

Special Treatise on the Echo

(author unknown, drafted 1625; revised January 1626)

“...several observations that were made by a fine gentleman in Marne in the year 1625.”

- F. Marin Mersenne, **Treatise on Universal Harmony**, (1636)

I am reminded of the promise that I made you upon my departure from Paris in October 1625, and I have, at long last, finally compelled myself to fulfill my obligations to whatever end I am able. But considering the fugitive nature and the obscurity of the Echo, Nymph of the Air, Daughter of Juno, Nyade, Dryade, or Oreade, please excuse me for not having excised from her the rent that is due to me for her residing over the woods, distant lands, gardens, houses and mountains. For this delinquent debtor often leaves the home so that she may say she wasn't there. This has tormented her creditor, for an entire month, as I have searched ceaselessly for her morning, noon, evening and night, through good and bad times, lying in constant waiting for the occasion to speak with her. This Nymph employs her knowledge of the extensive routes connecting the woods, river valleys, ponds, islands, caves, churches, bell towers, roads and city walls, wells, barnyards, smoke pits, presses, courtyards, canals, aqueducts, openings below the earth, bowers, plaster vaults, shacks, large spaces such as ports, arcades, portals and bridges, outcroppings of rock, banks of columns and high mountains. All that I might be able to learn about the Echo would amount to nothing more than the vague assurance and knowledge a mariner might derive from the tremblings of his compass as he searches for new worlds.

There are two possible methods of approach to researching the nature of this Image of the Voice: namely, investigation of its practical operation, or, engagement in theoretical and philosophical speculation.

In the area of theory, we may approach our investigation from the standpoint of the three elements or principals of generation: namely material, form and absence; or one could speak of the four causes, universals, or the ten categories. In the area of practical investigation of the Echo, we may undertake this outside, along promenades, where one may beat two small rocks against each other and take note of the repercussions that follow: the initial wave, those that follow and the aftershocks mark the abode, the resting place of the Echo. And if we were to use a geometric system to map the dimensions of this space, in geometric units of five royal feet, we might eventually find some part of the knowledge that we seek. But we would have to investigate all of the places that constitute the Echo's sphere of activity, until we finally gain victory over this resonating phenomenon, and may observe the vocal line, at what point it originates, at what point it terminates, and inquire into what time of the day is optimal for propagating Echos, and what the time intervals between iterations and reiterations are, which we may measure by counting on our fingers or by rotating our bodies, both of which are able to measure the time intervals between Echos.

But I recognize that I must leave the attainment of this goal to another Pan, that is to say, to a man more polymathic than I, who is possessed of all kinds of other knowledge capable of trapping this *femme fuyarde*—*she who flees into her hiding place, and vanishes before our eyes*. He who assumes this challenge must dedicate his entire life to the relentless pursuit of her, even into her very bedroom suite, into her den.

Based on the observations that I have made, I am inclined to call the Echo “substance” rather than “accident”, since she is nothing more than a “song” or “air”, a recitation of “impressions” of one phrase or another, which one may initiate whenever one uses one's lungs to press the air into articulated, animated syllables.

The path or environment of the sound dampens or accelerates the movements of the Echo, and the initial percussum of air, created by the collision of two hard objects, bears enough witness to the fact that sound is not a simple *accident*, but rather a *substance*, which is not always the same in dimension or nature, since it always represents a different tone: she is always morphing and changing based on the disposition and shape of the islands, small river banks, marshy ditches, rivulets, grassy fields, all of which disguise her sound, like a mirror that has been tinted with a certain color, imposing a certain affect onto every image that it reflects.

Concerning the size and length of the vocal line of the Echo, I find that in order to hear clearly a two-syllable word, it is necessary to be a distance of 25 meters from the point of reflection and that the space not be open and ill-

defined, but rather enclosed by a ditch or a wall. I encountered an Echo at 100 geometric feet—this one quite weak—as it propagated itself along the roads, through the underbrush, hedgerows, old sheds and cottages, here and there, in no determinate order, through the trees, palisades, gardens and deep holes, at last finding refuge in the narrow corner of two joining walls, supported from behind by an embankment. This sound echoes briefly but distinctly 4, 5, 6 and 7 syllables such as those in the words and phrases *colintampon*, *abdenago*, *l'amerabaquin*, *parafaragaramus*, *arma virumque cano*. It travels a distance of 120 geometric feet, at which point one must mount a hilltop of three or four feet in order to hear it, otherwise it becomes quiet, mute, entirely inaudible.

Our Science of Echoes, our *Echometrie*, has an advantage not found anywhere else, not even in the science of optics, namely, that Echoes have the ability not only to be transmitted through diaphanous materials, but also through entirely opaque materials.

The above examples are accompanied by many other Echoes, which speak first at a lesser distance, and which do not share any qualities with each other. If a voice sounds at noon in woods or an outside space sufficiently resonant the sound wave begins and ends in one vocal line, without reflection. The actual Echo may originate from behind the space, where it resounds over a river and through a stand of willows. At nearly 25 fathoms, this Echo does not transmit words: whatever sound one encounters is not a decipherable communication of any kind, being that there are two sound rays running parallel or crisscrossing each other. But if we turn to face Southwest *between* the Echo, we can hear three or four Echoes, each repeating based on its environment: there are two such Echoes that repeat so numerous and quickly such that the time intervals between repercussions are not detectable. I have found an Echo at 60 geometric feet, which is the length of a road that gives way to a bell tower eight fathoms high. The Echo consists of two or three syllables, which pronounce themselves distinctly and with much force. And if we were to reinforce the voice here, we would encounter yet another Echo emanating from a fortress behind a farm. And there is another that occurs in a pressing house that has a courtyard and area covered by a thatched roof and walled on three sides, situated near a resonant roadway. This Echo happens at a distance of 65 geometric feet and can repeat two to three syllables, provided that one speaks them promptly, as the time interval between the initiation and the repetition is imperceptible. An Echo is nothing more than a relation between two things.

Someone else, who has more leisure time than I might be able to understand the parallels between Optics and Echometrie and be able to prepare a theory that outlines the relationships between both fields. But I am content for the moment to draw on the thought of Averroë, who tells us that the nature of the Echo is like the circles that are produced in water when one casts a small stone into a pond. One water particle touches another and impresses the circular figure of the stone onto adjacent particles until the wave reaches the shore; at the same time another wave return to the place where the rock entered the water.

Based on this relation, we see that the Echo is driven by a physical force. We might ask if there exist reciprocal Echoes and how they might be created. I have encountered an Echo of 500 geometric feet that travels along an inclining landscape and is stronger when heard traveling from low to high than when heard traveling from high to low, even though there is a small stand of trees between two walled embankments and a court of vaulted niches that help reinforce the Echo when heard from below. I am, however, left in a state of doubt, unable to arrive at a definitive answer about this Echo. I have considered requesting a more formal inquiry and soliciting 10 to 20 testimonials from others who share my curiosity, in order to support my claims and speculations. Regarding the quality of this particular Echo, it is quite strong at 15 feet and becomes much weaker at 80 to 100 feet, becoming more drawn out, distorted and fragmented, resembling more the sound of the sad man's sigh, as it reverberates all around. When washing at the river we hear, now and then, an Echo resounding between the isles and willows. This Echo terminates in a flat field next to a series of ponds, above which there is a small hill, which lifts the Echo and changes it a bit. It also is worth noting that rain as well may sometimes change and disguise the voice.

These phenomena are no less wondrous than anything else that we could say about the Echo, whose area of study embraces both the cause and the manner of its propagation and describe the forms and effects that can be produced.

Concerning the cause and manner of its propagation, we do not doubt that the human voice may produce an articulated Echo, following the logic that the air in the lungs, being expelled, impress upon another air mass that which the person desires to express. He who can contemplate this notion and all those that follow here below will approach an understanding of the Echo.

If we consider the sciences of Dioptrics and Catoptrics, we find a strong correlation between light rays and the sonic rays that constitute the Echo, from those that are cut off or interrupted, to those that pass through and over solid bodies, to those that are reflected. But to create an Echo, it is necessary to possess a sufficiently forceful voice, whose sound, after having resounded here and there, returns to its point of origin, if not by the same sonic path, then at least by one within the same general area of the person who initiated it. It is these ideas concerning sound that I believe Aristotle discusses in his second book on the passions, where he describes a resonant body as being like an open vase able to receive any kind of content, or like a ball that has been thrown against a solid object and returns to a place near to that from which it was thrown.

It is a similar kind of shock or collision of air that creates a sound capable of inciting panic in foreigners, as Poliaenus writes in his *Strategems*. Pausanias said that the Megareans supposedly gave to Diane the title of Guardian of the Echo. The Persians terrorized the Greeks through an unrelenting Echo that lasted an entire night. The Greeks, believing that they were hearing their enemy responding with moans and cries, attacked a giant resonant outcropping of rock only to find no enemy. This sapped all of their fury and courage. The next day many were taken captive by the Persians, and the others fled to Thebes via Mardonius, and upon their arrival recounted the terrifying effects of the duplicitous Echo. However, that which inspires fear in one man, may give pleasure to another, who may find utility in the Echo, as in the case of music or its employ in techniques for amplifying the voice so one doesn't have to shout.

Interest in this Collision of Air has endured over the ages. It has long proven an interest of poets, who have elevated the concept of the Echo to rarified climes, personifying it, calling it "daughter of the air", a "fugitive nymph", a "savage", "vagabond", a "mockler", a "vocal masquerader", a "deining respondent", "plaintive", "mournful"—all descriptions inspired by the diversity of impressions and forms that the Echo may assume. Along this line, the particular affects of the Echo are better studied in the repetition of syllables in which "a" and "o" are found, than those in which "e", "i" and "u" are found, owing to the fact that it is easier for the person speaking to form various configurations of the mouth and to vary the force of air with the vowels "a" and "o".

The nature of the place in which the Echo occurs contributes greatly to the knowledge we are seeking, since the Echo can occur anywhere from plaster vaults, to niches at the edges of gardens, bowers, resonant churches, arcades and great bridges spanning rivers, to grottos, niches in walls, woods thick with underbrush, thatched cottages, gardens, palisades, islands covered with willows and the ruts and gulches near ponds. The ingenious architect builds a place for the Echo in his plans for a garden or landscape, in order to take advantage of the Echo's qualities and effects, as exemplified in the architecture of the Gallery of Olympus and the Seven Towers of Byzantium.

Returning to the poets once more, they speak of the Echo as a Nymph transported by despair, who, against all pleading, is transformed into a rock as her blood is evaporated by the incendiary cruelty of Narcissus. Her body hardens into rock and her stomach opens to become a cavern—all for simply obeying her passions for another. This is testimony to the seductive nature that drives men to seek out and pursue her. She promenaded her wares over the waters and cast liberally her charms, whose magical attributes tormented Narcissus and all whom she scorned.

What do you make of this poetic discourse? Can we not see through these accounts that the screams and outcries of the Echo torment our very spirit as she resounds through the rocks and over the water, casting her natural magic over everything we can create, through our alleys and roads, hills and ravines?

Roman historians Schotto and Capugnano have brought to our attention a fine Echo near the church of Saint Sebastian where one finds the tomb of Metelli family, which consists of a round tower (common in Roman mausoleum construction), with the dimensions of 25 feet and named "Head of the Steer", after the carvings and ornaments that festoon the top of the tower. Just below it is the Circus of Antonius, which in ancient times was an exercise and parade ground for soldiers. At little distance from this tower, one can hear an Echo that is capable of repeating a series of words

or a whole verse eight times in entirety and with perfect clarity, followed by several confused and distorted iterations. We can also see the place in which the ancients conducted mass immolations, the resounding sound of which made one believe that the sacrifice was much larger than it really was. Whether this site was found or if was chosen for grand sacrificial celebrations, or if it was destined to be the sepulcher for the descendents of the House of Crassus and a means of immortalizing their name for posterity, I cannot say.

It is true that the Echo finds its abode rarely agreeable, as she makes everything that she says and does understood at a good distance from her residence. We may only hope to find the Echo in great halls and places of leisure. Regarding churches, the Echo cannot serve to make the priest's voice more understandable, as she will bother and interrupt him a lot, cutting through his words with her soundings. Dandinus tells us of an Echo that he has heard in a house in the Boulevard Millannois that reverberates up to 20 times. Majolus speaks of one in the Hall of Pavie that resounds the number of times corresponding to the number of windows in the Hall. I hope that these accounts be used in advancing the Science of the Echo.

In the sixth book of the *Tapestries* by Saint Clement of Alexandria, the author speaks of a miracle that God wrought with trumpets and fire when he handed the Ten Commandments to Moses and renounced the nonbelievers. He also describes several wonders drawn from natural history in order to show that the divine Author of Nature cannot be less powerful than nature herself. He also relates the story of a mountain in England that is open with a gaping cave from top to bottom, in which the wind resounds to create a harmonious sound capable of immediately inspiring overwhelming hope. And finally he recounts the story of an Echo found in the history of the Persians, namely that of three mountains situated on a flat plane such that if one approaches the first mountain, one can hear nothing but confused voices that cry and argue; if one approaches the second mountain the noise and din is even stronger and more violent, but approaching the third, one hears cries of rejoicing and celebration, as though the bellicose voices of the first two mountains have been vanquished.

Thus we find even in the case of such an ephemeral substance as air that it is capable of creating a diversity of wonders, and that the human spirit regards and researches the causes of these wonders in order to no longer have to admire them. You can see that the Echo is just as pleased to travel through the mountains as within caves; both are nothing more than mere vehicles for its easy transmission and comportment.

Regarding instances of more localized Echoes, it is difficult to derive any knowledge of them. For instance, music has no notes that are powerful enough, nor pauses or suspensions that can be sufficiently measured. At a distance of 120 geometric feet I have found an Echo capable of reflecting one word within the time of a minute, which I measured with a watch. Another time I found the same time ratio between origination and reflection to reach 16 to 20 minutes. This allows for 16 opportunities to repeat the word and 20 opportunities to hear the entire reflection, which one can best experience only up to nightfall, at which time the air starts to become thinner. But I should add that if there are fewer trees, houses or gardens for it to traverse, the Echo returns much faster, as I have experienced with an Echo of 60 or 70 geometric feet.

The best time to observe the Echo is in the early evening around the setting of the sun, between five and six o'clock. I find October to be a much better month than others for observing Echoes. Also, between noon and four o'clock, the air is too hot and diffuse and cannot receive a proper Echoic impression, and if it does, the Echo will not be very good, as the air lacks the proper density. Finally, foggy or misty nights are also not the best times to observe the Echo.

After having taken our Echo through eight investigations, I have recorded some of her specific characteristics and horizontal dimensions. It is notable that she does not always respond as nicely when reflected perpendicularly as she does when traveling horizontal to the ground.

The habits of this Invisible Force are observed in all manner of mediums, as she does not disdain the likes of walls, both polished and rough vaults, meadows, ponds, rivulets, old sheds, gardens and porches. Yet, after all of the research and pursuit that I have brought to bear concerning this fugitive, my pains and efforts have all come to naught.

Behold how the Creator gave voice to the woods, rivers and mountains, so they might praise and bless their wondrous disposition. This has resulted in a ravishing harmony and beautiful symmetry that is admired by some, examined and placed into practice by others, and reflected in all of the great works of human artifice.

In my research on the fugitive Echo, I have used all sorts of snares and nets, and although there may be other traps we might deploy, I will leave that to another Pan, that is to say, another person more polymathic than I, who is knowledgeable in all manner of sciences. If all people were fashioned after the same exact design, we would be better equipped to examine the common experience of our world. But for now, I pass the torch to another who can run with it and continue our noble pursuit of the Echo.

*Verum haec quoniam spatiis inclusus iniquis
Praetereo, atque aliis post me memoranda relinquo.*