UNIVERSITY OF CALIFORNIA, SAN DIEGO

The Development of Mechanized Sound, and its Ramifications on Habitual and Social Listening Habits

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Music

by

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ABSTRACT OF THE THESIS

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Regularity. Continuity. Consistency. Perpetually. Mechanized sound has characteristics, which are fundamentally different than that of the natural world. Forming an increasingly present sonic wallpaper, the inherent features of mechanized sound have had a dramatic effect upon human behavior. Increased use and reliance on machines have perpetuated a great transformation in the sonic environment of daily life towards the omnipresence of mechanized sound. The beginnings of this transformation took place in the immersion of workforces in the early textile factories.

In September 1846 in Hartford, Connecticut, Elias Howe patented the automated sewing machine. Shortly thereafter sewing factories developed, employing a generation of young women. An environment was created that was comprised primarily of mechanized sound. The people who worked in these factories where some of the first people to be immersed entirely in a mechanized sonic world. The uniqueness of this situation lies in this generation's perspective between listening to a world, which was exclusively natural to that which is a mixture between natural and mechanized sound. Natural and behavioral expectations and habits informed by sound had to be adjusted to the new environment. The sonic perspective of this generation, its effects on their listening habits and its ramification on their daily life will be explored.

The Development of Mechanized Sound, and the Ramifications on Daily and Social Listening Habits.

> But what a great contrast from the quiet country-home in the neighborhood of the White Mountains, was the City of Spindles, to the sisters! They had been accustomed to listen only to "nature's wild, unconscious song,
> O'er thousand hills that floats along"-
> But here was confusion in all its forms;
>
> - *Tales of Factory Life. No 2, The Orphan Sisters*

Written in 1840, this fragment from the *Lowell Offering* encapsulates the dramatic contrast between the world that had existed before the industrial revolution, and the recently developed mechanical sensory field. Before the onset of the industrial revolution "nature's wild, unconscious song" was the primary influence upon a culture's rhythms and a person's daily behavior. Much activity was limited to the daytime, the cycle of the sun was the collective timepiece. Stark environmental shifts soon entrenched themselves within the new mechanical environments, demarcating the sensorial fields as overwhelmingly confusing, regular and ceaselessly repetitive. Chief among the transformations between the pre and post-industrial environments was the striking transformation in their respective soundscapes. The girls in *Tales of Factory Life,* "had been accustomed to listen only to nature's wild, unconscious song." This was the world that has defined everybody's interactions with the surrounding environments. Now, the girls would be submerged in an environment whose sonic make-up was fundamentally structured upon striking differences. The consequences of this first transformation would continue to amplify as the march of mechanization, and afterwards electricity, became an increasingly pervasive and necessary feature of the modern world.

The sonic environment that we live in today blankets us within shrouds of mechanized sound. These sounds, emanating from the mechanisms so closely tied to our daily lives, have created a counterpoint with the natural sounds of the environments we live in. The dominance of sounds from the natural world has been lost in the course of a transformation that is still perpetuating itself to this day. What we are left with are two categories of sound, the natural and the mechanical, which continually intermingle and amalgamate to create all of the current sonic environments. The question that rises from this is: are we creating an increasingly alien sonic environment that envelops us more and more as it diminishes in its resemblance our own sonic habits? And if so, how have these transformed our interaction with our surrounding spaces?

Before we begin to trace the beginnings and evolution of this counterpoint and the introduction of mechanized sound into the sonic field, I think it is first important to discuss the differences between these two categories of sound. What defines natural sounds from those sounds that are created by mechanization? Is there a need for such a division?

The Natural and the Mechanical Sonic Fields

The natural sound world consists of all sounds that are created by a force, organism or object acting solely under the guidance of natural energies. These are the events that occur in natural settings, and had been occurring before the heavy hand of human influence began to mask the surrounding environment with the sonic and visual waste of our progress. From rain to lightning, to the sound of a fly, the rustling of leaves to the sound of blood running through our veins, all of these are but a sliver of the great expanse of sounds that in totality comprise all of the possibilities of the natural sound world. The primary characteristic that binds all of these sounds together is that they are always inconsistent in several or usually all of their sonic parameters. The amplitude and pitch of the wind for example is in a continual state of flux, as its movement and activity is influenced by a plethora of other forces and factors. The interconnectivity of the natural world is a crucial factor in the persistence of inconsistency in so many dimensions of sound in the natural world. Because all activity in the natural world is dependant on the actions and activities of all of the surrounding (and internal) organisms and forces, a stable network of influences can never be realized. The Butterfly Effect encapsulates this situation. Recurrence, the inexact return of a network of relationships towards its initial conditions is the desire of a system. However a small difference in the initial order of a dynamic network may have large-scale system behavioral consequences. This proposal is not meant to suggest that the natural world has a monopoly over the use of dynamic systems (some man-made systems such as the Internet certainly have a rich and mobile form of interconnectivity). However, a dynamic character is a major difference that was

quickly perceptible between the natural and mechanical sound worlds. This perpetual flux of influences and catalysts creates a sonic environment whose core characteristics include variability, unsteadiness and fluctuation.

The mechanized sound world on the other hand functions in an environment that has an extremely limited number of influencing parameters. Instead of existing in a complex matrix of relationships as the natural world does, mechanization developed in isolation, away from distracting influences and forces. Machines were developed and proliferated during the industrial revolution with the desire of increasing economic productivity and efficiency. As a result, machines were designed to achieve a specific task productively, reducing a company's dependence on expensive skilled employees. Due to their novel and unique features, as well as the difficulty in creating and maintaining these early contraptions, the machines were initially only clustered together in factories. This had the obvious effect of allowing economic productivity to increase at an enormous rate, and it also created an entirely new sonic field of activity. This was a sonic environment which was kept within the buildings at Lowell, divided from the external world of influencing factors. As the machines were kept in areas that were isolated and insulated, the walls surroundings the factory floor muffled the sonic effects of any external influences. Many similar machines would work simultaneously within the same space. As a result, repetitive tasks could be achieved with consistency. These factors lined up together and sparked the creation of a new sonic environment.

Interactivity is yet another fork in the road where one can see the sonic behavior of the natural and the mechanical environmental worlds diverge from one

another. Machines, unlike people, animals, water and other natural elements, do not interact with their surroundings. They do not slow down or speed up in relation their environments. A machine will continue to achieve its task until it is either turned off, or when it breaks down. The result of machines being interactively blind is that they create a blanket of sound that covers and masks all other resonance. It functions consistently regardless of its settings, conditions or circumstances. The resultant sonic characteristics that separate mechanized sound from natural sound are that the sounds emitted from machines are continuous, consistent and perpetual. This new sonic paradigm, which refuses to ebb and flow as all organic actions do, would require a recalibration of habituated sonic behavior, especially in terms of traditional forms of communication.

Human labor has for a very long time been one the most pervasive sources of man-made sound. All types of work and movement, from farming to transportation, were punctuated and characterized by sounds specific to each action. The sonic environment of the farm was strikingly different from that of riding on a horse through a town. Nevertheless as tasks were carried out, the accompanying sounds would follow the rhythm of the actions. As an action is carried out, slight nuances in the creators state, at times exhilaration, at other times exhaustion, effect the actions, throwing them into an inconsistent world of fluctuation. Eventually the gripping force of exhaustion will grab hold of the natural world, and the activity with its related sounds will slow, move or transform as energy is transferred elsewhere.

The immediate transition between not emanating sound to functioning when turned on (with the sonic field that accompanies its function), is yet another key

difference between the mechanized world and the natural world. Natural functions are unable to imitate the characteristic of immediate action and immediate inaction. Actions (and of course their resultant sounds) in the natural world take time to begin and to finish, these loci in the evolution of a sound have especially inconsistent profiles of dynamics, pitch and amplitude. It simply takes effort and time to adjust from an idle state to a state of motion in the natural world. The commencement and cadencial qualities of natural movement have governed our behaviors and the evolution of how we act within the world. However, our perpetually increasing reliance on this immediacy (movement in the mechanized world) has transformed our social, cultural and perceptual behaviors to expect this from the machines and the world around us. Today, machines are expected to function immediately, a machine idling from a few seconds often encourages a manic blast of signals to be sent to it from the operator (for example when a computer freezes briefly, how many times does one click the mouse?). Not only have we surrounded ourselves physically with the expectation of mechanical immediacy, we have also transformed ourselves to expect it from the sensorial environment of our surroundings. Thus we have become acclimatized to, and to a certain degree expect that these characteristics permeate our sonic space.

Today, both natural and mechanized sound environments constantly surround us. Several generations have passed through the threshold where mechanization became so pervasive that its absence is immediately noticeable. Undercurrents of electricity moving behind the surrounding walls, adds an increasingly pervasive buzz to the sonic tapestry of our daily lives. Fans, motors, light bulbs, cars, and planes,

along with a seemingly boundless list of other mechanisms add to this sonic matrix. This sonic environment, and our behavior of relating to it, is a modern phenomena. So how did our current sonic environment develop? And how did it shape how we listen? And how did it transform our relationship to the sounds around us?

Beginnings of a new environment

> In those days men's ears heard sounds
> whose angelic purity cannot be conjured
> again by any amount of science or magic
>
> Hermann Hesse, *The Glass Bead Game*

The nature and tempo of the world's soundscape before mechanization was such that an environment comprised of individual sounds that would intermingle together while maintaining their own discrete informative nature. This was the environment that surrounded everybody. All sounds, loud and soft, intermittent and recurring would have been derived from the natural sound world. The soundscape was sparse enough to allow perspective to be perceived. Background and foregrounds of the soundscape informed people of their physical surroundings, and their relationship to their encompassing space and environment. The natural sound world held a dominant stake in the make-up of the sonic environment. The loudest sounds created by the environment would have been thunderstorms and waterfalls. The loudest sounds made by humans would have been wars and the far more common religious use of sounds such as bells and singing. All of these instances of unusually forceful amplitudes were encountered intermittently and would also be tied to extremely significant social and cultural events. These particular sounds would have

punctuated the daily sensorial experience. They would not have been the material which wove together the fabric of our sonic environment. This is not to suggest that it was necessarily a quiet place all of the time. In some instances one can imagine that the pre-industrial world was actually louder than the world today. The common use of cobblestones and bricks as road surfaces provided an especially percussive surface for the many metal horse-shoes and wooden carriages and carts that would clamored over them. Also taking into account the fact that any sort of architectural sonic insulation (something that would divide people from the sounds of their surrounding world) did not begin to develop until the early part of the twentieth century, one can see that noise pollution could amount to a serious issue in the nineteenth century. These factors all contributed to the possibility of the pre-industrial world being a very loud place. Nevertheless, despite the fact that the environmental amplitude of this period of time could rival some mechanical environments that were developed later, all the sounds created were in a continual state of flux. Human contributions to the soundscape, notwithstanding their volume, would have complemented the natural sound world.

Textile workers of New England in the 1840s were accustomed to an environment completely comprised of sounds that were created by the natural world.

> There was neither railway, steamboat, telegraph, nor telephone, and direct communication was kept up by the lumbering stage-coach, or the slow-toiling canal, which tracked its sinuos way from town to city, and from State to State. The daily newspaper was almost unknown, and the 'news of the day' was usually a week of so behind the time.
>
> *Loom and Spindle,* Harriet Robinson

The global and environmental transformation towards a sound world that would eventually become saturated with mechanized sound occurred between 1760 and 1840, when the beckoning call of progress transformed the speed, quantity and material of manufacturing. What followed was the introduction, expansion and proliferation of mechanization that transformed the economic landscape of the society, as well as fundamentally altering the sonic make-up of many environments.

The consequences and mushrooming of this early sonic environment have grown continually since their onset, moving well beyond the scope of the industrial revolution as they became a central feature of the electrical revolution. So the question becomes, what were the characteristics of this new sonic environment? And how did the factory girls, who were unfamiliar with the sounds of the factory, react and adapt to them. The growth of this new environment's influence quickly became more and more pervasive. Alfred North Whitehead captured the character and extent of the transformation as he noted: "The greatest invention of the nineteenth century was the invention of the method of invention" (Opper). The nature of the time was change. Development and innovation, improvement and advancement were the principles of this revolution. The transformative parameters, many of which (including sound) were being altered as a means of achieving other goals, began to permeate every facet of people's lives.

The early textile operators such as Harriet Robinson, who authored her thoughts in her memoir *Loom and Spindle*, were the first people to be immersed in a soundscape that was dominated and saturated with mechanized sound. For the first time, qualities of sound such as perpetual motion and consistency blanketed the

surroundings. The looms of these early factories clattered and rattled loudly as they spun the yarn the girls were feeding them. This was a sound that was much too dense, thick and loud to be penetrated by anything in ones normal behavioral repertoire. The new environment had enormous consequences for both the individuals who were immersed within it, as well as the community at large.

The development of the textile industry, in any country or area, is an extremely significant moment in an economy's advancement and development. The textile industry was the first industry to undergo mechanization. This was largely due to the modest amounts of capital required to develop the technology coupled with the limited skill needed from the operators. Because of this, the textile industry usually holds a great deal of significance in a societies evolution towards the modern state of living. It is widely considered to be the first step that a country will take on the road towards modernization and industrialization. After a textile industry has been mechanized, proliferations of this early industry can spread quickly. Proliferating to related industries, increasingly surrounding people in layers of mechanized sound.

The first country to develop a mechanized textile industry was England in the 1820s. Subsequent national industrializations that had their beginnings with textiles include the United States in the 1840s, and Japan in the 1870s. In all of these cases the textile industry was the countries first exposure to a mechanized sonic environment. This is not to say that textile factories were necessarily the first instance of any mechanized sound occurring in any of these countries. However, it does represent the first mechanized sound environment that was exposed to a large group of people for an extended period of time. Later industrializations, for example in Latin

America, have occurred in more recent times. When Latin America began to develop a mechanized textile industry the spread of mechanization in the United States had reached a ubiquitous level. Despite the widespread proliferation of mechanization in several worldwide areas, the lack of a textile industry points to the undeveloped nature of the country's economy. While there is no doubt that specific manifestations of the mechanized world would seep into the environment of an underdeveloped country. However, a country that has not mechanized its textile industry does not have the resources required to create a mechanized sound world that would be pervasive, and have the necessary size and scope to be called an environment. Because of this, people who live in countries or areas whose economic infrastructure has not developed a mechanized textile industry, generally have not been acclimatized to an immersive mechanized sonic environment. In relation to the lack of perspective between sonic environments, the people living today in these areas share a similar sonic perspective to New Englanders of the 1830s.

In 1814, Francis Cabot Lowell built his first textile factory in Waltham, Massachusetts. He subsequently developed an employment system that engaged young women from New England farming families. The girls lived and worked in towns that were centered around the factory, and where a litany of social rules ensured curfews, temperance and work ethic. These women were the first people to experience the creation of factories in the United States. They had an extremely interesting sonic perspective as they were immersed in one of the great sonic schisms of all time. They began their lives without mechanization influencing their habits or

interactions, and later in life they found that they were surrounded my machines and their accompanying wall of sound.

Before their time working in the factory, these girls by and large came from the farming communities that dotted New England. As Harriet Jane Hanson Robinson recalls, there was an extremely wide cultural gap that existed between the factory culture and the country girls who arrived to operate the machines.

> A very curious sight these country girls presented to young eyes accustomed to a more modern style of things. When the large covered baggage-wagon arrived in front of a block on the corporation, they would descend from it, dressed in various and outlandish fashions, and with their arms brimful of bandboxes containing all their worldly goods…they had all left their pleasant country homes to try their fortunes in a great manufacturing town.

Starting work at 5:00 AM and working until 7:00PM was standard, and the girls were often only permitted one half an hour break a day for lunch. The factory girls were being plunged into an immersive experience of this new sound world.

A choir of new mechanized sound accompanied the development of the textile industry. The nature of this new sonic environment should be examined. Of course we have no recordings of the actual sound, so we must rely on descriptions of the sonic environment and it's effects on the people through accounts of the environment.

One such observer, an inspector of a factory in Manchester wrote in the 1840s his impression of the factory floor:

> …Enter with us into the large rooms, when the looms are at work. The largest that we saw is in the Amoskeag Mills at Manchester. It is four hundred feet long, and about seventy broad; there are five hundred looms, and twenty-one thousand spindles in it. The din and clatter of these five hundred looms

> under full operation, struck us on first entering as something frightful and infernal, for it seemed such an atrocious violation of one of the faculties of the human soul, the sense of hearing. After a while we became somewhat inured to it, and by speaking quite close to the ear of an operative and quite loud, we could hold a conversation, and make the inquiries we wished.

The inspector calls the experience of the environment "an atrocious violation of one of the faculties of the human soul, the sense of hearing." This environment was the first manmade and mechanized soundscape to completely mask the sounds that it coexists with. All other sounds, regardless of their purpose, origin or location become subservient to the continuous layer of mechanized sound that is emitted by the sewing machines. The volume of the new sound in this environment created a situation where people had to adjust their social sonic habits related to communicating.

Several other aspects of the inspector's observation are interesting. Another issue to note is the fact that the observation about the volume of the sewing machine is featured so prominently in the inspector's examination. Not only is the volume discussed, but the behavioral alterations made to cope with this new environment are discussed as well. One would have a difficult time thinking of a situation today in which the amplitude of a sound would strike one as such a significant event that one would offer so much reflection on it. This did however point to a large transformation in how the shift of sound changed our perception and interaction with our surroundings.

Despite this new and dramatically different environmental transformation, volume did not have large role in the vast majority of observations being made about early factories. There are two main contributing factors to this outcome. The first is

that volume was not an objective quantity in mid eighteenth century. It was qualitatively experienced, and therefore, without the tools or means to discuss sonic amplitude its impact upon the environment, while experienced, went largely unrecorded.

Many of the surviving accounts of the environments created by the factories come from inspectors written observations. In order to establish, understand and quantify this contemporary environment, inspectors were sent to observe and record that various goings on. Which leads us to the second component that lead to the muted discussion of sonic amplitude. The inspectors were largely looking for, and recording issues that they believed were having adverse effects upon the employees of the factory. It was not until well after the establishment of the mechanical environment that a connection between the force of the environment's sound and noise-induced hearing loss was established. And since no harmful consequence was known to exist, early factory inspectors recorded very few observations discussing the scale and force of the setting's sonic field.

The ramifications and extrapolations of the mechanic being a catalyst for social or behavioral transformations went well beyond what we have just seen. In the description above, the inspector describes how he was forced to adjust his physical position in relation to the person he is trying to speak with in order to communicate. This exemplifies the most basic of transformations that would occur in this situation. The sound of the sewing machines would become a model for bolder, more extended and abstracted forms of behavioral alteration. When new women arrived at the Lowell factories they were counseled by older women in domains such as dressing, speaking,

behavior, and the general manners of the community. Often, the factory girls would recruit their friends or relatives to work in the factories, creating a familial atmosphere among many women at the factories. The girls who worked at the Lowell factories were expected to attend church and demonstrate a moral composure that befitted a proper society. The 1848 Handbook of the Boston Manufacturing Company proclaimed that "The company will not employ anyone who is habitually absent from public worship on the Sabbath, or known to be guilty of immorality." The emphasis on maintaining a morally upstanding behavior and restraining all forms of excess was imparted upon the girls in a number of ways. One of the most interesting ways in which this was expressed was in the form of temperance rounds. These were rounds that were sung in a perpetual state of continuum and have lyrics that speak of the virtues of temperance. Three examples of temperance rounds such as these were published in the *Lowell Offering*.

The interest in these songs is the striking similarity between several sonic dimensions of the songs and the sounds which were being emitted from the sewing machines. Structurally speaking, very little is different between the sound fields of the looms and that of these temperance rounds. Both the sound of the sewing machines, as well as the temperance rounds make use of endlessly repetitive loops or cycles. Once the round or the machine begins, there is no beginning, middle or end to the sound's structure, they both continue until they are stopped. The rounds' formal structure directly parallels the mechanic activity of the looms. Small sonic loops are repeated endlessly. The experience of any moment is not so different from that of the

other moments, the rounds or the looms can be sung or turned on in different circumstances, with little, if any difference to their sound.

Other similarities can be noted in that the rounds, as they are sung by several people, are more or less sonically layered upon one another. Aside from maintaining the correct alignment between the parts, every little expressive, or individual nuance is needed to sing the rounds effectively with other people. Their simplicity is essential, as the songs would have been memorized and often sung at the same time as one would be doing something else. One can also note the lack of skill required to sing the rounds, as paralleling the modest amount of skill required to operate the sewing machines. Perceptually, the temperance rounds would be a similar experience to working in the factory. Both the sound of the factory and the singing of the rounds acted as a sonic background to the flurry of other activity that encompassed the moment.

The exceedingly short duration of the rounds and the sewing machine's sonic identity, which is subsequently repeated at enormous length is yet another core characteristic linking the two ideas. Both of these sonic fields rely on incessant repetition and extended exposure to a group of people to be effective. Neither sound is presented as a broad and primary focal point of one's attention. They are experienced as one negotiates a plethora of other distractions, either within or outside of the factory. The importance of the sewing machine's sonic nature is displayed by the fact that the same sonic parameters which were instilling many coping transformations within the women, were also being harnessed to enact and solidify more targeted social expectations. The rounds, which discuss and encourage

temperance, were tapping into the transformative power that these sonic characteristics had upon the population. Whether trying to impart social and behavioral transformations upon the Lowell women consciously or subconsciously, the sonic make up of their environment was fundamental in the process.

The discrepancy between a sound's actual properties and its perceived properties is never especially clear. What is the measure of fidelity versus perception? The floor quickly gives way to a flood of multiplaned and multidimensional perceptual and philosophical arguments. Despite these issues, we know that human sound perception developed in a manner (along with many other perceptive tools) to aid our ability to survive and thrive within our environment, gleaning the information we needed to survive from our surroundings. It is also our developed ability to perceive spatial relationships from sound as we encounter an environment. However, our perceptive abilities become bogged down when challenged with a new environment such as those of the early textile factories. So many dimensions that were once informative, have been stripped of their enlightening power.

Take, for example, the extended exposure to a sound with a decibel level of over 90 (about the decibel level of a lawn mower or noisy office). Before the industrialization process an experience of this sort would have been rare. This is the point at which sustained exposure to sound of this volume can actually inflict permanent damage upon a person's hearing. At the least, exposure to this environment for any substantial amount of time would trigger your body's temporary hearing loss. This is called is temporary threshold shift, it is the constriction of the blood vessels (vasoconstriction) which reduces the blood supply reaching the hair cells

of the organ of corti. The outer rows of hair cells respond primarily to low intensity sound levels and thus are easily saturated by high amplitude sounds. This leaves the inner rows of hair cells working within the ear since they need a higher intensity for stimulation. The physiological transformation that is undergone to deal with these amplitudes leads us to infer that humans while humans have developed to be exposed to this level of amplitude for brief periods of time, it is not our preferred environment as our sensorial perceptive ability become significantly reduced. The sound levels created by the mechanization of manufacturing have challenged our ability to use the most refined tools our aural development. Human sound perception is simply not built to be able to glean a significant amount of information from the sounds that accompanied industrialization.

Beyond breaking into new realms of amplitude, the factory floor further altered our daily interactions with sound. Spatial perception, a fundamental characteristic of human sound perception, was ultimately entirely flattened by the onslaught of sounds emanating from within the factory. Deciphering spatial relationships through sound, has of course has been enormously helpful over the course of human history. This skill allows one to draw information about ones surroundings beyond the limited scope of what one can see (which often provides important but limited information about ones surrounding). Several dimensions of sound help us place its location, for example, as a sound moves from one of our ears to the next, we are able to place the direction of the sounds movement. And from the direction of the sound as it passes past our ears we are able to place the direction of the sound's origin. The distance of a sound's origin is understood by perceiving the difference in time, between a sound's

arrival to each of our ears. These habitual listening habits inform our daily lives, help us contextualize our surroundings, and enables us to interface safely and effectively within a given surrounding. Our perceptual capacity becomes challenged when encountering environments that do not allow our abilities to decipher natural sonic environments. The factory environment can be seen as a democratization of sound, where identical sounds are created from many sources. This removes the ability to perceive direction and distance from the surroundings, as sound instead blankets its environment in sonic equality. The sonic field has been flattened, an environment where perspective has been lost.

Our reduced ability to perceive spatial relationships coupled with the new volumes of the factory environment rendered many sonic perceptual abilities obsolete. Deprived of the ability to use sound to gain information from one's surroundings required the development of a set of ad hoc perceptual abilities and behaviors that would allow people to safely interface with the new conditions of the factory. This amounts to an entirely new sensorial relationship to one's surroundings. Senses of sight and touch would have to rise in importance, in order to serve the ability to orient oneself without the effective use of one's hearing. These adjustments, however dramatic, would never be able to provide the contextualization that our sonic perception is able to render under more dynamic circumstances.

This flattening of the sonic perspective leads us to another stark environmental shift that these machines introduced, namely that of layered sound. The layers of sound are created by the machines who all emit sound within the same space, but do

not interact between one another in any significant manner. As a result the sounds stack continually upon one another, forming a dense wall of sonic layers.

The idea of layered sound has become extremely normalized in our daily aural experiences, and has become an extremely pervasive parameter of expression in recorded music. Layering is an essential and unique characteristic of the mechanized sound world. Though sounds certainly mix and layer upon one another in the natural world, the continuity and consistency of the sewing machines is something different. The creation of multiple layers of activity, instead of a matrix of interconnective interactions requires the isolation and limited influences that come with a mechanized environment. The various layers of sound act individually from one another, insulating their sonic identity from the influence of others. The actions of one machine does not effect those of its sister machine. And likewise the sound emanating from one machine does not react to, listen to or adapt to the sound emanating another machine. All of these issues of layered sound are echoed in the two temperance rounds that were discussed earlier. These are a musical form that is comprised of several sonic layers that lock together in an endless repetition that unfolds itself upon all other sounds in the environment. This layered texture of sound has become more and more pervasive in our culture as the use of recorded sound developed.

Though limited in its size and scope, the early factories at Lowell offered the first examples of people interfacing with a mechanical environment for an extended period of time. Even with the mechanical sounds being limited to a specific location and only being experienced for a certain portion of the day, the effects of this dramatic environmental shift are evident and distinct. This moment in the course of our

sensorial development proved to be but a microcosm of what was yet to come. The use of machines quickly broke beyond the barriers of the textile industry, and with that came the augmentation of people's exposure and interaction with mechanical sound.

Expansion and Proliferation

The rapid expansion of the textile industry in the nineteenth century generated a demand from other industries, such as engineering, coal, transportation and construction, thereby stimulating their rapid development. As this unfolded, a pattern developed in national economies where the textile industry would eventually recede in its economic importance, as other industries grew. And with its disappearance followed the sonic environment that was created by it. It marks a significant and specific point in a cultures economic and sonic development. The rush of mechanization has yet to stop, but the cacophony that was created in its earliest manifestations is gone. Today the constant hum of mechanization around us has become a persistent tenor to our daily lives, weaving a tapestry of consistent, perpetual and continuous sound. The experience of living in this environment informs our how we experience, interact with, notice and remember the sounds around us.

All of the characteristics indicative of the sonic world created with the industrial revolution, contributed to forming an aurally deprived cocoon around the individuals who existed in it. Despite a plethora of sonic events and activity that filled the early (and subsequent) factories, these environments became deserts of most actionable sonic information. Interactions within space, with surrounding people and objects were all completely disrupted and the need to orient oneself within a space became reliant on less refined sensorial perceptions.

The sound of the machines did begin to serve a more utilitarian purpose after some adaption. The sound the machines made was the most invasively experienced expression of the factory's functions. Because of this, the sound of the looms became closely related to their function. The clap and clatter of the factory floor would speak a language, expressing the state of the looms, their needs for repair, and their rate of industry. The sound of the machines would become their diagnostic characteristic.

The limited scope of this new sonic paradigm first began to shift as mechanization moved beyond the stationary setting of the factory floor. As was discussed earlier, the increased economic demands that accompanied the industrialization of the textile industry quickly put pressure on other industries. The following list, selected from R. Murray Schafer's book *The Soundscape* illustrates the expansion of mechanization through the nineteenth century, as it migrated to other fields and industries.

- 1711: Sewing machine
- 1714 Typewriter
- 1738 Cast-Iron rail tramway
- 1755 Iron Wheels for coal cars
- 1761 Air cylinders
- 1781 Steamboat
- 1785 Power loom
- 1791 Gas machine
- 1796 Hydraulic press

The development of the railroad and transpiration industry was soon to follow the textile industry's march towards mechanization. However, the nature of transportation and how it interacts with its surroundings is entirely different from that of the textile industry. By its very nature, transportation would be built to effect new

environments. It created both a physical and aural interconnectivity to the areas that is would increasingly service.

Any vehicle of transportation has two environments that can be perceived and experienced. You have the external world, which the vehicles interacts with only as it passes through the space. Nevertheless, the repeated presence of noise, at increasingly regular and loud intervals along established routes, had pervasive effects throughout the host environment. Transportation additionally has an internal environment that occurs within the mechanism of transportation. The internal environment is dominated by dense layers of mechanized sound, which like the workings of the early factories, are barren sonic fields. Despite the extreme nature of this internal environment, during the nineteenth century, transportation was experienced more often as a disruption of a natural environment. This was the means, and the context by which a majority of the population during the nineteenth century would first interact with mechanized sound.

Due to the intermittent and transitional nature of transportation, in its early stages the industry was not able to establish an environment of its own. Rather, it began mechanization's counterpoint with the sounds of the natural world. The sounds of railways would interweave themselves within the surroundings, eventually building up to become our current sonic web, always mixing the mechanical and the natural. The great significance of this transition is that this moved mechanized sound into the publicly shared space. No longer were mechanical sounds encapsulated within a structure, instead automated transportation was increasingly paraded about, becoming the symbol of progress reaching its arm through the countryside.

Beyond acting at the catalyst for the beginnings of mechanization, sewing machines were also the vehicle by which mechanical sound moved beyond the limited scope of the factory and the public sphere, and into the private sphere. Until the 1870s mechanized sound in the United States largely existed exclusively in public spaces. Mechanized sound was limited to the workplace and thus had strong cultural connotations tying it to a specific time of the day, as well as to a specific class of people. The sonic experience of this environment (as well as transportation) was additionally a shared experience, with many people collectively being cocooned within the same sonic blankets, limiting their ability to interact with each other and their environment. After the workday had completed, the workforce would return to their homes, environments that were free of any mechanization.

By the mid nineteenth century mechanization had become mature enough to be marketed to the public for personal use. The first automated machine to be sold to the public was the personal sewing machine, which was first marketed in the mid-nineteenth century by Isaac Singer. The machine was quickly proliferated throughout the United Sates. In 1853 the Singer Sewing Machine Company sold 810 machines, by 1876 the number had climbed to 262,316 machines. In most households the sewing machine would be the first automated instrument to be introduced to the house. Moving onwards from this point, the house would become as cluttered with mechanical sounds as the public environments had before. There were of course significant differences between the nature of mechanical sound in the factory and in the house. For example the sounds in the household would be much quieter then those of the factory. Also, the desired variety of machines in the house would ensure that

the mechanized sounds would be much more diverse in their nature. Nevertheless, the fundamental characteristics of mechanized sound would remain intact. Mechanized sounds gripping influence now entered the private world, forming a perpetual coat of buzzes and hums over everybody in the industrialized world.

The movement of mechanized sound from the stationary and isolated factory floor, to streaking through the outdoor environment, to taking a place within the private home paints an increasingly claustrophobic image of our relationship to this sound. As we continually ride the moving tide of mechanical and electrical progress, we are changing our surrounding environment in dramatic and pervasive ways. So what is our relationship this these relatively new sounds? Where does the desire to saturate our environments within shrouds of this sound come from? Perhaps in order to think about this issue we need to alter the perspective of our thoughts on sound.

More fundamental than the experience of mechanical and natural sounds is the division of the sound world that envelops us into two sources: the sounds that occur in the world and move towards us (eventually moving within us), and the sounds that are created within ourselves. As we have seen, before the mechanization of the textile industry, cultures were free of any widespread mechanized sounds in their environment. After the mechanization of textiles began, we can see a steady increase in the pervasiveness of mechanized sound in the culture's sonic environment. What begins as an isolated sonic environment sweeps across the community as the tide of progress pulls more industries towards industrialization. Today, people have lived their entire lives in an environment that is a mixture of the natural and mechanized sound worlds.

Origins, Reflections and Projections

The sonic nature that accompanies the progress of our development has inflicted a deep scar into the sonic fabric that was once made up entirely of natural sounds. This interaction has undeniably transformed the soundscapes that surround us. What has remained consistent, are the sounds produced by natural beings or forces on a local level (removed from the environment). These natural sounds include all of the sounds created by the weather, the earth, animals, plants, and of course the sounds that are made by our own body's functions. The sounds our bodies produce share interesting parallels with the mixture of sounds that currently surround us as a result of our mechanical and electrical revolutions. What is a manufactured sonic interaction between the natural and mechanized in the external world, actually has an entirely natural parallel within ourselves. The sound that occurs within the self, within each of us mirrors the new external sonic counterpoint, between the natural and the mechanical, that we have increasingly surrounded ourselves with.

Rhythmically speaking there are two models of activity for the sounds that emanate from within us: intermittent sounds and continuous sounds. The intermittent sounds, such as those of our digestive system share all of the characteristics with the natural sounds that occur outside of ourselves. They are inconsistent in terms of their local and global rhythms and they are constantly fluctuating their pitch and dynamic. These sounds occur as a result of a complex matrix of organic and chemical processes and interactions, and thus have all of the inconsistent and intermittent characteristics that we have ascribed to the sounds of the natural world.

The second category of sounds that are produced by the body are continuous sounds, these sounds include the functioning of our nervous, circulatory and respiratory systems. The experience of hearing these sounds is a paradox. They are on the one hand constantly present and on the other hand muted to the creator of the sound. It is, in fact significantly easier to hear another person's heart beat than to hear ones own.

These sounds, that are entirely continuous, walk a fine line between the natural and mechanized sound worlds. These systems share characteristics of both, as they create a consistent and continuous hum of sound that additionally fluctuates as it is influenced by internal and external forces.

The character, rate of change and amplitude of these continuous sounds are controlled by our internal state of being. It can be said that these sounds are our most honest sonic barometers. They react, mirroring the creator's internal state, speeding up when activity or anxiety is increased and slowing when one's state relaxes. These sounds are continually interacting between the forces that cause the fluctuation their pace and rate of change, which is influenced by a multitude of internal and external factors. On the other hand, these sounds are governed by an inherently continual force, which perpetuates itself to make life possible. This amalgamation of characteristics makes these systems especially complex when thinking about in terms of natural and mechanized sound.

These sounds are additionally only heard (in normal circumstances) by the creator (if they are consciously heard at all). Unlike sounds created in the external world, which once created, reverberate off of walls and people, participating in a

public experience being heard by anyone attentive enough to hear it, these sounds remain private, heard only by the creator. These three systems: the respiratory, circulatory and nervous systems form a continuum of becoming increasingly private and further removed from the public experience.

The sound of breathing, while generally private, can enter into the shared sonic space without imagining any extenuating circumstances. Exercise is one of the most common situations in which the sound of our breathing moves beyond the limited of our personal experience, and joins the public sonic tapestry. The circulatory system is significantly more removed from the public world, as one must be either aided by a stethoscope, or by placing ones ear upon another's body. Both of these situations are extremely personal and intimate, far removed from the public sphere. The most internal of sounds, are those of the nervous system. These sounds go largely unheard by even its creator a majority of the time. This sound creates a constant hum, blanketing all aural experiences of everybody's perception without conscience recognition.

In this context, it is especially interesting to think about these internal sounds as being the first and until the industrial revolution, only representation of continuous sound that humans would have perceived on a regular basis. What then is the relationship of the internal and the external sound worlds? The tide of mechanization brought by the textile industry, began the proliferation of repetitive and mechanical sound that has grown at an alarmingly rapid pace, becoming entirely pervasive. During the course of this transformation we have projected the mixture of sonic activity that has always accompanied our body's functions onto the external world.

The side effect of our increased dependence upon the mechanical world around us is that we have reflected and projected the sonic environment of ourselves upon our surrounding world. This creates a complex sonic texture, made up of both fluctuating and constant sounds emanating from within and outside of us.

Being immersed in a sonic surrounding, that is made up of sounds which are characterized by continuity and perpetually has a curious precursor in the early stages of human development. The development of the fetus takes place in the womb, which is itself an environment comprised of continuous sounds. All of the sounds of the mother's body, namely the circulatory and respiratory systems create the sonic wallpaper of the womb. The sonic experience of the fetus inside the environment is also one with a limited number of influencing parameters. The stationary environment of the fetus does not allow a broad number of direct sonic experiences other than the sounds created by the mother's body. All other sounds, emanating from outside of the mother must be filtered through her body and would clearly have foreign qualities separating them from the sounds created within the Mother's body. The continuous sounds of the Mother's body enjoy complete primacy within this environment, interlocking these reverberations with the safety and security of the womb.

Steven Connor begins his article *The Sound and the Self* by saying "[d]epending on who you believe, modernity is identified both with the making and the unmaking of the self." We have over the course of recent history projected the continuity of our internal sonic make-up onto the external world. Our relationship to this projection of ourselves has grown from the initial rejection, to acceptance, and now to complete dependence as its presence takes an increasingly dominant stake in

the make up of our sonic environment. Today our daily lives depend entirely on the functions of a multitude of mechanisms, they provide our security, our communication our ability to function in our world. The comforting nature that now accompanies our cocooned sonic nature mimics the womb, our first sonic environment.

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