

Is silence a sound?

Ten principles towards an expressive theory of silence

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ABSTRACT

This paper reviews the main theoretical and empirical models on which research into silence has been based, intending to locate and articulate the concepts considered to be orienting and practical to deploy a systemic and transdisciplinary review of “silence” as the object of research.

The study was carried out by confronting silence as an object of a phenomenological character triggered by the sense of hearing, whose expressive nature goes far beyond the sonic sensorial universe, and aims to obtain valid conclusions for any of the languages and expressive systems that incorporate it.

To locate and gather the contributions, the essential elements, and the theoretical gaps that may constitute the bases of an expressive theory of silence, the present study conducts a review of the knowledge on silence by grouping it into seven major research currents: philosophy and art, bioacoustics, psychoacoustics, theory of forms, musicology, semiotics, and pragmatic linguistics, while taking the communicative function as its backbone.

Lastly, the paper will propose ten principles for developing and empirical testing of an expressive theory of silence.

RESUMEN

Este artículo revisa las principales tendencias teóricas y empíricas en las que se ha apoyado la investigación sobre el silencio, con el objetivo de localizar y articular entre sí aquellos conceptos que se han considerado orientadores y útiles para desplegar una revisión del objeto de estudio “silencio”, sistémica y transdisciplinar.

El estudio se desarrolla afrontando el silencio como un objeto de carácter fenomenológico desencadenado por el sentido de la audición, cuyo carácter expresivo rebasa ampliamente el universo sensorial de lo sonoro, y tiene la voluntad de obtener conclusiones válidas para cualquiera de los lenguajes y los sistemas expresivos que lo incorporan.

Con el objetivo de localizar y recoger las aportaciones, los elementos esenciales y, también, los vacíos teóricos que puedan constituir las bases de una teoría expresiva del silencio, a lo largo del texto se desarrolla la revisión de los conocimientos sobre el silencio agrupándolos en siete grandes corrientes de investigación: la filosofía y el arte, la bioacústica, la psicoacústica, la teoría de la forma, la musicología, la semiótica y la lingüística pragmática, tomando la función comunicativa como eje vertebrador.

Por último, el artículo aporta en sus conclusiones la propuesta de 10 principios para el desarrollo y la contrastación empírica de una teoría expresiva del silencio.

Introduction

Silence is one of the most transversal, suggestive, and slippery perceptual phenomena we come up against in expressive systems. Its polymorphism and ambiguity make it particularly interesting both in audiovisual narrative and in oral and musical communication. However, what really turns silence into a robust and vigorous expressive instrument is that its phenomenology goes far beyond the auditory spectrum; literature, philosophy, art, and popular language also place silence in writing, painting, photography, architecture, and so on; in other words, in multiple forms of non-sonic expression.

All us scholars who have tried to answer questions such as *What is silence?* *What does silence express?* *How is meaning assigned to silence?* *What are the conditioning factors for the use of silence?* etc. have come up against an unexpectedly complex problem with, in general, unsystematized, vague, and very patchy knowledge available. It is true that relevant studies dealing with silence are produced within the framework of pragmatic linguistics and musicology, but their orientation is also diffuse as is the very nature of this object of study.

Thus, the scientific literature on silence is overloaded with terms such as: paralinguistic, multisensory, plurifunctional, contradictory, borderline, heterogeneous, changing, etc., which illustrate the profound ambiguity in which the studies that attempt to approach silence with scientific rigour move and evolve.

This paper reviews seven of the different theoretical and empirical perspectives on which general research on silence has been founded, in order to locate and articulate those concepts that have been considered clarifying, guiding, and valuable for the construction of an expressive theory of silence.

Methodology

Silence will be approached as a phenomenological object of study triggered by the sense of hearing (Basulto, 1974), whose expressive character goes far beyond the sensory universe of sound (Navarrete, 2020; Torres Cantón, 2017), thus generating complex perceptual experiences.

A systemic and transdisciplinary review of the object of study, “silence”, will be deployed, and which is intended to be valid for any languages and expressive systems that incorporate it. In order to achieve this globalizing approach, knowledge about silence will be addressed from seven major research currents: philosophy and art, bioacoustics, psychoacoustics, form theory, musicology, semiotics, and pragmatic linguistics, taking the communicative function as the backbone.

This approach aims to locate and bring together contributions, essential elements, and theoretical gaps to form the basis of an expressive theory of silence.

From philosophy and art

It is probably the philosophical perspective that has historically generated the richest and most heterogeneous production on silence. From Cicero's *The Orator* (1967) —106 to 43 BC— to current articles focused on the philosophy of communication, it is possible to find abundant literature explaining the communicative capacity of silence based on the absence of speech (Potestà, 2019; Sevilla Godínez, 2020).

On the other hand, reviewing the current theoretical approaches that approach silence from art reveals that these do not limit its expressive capacity to verbal absence but extend it to any absence perceived by any sense (Torres Cantón, 2017), with silence contemplated from fields as far from the spoken word as photography (Flores, 2020) or architecture (Navarrete, 2020). Obviously, if these two disciplines are approached in their broadest and most inclusive sense, it seems evident that silence can be understood as an internal experience, which is triggered by perceiving the absence of something we expected to be present.

All this richness and diversity makes a systematic and coherent approach to silence difficult. Nevertheless, three clear conceptual elements repeatedly appear in philosophical and artistic approaches to silence: its phenomenological character, its origin in the perception of absence, and its transversality.

Attributing a phenomenological character to silence situates it in the human universe. However, insofar as we face an unresolved problem, it is necessary to turn to broader and more diverse conceptual bases to advance our understanding of it. I will begin by reviewing the contributions that can be made to the understanding of silence by bioacoustics, a discipline whose object of study is the sound productions and habits of living beings in the broadest and most general sense.

From bioacoustics

Research on the use of acoustic signals by wildlife has made it possible to explore such primary behavioural and communicative aspects as defence of territory, alerting others to the presence of predators, attracting the attention of mates, locating individuals, detecting prey, etc., in a wide range of species (Martínez-Medina et al., 2021). If we consider that all these animal behaviours are based on emitting and perceiving sounds, it is not difficult to conclude that bioacoustics brings a new perspective to the concept of the “transversality of silence”, in that it extends it to all living beings with a sense of hearing. Obviously, any living being capable of perceiving, recognizing, and processing the presence of a sound form must also have the capacity to perceive, recognize, and process its absence. Consider, for example, how a cheetah and a gazelle use the sound/silence relationship in the environment of a pond in the African savannah to make vital decisions, as the former tries to hunt and the latter to drink.

The essential logic for the communicative use of silence in the predator/prey relationship is to extract information about the presence/absence of sounds coming from the other, because

that information will make it easier for both to react, or not: the predator initiating the hunt and the prey fleeing. This situation shows that the trigger of the communicative process in critical survival conditions – both for the prey and the predator – is not the voluntary emission of signals – which both try to avoid – but their reception and correct interpretation.

I now invite the reader to think about how humans use the presence/absence relationship of sound while crossing a street on a bend with no traffic lights in any urban centre with heavy traffic; in this context, correctly interpreting the noise of engines and rolling on tarmac is also vital information for human survival.

It is true that the human use of silence, for example, in music and speech, can be much more sophisticated and complex. However, a review of the literature on silences in musical language (Arias Puyana, 2018; Arroyave, 2014) and in speech (Méndez Guerrero, 2014; Poyatos, 1994) shows that no abstract units have ever been formalized to assign concrete meanings to silences that go beyond the concept of pause. The truth is that the maximum state of technical and scientific formalization of silence with which human beings operate, both in music and in oral expression, consists of an approximate systematization of the presence/absence of sound as a function of time; in other words, in grouping pauses into different categories depending on their duration and context.

It seems, then, that in terms of the use and interpretation of silences, humans are much closer to other living organisms with an auditory sense than we imagine, and that the interpretative and expressive use that we *homo sapiens* make of silence is, in reality, quite basic and primitive. This reflection also leads us to think that the exploration of the use of silence in other species may provide essential and enlightening clues about our communicative process. An example would be the relevance of a new paradigm that contemplates the entire logic and deep meaning of communication as a result of the constant need to extract information from the environment we living beings have in order to maintain our survival (Rodríguez Bravo, 2008).

From psychoacoustics

Surprisingly, looking for specific research on silence within the strict field of psychoacoustics is a true wilderness. From the first third of the 20th century, with the development of Fletcher and Munson's well-known diagram, which organizes sound sensation into perceptual thresholds relating frequency and intensity (Fletcher and Munson, 1933), to the latest psychoacoustic research on auditory sound processing, silence has been absent as a specific concept of the discipline. It is very illustrative, for example, that in the more than 400 pages of *Psychoacoustics: facts and models* (Fastl and Zwicker, 2007), a scientific compilation of references in this field, the word "silence" appears only once.

Along the same lines as psychoacoustics, psychophysical research on the auditory organ (Sánchez Naranjo, 2004) and neuropsychiatric research on deaf people (Pardiñas, 2008) also do not explicitly address or explain the perception of silence.

In all these psycho-technical fields, silence tends to be seen as an abstraction and is entirely masked by the study of the perception/non-perception of sound in terms of acoustic parameters such as its duration, intensity, frequency, temporal evolution, or harmonic structure. The focus of psychoacoustic research is to formalize sound vibrations' physical characteristics to associate them with the auditory sensations produced during their reception. Those perceptions generated during periods of sound absence are simply ignored. They do not exist.

Nevertheless, the physical-perceptual articulation provided by psychoacoustics has been a source of knowledge and essential methodological support for those disciplines that have approached silence from a communicational perspective. Since silence arises from the relationship between the presence and absence of sound and evolves in the perceptual flow, the acoustic formalization of this presence/absence and its relationship with sonic communication could provide valuable knowledge.

From this psychoacoustic inspiration, some significant advances have been made in the field of communication in terms of knowledge of silence. Specifically, the possibility of formalizing sound in an acoustic way has made it possible to reach two relevant conclusions:

1. The first is the awareness and acceptance that *there is no such thing as absolute silence* (Mateu, 2003; Rodriguez Bravo, 1998; Terrón Blanco, 1991; Torras i Segura, 2021; Torres Cantón, 2017).

Should we accept, then, that silence does not exist? Of course not. In the techno-acoustic disciplines, the relevance of the concept of silence is never discussed or denied. Psychoacoustic formalization shows us that there are no situations in which sound is totally absent and that it is always possible to find and measure some sound. Nevertheless, silence is perceptible; we hear it, and we feel it. This paradox brings us back to the problem of the definition of silence, pointing out the inadequacy of merely describing it as “absence of sound”; and it also indicates the relevance of the philosophical perspective that understands silence as the inner experience we have when we perceive the absence of something we expected to be present.

2. The second is that *silence is a sonorous form*¹ (Rodriguez Bravo, 1998).

In fact, defining silence as the result of perceiving a class of sound forms is the corollary of

¹ The author of this phrase, in his work *La dimensión sonora del lenguaje audiovisual*, defined silence perceptively as the “sensation of the absence of sound” produced by certain types of “sound forms”, and described these forms as acoustic structures in which there is an abrupt decrease in the intensity of the sound signal after it has been extended in time for several seconds, leaving in its place a diffuse background of sound events of very weak intensity (Rodriguez Bravo, 1998, p. 150).

assuming the paradox that silence exists and, at the same time, that total absence of sound is not possible.

From the theory of forms

The assertion that specific acoustic sound structures make us perceive silence leads to the cognitive universe and the very concept of form. I will now move in this direction, but before reviewing silence from the postulates of Gestalt theory, the reader is invited to imagine the following situation:

You are walking on a bridge, which spans a large highway of ten lanes, five in each direction. You can see and hear dense and high-speed traffic of hundreds of vehicles in both directions from the bridge. You hear, therefore, a thunderous roar of engines and rolling on the tarmac. It is a place where it is difficult to converse, and other sounds are barely audible because the loud roar of the traffic almost completely masks them.

Now, suppose a few days have passed, and you are back at the same place, on the same bridge over the same motorway, but all the traffic has disappeared for some mysterious reason. Not a single car is moving. As you walk, you hear an eerie silence. Only the sound of the wind, some birds, and your footsteps can be heard. The disappearance of *the roar of traffic* sound form in the soundscape described above illustrates how a given acoustic structure can generate the perception of silence, and that the sensation of silence is perfectly compatible with the perception of other sound forms.

Gestalt theory (Koffka, 1935; Köhler, 1974; Wertheimer, 1923) explains that perceptual processing tends to group similar stimuli (rolling and engine noises of multiple vehicles), segregating the auditory stream into forms that fit the previous informative categories available to the receiver in his or her memory. We are now talking about top-down, concept-driven processing (Matlin, Foley, Ramírez Escoto, & Ortiz Salinas, 1996, p. 128). Since it is common to hear the rolling and engine noises of multiple vehicles when approaching a road with heavy traffic, this acoustic structure is loaded in our memory as the specific sound form of *roar of traffic* and is rigidly associated with visual landscapes containing large roads. However, on the second imaginary visit to the bridge over the motorway, the rolling and multi-vehicle engine noises that we would recognize as the *roar of traffic* have disappeared. This triggers two perceptual effects in us:

1. *The formal recognition of a solid comparative sensory difference*, which is produced by listening to a sound background with natural acoustic details of very low intensity (wind rustling, trills, and footsteps) where before we heard intense and multiple rolling and engine noises;

2. *The perception of absence*, generated when we realize that a relevant part of the soundscape strongly linked to that same place in our memory has disappeared. We do not find the expected sound form: the roar of traffic.

We have processed the two essential dimensions of silence:

- a) The sensation of a relevant physical change in the acoustic structure;
- b) The perception of absence associated with this change.

The evidence developed so far explains silence by acknowledging the paradox of its acoustic impossibility and its strictly cognitive character. However, there is still another relevant question, also paradoxical, which repeatedly appears in the musical literature on silence and which needs to be explained from the theory of form: the claim that musical forms (and as a corollary, sonic forms) are constructed in the auditory flow on a soundless background, that is, on silence (Chernoivanenko, 2019; Arias Puyana, 2018; Arroyave, 2014).

To the extent that we accept that silence is a sound form and, therefore, a concrete mental phenomenon based on auditory sensations, and also that the natural state of our sense of hearing (since there is no absolute silence) is to be immersed in a permanent and complex sound flow, then by paying attention to silence, sound will become the background, and silence will act as form. Thus, while Gestalt theory postulates that it is the perceptual act itself that endows the stimulus with formal structure and meaning (Martín Jorge, 2010), from the moment we direct our attention to observing silence, silences become perceived as acoustic gaps that are outlined on a continuous and omnipresent sound flow, and not the other way around. In short: silence becomes the form and sound becomes the background.

This reflection on the background/form relationship demonstrates the sound version of the well-known visual inversion effect in which the background becomes the form and the form becomes the background, the same image being perceived as either a white cup on a black background or two black faces on a white background.

From musicology

Silence is an essential part of the formal and expressive structuring of music, and analysing pauses as a structure of the presence/absence of silences is not unusual in music theory. Musical language has developed a thorough coding of rests according to their durations in conventional score notations and by creating new codes based on acoustic analysis (Syroyid Syroyid, 2019). In fact, the musical notation of silence is the most advanced and accurate notation that can be found in human languages if we exclude strict temporal measurement.

Indeed, the most important contributions of music creation and musicology have been to pose and explore the expressive value of silence through sound experience, defin-

ing its structural basis in time and assuming the formal ambiguity of sound absences (Arroyave, 2014; Cage, 1970). From these contributions, musical creation takes us to a particularly suggestive territory, in which silence is granted cultural, aesthetic, psychological, and philosophical meanings, such as stillness, tranquillity, emptiness, absence, discomfort, death, etc. (Chernoivanenko, 2019; Metzger, 2006).

We can see how the conceptual review of silence leads us to its expressive and significant capacity (Torrás i Segura, 2015); let us then turn to silence by paying attention to its mechanisms of signification, that is, to the mechanisms from which it generates meaning in the processes of communication.

From semiotics

The academic review to this point has arrived at the following deductions:

- a) That silence has its origin in a class of physical structures which, by stimulating the senses, make the receiver appreciate the absence of some perceptible or imaginable object (a sound source, a word or phrase, a situation) that was expected to be present;
- b) That the impression of absence associated with these kinds of forms is transverse, in that it is not restricted to the sense of hearing or human beings;
- c) That these physical structures act perceptually as forms in the “gestalt” sense of the term;
- d) That silence is an internal experience that, in addition to expressing the absence of perceptible or imaginable objects, can also express cultural, aesthetic, psychological, and philosophical meanings.

If we accept that the concept of silence is constructed on the basis of the relationship between a perceptible physical structure (recognition of a form) and a sensation of absence, i.e. that all silence points to some absent object, it becomes evident that silence can act as a sign in the strictest semiotic sense (Peirce, 1982, pp. 244-245). And to the extent that silence generates meaning from its capacity to direct the receiver’s attention towards some absent object – just as the silence on the savannah indicated to our gazelle the absence of predators and the silence on the bridge over the motorway the absence of moving vehicles to passers-by – we can say that silences act as indexical signs (Peirce, 1987, pp. 174-175). For this reason, when the *roar of traffic* disappears, we become aware of the absence of circulating cars. That is, we discover that the sound source of the silenced noise has disappeared.

In fact, applied acoustics’ methodological orientation is consistent with the thesis that sound absences always act as a sign that is physically connected to the absent elements it reveals. Thus, when silences in speech are investigated for programming systems for automatic emotion recognition (Atmaja and Akagi, 2020), pauses and gaps provide information physiologically linked to the speaker’s emotional states. Also, when hesitations (pauses and vowel lengthening) are analysed to characterize speakers for judicial

purposes (Llisterri, Machuca, and Ríos, 2019), absences in the flow of speech provide information on verbal behaviour linked to the identity of the speaker.

In the approach developed so far, we have addressed silence as a primary stimulus, generated without communicative intent, such as the absence of the sound of breathing from the person with whom we share a room or the sudden elimination of the sound of footsteps. However, what happens when silences are located in environments constructed with communicative intent? How does silence manage to express complex cultural meanings such as stillness, discomfort, or death?

From pragmatic linguistics

Pauses and silences in the speech environment have been studied within the framework of non-verbal communication, albeit considering them closely linked to language (paralinguistic). From this perspective, a meticulous and extensive classification of uses of silence has been developed (Mateu, 2003; Poyatos, 1994).

At the same time, from a pragmatic point of view, much research has been done on the interpretation of silence as another communicative sign that can be consciously and multifunctionally constructed. The problem of its significance has been explained based on what is located before and after each silence, who produces it, who receives it, where it takes place, and the type of relationship between the speakers (Méndez Guerrero, 2014). In fact, pragmatic studies specify that in order to explain the meaning of silence, the following five factors must be taken into account:

1. Other verbal and non-verbal signs that precede or appear next to it
2. The context (situational and sociocultural)
3. The social relationship of the participants
4. Previous and shared knowledge
5. Cognitive processes

(Méndez Guerrero, 2016, p. 181)

The five factors that Méndez Guerrero includes as fundamental to explain the meaning of silences, although their scope of analysis is fundamentally in the domain of language, can also be extrapolated to music, audiovisual narrative, animal vocalizations, biomechanical noises, and environmental noises. That is, to any other expressive system that incorporates silence. Logically, providing we assume that all living beings with a sense of hearing: 1) handle silences as signs – specifically as indices²; 2) maintain social relationships; 3) interpret sound absences according to their contexts; 4) share knowledge, and; 5) develop cognitive processes³.

² “Anything that concentrates the attention is an index. Anything that startles us is an index, to the extent that it marks the conjunction between two portions of experience. Thus, a fierce thunderclap indicates that something considerable has occurred, even if we don’t know what happened” (Peirce, 1987, p. 266).

³ The theoretical approach proposed here to address the social relations, knowledge, and cognitive processes of living beings is the Biological Theory of Knowledge (Castro García, 2020; Maturana & Varela, 1990 & 1998).

However, let us go back to the human environment and review how the meaning of silence works in two sound sequences that narrate the same situation in different ways in an example in which the essential difference is the change of context:

Sequence (A):

- Weak and very relaxed breathing is heard for five seconds with the almost inaudible background sound of the hum of a refrigerator.
- The breath stops sounding while the slight hum of the refrigerator compressor continues for three more seconds.

Sequence (B):

- Weak and very relaxed breathing is heard for five seconds with the almost inaudible background sound of the hum of a refrigerator.
- Against this background, a voice in the foreground explains: “That night Adela was calm, she had said goodbye to everyone, she no longer had to worry about anything else, she only had to abandon herself ... and let herself go”.
- After the text, the breath and the faint hum of the refrigerator are still audible, and two seconds later, the breath stops sounding while the slight hum of the refrigerator compressor continues for three more seconds.

The difference between introducing, or not, the presence of a spoken sequence describing Adela determines two very different interpretations of the cessation of breathing, resulting in the silence of sequence (B) being much more transparent and accessible to interpret than that of sequence (A). Since sequence (B) is already located in the linguistic system in addition to the naturalistic context of primary sound stimuli, the significant capacity of the absence of the breathing sound acquires a much higher level of precision and complexity, allowing us to interpret that Adela has expired, she has just died peacefully and calmly, accepting her passage with serenity.

It is important to note that reading the linguistic text in isolation without linking it to the naturalistic sound environment proposed will hardly communicate the same information. In other words, it is essential to note that the information encoded in the silence of sequence (B) comes from the articulation of two sign systems: that of the primary sound stimuli and that of the language.

The previous example indeed shows how the expressive capacity of silence depends on the signs that surround it, but, above all, it shows us that the level of development and sophistication of the languages in which each silence is located determines its ability to communicate complex cultural meanings. Thus, silences located in a sophisticated coding context, such as linguistic or musical ones, will not have the same communicative capacity as those located in environments in which a symbolic system of basic signals is

shared; or those perceived in sound environments whose level of coding is limited to relating the auditory forms with their original sound sources.

However, as shown in the previous examples, when the context in which silence is situated simultaneously articulates several sign systems, its communicative possibilities expand, widely exceeding the expressive universe of sound.

On silence's density

We know that silence is not associated with specific codes (Torras i Segura, 2015) and that its interpretation is a dynamic process that depends entirely on its context (Méndez Guerrero and Camargo Fernandez, 2015). However, we have also deduced that silence is associated with the perception of absence and that its expressive capacity is determined by the degree of sophistication of the languages in which it is contextualized. Conceptual research into silence thus reveals this phenomenon as a complex perceptual experience, but it also leads us to a new question: how can we contrast and disentangle this sophisticated conception of silence?

Music theory proposes the concept of “density of silence” as a parameter related to the “capacity to resonate or dampen, to push or contain the flow of sound” (Arroyave, 2014, p. 153). Thus, the greater or lesser the number of instruments (of instrumental sound flows) simultaneously silenced in a composition, and the longer or shorter the duration of these absences, the greater or lesser the density of silence.

Indeed, we find ourselves before a very suggestive concept, but as is usual in any intuitive approach to the experience of sound, speaking of the density of silence means mixing, and therefore confusing, a physical signal with the sensation that this signal produces in its receivers. Therefore, to avoid confusion between stimulus and perceptual effect, we will replace the concept of density of silence, which is very ambiguous, with the much more precise “auditory emptiness”, since it refers clearly to the sensory. Thus, we understand that the perception of silence is triggered from a certain degree of auditory emptiness onwards.

If we assume that:

- a) the accumulated synchronous elimination of sound flows is experimentally manipulable and can be measured with acoustic analysis instruments;
- b) the sensation of auditory emptiness can be observed and measured through reception tests;

the concept of auditory emptiness provides us with a theoretical approach to silence that can be explained and formalized separately:

1. The relevant physical changes of the acoustic structure that trigger the perception of silence;

2. The type of sound forms and flows whose absence triggers the perception of silence;
3. The different degrees of auditory emptiness that trigger the perception of silence.

Let us look at a new example to explore this approach, now from audiovisual language:

The screen shows a soldier in a wide shot as he wanders alone and taciturnly among the people amidst the colour and bustle of a fair. The soldier approaches a young woman. Simultaneously, we hear four superimposed sound flows composing the aural landscape: 1) mechanical noises of Ferris wheels, booths, and merry-go-rounds; 2) *the hubbub of voices*; 3) *strident musical confusion*; 4) *the melody of a violin* that is almost masked by the rest of the sounds that make up the environment.

As the soldier approaches the girl, the shot closes in, framing them both, and they look at each other. At that moment, the simultaneous and progressive disappearance of three of the four sound flows takes place: all the mechanical noises, the din of voices, and the strident musical confusion disappear, and only the melody of a violin remains in the sound background, which, when heard alone, acquires all the sonorous protagonism. At that moment, the spectators feel the emotion of the encounter that the characters are experiencing.

Let us now review the case from a perceptual point of view: the receiver exposed to this variation of sound stimuli will feel a more significant sensation of auditory emptiness the more sound flows have been eliminated. In psychoacoustic terms: the more the “sound pressure” (Sleifer, Santos Gonçalves, Tomasi, and Gomes, 2013) decreases, the greater the sensation of auditory emptiness. When this auditory emptiness exceeds a certain threshold, the receiver will perceive silence and, from that moment on, will feel the emotional intensity experienced by the characters at that moment of the encounter.

Let us now imagine a second version of the sequence:

At the moment of the encounter, the effect of mechanical noises disappears, but we continue to hear a soundscape in which competing sounds are: *the din of voices*, the *strident musical confusion*, and the *melody of a violin*.

This second version is unlikely to produce the same sensory impact as the first because, even if the receiver identifies the absence of the flow of *mechanical noises*, the silence has not been perceived; that is to say, the weak drop in sound pressure will not have succeeded in exceeding the minimum necessary threshold of auditory emptiness to trigger silence.

The above observations suggest three hypotheses:

- The degree of auditory emptiness depends on the number of silenced sound flows.

- The sensation of auditory emptiness is associated with the sound pressure drop: the lower the sound pressure, the greater the sensation of auditory emptiness.
- The degree of auditory emptiness determines the thresholds of perception of silence.

If we assume that silence is linked to the unveiling of absences, it seems evident that the perception of silence is a complex cognitive process that, in addition to involving acoustic thresholds, incorporates the recognition of eliminated sound forms. Moreover, it seems obvious that measuring the primary sensation of auditory emptiness through reception tests would allow us to explore the physical realm of the density of silence rigorously. That is to say: the acoustic structures that trigger the perception of absence.

The above example does not allow us to define concrete thresholds for the perception of silence, and this task would have to be solved by an experimental research programme that articulates:

- 1) The manipulation of sound flows formally recognizable by receivers.
- 2) The manipulation and measurement of the acoustic pressure of these flows.
- 3) Perceptual tests that explore separately:
 - a) The sensation of auditory absence.
 - b) The sensation of silence.

To complete this conceptual investigation, I propose, by way of conclusions, ten principles for the development of an expressive theory of silence.

Conclusions

1. The main conclusion of the present conceptual research is that silence is not a sound but a complex perceptual experience triggered by the sensation of auditory emptiness and the recognition of formal absences. This recognition can provide information at very different levels of complexity depending on its immediate physical context, its receivers' needs and capacities, and the sign systems in which it may be inserted.
2. In order to understand the expressive logic of silence in its most transversal and extensive sense, it is necessary to move away from the anthropocentric and "*audiocentric*" communicative approach. Undoubtedly, communication is a constant and permanent human process, but it is essential to remember that it is not restricted to exchanging messages through verbal activity nor exclusive to humans. To advance in the knowledge of silence, we need to understand the communicative process as an essential function for all living beings, in which it is not the sending of signals with communicative intent that is fundamental, but their reception and processing, for the primary and essential purpose of improving adaptation to our environment in order to survive.
3. From a physical and psychological perspective, silence is constituted from a presence-absence relationship, or the disappearance, elimination, suppression, or lack

of a form – or class of forms – in an identified perceptible environment.

4. When we turn our attention to observing silence, silences come to be perceived as acoustic gaps looming over a continuous and pervasive flow of sound, rather than the other way around. That is to say: silence becomes the form, and sound becomes the background.

5. The perceptual impact of silence is enhanced by the accumulation of synchronous absences (for example, sudden and synchronous disappearance of noises, voices, and music in an audiovisual narration showing the hustle and bustle of a fair). We can describe this phenomenon by saying that the greater the accumulation of absences, the greater the density of silence.

6. Silence is a perceptual experience triggered by any formal void that can indicate absent elements. Therefore, these voids act as signs. In Peirce's (1987) terminology, such forms are always indexical as they direct our attention by indicating relevant absences in any perceptible environment.

7. We do not have a priori standardized codes that allow us to assign a specific meaning to silence. Therefore, it must always be interpreted in terms of:

- a) Its perceptual environment.
- b) The needs and capacities of its receivers.
- c) The sign systems in which it may be inserted.

8. Silence is loaded with information according to its context. This context increases its capacity to express complex meanings according to the sophistication of the language—or languages—in which it is situated.

9. When silence is located in contexts that simultaneously articulate several sign systems, its perception triggers cognitive mechanisms beyond sound's expressive sphere.

10. The relevant methodology to contrast the theoretical model proposed in this article should be experimental, based on perceptual tests, and oriented to study the articulation between:

- a) The presence/absence of recognizable sound flows (cognitive perspective).
- b) The sound pressure of present/absent flows and their summations (psychoacoustic perspective),

on:

- 1) The sensation of auditory absence.
- 2) The sensation of silence.

This methodological approach will also allow exploration of the expressive capacities of silence in its most transversal and extensive sense, empirically and with quantitative precision.

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