Biomimetic design to encourage children's aptitude for reading and counteract attention deficit

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Abstract: Nature has always been an inexhaustible source of inspiration and reflection. We are surrounded every day, unconsciously, by bio-inspired solutions, especially in the field of architecture and design. In opposition, today's digital technologies tend to "divert" men, creating attention problems, especially among the new generations which are no longer interested in reading. However, is it possible to think of a future without books? A home environment without libraries, a symbol of knowledge and personal wealth? Moreover, a study conducted by New York University, published in the journal Pediatrics, shows how reading aloud to children can prevent behavioural disorders like hyperactivity and attention deficit. From these reflections comes the project presented, designed to stimulate, with a hybrid object, young generations with attention difficulties. The inner configuration of echinoids' spines has been a source of inspiration for the creation of the structure of a library, with a circular plan, multifunctional and intergenerational. The cylindrical shape houses a canvas for projecting books and more. In this way it adds to the usual function of the library, storage and support for books, even the innovative function of multimedia transmitter. Thus, reading can become a moment of sharing, reflection, but also support for those who need to be followed in reading and learning. This project embodies the concept of hybrid library which combines and connects two generations in comparison, analog and digital, allowing each one to get in touch with other lifestyles, using different means and breaking down any kind of barrier and prejudice within the domestic environment, linking different generations with different habits, around what should be the central focus of every society, culture. This project shows how biomimetic design can help children's ability to read and contrast attention deficits.

Keywords: Human Centred Design - Sea urchin - Echinoids - Multifunctionality - Culture - Bookshelf - Multiage - Gathering - Bioinspired solution - Design for All

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The consequences of technology on children

Technological innovation has made huge strides over the past decades, contributing to an increasingly fast-paced lifestyle with no real connections. Technology has also been introduced in schools, using computers and tablets as teaching aids. However, many psychologists argue that computers and internet reduce writing and memory skills, causing many problems in learning itself. The OECD (Organization for Economic Cooperation and Development), specialized in the analysis of school systems, published a report in 2022, the result of a two-year survey in 30 countries, on the relationship between children's well-being and the use of digital technologies. The report notes that in the countries of northern Europe, children are approaching technology at an early age, between 4 and 6 years, and how the prolonged use of it has a great impact on school performance by lowering the school average. This thesis is supported by a research of the Gonski Institute for Education of the University of New South Wales. The 84% of interviewed, namely teachers, principals and school staff, agree that technology makes it easier for children to get distracted: "Digitalization has become a strong distraction from learning and students are less able to concentrate on homework. They use Apple and Android digital assistants too often to find answers to questions and get distracted with video games" (2020).
The use of electronic media by children, including internet and video games, has increased dramatically to an average in the world population of about 3 hours a day (Weiss *et al.*, 2011). Studies in recent years have shown that the frequent and prolonged use of screens (screen time) can worsen the symptoms of ADHD (attention deficit hyperactivity disorder) or even increase the vulnerability of the person to develop them (Tamana, 2018). For example, it has been shown that by using computers, video games, or social networks, children become excessively impulsive, hyperactive, restless, distracted, and disorganized, all typical signs of ADHD (Ra, 2018). Moreover, the circadian rhythm is also affected, compromising the sleep-wake alternation. Everyone, in particular parents, should be more aware of the harmful effects of the prolonged use of technology, especially in the most fragile subjects.
Children, therefore, today are more stressed, anxious, obese, impulsive and devoid of stimulation, they no longer show interest in outdoor activities or hobbies with a cultural impact, such as reading. Yet, in this latter case the child has the opportunity to know new worlds and stimulate their imagination since reading has a huge positive impact on the growth and formation of an individual (Frolli, 2023).

The evolution of books and reading

Books have always been synonymous of knowledge and evolution; they educate us to beauty and to discover ourselves. Since Gutenberg, in 1455, invented movable type and printing, the book has undergone an evolution destined to last even today (Balsamo, 2017). The passage from the handwritten transcription of books by the amanuensis monks to the invention of printing has made a decisive contribution to mass literacy, since information on a variety of subjects was now available in large quantities and at more affordable prices. This moment in history has marked a huge development in the communication and dissemination of information and news. In addition, the growing production of newspapers, magazines and books has allowed many to express their ideas, but also to make one, thanks to an increase in the spread of culture. The book has been, and still is, the means of dissemination of information and culture preferred by man and within the reach of all. The invention of printing facilitated the circulation of information and helped the population in their cultural formation.

However, new technologies are also revolutionizing the look of paper books, with the introduction of e-books. An eBook (electronic book) is a book in digital format that can be accessed via computers and mobile devices, such as smartphones, tablets, PCs, and devices specially designed for reading texts digitally, called eReader. Its origin takes place in the late 90s, with the aim of creating a library of electronic versions of printed books, in order to spread, exploiting the possibilities offered by technology, the cultural heritage of humanity to as many people as possible, just as the press did hundreds of years before. The 2007 was the year when Jeff Bezos, founder and CEO of Amazon, put the first Kindle on sale on the platform, the most well-known reading device on the global market. Finally, in 2010 Apple launched the iPad, a tool used mainly by children for multiple functions, including reading.

Today we are witnessing a profound change in the debate that in the last twenty years has involved the publishing sector, contrasting the design and distribution context of the traditional paper book with the new digital publishing. The 20th century saw the overtaking of the typographical book, even if this does not guarantee its disappearance. The technological revolution now allows, thanks to electronics and telematics, to offer books no longer printed, but composed and stored in digital format made accessible to both offline and online audiences.

Today we are in full digital age, but this doesn't mean that the book on paper must be extinguished, indeed we are heading increasingly towards the creation of a hybrid library in the houses of each one of us, where books and eBooks can coexist.

The entrance of culture into everyone's home

As the bibliographer Alfredo Serrai teaches in "Library systems and catalographic mechanisms" (1980): "the library is created when are collected the objects that constitute the physical support of the recordings of symbols that are in place of oral communication, or

to evoke or to represent it. Such objects are documents: clay tablets, papyrus rolls, printed books, discs, photographic films, magnetic tapes. With libraries as deposit of symbols humanity has clearly and stably set the lines of its own development, and, becoming aware of it, has created the conditions for a story". With this explanation, Serrai not only outlines the role of the library, aimed at perpetuating the memories of humanity through the collection, organization and dissemination of the physical media of information, but shows that no historical dimension is possible without an adequate preservation of the collections and the documents that compose them. It is quite clear, in fact, that the impact of technology and the consequent change of media is transforming our approach to information and the criteria of its organization within libraries; and yet, of the wide discussion that in recent years has developed on the role of the library and the concepts of virtual or digital library.

Given these assumptions, it is interesting to discuss a particular notion, namely that of hybrid library. According to Chris Rusbridge, the author who first proposed this theme (1998), the hybrid library is a combination of a traditional library, containing only analog resources, and a virtual library, which uses only digital resources. A library, in short, that brings together a plurality of information sources, printed and electronic, local and remote, seamless. The aim of the hybrid library is to encourage consumers to use the best source of information available, regardless of its format. This discourse obviously, must also be applied to the domestic environment. The bookcase is nothing more than a transposition "in miniature" of the library, but in our home. The bookcase is a piece of furniture that is not missing in any home. In the bedroom, in the kitchen, in the living room, everywhere is an object that speaks a lot about us but at the same time is functional and decorative. It was born with the obvious purpose of containing books, therefore, its existence has its roots in ancient times. In the *tabernae librariae* of ancient Rome, places used for the sale of books, there were the first forms of libraries called "*loculamenta*, *foruli*, *nests*, *capsae*". An embryonic state of the library, as these cabinets of parallelepiped shape also contained other objects besides books. They were simple pieces of furniture, little decorated, where the volumes were placed one above the other, with the back facing inwards. As mentioned above, thanks to the invention of printing, books began to enter private homes. Initially, only the wealthiest families owned several volumes and felt the need for a real piece of furniture suitable to accommodate their collections. This is how the bookcase was born, which also had a status symbol function. From the nineteenth century onwards, bookcases finally found a large-scale distribution, thus entering the homes of all.

But in today's homes, are bookcases still considered a fundamental piece of furniture, or is technology undermining the usefulness of these supports?

Case studies

The design was preceded by an investigation of the national and international scenario through the collection and in-depth analysis of some case studies. The survey focused on products that used technology to help children, supporting and encouraging them to read

aloud. In the world of design to this day, there aren't many products whose main objective is to encourage children to read their books aloud, in order to stimulate, among many benefits, their language skills and interpersonal abilities.

It is certainly possible to rely on numerous assistive technologies (AT), especially thanks to the advent of AI (artificial intelligence), which helps children with reading difficulties, such as dyslexia. For assistive technologies, reference is made to all those technologies created to make IT products accessible and usable even to those who have disabilities: screen readers, Braille displays, mouse-alternative pointing devices, speech synthesis systems, etc. (Lee, 2018). In particular, speech synthesis, or text-to-speech (TTS), allows children to read the text and listen to it at the same time. To use this tool children, click or highlight words and these are read by a computer generated voice. This tool can be used with books, emails, web pages and any digital text. It can also be useful to convert text files into audio files. Also audiobooks allow children to listen to books read aloud. In this case the voices are human and the physical book is not available, stimulating in this way, only the hearing and leaving the sight aside. Optical character recognition (OCR) instead, reads aloud texts from images or documents.

Today, however, most AT tools for reading are only accessible via mobile device and require an internet connection.

Always with a view to accessibility, was born the concept of the device named Snail, by American designer Wonkook Lee *(See Figure 1)*. It is a small technological device, easy to carry, that helps the blind to read, recognizing the differences in height of the surface on which it flows and converting the pattern into words. Just by pressing the button and then scrolling the wheel on the page written in Braille, it can record the text to play in the future and can sync it with a Bluetooth headset so that the user can listen to the book without disturbing others. However, this idea has never been realized and, moreover, it is addressed to a very specific audience and not to the generality of children.

In order to design a product which connects new technologies and the usefulness of reading aloud for children, the project that has particularly captured the attention and stimulated interest has been Clova Lamp *(See Figure 2)*. The famous South Korean tech company Naver Corp, in 2020 developed a light for reading that helps children cultivate healthy reading habits by telling their books aloud. Using the technology of artificial vision and artificial intelligence, Clova Lamp is able to convert the text and images of a book into voice, while an integrated virtual assistant can explain the meaning of words and answer children's questions to help them learn. In this way, the product hopes to replace smartphones as an independent method of entertainment when parents cannot play with their children. The lamp was born with the intent of: "listening to books frequently to promote the thought skills, concentration, imagination and creativity, but also to help children develop an interest in reading" (Kim, 2020). The product takes the form of a classic desk lamp, made of matte white plastic, impact resistant, with an inclined hemispherical head containing a ring-shaped LED light with a small camera in the centre, which uses image recognition technology to decode illustrations and identify written words using optical character recognition (OCR). After being analysed by artificial intelligence, the input of the camera is converted. The lamp reads books that are positioned below it when the 'read' button is pressed or a voice command is given. It speaks with a human-like voice, in ko-

rean, developed using speech synthesis technology to create a more immersive experience for listeners. It can also read books in english and japanese, which can encourage children to study new languages. The device creates a list of books completely read, rewarding children with badge for different achievements and offering parents detailed informations about their reading scheme and helping them choose the right books to propose to their children. In its light function, the device is able to perceive environmental factors that can affect the reading experience and provide a reactive light that does not strain the eyes, basing on the type of environment. However, the project aims to help the parent, replacing it, in cases where the latter is too busy to read with his child, not focusing on the creation of links, especially in the domestic environment, essential for the socio-emotional development of the child.

Always based on the idea of creating toys that help children to promote a healthier relationship with technology, Yoto's educational device was born, in collaboration with Pentagram who took care of its visual identity (2015). Technology startup Yoto has developed an interactive audio toy that plays stories, music, radio and podcasts for children without the need for a screen *(See Figure 3)*. The Yoto Player has a simple design, with a slot where cards are inserted and two buttons that can be pressed and rotated for playback and audio control. Instead of a screen, the device is equipped, on the front surface, with a 16x16 pixel colour display, which projects feedback and interactive content without distracting from audio. Content tabs are available in many categories (stories, music, podcasts, activities, sound effects, radio) and divided by age. Users can also purchase a customizable card, which allows children to draw and upload their own homemade content. The device has the back angled, this allows it to be positioned vertically on a table or shelf or tilted upwards so that the display is facing the child when used on the floor. It also has a battery that allows to use it anywhere, and a magnetic dock, so that children can safely charge it themselves when needed.

Returning to the need of bringing new generations closer to reading and discovering the pleasures that derive from it, it is also good to emphasize the importance of aesthetics and functionality of places, such as libraries and bookshops, which host books and reading workshops.

The architecture studio GAISS has renovated a library located in Riga (2019), Latvia, with the intention of encouraging children to discover the joy of reading *(See Figure 4)*. Playful and engaging elements have been carefully placed within the space, so that design can generate several welcoming reading points for young visitors. The reading room is suitable for readers of all ages, everyone has the opportunity to find the perfect place to read: at the desk, on a sofa, in an alcove, in a hammock, in the theatre or on top of a hill. Platforms of various heights and other furniture elements that can be moved, such as poufs, have been scattered so that children have the opportunity to find spaces and accommodations that best suit their needs. The space is also accessible to children who cannot read yet, inviting them to enter the tiny house or to find one of the many illustrated books hidden in secret compartments. Today, the library is constantly hosting numerous events and is able to actively involve an audience of all ages thanks to its innovative layout, far from traditional libraries, which generates a lot of attraction.

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Figure 1. Snail: the Braille converter (Note. From Wonkook, L. (2009). SNAIL [Rendering]. https://www.behance.net/gallery/111092123/SNAIL-Braille-Coverter). **Figure 2.** Clova Lamp (Note. Naver Corp. (2020). Clova Lamp [photography]. https://kkjp.kr/clova-lamp). **Figure 3.** Yoto Player (Note. Yoto. (2015). Yoto Player [photography]. https://eu.yotoplay.com/yoto-player). **Figure 4.** Children's Library (Note. Gaiss. (2019). National Library of Latvia [photography]. https://gaissarhitekti.lv/project/childrens-library).

eBookshelf: meeting between digital and analog

From these conditions, is born a reflection on how it is possible to redeem and give concreteness to the theme of the hybrid library. The answer comes with a project that combines analog and digital, with a bioinspired design, created to bring and support children in reading. The bookcase has a particular cylindrical shape, which allows to interact with it from every side and angle and can be placed anywhere in the house becoming a piece of furniture and design *(See Figures 5 and 6)*. On the inside, it features LED lights that will facilitate the research of the book or object to take, at any time of the day or night *(See Figure*

7). In addition, the central perforated sheet, will create a game of light and shadows that will be projected throughout the room. The unusual bioinspired shape can accommodate many books without a large footprint. This advantage turns out to be practical for those who live in a house with small dimensions and for those who don't want to give up the pleasure of reading but at the same time need the useful space for furniture. Another option would be to place two or more of them, if necessary, at the ends of a room and connect them with the removable projection cloth. The user can take advantage of the traditional paper book by drawing on their library, but at the same way doesn't give up innovation, with the use of a simple projector connected via Bluetooth. The white screen is hidden inside the structure, rolled up on itself, and was designed to project onto it books in digital format to be read with the whole family *(See Figure 8)*. In addition to the usual function of book storage and support, there is also the innovative multimedia transmitter. In this way reading also becomes a moment of sharing or learning, being able to follow children in reading more easily and making the moment of study lighter and easier. With a simple gesture it is also possible to show someone a passage from a book we are reading, or a quote that struck us particularly. In this way, reading can become a pleasant pastime and a moment of leisure for children, subjected to a continuous technological hyperstimulation. This is fundamental in the domestic environment, where the digital approach of children frequently begins and often without special parental controls and attention (OECD, 2023). In addition, according to a study by New York University, reading aloud with their children (0-5 years) helps the social and emotional development of them, as well as strengthening the parent-child bond. Pedagogists have established that a child who receives daily readings will acquire a richer vocabulary, will have more imagination, will express themselves better and will be more curious to discover the world (Mendelsohn *et al.*, 2018). Listening to a story, or even an entire novel, means exercising working memory and attention, stimulated by the interest in storytelling and the creation of a relationship with the reader. Children will also be less hyperactive and more patient, developing a healthy lifestyle. These countless benefits would counteract the typical symptoms of children with ADHD. This would provide their parents, or caregivers, with an additional therapeutic tool, in this case not tied to technology as usually are the tools recommended by therapists to reduce emotional dysregulation and lack of attention.

In Italy, the association "Nati per Leggere" (Born for Reading), founded in 1999, offers families with children up to 6 years of age, reading activities that are an important experience for the cognitive development of children and for the development of parents' abilities to grow up with their children. On the official website of the association are indicated the ten good reasons why this activity is so important: it pleases to children, creates bonds, creates memories, is good for the mind, promotes sleep, allows to discover always new things, likes listening to the voices, discovery of new worlds, attraction to figures, curiosity stimulation. The project combines and connects two generations in comparison, that of analog and that of digital, allowing each one to get in touch with other lifestyles, using different means and breaking down any kind of barrier or preconception. It is essential to eliminate any kind of partition, physical or intangible, that can exist within a domestic environment, bringing together all members of a family, and not only, of different generations and with different habits, around what should be the central focus of every society, the culture.

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Figure 5. Bioinspired hybrid bookcase (Note. eBookshelf is a circular bookcase inspired by the structure of the sea urchins' spines. It has a height of 270 cm and a diameter of about 100 cm. Its large size allows to accommodate, at 360°, numerous books and not only. The shelves have an adjustable distance between them and can be removed easily with the help of a star-shaped screwdriver). **Figure 6.** A library designed for all (Note. The project was born with the aim of bringing the young closer to reading and diverting their attention for a while from their technological devices; but also to follow them step by step in learning, transforming the hours of study into a pleasant moment of dialogue and sharing). **Figure 7.** Design and functionality (Note. The central body of the bookcase is formed by a micro-perforated aluminium sheet, painted in white. Inside was placed a strip of adhesive LED lights with a cool coloring. The light projected from the inside creates on the walls and on the floor some suggestive shadows. In addition, the environment is fully illuminated without having to turn on additional lights to look for the right book). **Figure 8.** Technology at the service of knowledge (Note. Inside its structure, the bookcase houses a white removable sheet on which you can project the pages of a book. Thus, children can be followed more easily by their parents as they learn or practice reading. This innovative approach helps children maintain a high level of attention and creates deep emotional bonds in the home environment).

Natural intelligences answer the emerging needs of contemporary living

Nature has always offered solutions to mankind problems and needs, becoming an inexhaustible source of inspiration and a fundamental resource for survival. In the design and architectural field, it is enough to think about Zaha Hadid's organically shaped structures or organic fabrics made by Neri Oxman, just to name a few. Moreover, the natural world is characterized by a great ability to evolve and adapt to the development and changes of contemporary life (Langella, 2019).

With eBookshelf, inspiration comes from the marine world, particularly from the composition of the sea urchins and the movement of the spirograph.

Echinoids, or more commonly known as sea urchins, are a group of invertebrates that can be found in most marine habitats today. They have a skeleton composed of calcific plaques embedded in their skin, which forms a spherical case. Outside they have long and numerous spines whose multiple functions include: locomotion, detection and protection from physical trauma and predators. The spines protect the spherical part in case of attack by a predator or impact with an object. They consist of a single crystal of calcite which would usually be very fragile, however, they turn out to be relatively flexible and this has been attributed to a small amount of glycoprotein rooted in the mineral phase that improves their fracture resistance and increases their elastic limit. The spines, generally purple colored, can reach up to 10 cm in length, with a diameter varying from about 4 mm at the base up to 1 mm at the tip and are divided into three parts: a long rod, a short neck and a base. The characteristic microstructure of all the spines is composed by: a wide and hollow core surrounded by a porous zone that extends up to a set of radial wedges that form most of the solid cross section; the bridges that connect the adjacent wedges (these bridges follow an irregular helical pattern around the longitudinal axis of the column), and the central core consists of a thin calcite wall incorporating a regular series of holes. Overall, the spine is highly porous with an intricate structural hierarchy (Tsafnat. 2012). In the eBookshelf library, such wedges and bridges correspond respectively to the septa and shelves. The porous inner wall is also taken from the perforated sheet of the library.

Instead, the spirograph, or *Sabella spallanzanii*, is a worm that belongs to the marine annelids of the family *sabellidae* and lives on the soft, muddy or sandy bottoms of various parts of the world. The animal, with a vermiform body, lives inserted inside a soft and flexible tube that is fixed to the substratum. The species is included in the Invasive Species Global Database (GISD). It is made with sand and shells that are cemented together by a mucous secretion produced by the worm itself. The spirograph has the tube about 30 cm long, the diameter of which is between 1 and 2 cm. In the cephalic end it has very showy filiform gills covered with cilia and mucous glands, variously colored similar to feathers that are normally left swaying in the current in order to catch food. The analogy between the spirograph and the project is found in the mechanism that uses this organism: just as it closes by withdrawing into its tube and opens extroflecting the filiform gills, similarly the projection cloth is extracted from the library, or is rolled up and hidden inside.

The project realized with the support of prof. arch. Carla Langella and the biologist Valentina Perricone, was exhibited in February 2022 at the international exhibition EchinoDe-

sign, hosted by Città della Scienza in Naples, which investigated the relationship between design, art and science.

Conclusions

Technology has a great impact on children's lives. On the one hand, it offers unprecedented educational opportunities, allowing them to access educational learning resources, active training equipment and even online classes. On the other hand, there are numerous well-founded concerns about the excessive or improper use of technology that threatens children's mental health, sleep and well-being. In general, parents and teachers should regulate the online activities of their children and/or students, imposing certain restrictions and encouraging the right balance between offline and online activities, between playing outdoors, reading and communication face to face.

Reading regularly to children from birth is very useful to stimulate their growth and passion for reading, because they associate this activity with fun, adventure and do not see it exclusively as a school task. Reading aloud can also improve communication abilities and facilitate the learning of many fundamental skills, such as reading and elaborating complex concepts. It is not necessary to have a lot of time to read together, it takes just five minutes a day to dedicate to this activity. It is thus important to find time to integrate shared reading into the daily routine to form bonds in the family environment and help children with more difficulties. Design and nature offer a useful tool for the dialogue of new technologies and new generations with the traditional media used by past generations, combining past, present and future around reading, and consequently culture. The project of the hybrid library represents the answer to the need of approaching the young to reading, diverting for a while the attention from individual technological devices, but using new technologies to create healthy and constructive relationships. As well as offer a way for all those who experience difficulties in learning and maintaining attention, transforming reading time, an activity that would usually generate anxiety and stress, in a moment of joy and sharing.

References

Amy Graham, A. & Sahlberg, P. (2020). *Growing Up Digital Australia: Phase 1 technical report*. Gonski Institute for Education.

Balsamo, L. (2017). *La bibliografia. Storia di una tradizione* [Bibliography. History of a tradition]. Edizione Unicopli.

Frolli, A., Cerciello, F., Esposito, C., Ricci, M. C., Laccone, R. P., & Bisogni, F. (2023). *Universal Design for Learning for Childern with ADHD*. Children10, no. 8: 1350. https://doi.org/10.3390/children10081350

Langella, C. (2019). *Design e scienza* [Design and science]. Listlab.

Lee., A. M. I. (2018). *Assistive technology for reading*. https://www.understood.org/en/articles/assistive-technology-for-reading

Mendelsohn, A. L., Brockmeyer Cates, C., Weisleder, A., Berkule Johnson, S., Seery, A. M., Canfield, C. F., Huberman, H. S. & Dreyer, B. P. (2018). *Reading Aloud, Play, and Social-Emotional Development*. Pediatrics May 2018; 141 (5). https://doi.org/10.1542/peds.2017-3393

OECD. (2023). *Empowering Young Children in the Digital Age*. Starting Strong. https://doi.org/10.1787/50967622-en

Ra, C. K., Cho, J., Stone, M. D., De La Cerda, J., Goldenson, N. I., Moroney, E., Tung, I., Lee, S. S., & Leventhal, A. M. (2018). *Association of Digital Media Use with Subsequent Symptoms of Attention-Deficit/Hyperactivity Disorder Among Adolescents*. JAMA, 320(3), 255–263. https://doi.org/10.1001/jama.2018.8931

Rusbridge, C., (1998). *Towards the Hybrid Library*. University of Warwick.

Serrai, A. (1980). *Sistemi bibliotecari e meccanismi catalografici* [Library systems and catalographic mechanisms]. Bulzoni.

Tamana, S. K., Ezeugwu, V., Chikuma, J., Lefebvre, D. L., Azad, M. B., Moraes, T. J., Subbarao, P., Becker, A. B., Turvey, S. E., Sears, M. R., Dick, B. D., Carson, V., Rasmussen, C., CHILD study Investigators, Pei, J., & Mandhane, P. J. (2019). *Screen-time is associated with inattention problems in preschoolers: Results from the CHILD birth cohort study*. PloS one, 14(4), e0213995. https://doi.org/10.1371/journal.pone.0213995

Tsafnat N, Fitz Gerald JD, Le HN, Stachurski ZH (2012) Micromechanics of Sea Urchin Spines. PLoS ONE 7(9): e44140. https://doi.org/10.1371/journal.pone.0044140

Weiss, M.D., Baer, S., Allan, B.A. *et al*. The screens culture: impact on ADHD. ADHD Atten Def Hyp Disord 3, 327–334 (2011). https://doi.org/10.1007/s12402-011-0065-z

Resumen: La naturaleza siempre ha sido una fuente inagotable de inspiración y reflexión. Cada día estamos rodeados, inconscientemente, de soluciones bioinspiradas, especialmente en el campo de la arquitectura y el diseño. En contraposición, las tecnologías digitales actuales tienden a "desviar" al hombre, creando problemas de atención, especialmente entre las nuevas generaciones, que ya no se interesan por la lectura. Sin embargo, ¿es posible pensar en un futuro sin libros? ¿Un entorno doméstico sin bibliotecas, símbolo de conocimiento y riqueza personal? Además, un estudio realizado por la Universidad de Nueva York, publicado en la revista Pediatrics, muestra cómo leer en voz alta a los niños puede prevenir trastornos de conducta como la hiperactividad y el déficit de atención. De estas reflexiones surge el proyecto presentado, diseñado para estimular, con un objeto híbrido, a las jóvenes generaciones con dificultades de atención.

La configuración interna de las espinas de los equinoideos ha sido fuente de inspiración para la creación de la estructura de una biblioteca, de planta circular, multifuncional e intergeneracional. La forma cilíndrica alberga un lienzo para proyectar libros y otras cosas. De este modo, añade a la función habitual de la biblioteca, almacenamiento y soporte de libros, incluso la función innovadora de transmisor multimedia. De este modo, la lectura

puede convertirse en un momento de compartir, de reflexión, pero también de apoyo a quienes necesitan ser seguidos en la lectura y el aprendizaje. Este proyecto encarna el concepto de biblioteca híbrida que combina y conecta dos generaciones en comparación, la analógica y la digital, permitiendo a cada una entrar en contacto con otros estilos de vida, utilizando diferentes medios y rompiendo cualquier tipo de barrera y prejuicio dentro del entorno doméstico, vinculando diferentes generaciones con diferentes hábitos, en torno a lo que debería ser el eje central de toda sociedad, la cultura. Este proyecto muestra cómo el diseño biomimético puede ayudar a la capacidad de lectura de los niños y a contrastar los déficits de atención.

Palabras clave: Diseño centrado en el ser humano - Erizo de mar - Equinoide - Multifuncionalidad - Cultura - Estantería - Multiedad - Reunión - Solución bioinspirada - Diseño para todos

Resumo: A natureza sempre foi uma fonte inesgotável de inspiração e reflexão. Estamos cercados todos os dias, inconscientemente, por soluções de inspiração biológica, especialmente no campo da arquitetura e do design. Em contrapartida, as tecnologias digitais atuais tendem a "desviar" o homem, criando problemas de atenção, especialmente entre as novas gerações que não se interessam mais pela leitura. Entretanto, é possível pensar em um futuro sem livros? Um ambiente doméstico sem bibliotecas, um símbolo de conhecimento e riqueza pessoal? Além disso, um estudo realizado pela Universidade de Nova York, publicado na revista Pediatrics, mostra como a leitura em voz alta para crianças pode prevenir distúrbios comportamentais como hiperatividade e déficit de atenção. A partir dessas reflexões, surge o projeto apresentado, concebido para estimular, com um objeto híbrido, gerações jovens com dificuldades de atenção.
A configuração interna dos espinhos dos equinóides foi fonte de inspiração para a criação da estrutura de uma biblioteca, com planta circular, multifuncional e intergeracional. A forma cilíndrica abriga uma tela para a projeção de livros e muito mais. Dessa forma, acrescenta-se à função usual da biblioteca, de armazenamento e suporte para livros, até a função inovadora de transmissor multimídia. Assim, a leitura pode se tornar um momento de compartilhamento, reflexão, mas também de apoio àqueles que precisam ser acompanhados na leitura e no aprendizado. Esse projeto incorpora o conceito de biblioteca híbrida, que combina e conecta duas gerações em comparação, a analógica e a digital, permitindo que cada uma entre em contato com outros estilos de vida, usando meios diferentes e quebrando qualquer tipo de barreira e preconceito dentro do ambiente doméstico, ligando diferentes gerações com hábitos diferentes, em torno do que deveria ser o foco central de toda sociedade, a cultura. Esse projeto mostra como o design biomimético pode ajudar na capacidade de leitura das crianças e contrastar os déficits de atenção.

Palavras-chave: Design centrado no ser humano - Ouriço-do-mar - Equinoides - Multifuncionalidade - Cultura - Estante de livros - Multi-idade - Reunião - Solução bioinspirada - Design para todos