A TECHNICAL REVIEW OF WHITE NOISE IN A SPOTIFY SAMPLE

Bahadırhan KOÇER[1]

Abstract

As of its development, synthesizers used in the early stages of electronic music had noise panels, to present a realistic imitation of several instruments like woodwinds, brass bells, strings and some percussion instruments. These noise panels played the most important role for sound designers and music producers in developing their usage practices of white noise. In time, after the effects of white noise on humans began to be examined with scientific studies, it became possible to use white noise for alternative purposes other than its primary purpose in the production universe. Some opinions are that white noise is an auditory element observed in nature and it played an important role in the auditory side of human evolution. In this respect, white noise evokes the idea of "organic" in the field of mixing, in signal generation or processing stages of electronic music production to producers. In the process of invention and development of synthesizers and also in the present, attaching or integrating white noise into synthesis has been one of the various basic methods integrated in synth music to achieve an "organic" sound. Also, white noise or other noise signals are frequently used in foley creation processes of motion pictures to create the perception of "field sound". With all these aspects, white noise is a unique subject for all auditory disciplines and it is suitable for examination. Today, music production has become quite individual as a result of the software developments which have created virtual studios. Consequently, white noise was also affected by this individualization, subjected to different perspectives and became an easily produced and marketed product. The development of digital audio workstations has a great impact on this evolution. Ultimately, as digital sound processing stations began to become widespread in personal computers, approaches to white noise have diversified and today, white noise has been shaped by different digital sound processing methods (DSP). So that it became sort of a functional relaxation tool. In this study, technical practices that enable white noise to become a final product in online music markets will be examined and the role of white noise in consumption practices will be discussed. Also, the connection between the changes caused by the technical practices used in the production phase and the form of the white noise in consumption will be made visible in this way.

Keywords: Music, White Noise, Sound Design, Spotify

White noise, which was studied by sound engineers before the development of synthesizers, is now widely used in electronic music production where synthesizers and effectors are perceived as main instruments. White noise, which is the subject of this research, is usually created with the help of noise panels included in the hardware of synthesizers as a filter input to generate noise signals. White noise has been widely used in synthesis to recreate percussion instruments such as cymbals or snare drums that have high noise content in the frequency domain, and other instruments (such as woodwinds, brasses, and strings) that naturally contain this form of noise during the performance. Outside of its musical context, the static signal caused by a non-existent radio station is an

[1] Istanbul Technical University, Department of Musicology, Master Student, bahadirhan.kocer@hotmail.com
ORCID: 0000-0001-5800-2541
Day of Application: 04.03.2021 Acceptance Date: 22.08.2021

adequate example to describe white noise. "In signal processing, white noise has equal intensity at different frequencies" (Mancini Carter, 2009: 10-11).

The fact that white noise got this name can be attributed to the fact that white colour is a mixture of wavelengths of all other visible light. “When light models are considered, the mixing of all colours creates white. In this context, white noise contains all the frequencies that the human ear can hear. In white noise, all audible frequencies are of equal intensity. Environmental sounds can also be included in this category. The most obvious example of this is the sound of rain. White noise can exist spontaneously in nature in the form of an "atmospheric" element, as in the case of the sound of rain. On the other hand, mechanical productions such as ventilation fans can also create white noise. " (Kalma, 2021) White noise, which covers all auditory frequencies, is often used by some people to achieve some sort of relaxation or ease of falling asleep, as it "obscures" other sounds and suppresses unwanted noise in the environment. Functionally, white noise was used to mask the dominant frequencies in the environment and to block the eavesdropping devices in between the 70s and 90s (Ebert, 2019). Also, white noise is in use to make it easier to determine from which direction the ambulance siren sounds that are sweeping between 500-1800Hz are coming from (Carl Q. Howard, 2011: 44). On the other hand, the calming effect of white noise on humans has been examined in various clinical studies. With different experiments, it has been shown that babies exposed to white noise fall asleep faster or children and adults with tinnitus are less exposed to the effects of this disease through listening to white noise (J.A.D Spencer, 1990: 135-137). There are also studies showing that white noise improves cognitive performance (Goran B.W. Soderlund, 2010: 55). Considering the scientific pioneering of these studies white noise machines produced by various manufacturers with different models enabled the marketing of white noise as a consumption material for the first time in the late nineties (Hill, 2020). Nowadays, online music platforms (like Spotify) have evolved into mediums where white noise –and other types of noises are presented to the audience for their relaxing and soothing effect. The algorithmic playlists of these sort of online music platforms categorize the generated noise formats and offer the listener several options. However, white noise is also divided into varieties within the technical context. Therefore, considering these technical differences, changes can be made in the algorithms of online music markets to enable the listener to make a choice between multiple options.

In this respect, if white noise is examined together with its past, it is seen that white noise and other alternatives such as ASMR, Binaural Beats, which can be observed nowadays on online platforms such as Youtube, Spotify, Apple Music, can fall into the *orphic media* category conceptualized by Hagood. Based on Hagood's definition, orphic media is a "freedom" to escape from the strenuous and stimulating practices of metropolitan life or, more generally, from chaos (Hagood, 2019: 4-10). In this manner, people can turn in on themselves for a moment, escape everything external, move away from the "cluster" of information and re-recognize themselves in the world of stimuli with the help of the *orphic media*. This way of thinking conceptualized by Hagood can be examined from different aspects, but the white noise and its place in the consumption chain, which is the subject of this research, is intertwined with the concept of *orphic media*. However white noise also provides metropolitan people a chance to escape from the anxiety of the outside world. It is noteworthy in that it enables humans to move away from the world they live in, to fall asleep more easily, to relax and perhaps to "escape". All of the features identified by the determinations to be made in this study should be considered with the concept of *orphic media*. Because such as the stages of creation and marketing, the stage of processing of white noise is also an action that respects and responds to consumer needs.

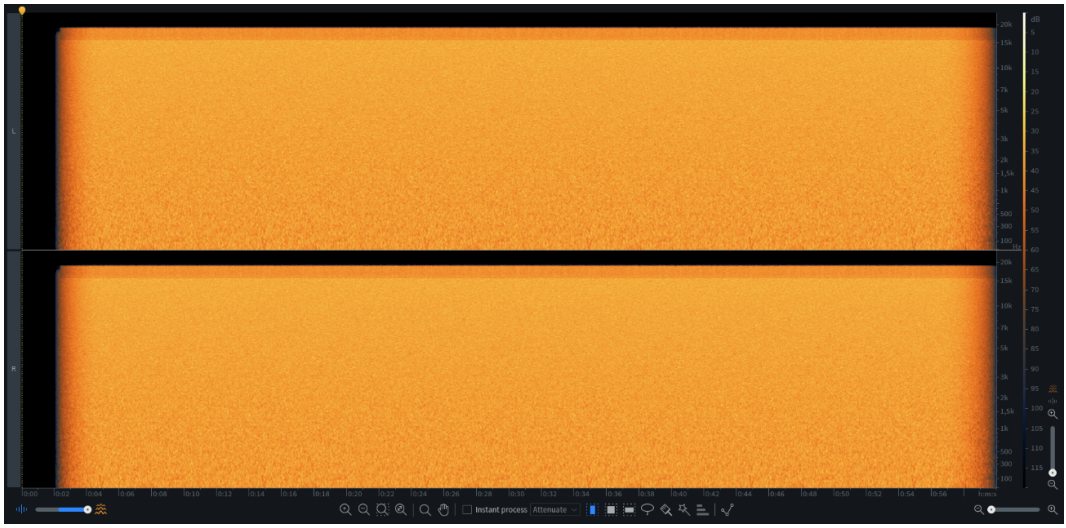

Image 1: Image of Pure Stereo White Noise Signal in Spectrum View of *Izotope RX8*

The main question of this study is "What kinds of technical processes carried out while white noise signals created by digital sound processing stations become a consumption material?" So it will be examined how noise signals, which can now be easily produced and musicalized, are processed in line with consumer demands since digital audio workstations (DAW) can be used in personal computers in line with this main question. The research covers the technical context[2] of the forms of white noise produced today, and therefore the simple sound processing methods by considering the consumption pattern and purpose of white noise. In this direction, data is collected firstly from the white noise sections of several synthesizer manuals[3], the literature review on white noise, and finally the interviews with the producers who produce white noise for practical purposes. In this way, the subject will be examined in light of both theoretical and functional information about the technical background of white noise. In the literature, firstly, technical texts and related parts of synthesizer methods that have developed an approach to white noise for practical purposes are examined. Subsequently, the reports of various clinical studies that have investigated the common effects of white noise on humans were collected. Eventually, various opinions were collected from the producers who use white noise for specific purposes.

White noise can be easily created with synthesizer emulators that can work integrated with DAWs produced for personal computers and with third-party VST plug-ins[4] that are produced only to generate white noise, without concrete synthesizers. Then the created white noise signal can be rendered with different characteristics modified through the use of certain simple digital sound processing (DSP) methods.

“Especially for artistic purposes, the producer can produce the white noise, then filter it and expose it to a specific amplitude diagram. The producer can then apply a rhythmic modulation to the white noise output optionally. In

[2] Technical methods such as "*creating white noise, characterizing it by frequency separation, masking it with simple filters such as low-pass, placing it in a virtual space by subjecting it to stereo image*" are included in the technical context.
[3] (see also Arturia ModularV, Modular Moog Emulator User Manual, 2016)
[4] *The Noise 2* software produced by *Denise* is an example for the aforementioned third party VSTs.

the last stage, the producer can integrate the modified white noise with other instruments optionally. Distortion guitar is a good example to explain the basic role of noise in the musical structure" (Kalma 2021).

On the other hand, the sampling (collage) culture in music is important for the inclusion of various natural noises and samples from the vinyl records into the musical structure. “Sometimes, since a kick sample is not taken correctly, some external noises can lead the music into an unpredictable harmony" (Erteber, 2021).

To obtain basic statistical information about “which simple sound processing methods are widely used in the process of introducing white noise into a consumption chain” the top 60 of the algorithmic *White Noise* Spotify playlist has been examined. Spotify is programmed to update algorithmic playlists in a period of one to five days, taking listener habits and other parameters into account (Goldsmith, 2020). In this case, the determinations to be made on this playlist with 448.902 instant followers will reveal the current noise listening habits of 448.902 people at a simple level.

Basic Digital Sound Processing (DSP) Methods Frequently Applied to White Noise

Although characterizing the white noise by sound processing technically eliminates it from being white noise, when examining the forms of white noise being consumed in online markets today, it is seen that most works served as white noise to the listener undergo a series of processes. It is possible to reduce the white noise DSP process to five main headings as *Low-pass Filtering, Resonance Value (Q) Determination, Stereophonic Image Width Planning, Compression* and *Using Secondary Noises* and to determine the rate of processing the noise through these substances. Apart from the method of “using secondary noises", the other four sound processing methods mentioned above are frequently used not only for processing white noise but also for artistic and functional concerns in musical arrangements. It was roughly concluded that the main reason for applying the five basic methods to white noise is to make it "listenable". On the other hand, it is the case that white noise is characterized and authenticated by each producer with these methods and sometimes more. The reason for the determination of these sound processing methods as main methods is that each of these five methods drastically alters the sensation of white noise. Apart from these methods, various SFXs serve many different purposes in digital audio workstations (DAW). The exclusion of other SFXs not mentioned here does not mean that they are not used.

Low-pass filtering

The low-pass filter enables the signal in the frequency range above a certain frequency limit to be attenuated in terms of amplitude. In analogue low-pass filters, the precise frequency response varied depending on the filter design, but this is not a significative case because nowadays there are filter processors that are integrated into digital audio workstations (DAW). (Singhal 2014). This form of filtering is also called treble-cut or high-cut filter. The strong application of the low-pass filter highlights the unnecessary or undesirableness of the higher frequencies in the musical arrangement. On the other hand, it can be used in the field of acoustic analysis to eliminate environmental sounds (Julia K. MacCallum, 2010: 15-20).

After the white noise is created in the form of a signal, it can be subjected to a low-pass filter. This ensures that the white noise is free of the high frequencies it presumably hosts. Therefore, the low-pass filtering method is used in some products to create a more relaxing and in some cases lower amplitude listening by removing white noise from high frequencies. Using the low-pass filter gives the white noise (unless it is applied to a white noise signal at very high frequencies) to a tougher and "bolder" character. During the research, it is observed that several producers resort to filling the low amplitude (space) created by the low-pass filter at the upper frequencies

with different elements such as rain noise optionally. Such a purpose may be included in functional purposes, but producers may not pursue this purpose alone when exposing white noise to the low-pass filter.

Determining the resonance value (Q)

Resonance is the tendency in physics for a system to oscillate at some frequencies at greater amplitudes than other frequencies. In sound design, resonance aperture serves to announce a specific frequency range that a filtered sound is desired to be particularly emphasized while filtered. It can also purify the filtered sound from specific frequencies (Reiss, 2010: 1843-1848). Altering the resonance value of a sound signal in any frequency band is a technique that is used for practical purposes just like other methods, but when it is considered for music mixing in general, it can also have artistic purposes. For music arrangement, the changes to be made in the resonance parameters can prepare the environment for creative filter articulations after filtering processes such as LP, HP, BP. Thanks to various effectors it is possible to automate various parameters related to resonance value (Q) and therefore not to use a fixed parametric value. As an example, the Filter Freak effector released by the Sound Toys is widely used in this sense (Inglis, 2004). However, no such dynamic use has been observed in the sample of this study.

After filtering, the producer determines a Q value according to his will. This value sharply affects the sensation and characteristics of white noise. For this reason, the value of resonance aperture plays an important role in the processing of white noise.

Stereophonic image width planning

Apart from its detailed technical features or historical use, in terms of designing dual channel inputs or outputs in accordance with the organic structure of human hearing, stereo is a commonly used technology in white noise production. This type of design is called "stereo panorama".

Stereo panorama is a mixing technique that is used functionally with the idea of creating spaciousness by increasing the width in a simultaneous performance recorded with multiple microphones or with the idea of placing multiple different sound samples recorded at different times in a virtual environment. Its main purpose is to create a richness of sensation and hence take reality as a reference while doing so. For example, "you can place a guitar sample in the left stereo at 9 o'clock position in panning planning, send it to a delay programmed between 10-20 ms, and place the rotation of the delay on the right stereo at 3 o'clock position. In this way, you get the feeling of two guitars playing in full harmony, and also make room for vocals and other instruments in the middle channel" (Önen, 2018).

In acoustic music, the technique of determining separate virtual locations for each instrument through stereo panorama is called "rotate/stereo panning". The auditory width to distinguish the instruments from each other and to make them more distinct in a collective form is called "stereo width" (Anderson, 2009: 1-15). In summary, stereo planning emerges as a result of the urge of creating a perception of sounds. It is commonly used in the production of white noise by adjusting independent values such as amplitude and phase of the right and left stereo channels. The idea of creating stereo images is crucial in the digital sound processing (DSP) process of today's music.

Stereophony is used for both functional and experimental purposes to be creative in the auditory characteristics of today's music. Since the ability to detect where a sound is coming from has a natural origin in human evolution, this quality may have a different significance than other advanced aesthetic concerns (such as harmony, orchestration, virtuosity). In this respect, stereophony is functional. However, unconventional techniques can be used for artistic purposes when designing stereophony (Windsor, 2000: 7-35). Applications related to this

technique are diversified since it is possible to create a stereo image in digital audio workstations without the need for analogue equipment in electronic music.

The idea of creating a wide perception of sonic space is related to the concern to create a wide and comfortable virtual space for listeners. Creating a stereo image also supports this idea when there are no external sounds except white noise therefore a mixing process is not needed. However, when the white noise needs to be blended with multiple sound samples, the stereo image processing can serve the above-mentioned purposes. In short, creating a stereo image in white noise production is a significant technique to diversify and enrich the listening experience.

Compression

Compression (or "dynamic range compression") is a signal processing method that lowers the loudness of high amplitude sounds and increases the loudness of low amplitude sounds. Compression in music production generally makes music performances more consistent in terms of dynamic range and can aurally enhance the resulting work (J. C. Schmidt, 1996: 1013-1016). Thanks to compression, a vocal recorded in a rock orchestra, for example, can be distinguished from the other elements of the orchestra. At the same time, compression can make the instruments sound more clearly in a recording where multiple instruments exist with their channels, without screening each other.

Compression technology can also be examined as a result of the "loudness competition" in advertising or similar fields. Historically, there is also the idea that compression developed as a result of this competition (Katz, 2007). In such cases, overusing compression is also seen as a deviation from its original purpose. From this aspect, it has been observed that a sound sample that is subjected to non-functional excessive compression harms sound quality, and it is mentioned that it may be beneficial to use compression more consistently especially in the advertising area (Naomi B. H. Croghan, 2012: 1177-1188).

The aim of using compression is creating a coherent dynamic range after several applications like low-pass filtering and other processes. There are examples of white noise that have been subjected to excessive compression beyond its purpose as mentioned above. In short, compression can be used to make white noise sound more voluminous and rich but it can also be used to ensure that Q value changes give more consistent results and for other artistic purposes.

Using secondary noises

Apart from the four basic digital sound processing (DSP) techniques listed above, it is also possible to refer to secondary noises in white noise studies produced for online music markets. “In most electronic music sub-genres, the presence of non-musical but musicalized noises can be mentioned” (Kalma, 2021). For producers, these are often perceived as elements that support and improve the atmosphere of electronic structures. This method which can be found in several electronic music genres like Ambient and Techno is used in white noise productions to trigger the imagination and evoke natural phenomenons in the listener's mind such as forest images, rain or sea sounds.

The producers may resort to the option of blending organic noises such as rain, sea or bird sounds with white noise since those sorts of noises are considered to have soothing effects on humans. There is a general acceptance that white noise must be produced to appease the listener. These integrations seem closely related to this acceptance. In this case, the necessity of harmonizing the white noise with these secondary noises more

consistently arises and the producer may consider using different techniques for both functional and artistic purposes.

Observed Usage Levels of Basic Digital Sound Processing Methods in Spotify's *White Noise* Playlist

In this part of the study, the top 60 of the White Noise playlist created to compile white noise studies on the Spotify platform were measured in terms of their processing rates of five different methods specified above and explained with principles.

The top 60 in Spotify's algorithmic White Noise playlist were compared to each other by a one to five measuring procedure by using iZotope Ozone to determine the usage rates of the four basic techniques. The average length of 60 studies examined in this way was determined as 2 minutes 47 seconds. There are some works designed in less than a minute. The rate of producers to use a low-pass filter to remove white noise from high frequencies or to make it dominant at low frequencies is 54.6%; 33.4% of the noise is filtered to emphasize a certain frequency range or create a more "edged" feeling; the ratio of expanding the stereophonic image to create a perception of space by placing white noise in a virtual environment is 52.6%; the rate of using compression to make the white noise more voluminous after basic operations and to increase the sound intensity for functional purposes was determined as 42.4%.

Secondary noise integrations or the use of alternative effects have been observed in only 10 of the 60 productions. On the other hand, specifically used rain and vinyl dust sounds have been observed in just two productions. It can be argued that such sounds are organic references to white noise (Capritto, 2019). Apart from secondary noises, 8 out of 60 studies were found to use alternative sound effects and stereo shaping methods such as *phasing, pitch-shifting* and *dynamic* panning.

At the same time, references to the state of relaxation or sleep by pseudonyms of producers and names that producers give to their white noise productions are significant.[5] This is noteworthy for bringing to light the effect the producers intended when producing white noise. It is also an important feature to address the hypothesis that the use of excessive low-pass and wide stereo images brings sleep and relaxation. On the other hand, it is possible to observe that white noise phenomenon also hosts a culture of jargon when there is a consideration of a connection with producers' naming behaviours.

Conclusion

In light of all these determinations, it can be inferred that the use of low-pass and wide stereo images in white noise productions is frequently preferred by the producers. These two elements were observed as essential for 60 white noise productions examined. It is related to the idea that white noise, which is naturally dominant across the entire spectrum, is purified from high frequencies by low-pass filtering and thus "softened" to cause an efficient relax mood on listeners. Filtering the high frequencies of white noise, which is dominant at all frequencies, indicates the existence of the purpose of creating a relaxation meta since more than half of the 60 productions examined were filtered. It has been observed that the stereo design, compression and other modifications are in use for utility purposes among the producers. Still, some producers pursued artistic purposes rather than utility. The most obvious result is that white noise is also involved in a production process that must keep up with industry standards to meet consumer demands. In this direction, it is observed that white noise producers have developed

[5] *Descending Insomnia, Sleeping on the Beach, Dream On, City Sleep, Sleep Phasers, Dream Shard, Sleepy Parents etc.*

different techniques. Also the most common and important white noise processing method is filtering since it is present in more than half of the productions reviewed.

It is also observed that even unfiltered white noise signals were made suitable for listening by different modifications made by producers. In this study, examination of all these modifications revealed the general habits of producers who treat white noise as a relaxation meta (see Chart 1). At the same time, these examined qualities also give an idea of the mixing standards of white noise as a product in the online markets. It is obvious that the most common white noise processing technique is low-pass filtering among the producers. Also to determine a constant or variable Q value is important to add character to the white noise during this filtering process but resonance opening is a relatively less common technique in the examined samples as observed. On the other hand, compression is also thought to be an effector that producers prefer to use as a shaping tool for functional purposes only such as reaching market standards and the highest possible amplitude. As a result, digital sound processing (DSP) methods are used for both functional and artistic purposes by the producers to ensure the consumption of white noise.

These methods are used to further increase the relaxing effect of white noise and to prepare the white noise for an easier and more comfortable listening process for the listener. Clearly, white noise has been commodified with the claim of relaxation, and it has been concluded that its high frequencies have been extensively rasped to achieve a relaxing effect. For more than half of productions, the high frequencies of white noise are not considered suitable for relaxing effect by producers. Therefore, this study reveals that white noise is mostly filtered to comfort the listener. At the same time, a jargon culture was encountered during this research which was created by white noise producers. The producers have chosen their pseudonyms and song titles to refer to sleep and relaxation.

It must be said that the reduction of high frequencies causes a mislay of the basic characteristic of white noise and alters it from its natural state since the only fundamental characteristic of white noise is that it spreads evenly over the frequency range that the human ear can hear. When filtered, it loses this essential quality. Theoretically, what is obtained is brown noise when the high frequencies of white noise are highly filtered. In most instances, white noise converted to brown noise which is known for being weaker in terms of high frequencies due to high levels of low-pass filtering. "Although there are not enough scientific studies to show that brown noise causes sleep or calmness", the hypothesis that brown noise also has a similar effect can be investigated comprehensively, considering the processes and results that white noise is exposed to in the production process (Kirsten Nunez, 2019).

The mentioned link between white noise and brown noise as a result of low-pass filtering requires further research. Also the data of how white noise is subjected to the marketing process on online platforms and the cultural structure born with these productions can be revealed by collecting more detailed data from white noise producers and distribution companies and conducting planned fieldworks.

Chart 1: Levels of Processing of the Top 60 in the Spotify's Algorithmic "White Noise" Playlist with the Five Basic DSP Methods Mentioned[6]

	Name	Producer	D	LP	Q	STP	C	EXT
1	Dream Cave	Freq Molecule	02:13	1	1	4	3	Not Found
2	Soft Noise	WNX	02:55	2	1	1	2	Not Found
3	Cabin Noise Focus	Crafting Audio	02:29	3	1	2	1	Not Found
4	ZzzzZ 1.4 kHz	Wavelab	01:54	2	1	2	2	Not Found
5	Radar White Noise	WNX	02:26	2	1	4	2	Not Found
6	White Noise 700hz	Granular	03:25	1	1	4	3	Not Found
7	Dusty Noise	Astral Noise	01:28	2	1	3	2	Vinyl Dust
8	Soft Noise	Ozonezz	02:18	4	2	3	3	Not Found
9	White Noise Sound Mind	Sea of Noise	02:18	5	1	3	2	Phaser
10	Cabin Back Noise	High Attitude Samples	02:39	5	1	3	3	Not Found
11	White Noise 1kHz Gentle Curve	MiZzzter White	03:07	2	3	2	4	Not Found
12	Sierra Nevada	The Frequency Shifters	03:12	4	4	3	2	Not Found
13	Luscious White Noise	JBE Noise Factory	02:25	2	2	3	3	Rain
14	Baby Dreams	Dream Shard	01:27	4	2	3	2	Not Found
15	High Winds	Klangspiel	03:49	5	2	2	2	Not Found
16	Tiefe Schlucht	Klangspiel	03:49	1	2	2	2	Not Found
17	White Noise in Thin Air	Aeoluzzz	03:11	4	3	2	2	Not Found
18	Schlaff Kindlein Schlaf	The Inceptionists	03:52	3	2	2	2	Not Found
19	White Noise Machine 1500hz	Dr. Dreammaker	03:31	2	1	2	2	Not Found
20	White Noise in a Pyramid	The White Noise Travelers	03:23	2	2	3	2	Not Found
21	Basic White Noise	Fortuna	02:29	1	2	3	3	Not Found

[6] In the chart, D represents the length of the piece, LP represents the low-pass filtering, Q represents the resonance value, STP represents stereophonic image width, C represents the compression level, EXT represents the use of secondary noise and effects. Level criterion should be perceived as very low, low, medium, high and very high, from 1 to 5, respectively.

22	River of White Noise	Noise Nirvana	02:58	2	1	2	2	Not Found
23	Rich Orange&White Noise 364hz	Astral Noise	00:50	4	1	2	3	Not Found
24	Nighttime Noise	Celestial Noise	03:04	2	1	2	2	Not Found
25	Perfect Noise	Daily Calm	03:30	3	1	2	2	Not Found
26	Cozy Submarine Cockpit	Sonic Observation	02:11	4	1	3	2	Not Found
27	Paceful White Noise	Noie Nirvana	02:58	5	2	3	2	Phaser
28	Underneath the Stars	Day Nappers	03:24	3	2	3	2	Not Found
29	Underground	Exodar	02:40	2	3	3	3	Not Found
30	Street Noise - Brown Noise	Dream Shard	02:44	4	2	2	2	Not Found
31	Paradise Noise	Mind&Ears	02:23	1	1	4	3	Rain
32	Soft White Noise	Daily Calm	03:00	2	1	2	2	Not Found
33	Dry White Noise	NoiseZ	03:10	2	2	2	2	Not Found
34	Low Hum of White Noise	Sleep Miracle	03:10	2	2	3	2	Not Found
35	Descending Insomnia	Pink Fluff	02:12	3	1	2	2	Not Found
36	Senseless White Noise K	Thyyphoon	02:15	2	1	4	3	Not Found
37	Blissful White Noise	Sea of Noise	02:49	3	2	2	2	Not Found
38	White Noise Wasserfall	Klangspiel	03:48	4	1	2	3	Not Found
39	Gifted Noise	Fortuna	02:34	2	1	3	2	Not Found
40	Sleeping on the Beach	The Sleep Phasers	03:22	3	2	2	3	Not Found
41	Dream On	noiZzz in the dark	03:26	4	2	3	2	Not Found
42	Grainy White&Brown Noise	Astral Noise	00:50	2	1	2	2	Not Found
43	Tundra Lodge	Zero Oto	04:20	4	2	2	2	Shifting
44	Dimensions	The Frequency Shifters	03:16	4	1	3	1	Not Found
45	Dream State	The Sleep Phasers	03:21	4	1	3	1	Not Found
46	White Noise 773Hz Subtle Q	Day Nappers	03:24	2	3	3	2	Not Found
47	City Sleep	Sleepy Parents	03:32	4	1	3	2	Not Found

48	White Noise in Arena	Sleep Sleep Sleep	02:28	2	2	3	3	Not Found
49	Synthetic Planes	Exodar	02:34	2	4	3	2	Phaser
50	High Altitudes	Zen Maestro	03:36	2	5	3	2	Not Found
51	Sleep White Noise	Wavelab	02:24	4	2	3	2	Phaser
52	Clover	Granular	03:33	2	1	2	1	Not Found
53	Dreamy White Water	The SubOceaners	03:54	2	2	3	1	Not Found
54	Soft Brown Noise	High Attitude Samples	02:27	4	1	3	2	Not Found
55	Ocean of White Noise	Wavelab	01:55	3	1	1	1	Not Found
56	White Noise Waterfall	High Above the Clouds	02:39	3	1	3	1	Vinyl Dust
57	Baby Sleep BN Four	Dream Shard	02:10	1	1	3	2	Not Found
58	Noise 742 Hz	Astral Noise	01:36	1	2	3	2	Not Found
59	Heedful Pink Noise	Fizzonaut	02:14	1	2	3	2	Shifting
60	Intercontinental Flight Noise	Sonic Observation	02:04	3	1	2	1	Panning
				2,73	1,67	2,63	2,12	

Bibliography

Anderson, Joseph. 2009. “Classic Stereo Imaging Transforms-a review.” *Espacio y Música: Ciencia, Tecnología y Estética*. pp. 1-15. Buenos Aires: Quilmes University Press.

Capritto, Amanda. 9 July 2019. “The Secret to Better Sleep: Pink, Blue and Brown Noise”. https://www.cnet.com/health/white-noise-pink-noise-blue-noise-brown-noise/ (6 January 2021).

Carl Q. Howard, Aaron J. Maddern, Elefterios P. Privopoulos. 2011. “Acoustic Characteristics for Effective Ambulance Sirens.” Acoustics Australia. pp. 44.

Ebert, Joel. 22 May 2019. “White Noise Machines Installed in Glen Cassada's Office; Ex-aide eavestdropped on Meeting Rooms.” *The Tennessean*. https://www.tennessean.com/story/news/politics/2019/05/22/glen-casada-news-house-speaker-office-renovations-white-noise-machines-cost-taxpayers/3766658002/ (04 March 2021)

Erteber, Ergin. 2021 interviewer Bahadırhan Koçer. *"Beyaz Gürültü" Üzerine.*

Goldsmith, Kevin. 02 July 2020. “How Often Do Spotify Playlists Update”. https://www.quora.com/How-often-do-Spotifys-playlists-update (03 January 2021).

Goran B.W. Soderlund, Sverker Sikström, Jan M. Loftesnes, Enmund J.S. Sonuga-Barke. September 2010. “The Effects Of Background White Noise On Memory Performance in Inattentive School Children” *Behavioral and Brain Functions*. pp. 1-4.

Hagood, Mack. 2019. *Hush, Media and Sonic Self-Control.* London: Duke University Press.

Hill, Kashmir. 14 February 2020. “Activate This 'Bracelet of Silence' and Alexa Can't Eavesdrop.” *The New York Times*. https://www.nytimes.com/2020/02/14/technology/alexa-jamming-bracelet-privacy-armor.html (02 March 2021)

Inglis, Sam. January 2004. “Sound Toys Filter Freak”. https://www.soundonsound.com/reviews/sound-toys-filter-freak (22 March 2021)

J. C. Schmidt, Janet C. Rutledge. 1996. “Multichannel Dynamic Range Compression for Music Signals.” *Proceedings of the IEEE InternationalConference on Acoustics, Speech, and Signal Processing*. pp. 1013-1016. Atlanta.

J.A.D Spencer, D.J. Moran, A. Lee, D. Talbert. 1990. “White Noise and Sleep Induction.” *Archives of Disease in Childhood*. pp. 135-137.

Julia K. MacCallum, Aleksandra E. Olszewski, Yu Zhang, Jack J. Jiang. 2010. “Effects of Low-Pass Filtering on Acoustic Analysis of Voice.” *Journal of Voice: Official Journal of the Voice Foundation*, pp. 15-20.

Kalma, Ariel, 2021. interwiever Bahadırhan Koçer. *On "White Noise".*

Katz, B. 2007. *Mastering Audio: The Art and the Science.* Amsterdam: Focal Press.

Kirsten Nunez, Elaine K. Luo. June 2019 “What is Pink Noise and How Does It Compare With Other Sonic Hues”. https://www.healthline.com/health/pink-noise-sleep#_noHeaderPrefixedContent (6 January 2021).

Mancini Carter, Ron Bruce. 2009. “Op Amps for Everyone.” *Texas Instruments*, pp. 10-11.

Naomi B. H. Croghan, Kathryn H. Arehart, James M. Kates. 2012. “Quality and loudness judgments for music subjected to compression limiting.” *The Journal of the Acoustical Society of America,* pp. 1177-88.

Önen, Ufuk. 26 March 2018. “Mikste Panorama ile İlgili Bir Kaç Not, 2”. https://www.ufukonen.com/tr/mikste-stereo-panorama-ile-ilgili-birkac-not-2-bolum.html (6 January 2021).

Reiss, Joshua. 2010. “Design of Audio Parametric Equalizer Filters Directly in the Digital Domain.” *IEEE Transactions on Audio Speech and Language Processing*, pp. 1843-1848.

Singhal, Anirudh. 2014. “Filter Design: Analysis and Review.” *Anirudh Singh Int. Journal of Engineering Research and Applications*, pp. 236.

Windsor, L. 2000. “Through and Around the Acousmatic: The Interpretation of Electroacoustic Sounds.” *Music, Electronic Media and Culture*, pp. 7-35.