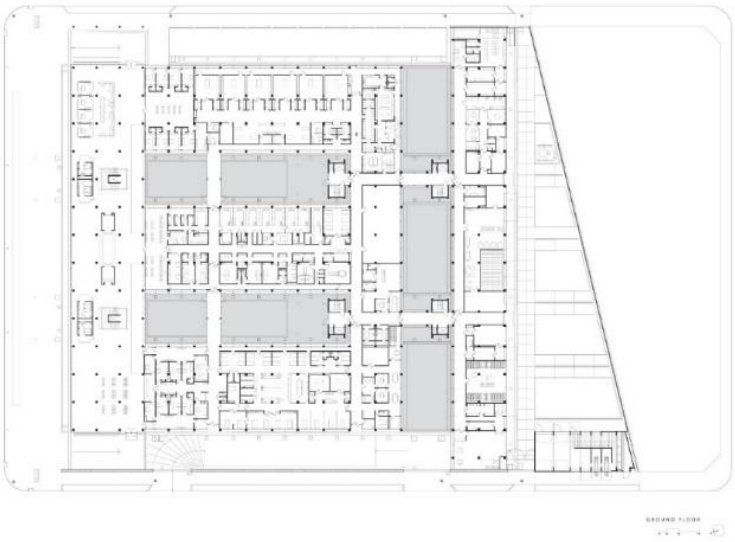


Figure 9. Organization: sensory and functional spaces with different components, open and closed spaces. Mario Corea, architect.

4.2 Nodes or focal centers

Nodal relationships link and unite in formal, functional, and sensory succession or sequence. When these nodes do not perform their different functions, they become **barriers or crossroads.**

Origen node

It is located after crossing the main entrance and receives (once already inside). It connects with all functional areas of the building.

*Receiving***:** located immediately after crossing the main entrance (and exit) door. If it is not designed with sufficient clarity, it should be signposted with references on how to reach it.
Informing: elements that provide information on the spaces to be encountered from the entrance to the furthest point (reception, information booths, directories, etc.).
Addressing: the architecture should address through the formal treatment of the synapses and if this is not possible, or has not been considered, there must be a support as a message that addresses and leads to all destinations.

In addition to the design conditions that must regulate this node as an access-exit point, one of its basic conditions is that it possesses the capacity to contain the impulse to "run-away" as a physical and emotional reaction.
The initial information at the starting "point 0" should minimize its complexity considering that what is sought is one piece of information, which is written and displayed graphically among all that is shown on the panel. The aim is to be able to make a visual tour in order to retain (in an action that presents the least difficulty) information equivalent to a localized activity.

Each of these signs refers to positive categories of spatial development and adaptation, unblocking difficulties and minimizing efforts.

Succession nodes

These are connectors to functional areas of the building along the circuits.

*Linking***:** elements/references that inform about the routes, pathways and/or other nodes with which it connects.
Addressing: elements/references that inform about the corresponding direction to reach the destinations to which it connects.

Figure 10, 11, 12: initial (access) and sequensial nodes. Day centers of the Madrid city council. Berta Brusilovsky.

Central functional nodes

Central, functional space that should formally enable the structure to organize activities around it, termed *hub* in previous texts. Its relationship with the previous node, the succession node, is extremely important. It is marked out and closed off by an interior perimeter for communal activities which differ to those carried out in the next node, which is outside, open, and welcomes or is dedicated, above all, to activities of free choice.

Functional, emotional node, or activity atrium

This model incorporates for the benefit of relationships and results in terms of design a node that is functional, formal, and emotional: the inner playground. It is incorporated for its values: recreation, exchange, and learning in school buildings. However, it is frequent that professionals who design facilities where there is a need to communicate rooms with very different uses have also incorporated this type of node almost permanently into their designs, even in large buildings such as hospitals, cultural centres and secondary schools, which require different solutions to be placed between functionally complex areas, such as public-private areas, using different semantics to the traditional corridor (Mario Corea Aiello's architect team from R. Argentina).

This node-playground (or courtyard) is a spatial connector that can operate as a link between different activities. Compared to the traditional corridor – longitudinal and uniform, often dark – it has a value of moderation and modelling that also enriches the experience of movement. It is emotional as it incorporates the quality that light gives it, and dimensions permitting, it allows for play, fresh air, and sunlight. And if its orientation is appropriate, as well as providing light, it allows for the passage from day to night to be experienced.

Figure 13. Courtyard as connector and functional, emotional node. Activity atrium. Autism Chihuahua. Oscar Chavez-Acosta, architect.

Its incorporation determines a typology that is different from that which is organized by means of circuits. And above all, combined with the latter, it results in a building type that changes functional, formal, and emotional internal relationships.

Characteristics: It articulates the floor plan and relationships by doing away with the labyrinth effect and can incorporate complex shapes so that the space can metaphorically transform into different places and the user into different characters.

Values:

Motivates by controlling the labyrinth effect, helps anticipate.
Develops activities considering spatial and temporal experiences: movement of the sun (morning and evening) and the moon in its different shapes and sizes throughout the month.
Creates open corners and differentiates activities without making it difficult to understand their different perspectives.
Creates sensory corners for the body to feel, to perceive the wet, dry, cold, and hot, rough, and smooth floor, along with smells.
With a canopy, activities can be carried out regardless of the weather.
Without a roof, it allows air, light, and sunlight to enter.
Has a greenhouse effect.

Difficulties and possibilities of playground (courtyard) design:

The semantics underlying the concept of the “corridor” that condition the designer’s imagination could well be the main difficulty in developing different and imaginative designs in architecture. Yet overcoming this idea – to communicate and relate – is easy, simple, and forceful. There are other ways of creating structures which, by making the corridor and the courtyard (playground/exterior zone) compatible, encourage richer and more diverse results.

As a complex space, the qualities of exterior zones can be assimilated to those that have characterized the rooms and that are repeated in simplified form below to reiterate the importance of the space.

4.3 Circuits

All pathways (hallways, stairways, corridors, etc.) should be identified, so that it is always clear where they lead, what they connect to and what can be found along them. They should therefore have the following characteristics:

Origin-destination-origin sequence: always indicate when and how the building’s destinations are accessed. The exit must also be indicated, so that it is possible to return to the outside.
On routes where there are written or graphic indications, the direction of exit should be marked on the opposite side (the other side).
This detailed marking can be omitted in visible routes of the exit that are perfectly identifiable, or on routes that are noticeably short and without any black spots that break off, although always considering the type of users of the building: if they are dependent persons, this measure would always be necessary (indicators reflected and weighted in the cognitive accessibility index, Brusilovsky, 2018).

The references established in the emergency standard must be respected in terms of distances, color, and exit directions. If exit signs or guides are required, the following concept should be considered.

Markers, thresholds, or guides

On any given length of passageway there should be call-outs to inform whether the user is on the right path and in the right direction, considering the functioning of the attentional systems for retention and maintenance (Brusilovsky, 2018).

Figures 14, 15. Circuits continuity through guides, lines near the wall and colors. La Salle University and Day centers of the Madrid city council. Berta Brusilovsky).
Figures 16. Circuits continuity through guides, lines near the wall and colors. Autism Chihuahua. Oscar Chavez-Acosta. architect.

The markers facilitate recall and can also anticipate everything that may occur or happen on the routes. And if the routes are flexible, i.e. changeable, this is a very important aspect to consider in order to identify distances and changes in routine (It's important to express that never have to be used lines in the middle of the routs for prevent difficulties in balance).

The circuit, in combination with the courtyard

Widely used by the team of the architect Mario Corea Aiello, the following figures show how all the activities are directly related to courtyards as generators of environmental spaces and formal protagonists which, in each case – and depending on the functions and organization of the floor plan and elevations – will be treated differently.

Figures 17, 18. Continuity through courtyard and open circuits. Mario Corea, architect.

This corridor-courtyard combination can serve as an extension or anticipation of the enclosed space in its diversity of uses. Other combinations are different for example when the placement of the courtyard is not related to the circulation areas. In this case, it loses its capacity to be an intermediary between sensorially different activities.

4.4 Synapses

Synapse, a concept based on Ramón y Cajal's descriptions as a "region of communication between the neurite or cytoplasmic prolongation of one neuron and the dendrites or body of another", has been taken by the author to define "bridging spaces between others, which may contain activities, or may be nodes and/or circuits". In this case, because of the importance of all structural factors, it serves to ensure a sequence between spaces, on the one hand, and flexibility of use, on the other. The concept is divided into synapse, and synaptic space.

The first is a bridge or spatial link, purely formal, to facilitate orientation and direction. The second, as a link between activities or **adaptive space**, could be one of the courtyards or playgrounds (or bubbles) before the classroom or workshop, or simply a roof that covers and protects.

As bridges or links

Synapsis, linking or bridging should ensure continuity of the sequence by means of shapes or, failing that, include references that inform about everything that is to be encountered along the route. In this case, the concept is close to a bridge that allows passage from one place to another with full certainty of what happens before and after.

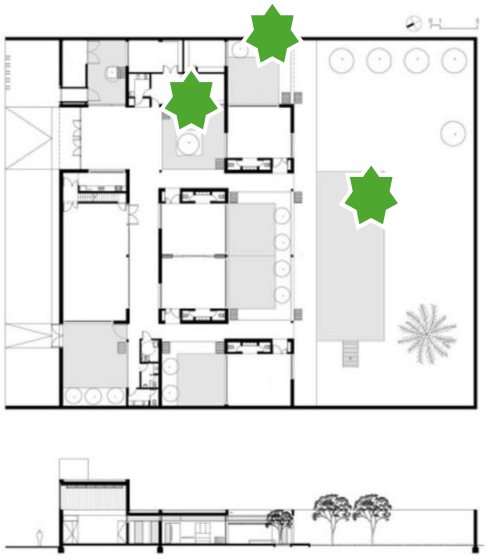
Interweaving connectors

The synapses enrich their functions from their present one, as unifying bridges, to become spaces with personality. By being accommodating, they "push" the structure until they fit in a place where they are truly necessary; for example, as a place of anticipation or sensory adaptation, thus taking on shape and a formal dimension that the simple bridge did not contain before.

Anticipation: they are connectors with specific characteristics that facilitate the management of unforeseen events before they occur.

They serve to move from one space of activity to another, help to make adaptation easier, to pause the previous action and provoke the entry into a different one. They help to give the necessary time for the adaptation to the change between speeds – or rhythms of the different activities – to be natural: like going from first to second gear before moving to third in the driving of a vehicle.

Because of their essential linking and bonding characteristics, they have been called (Brusilovsky, B. 2021) **synaptic interfaces.**



Figures 19, 20. Continuity through spatial, texts and graphics ***as synapsis*** and continuity through courtyards as spatial synapsis. Mario Corea, architect. And Day centers of the Madrid city council. Berta Brusilovsky.

Figures 21. Continuity through spatial, shapes, colors, and graphics. Day centers of the Madrid city council. Berta Brusilovsky.

5. LEXICAL AND PHONOLOGICAL ROUTE

Language is a complex higher psychological process. Difficulties in the visual lexical pathway, accompanied by the oral manifestations they develop – frontal and temporal region of the brain – can become a barrier to communication. There are many occasions in which verbal communication skills are not acquired, creating difficulties in formal learning and interpersonal relationships. For the former, language and written texts have always played an important role, despite the fact that over the years education has lost its encyclopedic qualities.

The **lexical** or visual route is that which reads words in their entirety, i.e. without the need to break them down letter by letter or syllable by syllable. In this route, the reader makes use of the representation in his or her memory, making a mental map of it.

On the other hand, **phonological** reading is one in which the main focus is on the identification of the letters that make up the word. This is also accompanied by their subsequent transformation into sounds in order to recognize the word aurally.

In any case, it is this route that complements spatial reading when it is necessary to inform, guide, and orientate.

Learning. Children with autism require extra time to process verbal instructions. According to the *Instituto Superior de Estudios Psicológicos* (Higher Institute of Psychological Studies).

The *Instituto Superior de Estudios Psicológicos* is a private European institution, founded in 1984, for advanced training and clinical intervention in the areas of clinical psychology, neurosciences, education, and speech therapy.: "When we talk about the lexical route, we refer to the one that reads the word globally without the need of breaking it down. When we read by means of the lexical route, we are able to compare the form of the word in front of us and we will read it with the words that already exist in our visual vocabulary". If there is a lack of attention, similar words such as, for example, "truck" and "duck" could be confused.

Aspects of content and form or expression of language are important in verbal communication and conceptual learning. This can be cut off or blocked if there are signs of difficulty in the mind's eye of the other and in their verbal and facial expressions.

6. GRAPHIC ROUTE

The graphic route has been considered extremely important both as a way of knowledge and alternative communication and as a substitute for children without oral language. More recently, technology has provided others, thanks to which communication is twofold, open, and complete. Stability is one of the qualities of graphic information because it can remain over time, more so than words, which can change or fade.

For preverbal children, gestures are crucial, and these appear very clearly so that they can be identified and differentiated graphically. Among the first and most important are: nodding, shaking the head, and signing to someone. With or without spoken language it is possible to use sign and graphic language as another form of communication.

"In the field of ASD[5] intervention, the use of visual aids has been popularized to the point of extreme indiscriminate use, without assessment of individual needs or criteria, turning what is merely a tool into the very end of the intervention".

The aim of systems such as Incidental Teaching, Pivotal Response Training, Milieu Teaching, Natural Language Teaching, etc., is the mainstreaming of the outcomes. They have been developed with the intention of achieving a more naturalistic approach to improve language and communication development.

They have both supporters and critics for their behavioral approaches, mainly because the highly structured learning environment is not representative of natural interactions: children are better able to generalize the skills learned in a naturalistic situation and then take them with them into the rest of their activities.

For decades, in order to overcome the difficulties of perception and cognition that may appear in the lexical and oral route, reading has been replaced by elements that

[5] Autism spectrum disorders.

graphically reproduce concepts, situations, movements, and phases for learning everyday tasks, and also the processes that the person has to follow in daily life, and even to do jobs if he or she is carrying out paid work. Among the best known are: ARASAAC, Minspeak, Bliss, Pecs, and Signed Speech.

A significant aspect of visual aids is that they can reconcile communication between environments. They can be visual bridges or synapses in the design model for cognitive spatial safety.

Experiences with our participatory methodology with different users[6] have shown that individualized graphic elements (as climbing, descending, walking, placed with an immediate or visual relation to real objects) should point not only to the corresponding object – e.g. a staircase – but to the direction the user should take. In complex cases, other types of signage should be sought so as not to create extra confusion due to the amount of information that would have to be placed.

Figures 22, 23. Graphic route: Day centers of the Madrid city council. Berta Brusilovsky and ARASAAC - Aragón. For children with autism.

The graphic route is widely used in senior day center, with older adults with sensory and cognitive impairment, short memory problems, dementia, etc.

7. SYMBOLS

Symbols can be confused with the concept of image. As a visual reference it is a referent associated with areas of the brain linked to the field *that specializes in the processing of numbers*.

The area of the brain known as the "temporal gyrus" has been identified as a vital area for simple visual field processing. Josef Parvizi, Associate Professor of Neurology and Director of the Human Intracranial Cognitive Electrophysiology Program (Stanford

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University) has demonstrated for the first time the existence of a group of neurons in the human brain that specializes *in number processing*. He writes: “In this small population of nerve cells we have seen a much larger response to numbers than to very similar symbols, to similar-sounding words, and to words with similar meanings”.
About 1 to 2 million nerve cells located here are involved in the processing of visual information from the visual cortex, which *is responsible for recognizing geometric shapes, objects, and numbers*, and is also involved in the long-term memory of these concepts. These are neurons with a primitive function of recognizing curves or crisscross lines common in nature (tree branches or edges), which are also part of numbers and letters.

The symbol, number, or digit (1, 2, 3, etc.) is a reference in the spatial sequence that should not be confused with the *symbolic function of evoking situations not currently perceived.*

Figure 24. Numeric symbol route. Day centers of the Madrid city council. Berta Brusilovsky.

SYNTHESIS

This project was designed taking in account the elements of sensory and cognitive design (Chihuahua, México by Architect Oscar Chavez-Acosta).

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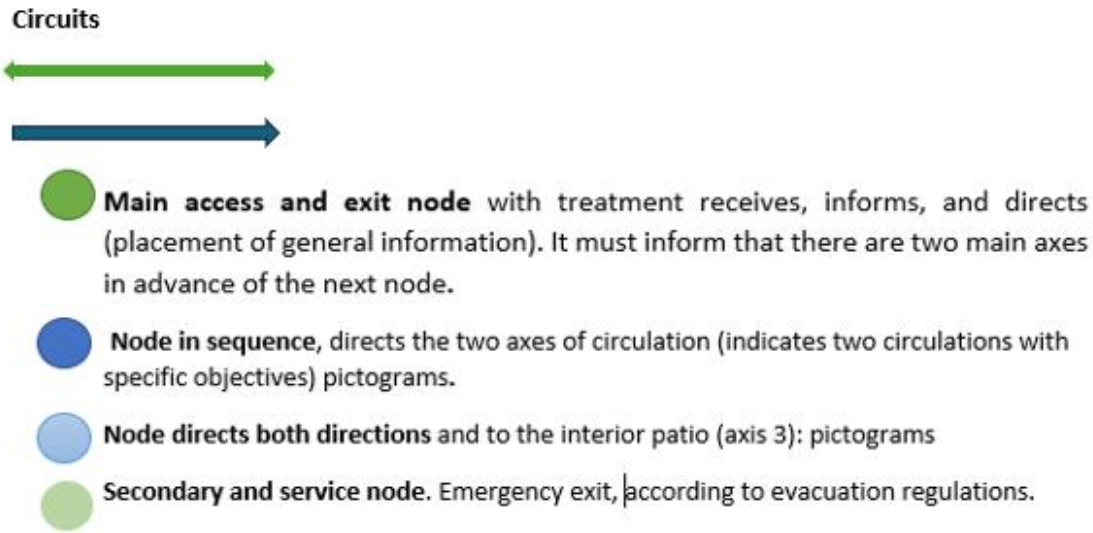

Figure 25. The system of internal and external relations: nodes and circuits. Model for designing accessible spaces. Berta Brusilovsky.

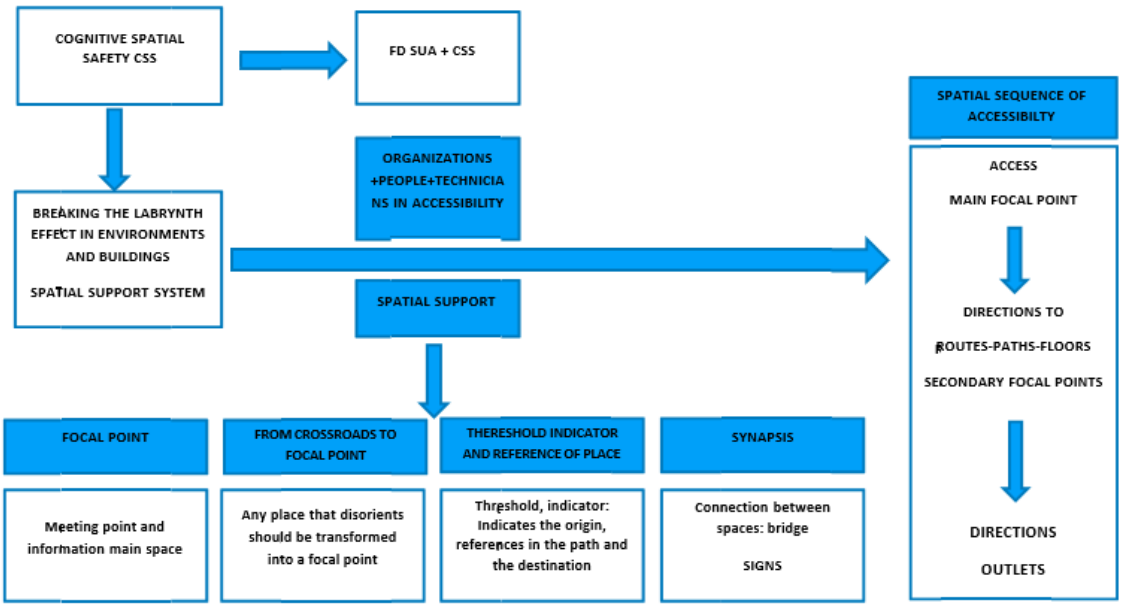

Figure 26. The system of internal and external relations, model for designing sensory and cognitive accessible spaces. Berta Brusilovsky.

8. DESIGN, CONDUCT, AND BEHAVIOUR

The access routes to understanding the geometry of space are multiple. Design should not aim for the user to adapt, rather it is the scenario that must adapt to the user. To do so requires the imagination of the professional and an understanding of people, which is why it is convenient to go back to the words of Theo Peeters, Belgian ASD specialist: “What we must learn, more than anything else, is to try to see the world through the eyes and brain of a person with neurodiversity. When we are better able to understand what makes life difficult for him/her, we will be better able to move obstacles and to develop respect for all the efforts he/she makes to be able to live among us”.

The relationship between conduct, behaviors, and contexts is very different in general but in particular in neurodiversity. The appearance of “indifference to the context” of many isolated behaviors should not mislead and it is essential to recognize which is the approach and the effective instruments for the adequate assessment of people with autism, cognitive and sensorial disabilities, old people or senior, in order to create the most adequate environments so that people respond, with the qualities they have, to the one that best adapts to them, not the contrary.

It is therefore necessary to know the “how” and “where” of the circumstances that are affected in the HNS in order to influence the factors which -when unable to modify the original causes - can be compensated for by external interventions.

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NOTE

This article may continue relating the model to design accessible sensory and cognitive spaces with neuroscience and architecture approach.