Noise-Interstate(s): toward a subtextual formalization

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Introduction: noise as transcender

Humans perceive noise as an indiscernible entity. Noise is problematic due to its intrinsically chaotic information, yet paradoxically fascinating because it presents great levels of richness and complexity. We view it pejoratively when it interferes with our logic and predictions, but at the same time we recognize its ability to avoid simple patterns and to embrace unpredictability. From a human perspective, reality is an extremely intricate network of relationships that we acknowledge, disregard, presage, judge ... the list could go on. Yet noise acts upon this reality as a chance operator: it transcends control, hierarchy, and imposed power.

For the past few years, my works have mostly been concerned with the attainment of formal richness. On a surface level, these pieces present highly active sonic materials that span short periods of time before they undergo multiple transformations. This is the result of employing multi-layered compositional processes that attempt to decouple instrumental means of sound production. I have found that this aesthetic tendency allows for the development of complex formal relationships on a deeper level of construction—this is an essential aspect of my aesthetic interests. A major consequence of my personal approach to instrumental decoupling is the intrusion of timbral noise, which is mostly due to paradoxical physical actions applied to a number of different instrumental techniques. Although this chapter does not primarily focus on this type of timbral noise, it delves into the role of a parallel "noise" in my notational practice, particularly the space between notational data and the execution of that data. I have termed this space the *noise-interstate*.

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Information Theory and the Noise-Interstate

Before I examine the peculiarities of the noise-interstate, I shall describe some key concepts that originally appeared within information theory, which will be discussed later in other contexts. Information theory gained substantial presence within the scientific community after the publication of Claude E. Shannon's 1948 paper "A Mathematical Theory of Communication." That paper was Shannon's attempt to describe the intricacies of communication systems and their basic elements (information source, message, transmitter, signal, noise source, received signal, receiver, and destination) and also offered mathematical explanations of concepts that would be highly influential in future research.[1] For the purposes of this essay, two of Shannon's original ideas will be examined: *noise* and *equivocation*. Shannon portrays noise as an element that influences negatively the proper reception of the message: "If the channel is noisy it is not in general possible to reconstruct the original message or the transmitted signal with *certainty* by any operation on the received signal *E*. There are, however, ways to transmit the information which are optimal in combating noise."[2] For Shannon, *noise* is simply an undesired phenomenon that needs to be terminated. As literary critic N. Katherine Hayles points out:

1 In music, information theory has been significantly influential within the domain of theory, especially between the late 1950s and early 1970s. As Vanessa Hawes writes, "[t]he idea of information theoretical studies of music imagines that it will give people a greater insight into the workings of human communication systems. The use of information theory assumes that communication can be used as a metaphor for music. This metaphor was used to a lesser or greater extent of sophistication. Using it in a quantitative way, as most of these writers did, naturally evolved into the use of computers in music analysis." ("Number Fetishism: The history of the use of information theory as a tool for musical analysis," *Music's Intellectual History*, ed. Z. Blazekovic (New York: RILM, 2009), 836) Some of the writers referred to by Hawes are Joel E. Cohen, Edgar Coons and David Krachenbuchl, Lejaren Hiller and Calvert Bean Jr., and Joseph E. Youngblood. Most of their theoretical work used concepts from information theory in attempts to discuss music on a more objective level.

2 Claude E. Shannon, "A Mathematical Theory of Communication," *Bell System Technical Journal* 27 (July and October, 1948): 407.

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> When Shannon gave information theory its definitive formulation in 1948, his main concern was how to get a message through a channel with the least possible distortion. Whenever a message is transmitted, some noise inevitably intrudes—snow on a television set, static on a radio, blurred type or misprints in a book. Shannon called this noise *equivocation* and defined it using the same mathematical terms he used for information. In fact the equivocation is information, but from the sender's point of view it interferes with the intended message. Shannon therefore gave the equivocation a negative sign in his equation, indicating that it should be subtracted from the received message in order to get the original information back again.[3]

Equivocation can also be defined as an unwanted surplus of information (which does not belong to the original message intended for transmission) or, in Shannon's own words, "the average ambiguity of the received signal."[4] Equivocation is noise.

It took almost 30 years for the nature of equivocation to be problematized. It was a French Algerian biophysicist, Henri Atlan, who envisioned another aspect to the equation. Equivocation, according to Atlan, does not necessarily have to be the amount subtracted from the information that has been sent through a channel; it can also function as a beneficial addition to the whole system of communication—it all depends on a matter of perspective.[5] As Hayles points out:

> in some instances the equivocation's sign should be positive because it is possible to imagine a viewpoint in which the equivocation is constructive

3 N. Katherine Hayles, "Two Voices, One Channel: Equivocation in Michel Serres," *SubStance* 17, no. 3 (1988): 3. Emphasis added.

4 Shannon, "A Mathematical Theory of Communication," 407.

5 Henri Atlan, "On a Formal Definition of Organization," *Journal of Theoretical Biology* 45 (1974): 295–304.

> rather than intrusive, for example *when it causes a system to re-organize itself at a higher level of complexity*. This ambiguity in equivocation's sign is related to the observer's position within the channel. If the observer is at the source, she knows what the 'correct' message is and will consequently regard the equivocation as interference. By contrast, if she is the receiver, she can see the effect of the noise on the system and will therefore observe instances in which it has positive effects.[6]

Atlan opened the door toward an understanding of noise as a potentially beneficial byproduct of the act of communication: "[o]ne thus sees how a positive 'organizational' role for noise could be conceived within the frame of information theory without contradicting the theorem of the noisy channel."[7] Furthermore, by drawing a parallel between information theory and biophysics (his main field of research), Atlan suggests that "where the evolution of species is concerned, no mechanism is conceivable outside of those suggested by theories in which random events (chance mutations) are responsible for evolution toward greater complexity and greater richness of organization."[8] Thus, Atlan notes not only that unexpected events are responsible for the ability of a system to reorganize itself, but also that life itself has developed toward higher degrees of complexity after *chance* mutations—that is, randomness. Noise, inasmuch as it is a phenomenon of chance, seems to fit this idea very well. For this reason, the inclusion of noise in my work has become an inevitable goal.

6 Hayles, "Two Voices, One Channel," 3–4. Emphasis added.

7 Henri Atlan, "Noise as a Principle of Self-Organization," in *Henri Atlan: Selected Writings*, ed. Stefanos Geroulanos and Todd Meyers (New York: Fordham University Press, 2011), 104.

8 Atlan, "Noise as a Principle of Self-Organization," 110.

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The Noise-Interstate as a Self-Generating Entity

The noise-interstate is a psychological state that exists within the performer's psyche during the interpretive process of my work. Its primary goal is to contribute to the elaboration of multiple potential sonic outcomes whose particularities share certain essential characteristics among themselves and in relation to the original musical score. While the identity of the resulting music stays intact, the noise-interstate diversifies the potential interpretations of the work, thus presenting a greater degree of sonic variation across a number of performances. Therefore, its influence during the interpretative process of the score can only be perceived after listening to multiple performances or versions of the same piece. What I propose is an approach to notation that allows the noise-interstate to intervene.

Deliberate equivocation attempts to reconsider the original notion of certain material and formal constructions in such a way that the process of interpreting the score triggers a procedure of reorganization that is partly unintended during the early stages of the work's formalization. Furthermore, deliberate equivocation inherently contributes to the understanding that composition and performance are categorically different activities; the former is principally concerned with both the creation and organization of notational signifiers, while the latter is intrinsically closer to interpretational operations in relation to the score. The type of reorganization that takes place during performance is not left completely to the performer's discretion but instead assists in the redistribution of potential sonic relationships in such a way that the piece is dimensionalized but its integrity remains intact. The performer is thus capable of creating degrees of variance, which may suggest unaccountable formal paths that transcend both the peculiarities and the original implications of the compositional process of the piece. This is, however, an issue that often needs to be reconciled—the level at which the noise-interstate (triggered by deliberate equivocation) becomes an undesired influence can be problematic. Nonetheless, a competent use

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of deliberate equivocation on behalf of the performer might produce a set of two parallelogramic windows: a quantitative one, which sparks a field of intermediate states between slightly and highly unpredictable results, and a qualitative one, which provides the possibility of unforeseen formal trajectories. The noise-interstate is thus a truly experimental mechanism, for it attempts to raise questions that would otherwise not have been formulated.

Deliberate Equivocation: a methodology

I must now briefly explain the nature of my recent notation before delving into the specifics of deliberate equivocation. On a basic level, this notation is divided into three fundamental domains: *projection surfaces*, *parameterized objects*, and *temporal organization*. One needs to imagine that these are separate layers (each with its own attached set of processes) that are superimposed onto each other. They contribute to an array of multi-level paradoxes that will be discussed below.

The *projection surface* (Figure 1) functions as a delimiter of vertical space. In other words, it provides a specific area where other materials acquire a defined contextual situation. The *parameterized objects* (Figure 2, see Appendix, p.231) consist of a number of signifiers that convey certain physical motions that the performer applies to her or his instrument. For instance, they indicate

Figure 1: Projection surface in *[k(d_b)s]*, p. 7

technicalities in relation to instrumental means of sound production such as amount of bow pressure, position of the left hand on the fingerboard, and bow speed. *Temporal organization* (Figure 3, see Appendix, p.231) provides an insight into the specific nature of the temporal speed and division that has been developed throughout the process of composition. Once these three domains are juxtaposed onto each other, one can see the final disposition of the score (Figure 4, see Appendix, p.232).

In recent pieces, I have developed two compositional techniques that contribute to the process of deliberate equivocation. These are *temporal displacement notation* (TDN) and *perspective notation* (PN).

TDN compresses and/or expands the horizontal scale to which the parameterized objects and the projection surfaces belong. In other words, its main purpose is to re-establish the relationship between the numerical information on the timeline and its visual counterpart in multiple states. TDN allows the performer to redefine the nature of her or his own comprehension of the notated timelines, thus sonically producing slower or faster surface *tempi* in relation to the translational possibilities of the notated materials.

[IVsax(op_VIvln/c)] is a piece for solo saxophone with optional parts for violin and/or cello. One can see from Figure 5 (see Appendix, p.232) that the saxophone part is visually the largest on the score, and also that it directly maps onto the two upper timelines (A and B). In fact, these timelines correlate only to the saxophone part. What this means is that the "outer" performers (violin and cello) do not translate the notational materials into sound based on their own interpretation of time but must rather gravitate toward the saxophone player's sense of time. The saxophone part functions as the temporal center of the work, whereas the violin and cello parts operate as satellites. This potentially increases the amount of entropy within the channel between score and performer. The main attribute that deliberately contributes to equivocation is the dislocational praxis in the relationship between the timelines and the spatial situation of the outer parts. For instance, the cello part shown in Figure 5 (see Appendix, p.232) is meant to be performed during

timeline B of the saxophone part[9] and should span the same duration (i.e., 10 seconds), though this is visually contradictory since the area occupied by the cello part on the score is substantially smaller than that of the saxophone part. Thus, the cellist is left with no visual references, in that she or he cannot base her or his interpretational decisions on the part's vertical alignment with the saxophone part. Such a disassociation raises many interpretational questions that need to be solved during rehearsal.

Another type of TDN appears in *[k(d_b)s]*, for solo double bass. Note the development of the temporal organization of this example, as indicated by the green timeline. The areas of the double bass part that are left white (as opposed to those that present different shades of green) contain the original spatiotemporal scale on which the parameterized objects are superimposed. The horizontal length occupied by the representation of one real second within the white areas is different than the length that one second will take within a green area (Figure 7, see Appendix, p.233).

Indeed, each particular shade of green indicates a specific speed at which the parameterized objects pass.[10] One major consequence of this technique is closely related to a type of parameterized object in particular. The bottom area of the projection surface in Figure 7 displays information related to the range of the instrument.[11] Within that area, one can see several groups, each consisting of an array of vertical lines of different lengths. The bottom ends of these lines indicate the approximate placement of the finger onto the string indicated by the attached Roman numerals—that is, the lower the notated end is within the range, the lower the sound produced should be in relation to the fingered string. Although one could count the exact number of vertical lines

9 The color code provides this information. Notice that the boxed letter B has a thin green rectangle to its left. This is the same shade of green that applies to the top of the cello part. For this reason, the cellist is only supposed to perform during the saxophonist's timeline B (7:02–7:12).

10 The darker the shade, the faster the speed, and vice versa.

11 The top line represents the placement where the strings meet the end of the fingerboard (high), while the bottom line signifies "open string" (low).

per group, the truth is that each collection should simply be performed as an extremely fast accumulation of left-hand articulations. Since one second will have differently notated lengths according to its surroundings (e.g., whether its background is white or green), the performer should keep in mind that the exact number and quality of the articulations produced after interpreting the groups of vertical lines fall into a realm that exists beyond the original text. The disconnection between the score and the performer is highly evident, thus contributing to the emergence of deliberate equivocation.

In contrast, PN, explores the potentially unstable peculiarities available via the juxtaposition of the parameterized objects onto the projection surface. PN, however, does not directly transform the characteristics of the objects, but instead redefines the topology of the projection surface to a lesser or greater degree. Such redefinition of the delimiting space provided by the score drastically affects the signification of the parameterized object to the extent that its own interpretational denotation reshapes the performer's views of the notation. Therefore, PN increases the entropy within the channel between score and performer, allowing a completely new level of textual ambiguity (or *interstateness*) to flourish and pushing the performer to recreate mentally a new subtext based on the original score that has the potential to trigger relatively unexpected sonic results, hence the multi-dimensional identity of the musical work.

My piece *[IVflbclVIvln/c]*, which was my first attempt to develop PN, presents a quite rudimentary approach to this technique. Figure 8 (see Appendix, p.234) exposes how the boundaries of the projection surface are no longer horizontally equidistant but instead lead independently in different directions. For instance, the bottom area of the projection surface (whose parameterized objects indicate the vertical position of the fingers of the left hand on the fingerboard of the cello) contributes to the steady reduction of its own area, thus readjusting the contextual scale to which the parameterized objects belong.

Figure 9 provides a more specific insight into this phenomenon. A simple calculation of the starting distance between the long horizontal line in the

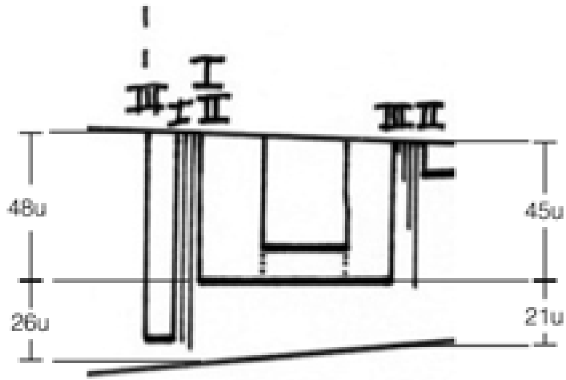

Figure 9: *[IVflbclVIvln/c]*, p. 1, cello part, detail

middle of Figure 9 and both the top and bottom boundaries of the projection surface at that particular vertical position, as well as the distance between the endpoint of the same line and both the top and bottom boundaries in relation to its own vertical line demonstrates that: (1) the vertical distance between both boundaries at the beginning of the horizontal line is 74 units (48+26), and (2) the vertical distance between both boundaries at the end of the horizontal line is 66 units (45+21). That this area has diminished by the end of the horizontal line was already visually clear just by glancing over this fragment. What is less evident is that by the end of the horizontal line the distance between the line itself and the bottom boundary of the projection surface (always related to the above boundary as well) is 3.32% smaller in relation to the distance between the horizontal line in its beginning and the bottom boundary of the projection surface (also, of course, in relation to the top boundary).[12] Technically, the horizontal line is going down. Considering

12 (26*100)/74=35.13% and (21*100)/66=31.81%, and 35.13–31.81=3.32%.

that the bottom boundary signifies "open string" (that is, the lowest possible pitch on the indicated string), the cellist's finger should move slightly toward the pegbox when performing this excerpt, thus subtly lowering the resulting pitch. Whether the performer ends up lowering the pitch a semitone, a quarter-tone, or an eighth-tone (among many other pitch gradations) is not necessarily circumscribed. Furthermore, the notation's deliberate ambiguity does not even guarantee that the pitch will be lowered, for some performers (or even the same performer on different occasions)[13] might conclude that the pitch should remain the same—hence the increase in entropy as well as the contribution in terms of equivocation.

A more sophisticated example of the use of PN can be found in Figures 10 and 11. Figure 10 (see Appendix, p.234) introduces a 19-second study for solo piano. The score is conventionally divided into right hand (RH), left hand (LH), and pedals.[14] The projection surface for each hand is divided into two secondary domains. For example, the RH area indicates the specific *hand shapes* (HS) that the performer needs to articulate. It also expresses precise information regarding the vertical positioning of the hand onto the keyboard—that is, the closer the notated hand is to the top line of this secondary domain, the closer the performer's hand should be in relation to the instrument's open fallboard.[15] Additionally, the secondary domain below HS has two purposes: its higher and lower boundaries function as delimiters of both horizontal spacing (i.e., register, whose information is conveyed by the purple lines) and intensity of attack (i.e., resulting dynamics, whose

13 Within the overall context of the piece, this section is performed twice at different *tempi* so that one can perceive the impact of PN (coupled with TDN) on the parameterized objects.

14 The amount of pressure on the right-foot pedal is represented by the black line; the amount of pressure on the left-foot pedal is represented by the gray line.

15 The pianist is strongly encouraged to wear relatively thick gloves (golf gloves seem to be the best solution so far) for both practice and performance, otherwise the experience of producing the piece can be physically painful.

information is conveyed by the orange lines).[16] This space is divided into seven horizontally equidistant subfields that translate into the number of octaves of a conventional piano keyboard.[17]

Version 1.0 does not incorporate PN—it does, however, project a byproduct type of equivocation that emerges from the inherent unpredictability that several of its notational devices evoke.[18] Version 1.1 of the study, on the other hand, introduces PN substantially (Figure 11, see Appendix, p.235). A reorganization of the spatial information between the octave-delimiters within the projection surface strongly influences both the number and the quality of the translational possibilities of the parameterized objects. Even though the exact placement of such objects has not changed at all, the context to which they belong has experienced a dramatic transformation. Consequently, version 1.1 uses PN to modify the potential sonic outcomes of the score, especially in terms of horizontal spacing and intensity of attack; the remaining parameters do not directly undergo this recontextualization. Figure 12 clarifies the intricacies of the metamorphosis that the projection surface has gone through from version 1.0 to 1.1. The PN in version 1.1 of the *Study* uses the same principle described above in reference to *[IVflbclVIvln/c]*. In this case, however, the original level of notational specificity in version 1.0 is higher than in Figure 9, generating a considerable disconnection between the particularities of the respective outcomes of the two versions.[19]

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16 The color code that I developed greatly helps economize the vertical disposition of parameters. Some of my previous black-and-white scores carried an excessive amount of information layered vertically, which is now surpassed by the parametrical superimposition that color allows. I have found that performers tend to prefer this method, for it makes the score more easily readable.

17 The smaller additional space below the first octave is a signifier for the remaining minor third interval between A0 and C1.

18 The exact physical characteristics of the pianist's hands, the thickness of the worn gloves, and the weight of the keys of the particular instrument used are some of the many possible variables that can increase the amount of channel equivocation.

19 In terms of register, in the notation of *Study on Deliberate Equivocation* the range of the piano is divided into octaves, whereas in *[IVflbclVIvln/c]* the lengths of the strings present only two points of reference: "open string" (low) and the place where the strings meet the end of the fingerboard (high).

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Figure 12: Comparison between projection surfaces from *Study on Deliberate Equivocation*, versions 1.0 (top) and 1.1 (bottom)

Further Applications

Deliberate equivocation can be presented to the performer in two fundamental ways: *statically* and *dynamically*. The "static method," which has been illustrated in previous examples, inserts the equivocation into the score itself so that the performer can internalize its modes of action during rehearsal. This is arguably the most traditional approach. The "dynamic method"[20] provides the performer with a rehearsal score that only contains the parameterized objects and non-equivocational projection surfaces; the remaining domains (PN projection surfaces and TDN temporal organization) are introduced only during performance. This method has not yet been solidified into a piece, although I have examined some of its potentialities on a speculative level.

On the one hand, this type of dynamism can be catalyzed as a paper score with additional transparencies (as in sheets of transparent plastic). The paper score consists of the parameterized objects only, so that the performer may acquire an understanding of the internal relationships among objects and eventually practice their intricacies on the instrument. The transparencies, which are meant to be superimposed onto the paper score strictly during performance only, bear the remaining dimensions: PN projection surfaces and TDN temporal organization. This juxtaposition contextualizes the parameterized objects within a larger pool of relationships, which in turn pushes the performer toward a quite unique performance practice. While the performer is aware of the interrelational peculiarities within the domain where the parameterized objects abide, she or he must adapt the previously learned materials to the constraints determined by the surfaces and the temporal organization in real time.

The dynamic method can also be explored as a video-score. In this case the transparencies are substituted by a video file that includes both the learned materials and their subsequent superimposition onto a separate layer consisting of the projection surfaces and the temporal organization. Although this principle is quite similar to that involving transparencies, the possibilities of the video-score tend toward more complex results.[21]

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20 My friend and colleague Pablo Chin suggested this approach, which opens up a large number of possibilities beyond what I had originally conceived.

21 The video-score allows a more interactive relationship between score and performer. For example, I have recently been exploring the application of motion sensors onto the instruments, in such a way that the gathered data reshapes the nature of the video-score in real time—physical inconsistencies thus articulate a score that is constantly metamorphosing. In this context, the disconnect between score, physical actions, and sonic outcome can in some cases be near absolute.

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Conclusion

While the noise-interstate has the potential to enrich the aural perception of translational mechanisms (i.e., the interpretation of a score), it can also cause problems. It is one element in a labyrinthine network in which many aspects, whose boundaries all seem somewhat ambiguous (textual [and subtextual] formalization, interpretation, perception, memory and expectation, history and semiotics), coexist and relate to each other. I have found that a substantial part of my compositional strategy must be concerned with what I believe is the appropriate balance of that network of ideas. The right balance is not necessarily one accomplished by making static decisions. Instead it tends to change according to the nature of the materials at stake. The noise-interstate offers a unique contribution to this array of interlocked aspects; it operates as cement that both unifies and complexifies the interconnectivity that is intrinsically unfolded among such natural features of the musical experience—hence its *interstateness*. This is its most beneficial and most risky peculiarity, for its tendency toward high unpredictability may lead to counterproductive results (i.e., completely undesired situations due to both the high quantities and qualities of the circumstances involved). The fine line that separates desirable and unwanted sonic outcomes is at the center of this problematization and it raises two fundamental questions. Firstly, does the delimitation of this fine line need to be treated from a compositional perspective or does this issue belong to the performative/interpretive domain? And secondly, what *exactly* is an undesired situation?

The answer to the second question has to do, at least in part, with a thorough evaluation of the context raised by the notated materials and their potential sonic implications. Similarly to what Atlan did with Shannon's equation, my role is to develop a set of criteria that redefine the very nature of perceptual aesthetic judgments, thus providing a sort of *tabula rasa* in which novel psychological responses and expectations might be constructed. In consequence, the line separating unwantedness and desirability becomes

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a dimensionalized entity. Its purpose is no longer to fix simple dicothomical boundaries (either/or; it-works/it-does-not-work), but rather to emerge as the volume in which the potentialities of the noise-interstate as aesthetic transgressor can be extensively explored. Instead of providing answers regarding the ability of a material to *work* within a particular context, the noise-interstate questions the *status quo* between object and context.

The aforementioned delimitation should be assumed neither to be a compositional issue nor a performative one: it belongs to a domain that lies in between historically acquired compositional and interpretational goals. Although I do not tend to perform in public, many of the decisions I make at my desk are closely connected to traditional interpretation, and they also result in compositional manifestations. My own interpretational image of a previously notated signifier might lead to underlying decisions regarding the formal evolution of a score. In other words, an interpretive conclusion that will never be properly consumed might transmute into a notational expression. It is a no-man's-land between composition and performance.

At its core, the noise-interstate represents my attempt to formalize musical possibilities beyond text. It operates as a gate toward a comprehensive oversight of the prospective subtextuality cultivated by the notational idiosyncrasies of my scores.

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Diemo Schwarz

What is noise (music) to you? Why do you make it?

Using non-tonal sounds opens a vast, infinite field yet to be discovered. Only there, real innovation is possible. Only there, can paths never trodden before be found.

Using noise as music prompts a form of active listening. In contrast to sound with a definite pitch, noise encompasses many frequencies more or less equally. This allows the listener to hear the song in many different ways, because one can concentrate on certain frequencies more than others, and discover new structures in the noise every time. Thus, the listener can create her own melody and form from the noise.

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