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Noise and signal as ground and figure: Emergence and interference in media ecologies

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This paper proposes an interdisciplinary and generative understanding of noise that can be useful for thinking critically about art across different media ecologies. This notion of noise would be the counterpart of an intensive concept of information, such as the one presented by Gilbert Simondon. Unfolding a remark made by that author, the paper proposes three distinct notions of noise, as correlated to "pure chance", "form", and "information". The noise of "pure chance" describes events of chaotic disruption and interference. The noise of "form" describes an index of the materiality and historical contingency of any transmission. The noise of "information" describes the irreducible margin of indeterminacy that is present at every layer of informational transmission and reception. An artwork created by Nam-June Paik is taken as a concrete demonstration of these three different kinds of noise. More generally, following sound theorist Aden Evens, an argument will be made for a speculative understanding of the signal in artistic practices as an emergent configuration from a ground of noise. To expand this idea for all media, we will explore the figure–ground relationship in the philosophy of Simondon as a scheme for the generation of forms from latent structural potential in a field. The work of Cécile Malaspina is used throughout the paper to clarify some confusions around the concept of noise and lay down the groundwork for fertile and rigorous interdisciplinary research across different media. The ambiguity of the concept of noise should not let us turn it into a night where all cows turn to greyscale. Instead, we should regard noise, in its distinct modes, as a marker of the granularity, speed, and resolution of any actual transmission and reception of information.

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Introduction: media ecologies and the ground of noise

"The noise is the system"

Alliah, Metanfetaedro

"'the essence of ground… can only be what precedes all ground"

Schelling

In 1964, physicists Arno Penzias and Robert Wilson could not understand where all the noise in their radio telescopes was coming from. They even cleaned the encrusted pigeon waste, hoping it could be the source of the unwanted interference. What they discovered, however, is that the noise was simply the cosmic microwave background, a trace of the universe's infancy, to some, a demonstration of the Big-Bang cosmological model (Strogatz, 2004, p. 207). Distinguishing between signal and noise is often much less trivial than it initially may seem.

The goal of this paper is to provide an interdisciplinary notion of "noise" that might be helpful for the critical study of media ecologies (and, particularly, to any theories of information that are oriented to intensity and transformation rather than quantity and operation, such as Gregory Bateson's or Gilbert Simondon's).

Here, the notion of "noise" should be understood in three distinct senses. Following Simondon's own suggestion to information theorists, I begin with an operational distinction between "pure chance, form and information" (Simondon, 2012, p. 190). My supplementary suggestion is that each of these three domains have their own correspondent mode of noise. Distinguishing between these three kinds of noise may help us better understand the many ambiguities that follow the use of the concept.

The noise of "pure chance" describes relations of disorder, disruption, and interference. Noise here is the undesirable, but ultimately inescapable, adversary to any transmission. As we will see, even this dimension of noise can have a generative dimension, although a weak one.

The noise of "form" describes selective historical traces of mediation, concrete indices of the material contingency of the historical chain of production. As we will see, is a kind of noise that can embody affect and mood and that can even carry information (in the sense of carrying traces of the network responsible for its concretion).

And, finally, "noise as "information" describes the margin of indeterminacy that is an irreducible part of the actual transmission of any signal. That is: noise in this sense is taken to be the ground of contingency that is at play at every ontogenetic layer of a transmission or inscription, and that can be understood as their ultimate genetic ground of historical structuration (I will explain what I mean by all of this).

In these three distinct senses, the concept of noise retains at its kernel the relation between "contingency and control" (Malaspina, 2018, p. 201). These distinctions do not describe any particular medium involved in the transmission, but merely try to address the different degrees of structural dynamism that an intensive understanding of information and noise may encompass. The idea is that these three modes of noise may occur throughout all media, and concrete examples will be given along the way. In these three distinct domains, the figure-ground relationship will take on a distinct kind of dynamism. And hopefully the appropriate jargon will be properly unpacked in the following pages.

My goal is basically to provide a theoretical distinction which, along with its necessary contextualization, might help prevent some of the most immediate confusions that arise around the idea that noise can have a generative dimension. To say that the signal, in a deep sense, emerges out of noise does not mean eradicating the distinction between the two and calling for a fundamentally relativistic understanding of what meaning is, or anything of the sort. Nor is it simply a naive naturalization of our own epistemological limits, as René Thom believes (Thom and Chumbley, 1983).

Chaotic disruption and interference (noise as pure chance) are not the same as layers of error and material trauma that are embedded in every gestural chain of transmission and inscription (noise of form), and these layers are also not the same as a field of indeterminate potential as the ultimate ground of every formation (the noise of information). However, it seems that *all* of these dimensions of noise could be immediately relevant to critical accounts of media ecologies. And giving each dimension it due can help understand the distinct senses that noise can take at different phase of ontogenetic formation. But first, then, we must first begin to explain what we actually mean by a *generative* understanding of noise.

The basic attempt that underlies the following discussion is to understand signals as emergent configurations of an extended field of noise (this is, in a sense, true about every kind of transmission or inscription, although not in the same way, a I hope will be made clear). Although the idea comes from the study of sonic events, following an insight from sound theorist Aden Evens (Evens, 2005, p. 15), I will sketch a version that can also be applied to all media.

In fact, this understanding of the emergent signal as contrasted by a background of noise seems to resonate strongly with the figure–ground relationship as it is deployed in the philosophy of Gilbert Simondon, a schema for visual perception from Gestalt psychology that he amplified and generalized to the point of becoming a paradigm for the generation of forms (we will return to this later).

In this direction, I propose that a generative ground of noise would be the necessary ecological counterpart of any intensive concept of information. The term "ecology" is used quite literally here to describe the collective and systemic dimension of any medium, as well as the structural and energetic dependency of any individuation on its environment (as argued by media theorists like Jussi Parikka and Matthew Fuller). Much like any being is inextricable from its environment, any signal is inextricable from its noisy background.

Information may always keep a sort of adversarial relation to noise, but they are not logical opposites; the existence of one does not quite exclude the other. We can say that, in ultimate terms, noise and information stand to each other as a polarity, rather than as an opposition. As stated by Olga Goriunova: "Pattern and randomness, and pattern and noise do not exist outside each other. If pattern is information, noise is not non-information; information encompasses and functions in relation to both pattern and noise" (Goriunova, 2015, p. 187).

In all media, from sound to video (and maybe even organic life), it can be argued that information is always actually constructed in a continuous and meta-stable state of generative contrast against a background of noise. According to Susan Ballard, noise is "both the material from which information is constructed as well as the matter which information resists" (Ballard, 2001, p. 62).

It should be noted that Simondon does not explicitly connect noise and ground. In fact, it could be said that, at least at first, Simondon's explicit understanding of noise mostly seems straightforward and orthodox (that is, a source of interference and random variation). However, I believe that there are elements in his own concept of information—and in his philosophy as a whole—that allow us to understand noise in a more expansive sense. As Malaspina suggests, even though there are moments in

which Simondon seems to agree with Wiener's unequivocal distinction between noise and disorder, information and neguentropy, there are other moments in which he "does not shy away from the challenge of conceiving of information as that which, from a certain perspective, can be said to disappear into the 'fog' of white noise" (Malaspina, 2019, p. 7).

For Simondon, information is an intensive and relational process, and not a question of mere probability. In this important aspect, Simondon distinguishes his notion of information from that of Shannon and Wiener, but he would have possibly agreed with the phrasing of another participant in the Macy Conferences, Gregory Bateson, and his understanding of information as a "difference that makes a difference" (Bateson, 1978, p. 459). That is, both understood that information never exists as disconnected data, but always as a relational becoming that produces some sort of change between at least two disparate systems.

But before we directly address each of these three dimensions, let us first clear some of the ambiguities that abound in the concept of "noise".

What to do with the noisy concept of noise?

Over the last few decades, the concept of noise has appeared in all sorts of theoretical work, and, perhaps predictably, creating a lot of confusion. As Cécile Malaspina points out, noise can be seen "here obscuring the clarity of a message, there causing genetic mutations or signifying the random input from the environment" (Malaspina, 2012, p. 65). In her opinion, the difficulty in holding on to a specific technical sense arises not only out of a lack of a transdisciplinary conceptual definition, but also due to fluctuations between theoretical contexts: "As, for instance, its quantifying role in physics and information theory, its metaphorical role in the life sciences and finally its role in probabilistic or deterministic theories" (Malaspina, 2012, p. 66).

Malaspina proposes that the versatility of the concept of information, although problematic, could be a direct consequence of Shannon's original formulations. The equations describing thermodynamical entropy and informational entropy are almost identical, but whereas Boltzmann's entropy equation has a direct reference to physical reality (by being multiplied by a constant, *K*, entropy as non-usable heat), Shannon's equation has no such reference, which means it can serve for phenomena bearing any mass whatsoever, abandoning the calorific dimension to describe and measure a pure probability (Malaspina, 2019).

In other words, thermodynamical entropy is based on the principle that a system's energy tends to level and dissipate with its environment (a cup of hot water will eventually become room temperature), but informational entropy is based on *any* distribution of possibilities. Again, according to Malaspina that is what endowed the concepts of noise and information with their capacity to "relate across otherwise heterogenous and incompossible domains of knowledge, from the physical to the biological sciences, from the socio-economic to political sciences in a transductive analogical relation" (Malaspina, 2012, p. 68).

The transductive power of the concepts of noise and information, however, should not seduce us in a way that *dissolves* the differences across domains. We will see that Shannon and Weaver's concept of information as entropy harbors and produces its own kind of ambiguity. This paper proposes a more expanded and generative notion of noise for the study of media ecologies, but taking special care not to erase the distinctions and foster unhelpful conflations.

We should not let the concept of "noise" turn into a night where all cows turn greyscale. Instead, let us explore each of these distinct dimensions—chance, form, and information—and see how these distinctions could hopefully contribute to an intensive informational understanding of our ecologies of art and communication.

Noise and chance (chaos, disruption, and interference)

The two most immediate senses of noise, of course, are usually negative. They describe either a sonic disturbance or a technical impediment in the transmission of information. In the second case, it may result from random fluctuations in devices or from outside sources of interference. However, even in this restricted and technical sense the notion of noise is ambivalent.

We have mentioned Wiener's concept of information as pure probability, but we must highlight that Wiener also equated information with neguentropy, putting information and disorder in a strict and unambiguous opposition. That is not the case with Shannon and Weaver's 1949 formulation.

According to Katherine Hayles (1989), Boltzmann has interpreted entropy as a statistical measure of disorder since 1877. However, when Shannon equated information and entropy, he suggested that some forms of disorder could be seen as the presence of information, instead of just the absence of order. If, for Norbert Wiener, there is a simple and inverse relationship between information and entropy (information resists entropy and disorder), Shannon's "audacity consists quite simply in correlating both information and noise with uncertainty" (Malaspina, 2018, p. 15).

If we understand the informational content of an event to be related to the inverse probability of its outcome (like Shannon did), then something highly unpredictable such as a chaotic system can be maximally informative.

This fundamental ambiguity in Shannon's theory of information, the suggestion that some forms of entropy could be considered maximally *surprising or improbable*, is well illustrated by Joyce's language in "Finnegans Wake". A superficial contact with the book will quickly show that its mixed oneiric style can be read as if it made no sense at all, a musical hallucination only remotely tied to the rules of ordinary speech, *total noise*; or rather as if it made every available sense, with each turn of phrase containing an impossibly compressed amount of brilliant and shameless puns and allusions, countless possible external and internal references, resonances and echoes with what has already happened in the book and what is yet to happen, a kind of *total signal*. In fact, while reading the book it is hard not to sway between both poles. To this day, Joyce's style in his last work is one of the most violently complex manipulations of the structural redundancy of language and the generative limits of noise and nonsense ever devised.

We know that the connection between "noise" and disturbance can have countless reverberations, but it also leads us directly to the sonic dimension. In music, noise can be roughly defined as any unpleasant or unwanted sound, unruly in face of codification. In 1913, the Italian futurist Luigi Rossolo writes his "Art of Noise", announcing a new world of mixture with the machinic sounds of the industrial environment. In the forties, John Cage ventured into new and wild territories of noise and indetermination in composition and theory.

When it comes to popular music, rock and jazz were already called noisy by its critics since their conception, but we can perhaps say that it was in the seventies that noise became a central element of many popular subcultures. In 1975, the *Sex Pistols* appear, Lou Reed's *Metal Machine Music* is released (ridiculed by many, considered by Lester Bangs to be the greatest album in the history of the human eardrum), and the *Throbbing Gristle* group was formed, performative pioneers of industrial music that embodied the material aggressiveness of noise throughout the entire production circuit.

Edgar Varése had already said, decades before, that every new thing in music is called noise, but for Jacques Attali (1985), author of the influential "Noise: essay on the political economy of music", sonic noise would be a disruption of the current order and a source of prophecies for new political compositions. The practical and technical definition that an era makes of what is noise always has deep connections to the dynamics of social production and reproduction. Noise is the unconsciousness of music, as the japanese noise artist Merzbow said in an interview late last century (Hensley, 1999).

For Attali, the codification of noise is always a sort of control of social forces. Besides the most immediate musical dimension, this distinction also points to other distinctions between what is public discourse and what is nonsense, what constitutes an acceptable grammar of public protest and revolt and what is simply considered as 'mere' confusion and chaos.

If, at its most intense, sonic noise "disorganizes your body" and "disrupts the organization of your organs", like Felicity Colman (2012) says of a *Sunn O)))* concert, that is because it addresses one as matter. You can feel it in your lungs, in your throat, it can turn you inside out. This aggressiveness of noise is not only symbolic, of course, but quite fleshy.

Listening to a concert of sonic noise is something one does with one's whole body, something one feels in the thickness of the surrounding air, and that can easily hurt. In a very literal, even farcical, demonstration of the aggressive nature of sonic force, the U.S. Military has used the music of groups like *AC/DC* and *Guns N' Roses* in the siege of Fallujah (Malaspina, 2018, p. 158) and other military conflicts, and has weaponized sonic force in crowd-control devices such as the long-range acoustic device (LRAD)[1].

The sheer sense of violence in noise, however, does not mean that it keeps a pristine potential for social transgression. For decades now we have had tamed and toothless territories of noise in image and in sound, both boring surges of juvenile energy and comforting (even cute) quilts of indistinct sound mass. That is the predictable arch of any successful *avant-garde* grammar, from surrealism to punk.

After all, if noise is understood as a transgression of conventional sonic rules, the fact that its formal features have come to be under some degree of deliberate modulation and control for decades must mean that this source of transgression is also being gradually domesticated (at least to some extent).

It is important to note, however, that the notion of disruption and chaotic disturbance is not only understood to be potentially generative of new rules inside the domain of esthetics. Ilya Prigogine presented his famous dissipative structures (and the idea of order through fluctuation) in the fifties, and there have been many developments in the study of the emergence, complexity, and self-criticality in dynamic and non-linear systems ever since. One of the first to present the theoretical possibility of order being created from noise inside information theory was Heinz Von Foerster, a father of second-order cybernetics. His famous and nifty example (Von Foerster, 2003) is that of a box filled with separate magnetic pieces, which, when shaken, would be made to connect, creating more order in the system with no injection of additional information (besides a disturbance, which can be understood as a sort of noise). The general idea is that violent perturbations can push a system to the latent attractors that were already present, thus reaching a more stable configuration (it would not, however, explain the previous *formation* of these attractors).

Besides the possibility of order emerging from disruption, there is also the similar possibility of noise triggering new responses in the form of a source of radical environmental fluctuations. The biophysicist Henri Atlan (1992), who studies the self-organization of complex systems in molecular biology, points out that a balance between redundancy and variety is needed to maintain a complex system running (following Ross Ashby). You need to reduce noise to allow for the efficient transmission of information, but the ability of being receptive to noise is also necessary to bring variety to the system, eliciting new responses from the environment's fluctuations. Atlan (1992) distinguishes his own version of order through noise from Von Foerster's, explaining than in his version there would be an increase of variety and a decrease in redundancy, whereas Foerster's order-through-noise would come as an increase in redundancy.

For Atlan (1992, p. 51), errors and disruptions would be progressively integrated as organizational factors. The effects of noise on a system would become an event on the history of that system's organizational process. Atlan also insists, however, that this apparently paradoxical possibility of complexity on the basis of noise comes from the very limits of our conceptual models. This 'positive' notion of noise would be a somewhat *distorted* way of re-introducing signification inside a theory of organization that is purely quantitative.

Some authors see these attempts to produce a generative notion of noise across diverse fields of thought as fundamentally misguided. The mathematician René Thom understands Atlan, Serres, and the philosophical extrapolations made from the dissipative structures of Ilya Prigogine to be all guilty of textually overplaying the role of indetermination in these processes. Thom believes that this fascination with randomness would be, in fact, anti-scientific (Thom and Chumbley, 1983, p. 11). He sees in the work of these authors a literary inflation of the notions of chance and chaos that, to his mind, neglects to understand the fundamental deterministic structures at play in all these supposed instances of generation of order from disorder. To confuse our own regions of uncertainty with fundamental building blocks of nature, for Thom, would be akin to giving up on the possibility of clearing up that region of uncertainty.

While his cautiousness is appreciated, and acknowledging that I am perhaps navigating in waters I have no business navigating, perhaps we can venture that he is exaggerating the role of the notion of 'chance' implied by most of these authors (with the exception of Serres (1980), to which his criticism seems, at least to this reader, somewhat adequate). If we replace Thom's 'chance' with other qualified parameters of indetermination (with Simondon's transductive amplification of the *ápeiron*, for instance), perhaps this so-called literary inflation of 'chance' can be otherwise understood.

The case of Penzian and Wilson is a striking example of how ambiguous the notion of "interference" can turn out to be, in practice. In that case, what seemed like random noise turned out to be the selective form of a highly informative historical trace. Which promptly leads us to the second dimension.

Noise and form (or, rather, noisy form)

The notion of "form" that is suggested in this threefold distinction that we deploy here is not a "strong" one. It is "form" as *natura naturata*, so to speak, not form as *natura naturans*. "Form" here means both a kind of selective historical trace and a passive structure for the reception of new information. For the purposes of this paper, we should understand it as historical strata that inscribe in their own contingent configurations the formal layers of their own ontogeny (that is, of their own growth and development).

Here, noise would not mean pure chance and interference, with eventual disruption and re-configuration of rules, but rather all those historical contingencies that are embedded in actual forms but that were not actual information (for that particular signal, at any rate). This would mean errors in transduction and

transcription like genetic mutations, yes, but also any a-signifying singularities that may be caught up and amplified along the chain of transmission.

To put it more concretely: whenever we hear the crackles and the singularities of timbre in a sound recording, we are listening, whether we want to or not, to the cumulative series of technical and natural contingencies that constituted that event. We are listening not only to all the non-linear fluctuations on the instruments, on someone's throat, the slight decisions of the musician's gestures, but the traces of microphones, cables, amplifiers, tables, jacks, and all the environment in which the recording was made; besides all the deliberate modulations and modifications that are overlaid by the producers and sound engineers, all the sound editing software (with its pirated or legal plug-ins, etc.).

When we hear a recording from "The Tincoãs" from the 1970s, the forms that we attend to are not only the deliberate and meaningful gestures of the musicians, but a whole chain of contingency that is captured, from the air of the studio to the skin of the drums (if you want to stretch the operatory chains far enough, they can encompass the gestural memory of the percussionists to the military–industrial complex that produced the recording devices). The actual song as intentional formal structure cannot be distinguished from its attending accidents of noisy transmission and amplification, its existence as a concrete historical network.

Like the sound theorist Aden Evens suggests, we can understand that in artistic practice it is the always the noise: "that binds the signal, that serves as a medium, a baseline, a plane of relief against which signal stands out" (2005, p. 15). Evens is talking about music, and how any discrete sound will always come as a disturbance or irruption in a previous pool of uncontracted noise, but I hope the following argument will help explain how we can apply this notion to all artistic media.

In his text "Floating the social", Massumi (2012) proposes that Evens' understanding of noise would be related to philosophies of ontogenesis and emergence, as well as to the work of artists like John Cage. Massumi extends Evens' image in its full topological dimensions:

Signal stands in relation to noise as a mountain rises from the continually shifting ground. A mountain is mute testimony to the past action of forces of emergence of the earth, and to the certainty that future tectonic shifts will continue to reshape the landscape. Like a peak, signal stands out against the generative, and regenerative, forces of its own tectonic formation (Massumi, 2012, p. 46).

This image suggests that much like we can assess in geological formations the historical trace of its material constitution, we can find in the distinct strata of noise of a given transmission a sort of genealogical trace of the ontogenetic formation of the signal and its medium. This means the collective network of human and inhuman interaction behind any artifact, in its extensive historical chain of production, but also the wider relational web of nature (as the general fabric of cosmic expansion).

However, to understand what this might mean in a deeper sense, beyond the genealogical trace of gestures and networks, we have to turn to the figure–ground scheme in Gilbert Simondon's philosophy.

Simondon adapted this scheme from Gestalt psychology, a school of psychology that emerged in Germany and Austria in the early 20th century, focused on establishing the fundamental structures of human perception. They came to propose the notion of "good form" as a stable configuration of a dynamic whole, and not merely a sum of discrete parts.

Simondon criticizes this notion of a good form as insufficient, stating that a fertile form would not be the most stable but, actually, one that is able to harbor many different kinds of dynamisms (which would have been previously incompatible). Still, he generalizes and transforms the figure–ground scheme borrowed from Gestalt psychology into a paradigm for the generation of forms[2]. Building on the work of Danish psychologist Edgar Rubin—the inventor of those bi-stable, or reversible, contrasted figures such as the "Rubin's vase"—the figure–ground relationship became for the Gestalt group one of these fundamental cognitive schemes. With this much Simondon would seem to agree, since he uses this scheme throughout his work, highlighting the analogical dimension of the shift from ground to figure in radically diverse contexts. In fact, Simondon uses it not only to explain processes related to individual human perception, but also to describe diachronic and collective cultural processes (in his strange triphasic theory of culture). We will focus here on his more detained description of the scheme in *Du Mode d'Existence des objets techniques* (*On The Mode of Existence of Technical Objets*).

Simondon (2012) distinguishes his use of the scheme by underscoring that, in spite of the initial focus of the Gestalt researchers, the determining, energetic role in the creation of forms is not in the *forms themselves*, but in that which contains them (that is, in their *background*). Marginal to our attention, the background is nonetheless, for Simondon, the field that harbors the dynamisms responsible for the generation of forms. This is precisely what matters for my argument.

In what I would submit is a strong metaphysical statement, Simondon (2012, p. 70) says that forms do not participate in other forms, but in their background. The participation of forms in their background would be akin to that of the virtual in the actual, of the future in the present.

It is in light of this statement that I believe an expanded concept of noise can be analogically understood as the actual ground for the emergence of intensive informational signals. It is in this sense that any actual signal would be closer to being an emergent property of an extended ecological field of generative noise than to being its strict opposite. The important thing is to understand that it is the participation of the virtual in the actual that I am trying to highlight in connection with the understanding of noise and signal as ground and figure.

Actual forms emerge from the dynamisms that are latent in a background much like concrete signals always emerge out of a noisy interplay of different strata. This can be understood in the immediate sense that when we perceive anything we do so by contrasting it against a background that is not what we perceive, but it can also be understood in the sense that the reality of transmitting and receiving signals is always a gnarly and bumpy chain of mediation between scales, a polyrhythmic assemblage of durations, and when *anything at all* emerges it always does so in a process of contrast against the ground of its own production. Throughout all scales, forms emerge out of a meta-stable ground of potential, with no pre-formed solutions, but rather through the transductive amplification of dynamic sets of operational constraints. Any actual existing form is the testimony of this noisy historical contingency of nested and interlocked rhythmic operations.

It should be highlighted that the depth of this extended sense of noise for ecological theories of art does not merely point to the materiality of media by way of error and miscommunication, ideological distortion, and compression (a dimension of noise that has been well-covered in recent critical discussion). These dimensions matter, naturally, but even in the most seamless, high-fidelity transmissions, we need to face the abyss of noisy contingency that is at play at the ontogenetic formation of any particular historical stratum.

The network's noise is always somehow made present in the signal, in finer or coarser grain, and sources of noise that

interrupt and intrude in the production or repetition of a composition may end up becoming a part of that composition's ultimate actualized form.

Being open to the noise of form means being open both to the extreme material determination of artistic production—the fact that every game is historically contingent, every repertory is materially limited—as well as to the perverse polymorphism that esthetic concretion allows for in the coupling of bodies to disparate material appetitions (we never know what a game is capable of until other bodies activate it). There is always, both at a deep level and at the surface, a margin of indeterminacy in any actual system of transmission and reception of information.

Which takes us to the third dimension of noise.

The Noise of information (the irreducible margin of indeterminacy)

"Technical production seeks to reduce the margin of variability, of imprevisibility. Real information that modulates an individual appears as a parasite; it is that through which the technical objects remain to some extent inevitably natural" (Simondon, 2005, p. 50).

Finally, we come to the notion of noise as the very ground for the emergence of information. I do *not* wish to address the fundamental problem of order arising from disorder, or of complexity arising from simplicity, under the guise of an informational sign that emerges out of a primeval noisy field. What I am trying to do is to provide an interdisciplinary notion of generative 'noise' that might be useful for the study of media ecologies.

Perhaps this distinction can be helpful: a "hard" theory of generation of signals from noise would claim that all complexity emerges from conditioned indeterminacy, that is, from a progressive and recursive process of structural differentiation that lays layer upon successive layer of historical concrescence on top of an initial noisy "àpeiron", or energetic ground of indeterminacy. In this sense, there would be an ontological primacy of noise over the signal, just as there is a primacy of the abnormal over the normal for Canguilhem. Every kind of signal, then, from the deepest to the most superficial strata, from mountain ridges and goats to symphonies and cartoons, would come from the underbelly of a noisy play of contingent energetic structures.

A "soft" theory of generation of signals from noise, however, such as is tentatively presented here, does not venture to guess at the fundamental nature of form-taking, but simply tries to describe the existing ecological networks of artistic production of information such as they are presented to our contemporary experience, in terms which can be helpful for critical discussion.

Simondon clearly states that actual information always needs some degree of indeterminacy, which he calls a margin of indeterminacy[3]. He also claims that every artificial modulation points to an essential modulation—a hazy ground that is present on every transmission.

This comes partly from the fundamental discreteness of electricity, but what it means is that the channel that modulates energy to carry the signal also carries noisy thermal entropy along the way. This must mean that there is a "co-naturality" between noise and information that is not to be reduced to 'harmonic distortion' or deformation (Malaspina, 2019, p. 8). In this respect, Simondon understands information to be *like the chance event* (but still distinct from it, which he calls a *technical antinomy*). As remarked by Malaspina, this is a long way from Wiener's understanding of information as neguentropy.

Every intensive process of signification can always fall back to the hazy ground out of which it emerged (including, right now, your attention while reading this sentence). It only exists as a meta-stable negotiation between the discontinuous signal and its material ground of intensive concretion. Information is neither here nor there, it is always a halfway house between pure chance and absolute regularity. It is a tensive process of mediation between noise and signal, and not the abstracted or disconnected bits of data. It is an active state of noisy tension between disparate systems, and never a stable set of static patterns.

The essential modulation by any signal is its own noisy ground of concretion, a ground that is composed both of the material medium of transmission and its environment, in their many ecological layers of interlocked energy and structure. In this sense, the ground of noise would be the very dimension of infinite intensive variability in any actual transmission and reception of vital information. Information is not noise, the distinction holds, but the limit between them is always tense and problematic. The cutoff between signal and noise is frequently turning itself inside out, so to speak. It is never a clear or unambiguous cut line. Signals are always concrete historical coefficients for possible relational intensities, and not ideal emanations of an abstract emitter.

In a way, to give noise its due means simply to acknowledge that actual processes of transmission and signification are always messy and equivocal, situated and entangled. The ground and figure may reverse, what was until then a negligible point may accrue sudden unexpected gravity and urgency, a violent source of interference can come and destroy the current system, creating an entirely new one.

Giving noise its due, like did John Cage and Nam-June Paik, and like the artists and theorists Gabriel Menotti, Hito Steyerl and Rosa Menkman all still do, also means acknowledging that disruption and even randomness can have generative effects in some ecologies of production. It certainly does not mean erasing the distinction between noise and information or claiming that everything comes from noise as a sort of mighty pagan God of the Aleatory.

Indetermination is not simply randomness, the *ápeiron* is a formless ground, but it's not quite chaos. Any materialist ecology of media should understand that all elements in the technical chain can offer their own kind of noise, and every level or plateau of artistic and bodily concretion of intensity can offer their own unexpected dimensions of erotic tension and modulation, including noise. The grain of noise is present at every layer or production and reception, and it returns whenever the thresholds of sense are surpassed or underachieved, standing at each limit of our measurements and predictive powers.

A concept of noise that might work as ground to the figure of the signal would have to be both genealogical (as the noisy trace of the past that is unavoidably available for formal selection) and indeterminate (as the concrete tingling of contingent actualization).

Being an index of the highest improbability, and thus of "unthinkable freedom of choice", in Malaspina's (Malaspina, 2018) expression, this expanded field of noise as the signal's ground would constitute the intensive and extensive (energetic and structural) grounds of creative possibility. Sediment of the past as well as grain of virtuality.

Here, we refer to the figure–ground scheme in Simondon not only in this immediate dimension of perception, but also in the diachronic sense of long-term cultural metabolism (like the anthropology of Roy Wagner, but with vastly different theoretical outcomes). There is no space here to explain Simondon's strange tri-phasic theory of culture (in which a primeval magical phase unfolds into the weaker but more systematic bifurcations of technics and religion). Let me just say that, for him, the figure-ground scheme seems particularly useful to understand these large collective processes of historical transformation, as well as

the generative processes that might lead to new configurations of society.

The tensive relationship between ground and figure can shift to bring new figures to the foreground and to elicit new collective structures from the background. Invention always comes out of the noisy margin of indeterminacy, forms always come from the background that harbors their generative dynamisms. Information is never decided beforehand, it is always a concrete and contingent transformation between systems. No cast of the die can abolish noise.

From noisy interference to form and information: Nam June Paik's "Magnet TV"

> "The main reason for the quick success of my electronic art was… my efforts on the creation of unusual scanning patterns."
>
> Nam-June Paik

Let us see how these three distinct meaning of noise can be articulated inside a single artwork, Nam June Paik's *Magnet TV*. Paik was born in Seoul in 1932 and began his career as a musician, having been greatly influenced by John Cage, as well as by other members of the multi-media collective Fluxus (which gathered artists like Yoko Ono, Lamonte Young and Joseph Beuys, besides himself). This piece, one of his many prepared televisions from the 1960s, consisted in the placement of a big magnet on top of a vacuum tube television set. The magnetic field distorted the image on the screen, forming abstract patterns, and by moving the magnet's position one could also move the abstract forms projected on the screen.

The idea of manipulating images on a screen—now so trivial—was still far from being a possibility for the general public at the time, which meant that Paik's intervention, although technically very simple, could transfigure the device and its relational disposition quite radically.

In a 1984 interview, Paik says that in order to outdo Duchamp's readymade he tried to discover how it was made, and from that he decided he wanted to mess directly with protons and electrons (Joselit, 2007). That is pretty much what he does here, creating with this technical miscoupling the possibility of an interaction that is both disruptive and intuitive (since the trajectory of the electrons traveling through the cathode tube can be analogically manipulated by the magnet). The patterns can be easily confused with a human esthetic intention. But what we see is not exactly the subjective formal impulse of a human being, but the interaction of electromagnetic forces that usually rest encapsulated inside a controlled technical circuit[4].

David Joselitt argues that Paik's interferences with televisions took the readymade a couple of steps further, in fact. Paik did not incorporate, from Duchamp, merely the placing of conventional objects inside an artistic context, but the gesture of producing a paradoxical object in perpetual oscillation. In his televisions, Paik gave us the readymade as a network composed of informational codes (Joselit, 2007). The gesture is both parasitic and systemic, as Joselitt correctly noted.

If a television, like most technical media, works by making its mediation disappear, Paik's artwork allows us to see, through cartoonish mutations, elements of the television's innards as well as of electromagnetic interaction in general. That is, a small part of the circuit of recurrent causality that produces the protocol of television (to speak in Simondonian terms) is transfigured and made apparent by his interventions.

The disruption of a system of rules creates "form" through interference from another system of rules, which in its turn is actualized as information by those that receive Paik's artwork as an informative gesture, made meaningful inside the parameters of an ecology of art production and reception. But it is precisely the third dimension of noise, the irreducible margin of indeterminacy, which is perhaps central to most of Paik's prepared televisions. Paik (2002) himself writes in the introduction to his first TV exhibition that "INDETERMINISM" and "VARIABILITY"[5] were the two yet undeveloped parameters of visual art (which he was trying to stimulate or manipulate).

Paik also remarks, in a later interview, that he initially wanted to place the magnet in front of the television, not on top of it. Someone else placed it there during the installation, and Paik embraced this happy accident when he saw the result (Zinman, 2013). This means that the piece emerged as a noisy accident that was simply incorporated inside the formal structure of the exhibition. We can say that Paik was exploring here a reversal of the signal-to-noise ratio, like Gabriel Menotti (2019) proposes he does in Zen For Film, from 1964, a work inspired by John Cage in which an unexposed filmstrip is projected in a loop, bringing the singularities of the medium and its environmental light to the foreground. In a similar gesture, in 2007 Menotti himself made a video called "a knife all blade", in which a digital camera tries to capture and process an image without any actual input of light. The resulting image is not just static black, as one could expect, what we see are clusters of gray pixels disturbing the corners, and a few chromatic aberrations, effects of the algorithm trying to work with an absolute lack of information.

The fact is that the technical contingencies and background noise of every channel for transmitting information can eventually become a deliberate element for the composition of the games that circulate on that channel. The analogical crackle of vinyl could be taken as undesirable for sound engineers that were seeking the highest possible fidelity of recording and reproduction, but when the clean sound of the CD arrived and, perhaps more importantly, the opaque MP3 compression became the new norm, the analogical reality of the vinyl grooves and the direct blunt of their peaks and valleys, suddenly attained a warm and newly attractive dimension for some ears. Feedback and distortion in sonic equipment were considered simply unwelcome until artists like Jimi Hendrix started to use it as deliberate elements of musical production. This also means that when artists design software to imitate glitch patterns they are embodying the expressive parameters of historically contingent compression techniques.

When Yasunao Tone plays with the mutations that arise from damaged CDs and from messed-up MP3 compression, he is playing with the technical parameters of production and distribution, taking them not as a neutral channel of transmission, but as his expressive matter.

In the age of digital image processing, visual noise has dislocated itself from the kind of analogical distortion that we find in Paik's work and moved to new territories and grammar of error and disruption. Much like aural noise has made its path from the avant-garde to pop sensibility, from John Cage and Cabaret Voltaire to Sonic Youth and Nirvana, visual glitch, the index of a mistake or a flaw in information processing, has also traveled from the avant-garde *net art* of the nineties of JODI and the like to Kanye West videos and sophisticated ads on the beginning of the millennium's second decade.

As remarked by Rosa Menkman, a theorist and practitioner of glitch art:

"In the *beginning* there was only *noise*. *Then the artist moved* from the grain of celluloid to the magnetic distortion and scanning lines of the cathode ray tube, he wandered the planes of the phosphor burn-in, rubbed away dead pixels and now makes performance art based on the cracking of LCD screens" (Menkman, 2011, p. 33).

Like sonic noise, visual noise has come such a long way that it's capacity for any kind of real shock and disruption seems vastly undermined. We may, at times, find it difficult to distinguish between faux glitches and actual glitches in our devices, when consuming deliberate visual or aural noise, but that merely points to how deeply embedded those parameters are in our current texture of esthetic and informational expectations. Domesticated noise ceases entirely to be disruptive, and simply slips into background static. This somewhat familiar dialectic of abnormality and normality, transgression and normativity, leads us to our conclusion.

Conclusion: Figure–ground reversals and noisy configurations

"Sound is all our dreams of music. Noise is music's dreams of us."
Morton Feldman

Hopefully these distinctions between the noise of pure chance (disruption and interference), the noise of form (strata of contingency), and the noise of information (as the ultimate margin of indeterminacy in any transmission) can be of some use for those who work with media ecologies and with intensives concept of information. There are many kinds of nonsense, interference, and disruption, and they are not all equally destructive. Not even all forms of destruction are equally destructive, for that matter.

Sources of noisy interference and random variation can, at times, turn into noisy form, which in turn can be activated as information by a concrete act of transmission and reception. The different domains can perhaps be better understood as distinct phases or velocities of signal and noise's configuration, rather than three kinds of events that retain their distinction at all times.

The reversibility of figure and ground can also be understood as structurally analogous to the fundamentally tensive relationship between signal and noise, which means that a shift in filtering parameters can always elicit new forms out of the ground such as when Penzias and Wilson came to understand that a source of interference was an actual trace of the universe's infancy, or when Paik gave us new scanning patterns for existing corporate hardware. This reversibility does not mean that any kind of signal can emerge from any kind of noise, naturally. But it does point to this generative tension at the heart of the relationship between signal and noise, a tension that manifests itself as the interval between intention and error, gesture and infrastructure, figure and ground.

The work of Cécile Malaspina, besides parsing out the philosophical problems at the root of information theory, traces a complex epistemological and political panorama of the concept of noise, from the use of sonic force as a military weapon to the ecology of noisy traders in finance capital. Her work demonstrates that you can be interested in the diverse conceptual possibilities of noise while maintaining the necessary epistemological rigor adequate to the affordances of each discipline.

Ultimately, harking back to Canguilhem's primacy of the abnormal over the normal (so central to the thought of both Simondon and Foucault), Malaspina proposes that noise, "understood as maximum uncertainty", is what calls forth "and hence precedes the normativity of reason, i.e., the judgment according to which uncertainty is valued as informative or discarded as spurious" (Malaspina, 2018, p. 217). The hard-earned certainty of any pristine signal, either transmitted or received, must come as an island of *docta ignorantia* emerging out of a shifting pool of constant noise.

The ground is always needed for figure formation, just like all the layers of background noise are needed for the emergence of signal. New forms can emerge right out of our peripheral attention, from indiscriminate static or from maximally complex chaos, from a bundle of old and slow strata and from high-speed fiber-optics of connectivity. Collective invention comes from the conditioned indeterminacy that lurks not only in any present layer of forms, but as the ultimate ground of their past structuration. There are always fields of noise to which we are not yet paying attention.

Data availability

All data analyzed are contained in the paper.

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Notes

1 Steve Goodman's (2012) book "Sonic Warfare" is perhaps the most ambitious attempt to address, in wide speculative terms, this dimension of sound as a highly militarized and privately incorporated vector of social compression and disruption.
2 He could have also taken this ontological ambivalence between ground and emerging structure from the work of Schelling, and his notions of *Urgrund* and *Ungrund*, but that is not made explicit (and my ability to retrace that possible connection is limited, to put it mildly).
3 There is no space here to fully explain Simondon's notion of margin of indeterminacy and its connection to technicity. For a thorough reconstruction of this notion and its relation to his notion of 'pure' information (see Malaspina, 2019).
4 This is highlighted by Paik in his introduction to his first exhibition of televisions, in 1963, in which he says: "My TV is NOT the expression of my personality, but merely a 'P H Y S I C A L M U S I C'" (Paik, 2002, p. 97; capitals in the original text) The same can be said about the work "TV Crown" (1965), in which the audio signal is transformed into a silent visual input, which participants can manipulate through changes of frequency and amplitude (Zinman, 2013).
5 Capitals in the original text.

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