



Novembro-Fevereiro 2021



MALASPINA, Cecile. *An epistemology of noise*. London: Bloomsbury Academic, 2018.



Por quê colocar esse livro na pesquisa

Parece que o ponto mais importante desse livro é que a partir de teorias científicas sobre sistemas, mostra-se como os recortes epistemológicos, ou melhor a seleção dos elementos que são destinados a construção dos saberes e ao conhecimento epistemológico do mundo, ainda querendo se basear em modelos supostamente “exatos”, não são isentos de arbitrariedades, muitas vezes ligadas a interesses de controle e domínio. Através de várias formas e se adentrando em várias áreas, Cecile Malaspina mostra como o conceito de barulho, está sujeito a um julgamento de valor e a uma instrumentalização para fins de controle (o uso instrumental da poluição acústica e o uso de armas pensadas a partir do barulho). O uso de expressões tais que “barulho mental” são índices dessa tendência. O barulho, enfim, faz parte do sistema do qual se retiram as informações e ele mesmo contribui para a construção de conhecimento do mundo. Até hoje ele é visto como elemento a ser excluído, já que se entende a informação — em uma lógica ligada aos essencialismos positivistas — como um dado exato, algo “ordenado” enquanto que o barulho representaria a “desordem”. O uso do barulho com finalidades expressivas, quem sabe, poderia disparar um potencial político, reafirmando a exigência de uma contraeducação senciante e epistemológica.

**Para citar essas notas de estudo use:**

[CAPUTO, Irma. Estudo de pesquisa de pós-doutorado “Da escrita para a *phoné*: estudo comparado da produção literária e da obra plástica de Nuno Ramos”. Supervisão de Paulo Henriques Britto. Fomento Faperj: Rio de Janeiro, 2021].



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Entendimento do barulho, visão lógico-matemática, em oposição à informação.

The term inforgs has since been coined to emphasize the idea that we no longer inhabit only an ecosphere, but also an infosphere (Floridi 2002). (MALASPINA 2018, p. 2)

No longer considered only as a factor of disturbance, detrimental to information like 'static noise in the channel of communication, the evolving concept of noise also becomes constitutive of new forms of knowledge and of new ways of understanding organization. (MALASPINA, 2018, p. 2).

Despite the ever more apparent complexity of the relation between information and noise, the latter is often taken for granted as the mere opposite of information, based on the intuitive analogy with acoustic noise disrupting communication. (MALASPINA, 2018, p. 2).

In this palimpsest of concepts, notions and ideas, noise always appears to occupy the negative place of a dichotomy, be it in that of order and disorder, of physical work and the dispersion of energy in the state of entropy, or of the norm and the abnormal. In other words, noise is at best associated with the absence of order, of work or of the norm – be it the statistical, moral or aesthetic norm – and at worst, noise is identified as a threat to the norm and subversive of work and order: a perturbation, a loss of energy available for work, a parasite. (MALASPINA, 2018, p. 3).

Entropy VS negentropy

Negentropy informação como negação da desordem p. 5

Barulho como metáfora → Cummings referendum campanha 2016.

This restlessness of the conceptualizations of noise, the shifting boundaries between what we consider to be information and what we discard as noise, requires that we think about this restlessness as a form of epistemological noise. Meaning quite simply that the communication between diverse theoretical and experimental fields is not only subject to conceptual 'noise in the channel of communication', but also generates epistemological noise. The very movement of the idea of noise across disciplinary boundaries, the conceptual distortions provoked by this movement, is a form of epistemological noise accompanying its dissemination and transformations. In other words, the unstable concept of noise is itself an example of epistemological noise in the communication of concepts across theoretical boundaries. (MALASPINA, 2018, p. 8).

PART ONE: Concepts: Information Entropy,  
Negentropy, Noise

## Entropy

physics

WRITTEN BY

[Gordon W.F. Drake](#)

Professor of Physics, University of Windsor, Ontario. Editor of *Atomic, Molecular and Optical Physics Handbook*.

[See Article History](#)

**Entropy**, the measure of a system's thermal [energy](#) per unit [temperature](#) that is unavailable for doing useful [work](#). Because work is obtained from ordered [molecular motion](#), the amount of [entropy](#) is also a measure of the molecular disorder, or randomness, of a system. The concept of entropy provides deep insight into the direction of spontaneous change for many everyday phenomena. Its introduction by the German physicist [Rudolf Clausius](#) in 1850 is a highlight of 19th-century [physics](#).

<https://www.britannica.com/contributor/Gordon-WF-Drake/4672>

Shannon's audacity consists quite simply in correlating both information and noise with uncertainty. Both concepts are henceforth derived from the statistical unpredictability he associates formally (mathematically) with physical entropy. While information entropy clearly implies a degree of desirable uncertainty, i.e. the novelty of the message, Weaver will say that noise can be discarded as 'spurious uncertainty'. (MALASPINA, 2018. p. 15).

The introduction to Shannon's MTC in fact begins by acknowledging Shannon's conceptual debt, not only to Wiener's mathematical work, but to his philosophy (Shannon and Weaver 1964, 3, n. 1). And yet, it proceeds to define information positively as a measure of entropy, and entropy as a 'measure of one's freedom of choice'. Contrary to Wiener's definition of information as the negation of entropy, for Shannon, greater information goes hand in hand with greater uncertainty. A completely predictable message, by contrast, has only one possible outcome and is therefore redundant; it tells us nothing new. In Warren Weaver's words,

[I]nformation is a measure of one's freedom of choice (p.9) [...] in these statistical terms the two words information and uncertainty find themselves to be partners (p.27) [...] entropy (or the information, or the freedom of choice [...]) (p.13). (Shannon and Weaver 1964, 9–27).

(MALASPINA, 2018. p. 15).

However, Wiener and Shannon arrive at diametrically opposed ideas of what information is, because Wiener defines information precisely as the opposite of 'information entropy', namely as the negation of entropy (which the physicist Leon Brillouin later entrenches as

the dominant technoscientific definition of the concept of information, by inventing the neologism negentropy):

The notion of the amount of information attaches itself very naturally to a classical notion in statistical mechanics: that of entropy. Just as the amount of information in a system is a measure of its degree of organization, so the entropy of a system is a measure of its degree of disorganization; and the one is simply the negative of the other. (Wiener 1961, 10–11, emphasis added). (MALASPINA, 2018. p. 17).

Para Wiener a informação é exatamente a redução da liberdade de escolha, e por isso a redução da incerteza. A informação na teoria cibernética de Wiener é uma medida de restrição crescente, associada com a ideia de organização e ordem, destinado a diminuir a entropia. Aqui a entropia não é mais uma medida de informação, como em Shannon, mas ao contrário uma medida do seu hipotético oposto, como por exemplo desordem ou barulho. (Tradução minha, MALASPINA, 2018, p. 17).

As diferenças de tratamento dos conceitos matemáticos são apontadas para sublinhar a ambiguidade

Ambiguidade que fica evidente na realização transposição discursiva desses conceitos. Passagem dessa ambiguidade – matemática – biologia – sociologia – economia

Claude Shannon's definition of information as 'information entropy' has the singular merit of having prepared the ground for a philosophy of noise that evades the Manichean opposition between information and noise, echoing that between order and disorder, life and death. It also evades the mere relativism according to which what we define as information or noise is a question of individual perspective. To demonstrate the cultural relevance of this conceptual feat, we will tackle the difficulty that arises when the concept of noise is no longer applied only to the channel of communication, but also to other domains, where the distinction between information and noise is not a given. In vivo, rather than in the well specified and controlled situation of the channel of communication, the distinction between information and noise is never readymade, but always presents itself as a vital decision or as an epistemological problem. (MALASPINA, 2018, p. 18).

Is not the challenge of every form of research the problem as to how we can identify what counts as information and what, in turn, can be discounted as noise? The dividing line between information and noise is so fundamental to all forms of enquiry and experimentation that the consequences of Shannon's 'entropic ideas' vastly exceed any technological framework, making the conceptualization of information and noise philosophical problems in their own right. Shannon's 'entropic ideas' require us to rethink our most basic attitudes concerning information and noise. Rather than opposing noise to information, as the presence of entropy to its absence, he divides the presence of 'information entropy' from the presence of 'noise entropy'. The dividing line between

information and noise now runs within entropy, rather than between entropy and its negation. (MALASPINA, 2018, p. 18-19).



ENTROPIA AMEDEO BALBI FISICO

<https://www.youtube.com/watch?v=C40Yjb6Xodc>

PENSARE CALORE E ENERGIA SE ABBIAMO UM CORPO CALDO E UNO FREDDO A CONTATTO IL CALORE DAL CORPO PIÙ CALDO AL PIÙ FREDDO (SECONDO PRINCIPIO DELLA TERMODINAMICA).

L'entropia misura quanto un sistema è lontano dallo stato di equilibrio.

Quando pensiamo al calore non dobbiamo pensare fluido magico, a livello microscopico la temperatura di un oggetto è legata alla velocità a cui girano gli atomi di quell'oggetto.

Gas sei atomi scatola, in qualunque istante ciascun atomo si può trovare nella metà di destra o di sinistra.

Entropia tendenza naturale al disordine.

Neghentropia negazione del disordine, ovvero dell'entropia.

This is a subtle but fundamental shift that effectively challenges the principle of the excluded middle, according to which a proposition is either true, or its negation is true, and which implicitly underscored the analogy of the information/noise opposition with that of sense/non-sense, and even organization/chaos. A new division between desirable and spurious uncertainty now competes with the classical opposition between truth and error or, as in the excluded middle, between the truth of a proposition and its negation. The philosophical consequences are profound, for the process of information can now also be understood as a cut across the fabric of uncertainty. Information becomes the process whereby this cut progressively gives rise to a form of measurable uncertainty. (MALASPINA, 2018, p. 19).

No comparable historicizing claim will be made about the splitting of the idea of noise across technics and religion, and across theory and ethics. Nor will there be an attempt to determine the role of aesthetics in mediating such a split.

The first is the implicit presumption that we can rely on an intuitive notion of noise, in order to bridge its definitions across different techno-scientific and cultural settings. The second presumption is that, rather than intuition, it is a formal, i.e. mathematical, definition that presides over the multiple uses of the concept of noise across the spectrum of scientific discourse. What emerges instead are far from uniform conceptions of noise, some of which

profoundly counter intuitive. Although ubiquitous, both the idea of noise and information reveal themselves to be conflicted, both displaying a fundamental ambivalence towards novelty and change, as signaled by Shannon and Wiener's mathematically identical, yet discursively opposed definitions of information. (MALASPINA, 2018, p. 20-21).

Informação – imprevisibilidade → ela precisa dizer algo novo.

Informação/incerteza, chegamos a uma conclusão aparente e paradoxal que mais informação significa menos incertezas

Let us be clear, Shannon's definition of information as an 'uncertainty relation' does not contradict itself, but the doxa according to which one ought to obtain from information simultaneously both novelty and a reduction in uncertainty. Shannon's definition of 'information entropy' instead frustrates this paradoxical need (novelty and certainty) and thereby enables us to think about contingency as belonging to the conditions of possibility of all processes of information, including but not only of those processes we associate with signification in the semantic communication between sapient beings. (MALASPINA, 2018, p. 24).

What, then, is the relation between uncertainty and information, and hence also between information and noise? The answer to this question is not as obvious as it might at first seem and unfolding it may change the way we think about both noise and information. (MALASPINA, 2018, p. 24)

Shannon Information is a measure of one's freedom of choice [...] (Shannon and Weaver 1964, 9).

Information as a process than a given

What, then, is the relation between uncertainty and information, and hence also between information and noise? The answer to this question is not as obvious as it might at first seem and unfolding it may change the way we think about both noise and information. itself. This attention to contingency and uncertainty is what will enable us to rethink the definition of noise, to take it outside the channel of communication, in other words to think about noise in vivo, where the distinction between information and noise is always a process in the making. (MALASPINA, 2018, p. 25-26).

**Nota reelaborada a partir do texto inglês:**

Shanno e Simondon: revolução copernicana, recolocando o indivíduo (mensagem ou ser) tradicionalmente ao contro da atenção, numa situação de atenção coevolutiva dentro do seu contexto (p. 46).

(...) the quality of information is more than a fortuitous aggregation: its structuring effect must be more than just fleeting, it must sustain a structuring power, and sustain what in French is called *sens* and which we can only partially translate as both signification or direction. The quality of information mediates information's power of structuration and the tension that characterizes a domain capable of receiving information. This mediation is quite literally the sense that information makes, the signification or organizing power it catalyses. A purely fortuitous process, in turn, would be subject to an equally fortuitous dissolution. In other words, what we could call a noise phenomenon, and which Simondon here characterizes as coincidence or chance (*hazard*), may act as a trigger for spontaneous structuration but – and this is the crux – the process of information itself remains a process of structuration for Simondon and ultimately a negation of entropy. (MALASPINA 2018, p. 49).

Simondon is already several steps ahead of the problem we are addressing here. His emphasis on the quality of information is already a problem of signification. For us, on the other hand, what is at stake is a rather limited problem that does not yet encompass the question of signification, but only the presence of uncertainty among its conditions of possibility. What Shannon enables us to think is not an absolute value of noise as novelty – which one could provocatively call 'pure information', if one were to attribute a maximal information value to maximal entropy. (...) if information can be thought as qualified uncertainty, then noise too can be released from the theoretical exile of negation into which it was thrown. Noise can become possible information. In other words, unqualified uncertainty can be understood as one of the preconditions of qualified uncertainty and, hence, of information. (MALASPINA, 2018, p. 52).

### Nota reelaborada a partir do texto inglês:

Se coloca a questão de definição de redundância no âmbito da informação, essa seria algo não necessário. Mas o que significa realmente dizer que a parte redundante não é necessária?

Now, if redundancy is the part of the message that imposes a constraint, that reduces 'freedom of choice' in terms of the message's probability, then it is hard to see how it could be unnecessary to the message. (...)

Redundancy, without which 'information entropy' would be indistinguishable from noise, is thus not only necessary to message, it is what, as self-evident, becomes the invisible or unthinkable a priori of information. The consequences of underestimating redundancy as unnecessary are far from trivial, if we acknowledge that every form of organization is based on constraints that introduce redundancy. (MALASPINA, 2018, p. 53).

When the necessary conditions of the information process, of communication more generally and of organization (including social or political) are what is redundant, then they are nothing less than the a priori of our way of thinking and acting. Yet if we fail to address

the informational value of redundancy by minimizing it as 'not necessary', then it becomes increasingly difficult to ask: when is an a priori a necessity, a sine qua non of being thus, of thinking and of communicating thus? And when is it mere prejudice? The a priori restriction on the 'freedom of choice' in the message, is nothing less than the condition of possibility of communication, also because, without it, nothing would offset the uncertainty that is a correlate of the novelty of information. In other words, without redundancy the pure novelty [entropy] of information would be absolutely incomprehensible and equivalent with noise. It is only on the basis of redundancy that novelty demarcates itself from what is already certain. Redundancy is, furthermore, in this sense, also an essential concept for our understanding of physical entropy. (MALASPINA, 2018, p. 54).

What is needed is a concept of information that places a relative uncertainty in the context of existing knowledge and problems that constitute such a field of tension, in other words, within which the antagonism between a priori uncertainty and a posteriori reasons to believe creates the potential to propel a process of information further. (MALASPINA, 2018, p. 74).

The analytical method of the modern sciences, based on the Cartesian method of analysis, which consists in progressing from the simple to the more complex, here it encounters a fundamental difficulty, as apparent simplicity reveals itself to be an epistemological stumbling block, rather than constituting the rock of foundation of knowledge. (MALASPINA, 2018, p. 79).

As a result, one of the difficulties in correlating noise with complexity is the common perception of entropy as the homogeneous murmur of 'white noise'. Apparently bland and predictable, noise becomes a blanket background against which a signal appears to stand out as what is least predictable. (MALASPINA, 2018, p. 79).

Noise no longer characterizes only entropic processes related to mechanical work, but increasingly conditions information networks, and even, if differently, the co-emergence of cognitive labour, characterized by information overload and even the 'mental state of noise'. (MALASPINA, 2018, p. 93).

How can we understand this transfer of the idea of noise from mechanics to information, and from its antithetical relation with work in classical mechanics to self-regulating systems with noise, bearing in mind also that the general notion of noise is derived from an aesthetic and moral connotation of acoustic events? (MALASPINA, 2018, p. 94).



Simondon's epistemological appropriation of the idea of transduction is helpful if we want to understand the transformation of this cluster of concepts (work-order-entropy-information-regulation-organization) around noise. (MALASPINA, 2018, p. 94).

The distinction between information and noise is a clear task only for the telecommunications engineer: here the problem is only that of fidelity of a message, after its selection has taken place and only once the decision has been made to transmit this message, whatever it may be, as information. The difference between information and noise derives from this decision alone, as it does from the selection of one scientific model over another. It is this selection that designates something, anything as far as information. It is only on the basis of an always already made selection that the telecommunications engineer or any other statistician can root out any increase in the message's entropy during transmission, which can then be discarded as accidental, i.e. as noise. What remains in the dark, if we consider only the problem of noise in the channel of communication, is thus the part that the accidental may play in the decision to select and designate something, in principle anything, as information. (MALASPINA, 2018, p. 98).

By deferring the choice upon which the distinction between information and noise is based, Shannon renders a hiatus explicit that is tacitly smoothed over, when information is viewed as already endowed with a signification, as an already given *datum* or, in the plural, *data*. The artist Marcel Duchamp revealed this implicit conflation between what is simply given and what is already selected as meaningful, by radically questioning what is acceptable as a work of art. By presenting an open-entry sculpture exhibition in 1917 with a urinal signed with the pseudonym R. Mutt., Duchamp created a situation that rendered the implicit assumption of criteria of pertinence explicit. His riposte to the removal of the piece from the exhibition and to the indignation it caused, is here reproduced in his own words, as a brief question and answer that points to the issue that interests us when thinking about the difference between information and noise, namely the issue of freedom of choice in the artistic process, and in its reception:

(...)

Whether Mr Mutt with his own hands made the fountain or not has no importance. He CHOSE it. He took an ordinary article of life, placed it so that its useful significance disappeared under the new title and point of view – created a new thought for that object. (MALASPINA, 2018, p. 104).

Duchamp's ready-made thus enables us to question the problem of normativity which, albeit in a scientific and technological context that could not seem more remote from Duchamp's concerns, also Shannon enables us to single out: what is transmitted as 'information entropy' is transmitted as raw material, isolated from meaning and value; both the choice that triggers the transmission of something as information and its evaluation upon reception imply a normative process. (MALASPINA, 2018, p. 104).

What appears to offend common sense in Shannon's definition of information is the brutality with which 'information entropy' is presented, like Marcel Duchamp's urinal, as a brute fact, unprocessed by interpretation, denuded of signification, and of its greatest value when at its most unpredictable. Yet, by suspending the question of interpretation and evaluation, Shannon, like Duchamp, also leaves open the possibility that the constraints of interpretation may change, that what may be, under current interpretational constraints, discarded as useless, may on the contrary become highly relevant, if different rules of interpretation are applied. This normative aspect of the selection and evaluation of a contingent fact can now be posed as a condition of possibility of signification. (MALASPINA, 2018, p. 104).

Shannon's very open definition of both information and noise as a pure measure of uncertainty, thus enables us to think of epistemological normativity, meaning the emergence and perseverance of new norms of knowledge, as the act of separating general uncertainty into two kinds: uncertainty we estimate to be of potential use and uncertainty which we deem to be 'spurious', whose pursuit would be 'futile'. Shannon thereby enables us to ask, as Duchamp did: on what grounds do we cut the empirical manifold in two, into what counts as information (or art) and what can be discounted as noise? While the engineer is not asked to assess the message s/he transmits, the scientist, the statistician and even the financial trader must, like the artist, continuously perform a normative act in order to draw and redraw the boundary between relevant and irrelevant empirical contingency, testing and recalibrating running assumptions. Only on this condition can 'a new thought be created', to use Duchamp's expression, for a reality that is never entirely divested of uncertainty. (MALASPINA, 2018, p. 106-107).

The authoritative tone with which a final narrative is traditionally presented as objective implies that we must pass a blind eye on the self-interest of each narrator, who uses, selects and shapes the raw material of empirical contingency into a streamlined informational flow. To this Enzensberger objects:

What he finds is not mere 'material', unintentionally dumped, in pure objectivity, untouched by human hands. On the contrary, everything that you see here has gone through many hands, shows signs of use. (Enzensberger 1977, 16)2

The consolidation of a myriad of narratives into one discursive flow thus masks the murmur of inconsistency, the loss of precision that, like entropy, makes every process, also the discursive process, irreversible. Noise is relegated to the margins of scientific discourse, dispensable and finally cut from the narrative as mere error or imprecision. (MALASPINA, 2019, pp. 116).

As a consequence, we can say that the form and hence limits of every scientific narrative or model are drawn against the backdrop of noise, cut out and lifted from noise with the surgical precision of a theoretical prism. Yet by cutting this narrative or model out from the empirical manifold, knowledge generates an excess that is then discarded as noise: a left over discarded on the other side of this epistemological cut through uncertainty. As mere off-cut, noise becomes the refuse, generated by the process of information itself – that which falls by the wayside, and whose negative connotation as epistemological refuse recalls the Germans call Abfall, and the moral connotation of apostate.<sup>3</sup> This implicit moral connotation is what perhaps explains the anxiety of seeing scientific discourse contaminated with fiction.

(...)

If this selection establishes a norm, by drawing a critical line through empirical contingency, then noise is that which does not conform to the norm, implying a certain threat of subversion of the norm. To quote Jean Cavailles once more:

[T]he empirical manifests its essential fragility in the unpredictability of its characters, in the illegality of sorts that it harbours [...]. (Cavaill.s 2000, 19) (MALASPINA, 2019, pp. 116-117).

Uncertainty falls on the side of noise and excess together with inaccuracy, illegitimacy and illegality.

Consequently, it is not surprising that in the dictionary definition of information also novelty, which necessarily implies a degree of uncertainty, is the least prominent feature and mentioned last. In fact, a single word for the relation between information and novelty suffices: c news. (Allen 2001) 'News' is thus, in the context of this definition of information, expected to serve a purpose, to consolidate knowledge, reinforce order and legitimate the exercise of the law. If these dictionary definitions accurately reflect the understanding of information in ordinary language, then information must be understood as facts and data that serve the consolidation of knowledge and law and order, hence consolidating established power through established knowledge, by reducing uncertainty, disorder and subversion.

What follows is that noise is not, in fact, a straightforward opposite of information in the ordinary sense, since the opposite corresponding to the first and thus predominant definition of information as 'knowledge obtained' would have to be ignorance or uncertainty, rather than noise, which the dictionary defines first and foremost as 'loud, confused, discordant sound, e.g. of shouting; din'. Noise is only secondarily defined in relation to the concept of information, and only in the context of the output of a computer, as

4. Irrelevant or meaningless information occurring with desired information in the output of a computer. (Allen 2000, 945)

The etymology of noise also prioritizes this socio-juridical rather than epistemic tension between information and noise:

Middle English via Old French noise strife, quarrel, noise. (Allen 2000, 945)

On the basis of these different levels of definitions of information and noise, it is worth asking ourselves how it is that noise becomes the opposite of information, in other words how the ordinary connotations of noise as improper and immoral behaviour becomes the opposite of knowledge. (MALASPINA, 2018, p. 134-135).

Conversely when we now speak of noise in statistics, of error in signal transmission or in the logical chain of reason, we must beware of connotations that are as much cultural and political as they are technoscientific. The connotations implicit in the words used in scientific discourse act as a murmur of moral and political values. The value judgement levied against noise, when defined as 'parasitic' on information, thus expresses not only a measure of uncertainty, but also an implicit threat of insubordination to the norm. (MALASPINA, 2018, p. 142).

APUD MALASPINA: [M]aking noise was thought of as barbarian, uncivilized, anti-intellectual and disruptive behaviour – in short, as a lack of self-control. (Bijsterveld 2003, 175).

The historical shifting of the boundary between what is considered a noise offence and what is considered a legitimate acoustic presence and civil right generates not only new social and political norms, but also creates a new culpability of transgression. Noise becomes the excess generated by the acceptance of a new norm. What is at stake here is not only the changing soundscape of modern society, but the divisive and decisive power of norms. (MALASPINA, 2018, p. 149).

In order to shift the lethargy in the perception of the noise problem amongst policy makers, the WHO report pitched the public health risk of noise in the only terms it thinks will rouse attention: namely in terms of the economic impact of noise pollution. Intensive urbanization of large cities in particular raises the problem of noise as a threat to productivity. The reduction of hearing range and even loss of hearing, due to noise, is an obvious example. But also other psychophysiological variables of the city dweller are affected by noise, threatening notably the performance of urban white collar workers:

Noise impairs the learning process of school-children, especially in the phase of speech acquisition, burdens communication in communal spaces with poor architectural design of reverberation and even the increase of aggressive behaviour in 'predisposed' individuals is considered a correlate of noise pollution. Also aesthetic considerations come into play, concerning for instance the report's recommendation to preserve the acoustic serenity of conservation areas (Berglund and Lindvall 1995, vii). (MALASPINA, 2018, p. 150).

'Noise pollution' measures and classifies noise as an object of experience (acoustic noise in the audible range of human hearing), according to its different logarithmic weightings. Information theory, as we have seen in Part One, measures both noise and information as a relation of probability. The two quantitative measures of 'noise pollution' and of 'noise in the channel of communication' thus share a statistical base, but they differ, apart from their domains of application, also in their epistemological priority. (MALASPINA, 2018, p. 153).

'Noise pollution', too, pays attention to relation, by emphasizing context and task specificity – but it still measures the amplitude, frequency and duration of something that constitutes, and is categorized and weighted as, an object of perception: noise. The very term, 'noise pollution', designates a substance, a pollutant. The quantity designated as entropy in information theory, on the other hand, measures the relation of probability of an event, not its ontological characteristics. This degree of probability can also be expressed in terms of frequencies, amplitude or duration, but it is the relation with a set of virtual events of equal probability that characterizes both noise and information in information theory. (MALASPINA, p. 154).

The difference between 'noise pollution' and noise in the channel of communication thus comes down to the difference between a theory of objects of perception, which constitute the terms of a relation between individual and environment, and a theory of relation that constitutes its terms as probable or improbable. This difference may seem irrelevant at this point, but it acquires all its importance if we recall Bijsterveld's historical analysis, where noise becomes the function of a conflictual relation that crystallizes the sociopolitical terms of the relation, both in the form of opposing political groups and in the form of their respective soundscapes. (MALASPINA, p. 154).

By presenting noise as a toxic, but accidental by-product of industrial development and urban density, the WHO report in fact casts a blind eye on the development of technologies for the deliberate use of noise. These technologies aim at exercising a new form of control and at producing a more acceptable show of power than the now unpopular visibility of violent militarization. Research into the psychology of perception and the physiological and psychological effects of noise has indeed become a valuable resource for the development of

military weapons to be deployed in situations where blood-shed is not politically acceptable, and of commercially available deterrent devices, aimed at situations where the visibility of such measures would be detrimental to the perception of a brand. What is striking that the scientific research and technological advances in the field of noise weapons appears to have no productive overlap with available scientific data on the correlation between noise and mental health. It is, on the contrary, characterized by the absence of public information and lack of access to independent experts. In Jürgen Altmann's words:

Acoustic weapons are under research and development in a few countries. Advertised as one type of non-lethal weapon, they are said to immediately incapacitate opponents while avoiding permanent physical damage. Reliable information on specifications or effects is scarce, however. (Altmann 2001) (MALASPINA, 2018, p. 158).

In the specific context of defining the toxicity of noise, however, it still makes sense to speak of noise rather than using the generic term sound. Consequently, reference to Volcler's insights into the military and commercial use of sound with intent to harm will feed directly into our problem of conceptualizing noise.

(...)

Laura Wilson, for instance, analyses the strategic use of low frequencies in avant-garde cinema, with the intention of causing physical and emotional unease, provoking in the viewer what Wilson calls a 'physical spectatorship'.

The conscious processes of perception and cognition and their cultural coordinates are intentionally subverted by inaudible noise, imposing an involuntary physiological response that can be disconnected from to the visual spectatorship of the witnessed scene. Wilson gives the example of a rape scene in the film *Irreversible* by Gaspar Noé, 2002, where noise in the range of barely audible frequencies constitutes an onslaught on the cultural dominance of vision and hence, implicitly, on the role of the voyeur (P. Wilson 2012).

The profound effect on the viewer of barely audible noise is here used deliberately as a critical and subversive technique, in order to high-jack the cultural dominance of vision, and of the male gaze in particular – meaning here not the male gaze as a form of self-perception of dominance in male spectators, or their potential identification with the rapist, but more generally the dominance of vision associated with a sense of power and control, which is culturally codified as a tacit assumption that this power is one of male dominance over the object of his gaze. (MALASPINA, 2018, p. 159-160).

By targeting the preconscious substrate of perception, and manipulating the physiological and affective dispositions of those exposed, audible and inaudible noise becomes effective in bypassing the cognitive functions not only of individuals, but of groups and potentially of entire populations. Steve Goodman's *Sonic Warfare – Sound, Affect and the Ecology of Fear* in fact argues for the idea of a 'sonic ecology', less in terms of noise pollution, than with respect to what he sees as a wholesale assault on perception, by means of technological mechanisms of fear production. In addition to the already mentioned use of noise as weapon or threat, and even artistic subversion of traditional codes of perception, Goodman draws our attention to the urgent need for a critical understanding of the way in which acoustic ambience in general is being manipulated – ranging from branding experiences to the induction of a general sense of unease, and even of fear or dread, notably by mobilizing the periphery of auditory perception or what he calls the 'unsound' of vibrational environments. Interestingly, he speaks of a transduction to describe the propagation of affective tonalities that modulate collective dispositions of fear and anxiety, and thereby potentially ready the ground for the reception of ideologies (Goodman 2012, xx): (MALASPINA, 2018, p. 160).

The problem of noise now reaches a theoretical crossroads, characterized by a dynamic correlation of scientific formalization, technological regulation, psychosocial convention and, not least, the act of perception (understood as an act of self-determination of criteria of pertinence, vulnerable to affective dispositions). This conceptual crossroads is relevant for anyone who wants to understand the transdisciplinary appeal of noise. (MALASPINA, 2018, p. 167).

The problem raised by Goodman's notion of 'sonic ecology' is that of recognizing within the process of cognition also the possibility of inclinations, of affective dispositions and hence also of the possibility that cognition is 'contaminated' by a pre-cognitive ground of experience. When noise is thought in epidemiological terms and presented as parasitic upon the conscious processes of perception of its host or, importantly, host population, then what we are potentially dealing with is a bio-politics of noise in the Foucauldian sense. The critical problem is thus not to determine noise 'in itself' or even 'for us', but emancipation: because it concerns the power of judgement and the power of control over its pre-cognitive ground. (MALASPINA, 2018, p. 167).

This correlation between noise and cognition, between noise as distortion of information and noise as a factor of the distortion of cognition, emerges as an important aspect of the conceptualization of noise. Any philosophical enquiry into rationality, human agency and collective self-determination must therefore arrive at an understanding also of the state of indecision and confusion associated with noise – a state to which information and knowledge

are temporary and always fragile solutions. Any epistemological enquiry into the nature of knowledge, finally, must contend with the role of noise as lived ambiguity, indecision and error. (MALASPINA, 2018, p. 167).

When introducing the distinction between fear and anxiety, as between fear of something and fear of the inconceivable, Goldstein puts the catastrophic reaction into an explicitly philosophical context: 'I am thinking of Pascal, Kierkegaard, Heidegger' (Goldstein 1983, 250). An existentialist orientation in Goldstein's thought could be further pursued here, by referring notably to Sartre's *La nausée*. But what we seek in Goldstein's concept of the 'catastrophic reaction', in the broader context of our argument about the epistemological aspect of noise, is

his attention to anxiety as the fear of the inconceivable. It is less an existentialist *état d'âme*, than his definition of disorder that is of the highest relevance to our considerations about noise:

What does disorder mean in this case? It goes without saying that objective disorder does not exist any more than objective order. Disorder means an arrangement such that it imposes no single, determined perspective, nor a unique mode of utilization, but allows several or even many. Total disorder (if it were possible) would, however, impose nothing, but freedom of choice. (Goldstein 1983, 39)

The catastrophic reaction is thus characterized by the rigid negation of all contingency. It is what we could call a catastrophically negentropic attitude. Its stability is in fact rigidity, a state of control petrified in an inflexible structure. The only certainty it avails is the avoidance of all ambiguity and complexity. Disorder for Goldstein means, as entropy did for Shannon and Weaver, 'freedom of choice'. (MALASPINA, 2018, p. 167).

To oppose order to noise thus continues to imply that disorder, uncertainty and error are the negation of a rule, of purpose, use-value or work. In this light the entire enterprise of rational and scientific discourse, in so far as it relies on the idea of order both in discourse and in the empirical world, must be understood as the assertion of the power to impose order and purpose where confusion, error and uncertainty loom large. This power, perhaps, is nothing other than the more or less successful attempt to exercise control, temporarily, in the midst of the fundamentally contingent unfolding of events that accounts for time's historical irreversibility and for the future's irreducibility. (MALASPINA, 2018, p. 202).