Social Medicine
Health For All
ISSN: 1557-7112

ORIGINAL RESEARCH

The Typhlosphere: Intersensoriality in the Use of Video Games by Visually Impaired Youth

La tiflosfera: Intersensorialidad en el uso de videojuegos por jóvenes invidentes

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Received: September 10, 2025.
Accepted: January 26, 2026.
Conflicts of interest: None.
DOI: https://doi.org/10.71164/socialmedicine.v19i3.2026.2349

Abstract

We analyze the recreational video game experience of visually impaired youth as a bridge to understanding the role of sound and touch in their experience. The methodology consists of classical ethnography based on interviews and participant observation, combined with embodied digital ethnography utilizing interaction, conversation, and participation across social networks and websites. The results are interpreted through the lens of enactivism, which posits that cognition is mediated by the body. We find that youth learn to play through interaction with other young people, utilizing sound and tactile sensations. We conclude that the digital-recreational world of blind youth is the result of the linking of the body, technology, and social interactions.

Key Words: cognition, technology, accessibility, serious games, visual disability

Resumen

Analizamos la experiencia lúdica del videojuego en jóvenes invidentes cómo un puente para comprender el rol del sonido y el tacto en su experiencia. La metodología consiste en etnografía clásica, basada en entrevistas y observación participante; combinada con etnografía digital de carácter encarnado, a partir de la interacción, conversación y participación a través de redes sociales y sitios web. Los resultados son leídos a la luz del enactivismo, que propone que la cognición está mediada por el cuerpo. Encontramos que los jóvenes aprenden a jugar a través de la interacción con otros jóvenes, utilizando el sonido y las sensaciones táctiles. Concluimos que el mundo lúdico-digital de los jóvenes con ceguera, es el resultado del acoplamiento entre el cuerpo, la tecnología y sus interacciones sociales.

Palabras clave: cognición, tecnología, accesibilidad, juegos serios, discapacidad visual.
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Introduction

This article analyzes the recreational experience of blind youth within the digital context. To understand how young people utilize technology in order to participate in the world of adapted video games and audio games, the study aims to elucidate their gaming experience as mediated by software and electronic devices. We understand the digital-recreational experience as a dynamic system shaped by correlations among the sensory, the cognitive, and the social, wherein the subjectivization of the world depends on the receptive and active capacity of the body. Within this framework, accessible gaming must not be explained solely in utilitarian terms—as is often the case with serious games[1], which are tied to a welfare-oriented vision of play that assumes the users' relationship with the game should center exclusively on learning, integration, and rehabilitation. In this sense, this research takes the social model of disability as its cornerstone, aligning with a critical stance against ableism[2] and understanding that disability has been historically constructed under asymmetrical power relations that perpetuate the ideology of normality. Ultimately, as has been demonstrated, audio games shatter these welfare-oriented boundaries: these youth are creators, designers, and editors of code.

A first-person narrative is used, as is characteristic of ethnography, where the ethnographer acts as author and interpreter of culture[3] and drawing from sensory ethnography[4], which transforms observing into feeling, reminding us that anthropology is a descriptive and interpretative discipline that does not deny the subjectivity of researchers. The objective is not to deny the body or the researcher's experience, but rather to use "one's own sensoriality" to construct knowledge. Here, the validity of the work lies in the researcher, through the first person, demonstrating their sensing participation and their direct bodily immersion in the studied phenomenon.

We proceed from the assumption that sound in the recreational experience of blind youth is not merely the result of abstract processes occurring in the mind-brain. On the contrary, it forms part of a socially learned, embodied experience. Therefore, auditory and tactile perception is understood through the integration of embodied, cognitive, and cultural phenomena.

We base our work on some of the ideas put forward by Gibson, Howes, Lux, Merleau-Ponty, Noë, Stoller, Tobón and León, and Varela, who,[5-14] who understand embodied cognition as an active and situated process in which the subject constructs their own perceptual experience. It is not a matter of a passive capturing of sensory data, but rather a dynamic integration among the body, the mind, and the world.

The protagonists of the research are the self-named “Tiflojugadores” (audio gamers). They are expert players of digital games who bypass any type of graphics. There are various interaction configurations with digital games on the part of the tiflojugadores; sometimes they use video games, other times audio games, and other times video game adaptations. In order to avoid a breakdown of concepts, which is not the objective of this research, the term “tiflojuegos” (audio games) is used in a broad sense.

The tiflojugadores—a term of self-ascription whose name derives from the Greek typhlos (blind)—are individuals with visual impairments who have found in video games a way to have fun and connect socially. By using devices such as cell phones, computers, and video game consoles, these individuals have demonstrated a great capacity to adapt technology to their needs. Through the creation of personalized tools and adjustments, the tiflojugadores have built an online community, which we call "the typhlosphere," a symbolic but also physical and sensory space where tiflojugadores share experiences and knowledge, demonstrating their autonomy and creativity to co-create the world.

In the case of people with visual impairments, sound and the haptic experience play a primordial role in the construction of the recreational experience. The capacity of digital devices to emit physical sensory information opens up a world of possibilities for blind individuals. By translating information into auditory and haptic stimuli, the subjective world of the blind person expands, allowing them to experience virtual realities that were previously considered inaccessible. In this

way, the interaction between the blind subject and the digital device creates a complex ecosystem where the borders between the physical and the virtual blur, giving rise to new ways of playing and relating.

We have mapped out the structure of this document into distinct sections. First, we present the theoretical framework, followed by the methodology; within that same section, we explore the relevance of accessibility in digital technology. Next, we address the influence of sound and haptics on digital recreational experiences. We then describe our findings and their analysis. In the final section of the text, we offer tentative conclusions accompanied by recommendations for future research.

It is important to clarify why we use the term disability. There is a broad debate surrounding the use of this term, as "disability" can imply that someone is incapable. Nevertheless, according to Pacheco and Leones, although the concept of "functional diversity"[15] may seem more appropriate, it appeals to the premise of a functional individual who is only fit within a system of production and consumption. For this reason, we prefer to employ the terms "people with visual impairments" or "blind people," which are the terms by which the participants in the study refer to themselves. Independent of the social model of disability, which critiques the biomedical model, this work does not understand play within the health/illness dichotomy—that is, play as a tool to remedy some "dysfunction." On the contrary, the premise of this research is that there are other modalities of sensory interaction that go beyond sight.

Sound and Haptics in Audio Games

To explain how the interaction between audio gamers and digital devices is constituted within the framework of audio games, we return to Scolari's[16] notion of interface, which proposes that the interface is the site of interaction. In the absence of vision, listening and touch take the place of interaction, integrating the biological component with the social and the technological. Thus, human-computer interaction occurs within an assembled sensory ecosystem based on listening and haptics.

To understand how this alternative sensory ecosystem functions, it is necessary to first understand its biological foundation. From a neurological approach[17], the senses are explained the senses as a subjective process of a neuronal and multimodal nature, resulting from the assembly of different brain regions responsible for generating multisensory integration. The somatosensory neurons responsible for touch activate in parallel with those of the auditory cortex, enhancing the perception of both senses. It is this capacity for multisensory integration that allows touch and hearing to functionally compensate for the absence of vision.

Within this integrated system, haptics emerges as the primary organizing axis for evolutionary and cognitive reasons. Haptics is the ability to tactually perceive surfaces (heat, texture, movement, vibration). It is a shared trait between humans and primates, resulting from the specialization of the hands to manipulate objects and perceive their characteristics. However, haptics is not merely a passive sensory mechanism; it is fundamental to the construction of knowledge. It is asserted that when seeing an object for the first time[18,19], we do not fully come to know it until we have held or manipulated it. This cognitive dimension of haptics becomes central when vision is absent.

González-Grandon[20] defines the haptic experience as the ability to become conscious of sensations, which implies active engagement and the generation of knowledge. For the author, within the auditory-haptic experience, there are two dimensions: a pre-reflective auditory-haptic sensitivity, where a coupling exists between the agent's habitual world and the history of prior interactions; and a reflective auditory-haptic consciousness, focused on noticing every detail within the lived experience. This haptic consciousness is precisely what allows audio gamers to navigate and interact with digital interfaces.

Current technological applications take advantage of these haptic capabilities. The ridges on specific keys (such as "f" and "j" on keyboards) help locate

hand positioning for writing without the need for sight. Devices with accessibility configurations facilitate use for blind people through haptic feedback.

In video games, this auditory-haptic integration reaches its highest expression. Sekhavat[21] notes that by manipulating controllers, feeling the vibration of devices, and listening to the sound environment of the video game, the user achieves an integrated sensory experience. For audio gamers, this integration is not an added bonus but the very condition of possibility for playing. An example of the accessibility tools mentioned by Ibáñez[22] —which we discovered to be fundamental for audio gamers—was NVDA (NonVisual Desktop Access), which describes screen images and texts at high speed through text-to-speech.

If haptics is the mechanism of interaction, sound is the vehicle of information and meaning. Sound represents not only external stimuli, but an intimate and subjective experience that carries symbolic content interpreted within a particular social context. Sound represents not only external stimuli, but an intimate and subjective experience that carries symbolic content interpreted within a particular social context. When we listen, a network of interrelations is activated within our body-brain: memory is activated, recollections are triggered, decisions are made, and sources are localized in space[24].

This subjective and cultural dimension of sound is crucial for understanding that the experience of audio games is not purely technical or biological, but also sociocultural. Sound and hearing are cultural products: we can only interpret a sound if it takes on meaning within our universe of cultural performance. The importance of sound production lies in the totality of the web woven between the biological and social behavior[12],[26]. Through the anthropology of sound, the concept of 'acoustemology' is proposed—a crossroads between acoustics and epistemology—granting sound a central role in the sensory construction of knowledge[26],[27].

All of the above is coherently articulated under the theoretical framework of embodied cognition[9]. This reframes perception as a creative action: the subject does not represent the world from the outside, but rather reactualizes and co-creates it. The perceptual experience is determined by our sensorium; the body is fundamental in cognitive structuring, making cognition an embodied process[28–30]. Likewise, the mind is an emergent property of the body: it emerges from the interaction between the organism and both the physical and social environment[7].

Thus, digital play for audio gamers emerges as the result of a phenomenology constituted by biological variables (multisensory integration), symbolic variables (the cultural meaning of sound), and sociocultural variables (shared play practices), all assembled through a body that not only feels, but thinks, knows, and creates a world.

Methodology: Information Construction and Procedure

The methodological tools supporting our research are based on sensory, multi-sited, and online embodied ethnography[32–38]. The choice of this perspective is not arbitrary; it responds to the need to investigate a gaming experience that goes beyond the visual. The reformulation of the ethnographic method transforms observing into feeling[4]. Qualitative research acquires a sensing nature[38–40], where knowledge is constructed from the researcher's own sensoriality.

For this reason, we use the term sensing participation instead of participant observation to refer to fieldwork conducted with full awareness of bodily sensations and by utilizing all the senses, without prioritizing vision. García[41] inspired us to establish this distinction based on the concept of "participant perception" as a tool for social research and a methodological proposal aimed at overcoming the bias produced by participant observation, which is conceptualized principally as a visual practice. This methodological need to recognize sensory particularities finds a parallel within the educational field. Peralta[42] establishes a "special didactics" for higher education based on "intersensorial educational practice," recognizing that intersensoriality is a crucial alternative for overcoming traditional practices that distance themselves from the recognition of student diversity. If audio gamers experience play through

hearing and touch, research must replicate that sensory experience in order to comprehend it.

Added to this sensory dimension is the need for a multi-sited approach, given that the community of audio gamers does not concentrate within a single physical space. Multi-sited ethnography focuses on the processes and the articulation of the practices of a group of social actors located in different sites[12],[43]. Digital ethnography[33],[44] understands the internet as a place where social interaction occurs, not a separate world distinct from reality or where true social interactions do not occur[45]

This theoretical understanding of the internet as a real social space guided the design of the fieldwork. Face-to-face fieldwork was conducted between 2019 and 2020 at CEIAC (Centro de Estudios para Invidentes A.C.) in the city of Chihuahua, where the initial data regarding the use of digital games by people with visual impairments was obtained. However, the majority of the work was carried out in the digital environment through groups on WhatsApp, Telegram, and Discord, allowing us to connect with blind and visually impaired individuals whose ages ranged between 14 and 35 years old.

The digital platforms where the fieldwork took place are Tiflojuegos.com and a WhatsApp group linked to the same site. At the time of the research, the group was comprised of a close-knit community of approximately 80 permanent users, with fluctuations that occasionally reached 95 users, consisting primarily of individuals from Mexico, Argentina, Chile, Brazil, and, to a lesser extent, other Latin American countries.

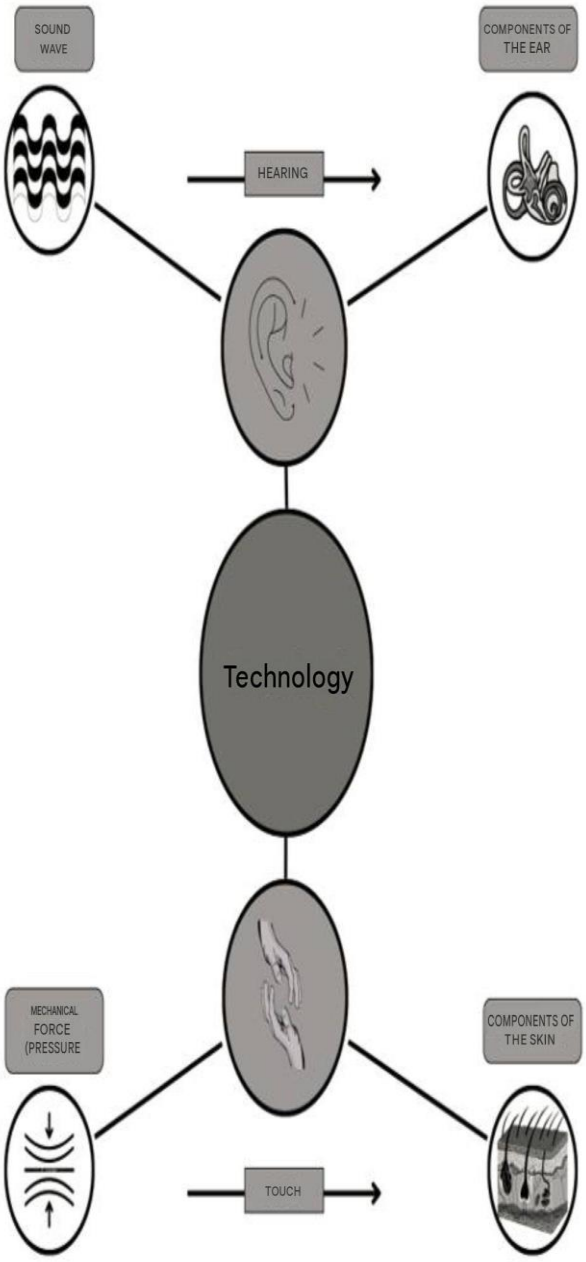
Given the ethnographic nature of the research, there was no sampling in orthodox terms, as is typically specified for more quantitative and experimental studies; our objective was not to evaluate, but to describe lived experiences. For this reason, the criteria employed for selecting interview participants relied on purposive, non-random, snowball sampling, inviting interested individuals from within the WhatsApp group to participate, who were then provided with an informed consent form. A semi-structured interview format was utilized, consisting of: 1) Demographic data; 2) Questions regarding the lived experience of their disability (duration, congenital, or acquired); 3) Initial experiences and learning processes related to digital games. These interviews were computer-mediated and conducted with 9 users, 3 of whom fall into the classification of digital content creators.

Due to the open-ended nature of the interviews, they lasted between 30 and 60 minutes. The participants' ages ranged from 16 to 35 years old: Jesús from Monterrey; Eduardo from Sinaloa (R.I.P.); Ernesto from Argentina; Juan from Spain; Daniel from Hidalgo, Mexico; Roberto from Oaxaca, Mexico; Manuel from Durango, Mexico; Rogelio from Ecuador; and Miguel and Mariana from Chihuahua. The latter, Mariana, does not have a visual impairment but is an avid video game player who assisted us by explaining certain aspects of the gamer environment. Only one female audio gamer was interviewed: Fernanda, who is originally from Argentina.

The organization of the gathered data was based on grounded theory[46], which suggests a specific methodological process for data classification. In this sense, the data gathered from interviews, field diaries, notes, and digital information were organized in Excel spreadsheets, identifying each data point by category, subcategory, code, and content. Concurrently, the data were linked with theoretical and analytical memos. Following the ethical precepts of social research, pseudonyms are used to protect the identities of the individuals.

Sensing participation was not limited to interviews or the observation of practices; it involved direct bodily immersion into the sensory ecosystem of the audio gamers. Principally, the first author undertook two activities: playing without opening their eyes, guided solely by sound. To achieve this, they previously listened to YouTube video tutorials used by blind youths to learn how to play. These videos are created by and for blind individuals; therefore, they progress at an accelerated speed, which also implies sharpening one's hearing and attention to understand the descriptions and instructions. The researcher's first-person sensing experience was recorded in the field diary through introspective narratives that

organized the embodied experience through the sensory integration of listening and haptics.



This immersion revealed aspects of the gaming experience that would not have been accessible through traditional visual observation. In the initial ethnographic exercises, we noticed the importance of listening for blind users of digital games. Understanding that the recreational experience is not limited to sight, it also requires the use of listening and haptic sensations. Immersed in the new perceptual horizon of audio games, the streets, the corridors, and the grass are not seen—they are heard. The gaming experience abandons the screen, transforming into a true ecosystem of 3D stimuli. There, perception does not essentially stem from the eyes; it integrates at the side of the face through the ears and through the skin of the entire body, because sound is not only heard, it is also felt[20]..

The researcher replicated the learning process of the audio gamers themselves, which consisted of 5 exercises lasting 40 minutes each. This involved listening carefully to tutorials from the YouTube channel "El punto ciego" (The Blind Spot), an initiative by Francisco to facilitate audio gamers' access to digital play. The learning process consisted of interpreting sounds and moving within the game using the keyboard with eyes closed. The basic lessons focused on listening and feeling how the avatar moved to the right or left when pressing the corresponding key.

For example, if during a game the avatar arrived at a site such as a shop, a click would be heard as if entering through a door. Miguel explained in detail: "you hear the shop, you know you are there, so then you press the down arrow to listen to the entire tool menu offered by the shop" (Miguel, online interview via Google Meet, January 16, 2022). Several of the young players served as guides, teaching how to pay attention to the audios to become immersed in the game environment. Immersion in a game consists of living it as a total experience—feeling that one is there, that one is part of it[47]. Using first-person discourse is not merely a stylistic choice, but a methodological one: it reflects that knowledge was constructed from the researcher's own sensoriality.

Results: Listening, Touching, Being There

Below, we present the most significant findings discovered within the narratives and dialogues maintained with the individuals who participated in the study, as well as the information resulting from our sensing participations. We offer an interpretative analysis, drawing upon the frameworks of the aforementioned authors. We will first present the evidence related to the acoustic dimension, followed subsequently by our findings regarding the role of haptics.

Sound: Spatial Guide and Perceptual Substitution

In the first place, we observe that sound acquires multiple meanings when utilizing accessible games. On one hand, it makes enjoying the game possible; on the other, it functions as a guide for generating spatial notions while playing. Furthermore, it allows players to identify the characteristics of locations, objects, animals, environments, and the trajectory of objects, among other qualitative elements of the act of playing. We found that visual perception is substituted by auditory perception through voice assistants and the game's native audio. Similarly, the software tools aim to teach users how to play and guide them through the environment; for example, when starting certain games, a menu would typically appear explaining the sounds that the user would hear.

One of the most salient aspects found relates to spatiality and the recognition of the characteristics of game design. Notions of spatiality within the typhlosphere acquire meaning not only in relation to the trajectory of objects and the movement of characters, but also through the spatial composition of the game's various elements. Each "location" or environment features a distinct design composition, and with it, the traits of the sensory ecosystem—which is different within each of those spaces. Through practice, players learn to perceive, principally via sound, the different locations, settings, objects, and characters. This learning occurs directly through constant gameplay, but it is also learned by interacting and conversing with other players and by listening to tutorials.

In digital games, when simulating the spatiality of the organic world, players perceive the acoustic characteristics of that environment. In this regard, Miguel noted: "There, when you enter, it says, rural city of Santa Bertalina, and you hear footsteps that sound like dirt" (Miguel, online interview via Google Meet, January 16, 2022).

According to Miguel's explanation, the notion of a rural city is not derived solely from the in-game voice; the information is enriched by an auditory hyper-history of the physical traits of the setting. Miguel builds the notion of rurality from an experience that is not merely abstract; it is not a metaphor occurring only on a mental plane, but is also a bodily experience. That is to say, Miguel brings his own lived experiences into the present by recognizing how footsteps sound when walking on dirt. When hearing "Welcome to the rural city of Santa Bertalina," the narrating voice triggers the player's sensory library, reviving memories, sensations, and previous notions about the category of a city. Not only that, but the user classifies environments based on the specific sounds chosen for the game by the programmer.

Audio gamers rely on these elements to develop an understanding of the game. For example, in the video game Smash, there is generally a platform located in the central zone, while at the edges, there is a void or a cliff; if the character falls off the platform, they lose a life. Learning allows audio gamers to identify their position in space, leading to a mapping of the environment, making it easier to determine their location, and enabling them to infer the distance to the cliff; this skill prevents them from falling when executing precise jumps.

When learning to play Smash through direct experience and via conversations on the Discord platform, it became possible to understand the capacity to construct a map of the game's stages using sounds. On one occasion, Arturo pointed out to me the following: "well, you can hear when you fall, so you start counting your falls" (Arturo, online conversation via Discord, December 15, 2020). Thus, little by little, we began feeling and understanding that playing implies immersing oneself in paying attention to sounds in a highly precise manner.

Furthermore, according to what the audio gamers expressed, each character is identified by a specific sound, which allows them to locate their avatar on the selection screen. Even though they could not see them, they somehow knew what they were like and what their abilities were. Once again, information was not created from visual characteristics, but rather through sound. However, the gaming experience was not always generated simply by recognizing the sounds produced by objects, living beings, or characters. For example,

Miguel explained to us that in "Batalla Constante" (Constant Battle), he did not even recognize or connect a sound to an object; although that sound did not exist in "real life," according to him, a voice-over would tell him which in-game element was associated with the unrecognized sound.

> "Because rabbits don't make noise in real life, basically when you enter the forest there is a very characteristic noise [mimics a sound] I don't know how to describe it, and right there you know there's a rabbit; plus, if you press 'e' to see what's there, it tells you—you see a rabbit, 2,000 health—and right then you grab a weapon to be able to kill it."
> (Miguel, online interview via Google Meet, January 16, 2022)

Batalla constante, unlike Smash, is a game designed specifically for the blind. Therefore, sound does not function solely to enhance the game's atmosphere; it provides guides for its execution. Even if the player has never heard a particular element, character, or action before, they enjoy the game and create their own personal experience through sound. At times, they make allusion to "seeing" by means of sounds.

> Researcher: You were just mentioning to me that there were dragons. What are the dragons like, or how do you hear them?
> Miguel: Look, basically it's like [mimics the supposed sound of a dragon] they make a strange noise and right there it says—you see a dragon with 2,000,000 health—and then you go ahead and kill it with the weapon.
> (Miguel, online interview via Google Meet, January 16, 2022)

The acoustic ecosystem empowers audio gamers to reconstruct the environment, identify characters, recognize actions, and determine attack movements, weapons, etc. During a conversation on Discord, Ernesto explained that within the hardware configuration, by having 2 speakers—one located on the right (R) and another on the left (L)—the sound generates a sensation of movement; this is because, during the game, the right speaker emits a higher volume, while the left is lower, thereby allowing players to localize the position of objects and successfully enjoy the recreational experience.

Learning in the Typhlosphere: Between Practice and Socialization

On the other hand, mastery within the game is obtained through two pathways; these are: individual learning and social learning. Indeed, although many audio gamers learned on their own, others attribute their entry into the world of digital games to friends and family members.

> "The first approach that I remember that I can tell you interested me was at 7 or 8 years old, out of being annoying with my brother who was playing—the game he was playing on an emulator of a 64—and well, I used to keep my brother company when he played, so then he would explain to me what he was doing, he would read the texts about the game to me, and so on."
> (Juan, conversation via WhatsApp message, April 21, 2021)

Haptics: Bodily Interaction and Tactile Feedback

In relation to haptics, the positioning of the hands on the keyboard and the recognition of the keys are essential to the ability to play.

> "So, one can hear when the ugly duckling is to the left, and you have to center it, and then it can be caught; and what you have to do is keep your hand on the arrow keys and then the F key right there to be ready."
> (Rubén, online interview via Google Meet, May 3, 2021)

In Rubén's words, one can appreciate the importance of precisely synchronizing the fingers with the sound, identifying the position of the keys. From this perspective, we can say that the typhlosphere is composed of an integral and multimodal universe where the entire body participates. Vision is not substituted; rather, it is simply not summoned—it is not required during immersion in the game.

Sound alone does not offer all the information about what occurs within video games. Some games do not even deploy sounds at all times. Haptics allow the player to navigate and operate in the absence of sounds. For example, when asking a young player how he realized when he made a mistake or lost a life if no sound was heard.

> Researcher: And doesn't it notify you about your health when you're losing it?
> Miguel: No, you have to press the 's' key yourself so that it notifies you.
> (Miguel, online interview via Google Meet, January 16, 2022).

Miguel's response points once again to the interaction with the keyboard, the most material form of the game. While sound can be reduced to physical information that is symbolically represented and felt, the keyboard embodies, so to speak, the most raw component of the electronic device. The manipulation of the keyboard enables a concrete relationship between the player's body and the game in material terms. Consequently, a macrosystem is generated among the device, the game, the sound, haptics, and the body. Haptics add a sensory element to the surface of the skin—a touching, brushing, pressing, or vibrating. At the same time, it represents the ability to intervene upon the hardware. Through the mixture of haptics and sound, a synthesis of creativity within the game is achieved, conferring power and agency to the player.

In accessible games, the options menu indicates the different uses of the keyboard; by following these instructions, players eventually manage to execute movements mechanically. In the game "Batalla Constante" (Constant Battle)—the Spanish version of "Bathala Constante," a game developed in Brazil—or in Crazy Party, knowing the layout of the keyboard and the position of the keys makes it easier to identify, almost automatically, which keys correspond to attacking or moving. The player listens, but that does not guarantee being able to navigate the game; haptics are strictly required.

In Crazy Party, a an example of mobile gaming, tapping and swiping the screen with the fingertips are made possible thanks to haptics; simultaneously, the hands perceive vibrations, sensorially enriching the play experience. However, Miguel mentioned that for chatting, he preferred to use the computer, as the keyboard allowed him to carry out a more fluid conversation compared to the cell phone. Regarding this topic, Rubén told us about a tennis game where the cell phone's vibration varied depending on the proximity of the ball: the closer it was, the stronger the vibration, whereas the farther away it was located, the weaker the force of the vibration.

> Researcher: So, it vibrates more the closer it gets?
> Rubén: Yes, because if not, the vibration is weaker; also, you have to move your finger pretty fast for the player controlling the application to win.
> (Rubén, online interview via Google Meet, May 3, 2021)

Based on the above, Rubén played by feeling the game; he did not need to see the ball approach and move away. He calculated the distance of the ball through haptic signals—in this case, vibration accompanied by sound. He accesses the physics of the game through an embodied immersion, aiding himself with sound and haptic sensations. He does not observe an image; he listens, feels, and touches. This demonstrates how variations in mobile phone vibration create a sensation of movement through touch. Nonetheless, the mobile device does not emit vibrations on its own; these appear, disappear, and vary in intensity according to the user's behavior within the game.

Discussion

The research findings confirm the enactive theory[28,29], the phenomenological approach[9,23], and the sensory perspective[6–18,12,14] regarding the particular configuration of the sensory experience of blind youth. We find that the experience of playing does not reflect a dualism; that is, the mind and body do not act separately. The sensory universe constitutes a situated cognitive process mediated by the body[13,29]. Sensory experiences are not unidimensional[23–25], meaning they involve more than one sense. In this case, the computer-mediated gaming experience acquires an intersensory role developed from the coupling of the subject, haptics, and sound. Finally, we appreciate the sensorimotor quality of play[28], meaning that motor skills or movement are integrated with what is heard. In summary, the sensory experience is embodied, multichannel, and sensorimotor.

Regarding the haptic experience, it is worth bringing into the discussion the sensory capacity to construct knowledge through interaction with

technological devices. In this sense, it is worth considering whether visually impaired individuals create and generate knowledge through a specialized haptic experience—the result of their previous experiences and embodied learning—or if this haptic capacity pertains more to a specific type of ability to attend to certain stimuli.

We agree with González-Grandon[20] in arguing that these two dimensions overlap, both as a product of habituation to tactile stimuli and as part of the process of reflective awareness and attention. However, our research findings reflect that the relationship with digital devices, in haptic terms, necessarily requires both social and individual learning. In this regard, learning to navigate haptically within the world of digital games requires peer socialization of skills. Therefore, it is crucial not to ignore the role of social interactions in the subjectivation of sensory experience, moving beyond what is biologically and physiologically inherited.

Another element to consider is the role of digitally mediated human social interactions. That is, the ecosystem of the *typhlosphere*—comprising the WhatsApp, Telegram, and YouTube communities—functions as a mechanism for the socialization of sensory subjectivity. This implies that no sensory skill or capacity arises by default; rather, these always emerge through social interaction, even in the absence of a direct physical presence.

Conclusions

Based on these findings, it was concluded that there is a need to understand the gaming experience of blind gamers (*tiflojugadores*) as a situated, embodied, and digitally mediated condition. The cognitive and sensory processes required for play do not depend exclusively on neurological processes occurring within the brain; rather, the body as a whole participates in this holistic, multisensory process. The body manifests itself not only in the act of perceiving, but rather creates, acts, and generates practical knowledge.

The phenomenological nature of listening and touch is configured[23–25] as a process where the embodied subject recreates and resignifies what is perceived. Furthermore, the results yielded by this research lead us to affirm that the social interactions of blind gamers are diverse and broad in nature, as they are sustained through internet-based interactions. They also involve symbolic and material exchanges through tools, devices, and software. We observed that the socialization of sensory experiences via WhatsApp groups and other digital platforms is fundamental to the distribution of knowledge. In a sense, the gaming experience can be shared and socialized through technology. The individual does not learn solely from their isolated experience; learning requires others and is, fundamentally, a social practice.

We have seen how games possess a sensory configuration built from images, sounds, and haptic feedback, through which the overall immersion of play is generated. Furthermore, sound does not merely generate sensory experiences; it also imbues characters, environments, or elements—such as water, earth, fire, and the void—with sense and meaning. This does not occur through purely abstract representations, but rather as a result of the integration of cognitive, embodied, and social processes. In this way, the typhlosphere establishes itself as a genuine space for collaborative knowledge generation, independent of oculocentrism, where blind gamers resist a world designed by and for normally sighted people.

Future Outlook

For future research, we consider it necessary to investigate more complex cognitive processes. For instance, analyzing the characteristics of mental imagery and bodily traces triggered by sound and touch. It is also worth exploring the social nature of the subjective mind-body experience across different subjects—specifically, seeking to determine whether similarities exist among these experiences, or if each subject constructs their perceptual world in a completely unique way. Future studies should aim to conduct research across diverse age groups, including children and adolescents from various social strata and cultural contexts, in order to generate more precise data regarding the personal and social variability in video game usage among visually impaired individuals.

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ISSN: 1557-7112