The Monument at Katwijk

They found it while doing repairs on the TAT-14 line. An especially wet summer had caused unexpected subsidence, leading the cable to sink further into the beach and putting extra strain on the junction. The cables were built to withstand far more than this minor trauma, but the depth, and strange and angular nature of the bedrock below meant that it was better that they controlled its descent rather than allow its movement unimpeded, which would inevitably lead to it awkwardly perched and pinioned amongst that odd toplogy, the pressure on the pipe unevenly distributed and leading to further problems down the line.

And so they started the excavations. A team of diggers rolled onto that bare and wind-battered beach - surrounded by dunes and North Sea facing - orange warning lights flashing in the night under the low sky. And they dug. And dug. The cable had sunk down further than estimated - the geophys readings were just a blizzard of neon static – and their careful hydraulic scoops were soon replaced by even carefuller, bicep-powered shovel excavation - eventually reaching the cable and hoisting it out of the beach-long trench that stretched from dunes to the surf, and laying perpendicular alongside.

The History of the Monument at Katwijk

The stone monument at Katwijk was over 10 metres across and covered in smooth, incredibly precise carved grooves that encompassed nearly every inch of its surface in large, sweeping arcs that looped around it in an impossibly complex geometry. It stood 3.3m high (2 Megalithic Yards) at its tallest point and was surrounded by a shallow trench that still showed flecks of the dark red paint it must have originally been decorated with. Each of the grooves on the object's surface, although looping in semi-cyclical orbits around the outside of its shell, contained an incredibly rich and precisely-cut set of depths ranging from 3 - 284mm. These carvings puzzled many of the archaeologists until further excavations uncovered a series of 37 small, single-story stone buildings arranged in tiers of sea-facing arcs with the monument at its centre and spreading far out into the dunes. In each building were what totalled to 938 bodies of young adult men and women, ceremonially arranged into simple geometric shapes. Carbon dating showed that those contained in the buildings closest to the object were the oldest, with the huts built and filled over the course of nearly 400 years, starting in around 2400BC. Each body was arranged such that they held in their arms a large mechanism around half a metre in diameter fashioned out of stone and wood. These instruments were unique to this site and had not been

The Sounding Stone

Dr Pim Padding was the first to propose how the Katwijkmonument might have been used, although his findings have been the subject of some controversy.

Dr Padding suggested that the objects found in the tombs surrounding the site were some type of primitive stylus and the monument itself some type of sounding musical instrument. In a convincing paper published in the *Cambridge Archaeology Journal*, he showed how wooden poles may have slotted into the wide tracks at the top of the monument and, via some type of simple suspension system (not yet recovered from the site), allow free movement of the stylus over the grooves around the outside of the object, passing these vibrations through to its network of internal cavities, which Dr Padding contested were designed for maximum resonance of the transduced frequencies, and not for a water-based divinatory practice, as had been previously thought. The monument would have sounded.

Although it has been several years since Dr Padding's first article on the subject, it was widely met with disbelief and derision on publication, partly due to the lack of any evidence for similar sonic uses of monuments at megalithic sites. However, two years ago, a confluence of different events led to a

Ley Lines and the Atlantic Wall at Katwijk

Ley lines were an idea first proposed in archaeologist Alfred Watkins' book *The Old Straight Track*, published in 1922. The term was originally used to describe straight prehistoric paths used to traverse the English landscape, often oriented around line-of-sight travel to and from settlements. Its etymology derives from the fact that these paths often passed through settlements with a *ley* suffix (e.g. Ottley).

Although met with scepticism by many archaeologists, geographers and statisticians, the idea later saw a resurgence in popularity by the New Age movement in the 1960s, when linear geographical arrangements were imbued with spirtiual meaning and presumed to be conduits of mystical energy.

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Work began on what later became known as the Atlantic Wall (or Atlantikwall) in September 1942. The German army decided that the sporadically-spaced coastal defences arranged along the North-West coast of their Reich, begun in January of that year, needed supplementing with further defences in order to combat the threat of attack from Britain and the United States, who had newly entered the war.

previously seen at any other archeological settlement neither in the Netherlands nor elsewhere in Northern Europe.

Further excavation around the main object, now nicknamed the "Katwijkmonument" by the locals, revealed the purpose of these strange instruments. The first clue came from the complex network of deep tracks cut into the top of the monument. Each track was around 20cm wide and was scored so deep that there was some debate about how this type of excavation could have accomplished, given the known technology of the time. These paths did not descend vertically down but varied in the angle in which they cut into the rock. Once these pathways had been cleaned of sand, a careful analysis showed remnants of splintered wood impacted in the inside of these tracks, indicating that some type of large wooden pole may have been inserted into them and moved around.

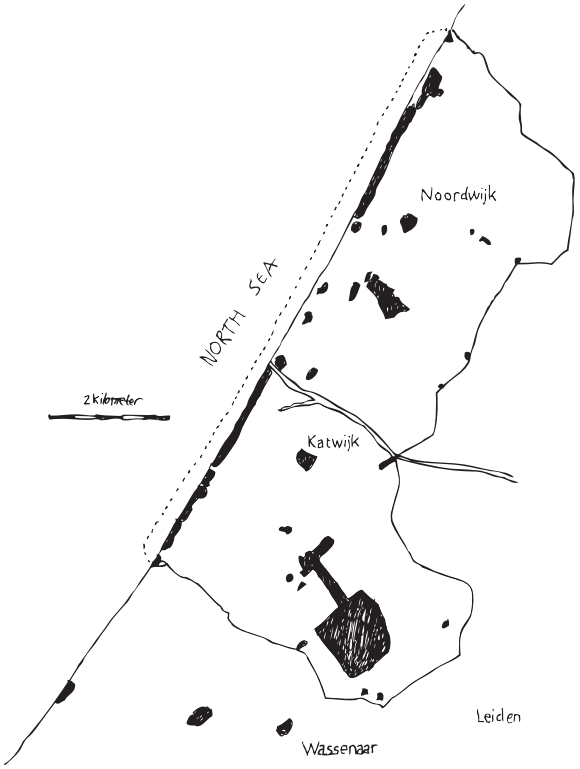
Further excavation showed that the monument was not solid rock, as had been previously thought. Instead, it appeared that it had been at least partially manufactured the opposite way up, as an elaborate network of different-sized cavities were arranged in an ant nest-style configuration within its main body - often such that the base of the tracks terminated only millimetres from their roof. This was precision engineering.

And they kept digging, now down to find the bedrock. It was even stranger than had been guessed – step-like shapes and unnaturally tapered curves now poked out from the whispy white covering of sand, lining the base of the trench, blown in by the unforgiving sea wind.

They found it almost exactly halfway between the dunes and the sea, the corner of it stuck out ominously from the North wall of the trench, but nobody thought anything about it until another of that summer's characteristic rainstorms caused the latest in a series of wall collapses. What was revealed when workers returned the next morning was a surface as black as obsidian, but with a smoothness that left its surface completely free of loose sand. In an environment in which boots and treads and coats and shovels and cable found themselves covered in cloying clumps of wet sand, its surface was eerily clean.

They called the geologists, who called the archaeologists, who called the cryptologists, who called the occultists. It took four weeks to fully uncover the object.

Strategic locations were fortified with a variety of elements, varying from coastal batteries, beach defences, hospitals, command posts and anti-aircraft batteries. Katwijk was one of these locations.



Atlantikwall defenses around Katwijk during World War II

reconsideration of these original hypotheses - most notably the development of n-dimensional sound synthesis and the beaching of a partially de-composed larynx of a large sea creature at Katwijk.

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TU Delft is a world-renowned technical university situated just to the south of The Hague. It was in 2015 that Jaike Duin and Joost Zeegers first started using 3D mapping to try and unravel some of the mysteries of the Katwijkmonument. Although the scanning itself was relatively quick, the process of digitally cleaning up the model to remove years of erosion and errant sand took much longer. By summer 2016 they had something approaching a usable model, but it soon became clear that the patterns inscribed on the surface didn't match with any found at previous archeological sites from the same period - or any period for that matter. However, they did make an important discovery: while it had previously been presumed that the monument contained only a single continuous groove that encompassed the entirety of the object, Duin and Zeegers 3D model showed the existence of two separate grooves, running parrallel and often overlapping each other.

Sharks and Disruptions

In 1987, The New York Times reported that sharks had started attacking undersea phone cables. As a result, undersea cable providers started wrapping their cables in kevlar.

In 2015, Vietnam's branch of the Asia-America Gateway (AAG) cable system (completed in 2009) suffered a series of physical ruptures. That same year, similar network blackouts or slow-downs occured in other Asian locations served by the 12,000 mile (20,000 km) trans-Pacific cable system, including Hong Kong, the Philippines, Brunei, Singapore and Thailand - in one case requiring 20 days to repair. One section of the $500 million trans-Pacific cable between Hong Kong and Vietnam was severed four times within six months.

Late September 2015's rupture of Vietnam's AAG termination occurred 42 miles (68 km) off the coast of Hong Kong, and within two weeks of another breakage, this time on the S1I section connecting the city and Vung Tau. The cable had also suffered incapacitating damage in July. It is presumed that many of these outages were caused by shark attacks, an idea substantiated by videos from deep sea submersibles showing sharks taking bites out of large fiber-optic cables.
It is unclear why sharks attack the cables. It may be due

Beached

In early June 2014, a large organic object washed up on the beach at Katwijk. At first, it was presumed that it was a beached whale, badly decomposed but the marine biologists indicated it was something far stranger.

Although it was over 15 metres in length, further examination showed it was not an entire animal at all but only part of one. Small huddles of bored news crews with nothing bigger to cover filmed the cleanup effort, as three JCBs waited for the tide to recess before starting to hoist it onto a waiting tractor-towed trailer. It wasn't until at least 9pm before the tide was low enough for the rescue effort to begin. With metal chains wrapped around their hydraulic arms and looped around the lump of biological flesh - now emitting an ungodly smell like rancid fish - they pulled it slowly up the beach, the horror of its dark flesh now flashing under the rotating orange lights of its mechanical chaperones.

But as they dragged it to the trailer and began to hoist it on board, a sudden North Sea wind blew in across the blackwater - now moonlitedged - and somehow, in the organ's awkward positioning - half-on, half-off the trailer - that salty blast of sea air entered into the fleshy maw at the far end of the fleshchunk - now free from its

The Larynx

The larynx found on the beach at Katwijk had some unique properties that had not previously been seen in other creatures.

Firstly, the size of it pointed towards a magnitude of creature far beyond that of those previously discovered, especially in the North Sea. In fact, if this was indeed a larynx (an idea that was the source of not a small amount of controversy in the marine biologist community), extrapoating the size indicated a sea creature that would dwarf all previously found upon the planet by quite some margin.

Although originating in an unfamiliar species, no-one involved expected dissection to take a full twenty-nine months. The organ seemed to possess some unique anomalies in its construction that resulted not only in difficulties in fully mapping its internal structure, but whose convolution of passageways had resulted in several injuries during the initial phase of the process. Scalpels making incisions upon one part of the organ seemed to create cuts in other parts that should not have been possible, the blades exiting at impossible geometries and often resulting in injury to those performing the procedure. Added to this, all of those whose hands entered the organ reported a strange numbness which lingered for several hours afterwards,

The TAT-14 Cable Network

TAT-14 is an undersea transatlantic cable system connecting the United States to the United Kingdom, France, The Netherlands, Germany, and Denmark. It is the cable that carries the majority of internet traffic between Europe and North America.

After two rounds of capacity upgrades it provides a variety of interfaces including all relevant SDH protocols from STM-1 (155,52Mb/s) up to STM-256 (40Gb/s). The cable system is comprised of four fiber pairs and traffic can be configured point to point or in (protected) ring configuration.

TAT-14 has a total design capacity of 9.38Tb/s.
TAT-14 has a total system (lit) capacity of 3.15Tb/s

TAT-14 makes landfall at the following locations:
- Manasquan, New Jersey, USA
- Blaabjerg, Denmark
- Norden, Germany
- Katwijk, The Netherlands
- St. Valery, France
- Bude-Haven, England
- Tuckerton, New Jersey, USA

previous resting place on the sand - and somewhere inside that putrid hunk, that saltlaced wind caught some ancient biomechanism, some dark vocal folds hidden in its sodden rottenness, and the most hideous sound started to chug to life. It started like a Godsized motorbike - those enormous laryngeal flaps starting to sputter under the pressure. Then the wind accelerated into that lifeless meat cavern and the air was filled with a sound of pure madness, as if the ears of those present had folded over on themselves, as if fear had suddenly spoke its own name - a godless sound of pure dread.

A week earlier there had been major disruption to the TAT-14 network just outside of Katwijk. The cabling appeared to had been severely savaged by what was presumed to be sharks but the discovery of the larynx of such a large creature pointed to the possibility that the animal from which it had originated might have been the culprit, perhaps drawn to it as a result of the same type of electrical confusion that had attracted sharks to undersea cabling systems in other parts of the world. Or perhaps it was drawn to Katwijk for the same reasons that the TAT-14 system, the Atlantic Wall and that ancient megalithic community had gravitated there - that it was a nexus of rare power lying at the confluence of a series of unique energies - the cynosure of a web of low country ley lines.

The rest of the body was never found.

to the cables interfering with their use of electromagnetic waves to forage for food, but fiber-optics on their own are not known to emit electromagnetic waves. They are, after all, just light. The New York Times' report cites copper wiring within the cables that is used to carry electricity, and that could be a source for some attacks. But, not all cables still carry such wiring.

Sharks are also known to be naturally curious. Many of their attacks on humans - which are rarely fatal - result not from hunger but from curiosity.

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On May 19 2014, preliminary reports from hosting provider Digital Ocean suggested that problems with the TAT-14 cable was the cause for the disrupted services between the EU and the US.

often resulting in an inability to accurately judge the size and position of objects by feel, greatly hindering their ability to interact with the world around them. Many compared the experience to the difficulties in grabbing an object when depth perception has been reduced by the covering of one eye. None of these effects were permanent, however they were worrying to those whose livelihood relied upon the nuanced motor-movement necessary for animal dissection.

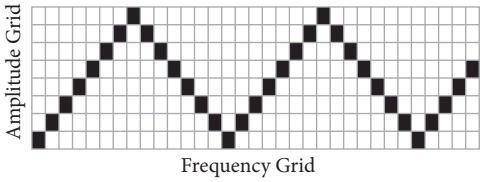
After nearly nine intense months of fruitless approaches, the same team at TU Delft responsible for the 3D mapping of the Katwijkmonument were brought in to attempt a similar procedure upon the beached organ, now held in a large cold storage facility in Scheveningen rented by the Marine Biology department of the University of Amsterdam.

But even this technological approach did not seem to help. The 3D mapping machines were all callibrated correctly and the external structure of the organ seemed to map fine but, for some reason, as soon as they tried the same process internally the 3D model ended up as unusable junk - all unrealistic angles and hopelessly overlapped and mangled nonsense. It wasn't until they started pumping air through it, that things started to make sense.

Non-Euclidean Sound Synthesis

In 1972, the German composer and theorist Gottfried Michael Koenig developed a sound synthesis method called SSP based upon the concept that all musical sounds may be described as a function of amplitude over time. In other words, sound could be represented in two dimensions.

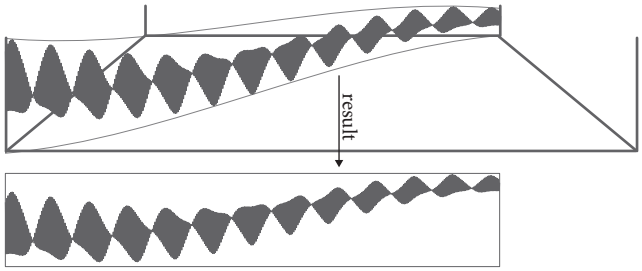
This idea is built into many of the way in which music is still represented in digital computer environments. For instance, .wav files (which are based on the Pulse Code Modulation principle) are essentially 2-dimensional tables that store a series of sequential amplitude values in reference to their position in time.



In a conventional representation of sound within the digital domain, we might have a 2-dimensional PCM table consisting of two grids: bit-rate grid governing amplitude, and a frequency grid governing time. A Compact Disc has a bit-rate of 16 bits and a frequency of 44100 Hz, meaning that sound is represented by a set of 2^{16} (65,536) amplitude values of which there are 44100 per second. In other words, this method of representation allows sound to be stored as a

Perspectival Sound Synthesis

Instead of a two-dimensional representation of sound, let us imagine a .wav files' PCM table as a 2D plane in 3D space. Under these conditions, a sound fading out can be considered not as an attenuation effect applied to a sound file, but as a 2D plane oriented such that its furthest end is angled away from our position as the viewer. In other words, sound is not getting quieter, it is getting further away. When we project this perspective of a 3D plane back into 2D space, the result is a fade-out effect on the original sound.



If a sound wave can be the result of a 2D projection of a 3D shape, we can also imagine that the digital playhead reading back the amplitude values of this sound wave and playing them back over loudspeakers, could also be moving in 3D space. Unlike a conventional playback of a 2D PCM table, this playhead could move along a vector which is not parallel to the orientation of the sound wave.

N-Dimensional Sound Synthesis

In 2017, Dr Karen Eliot, a young researcher part of the Computer Music department at the University of Surrey, proposed a new paradigm-shifting type of sound synthesis based upon increasing the number of dimensions sound could be represented in - a technique she referred to as *n-dimensional sound synthesis*.

Imagine a 2D representation of sound not as a 2D plane, but as a manifold in non-Euclidean space. Alongside this, we can now imagine a playback vector also moving independently through an n-dimensional space, perhaps of fewer or more dimensions.

As a simple example, imagine a 2D PCM manifold transformed into a moebius strip. This can be seen by printing out an audio waveform and playhead vector onto tracing paper and manipulating them in 3D space.

We can then imagine these sonic manifolds not just existing as 2-dimensional planes within a 3-dimensional space, but as n-dimensional planes and vectors within an n-dimensional space. Similarly to how we could place a 2D table of amplitudes in a 3D space then project it back into 2D to get a new set of amplitudes read back at a rate equal to the velocity of the playhead along the playback vector, we can do the same with any number of dimensions.

Propogation of Sound in non-Euclidean Space

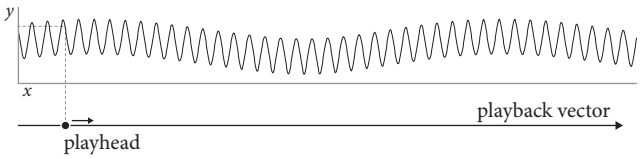
In August 2016 at MIT, a young researcher named Michael Johns published a paper in the *Computer Music Journal* describing a new method of sound synthesis involving the propogation of sound within non-Euclidean spaces. By creating impossible geometries and feeding sounds into them, new sonic possibilities could be created.

Scientists often try to explain string theory with reference to the vibration of strings on musical instruments, but what would a cello string that existed in 27 dimensions sound like when it was bowed?

This paper was largely ignored by the computer music community but, by chance, it fell into the hands of Duin and Zeegers, the two technicians from TU Delft trying to create a 3D model of the large larynx found on the beach at Katwijk in 2014. There had already been extensive sonic tests on the organ, created by blowing large quantities of air through it in order to get it to resonate. The hope was that the sounding result could somehow illuminate its internal workings, but this only created more confusion and a general uneasy feeling among those in the room, as a series of unimaginable noises emanated from it. The research was painfully slow, as only three minutes of exposure to the sounds created by the larynx could lead to temporary hearing loss for nearly half an hour. Added to this, all existing

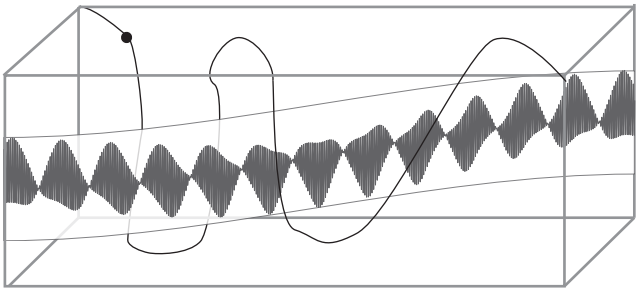
two-dimensional Cartesian graph.

However, this representation only exists "out of time". In order for it be represented back "in time" traditionally we use a digital *playhead* which moves through the table at a speed that allows the amplitudes to be played back over loudspeakers. This could be mathematically defined as a point on a line that reads through the 2D PCM space of the table on a vector parallel to the *x* axis of the Cartesian space.



The speed of this point along the vector defines the speed of the playback. The direction of movement along the vector defines whether the sound is played backwards or forwards. If the playback vector is not parallel to the *x* axis, speeding up or slowing down of the playback occurs.

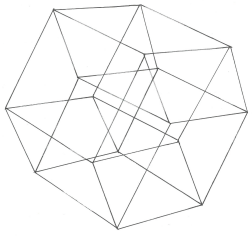
Many existing sound synthesis methods, such as additive, subtractive or wavetable synthesis, rely upon the interactions of waveforms in 2D Euclidean space and the use of a parallel playback vector. However, we can imagine other synthesis methods in which the space is not Euclidean and the playback vector does not run parallel or is even a straight line.



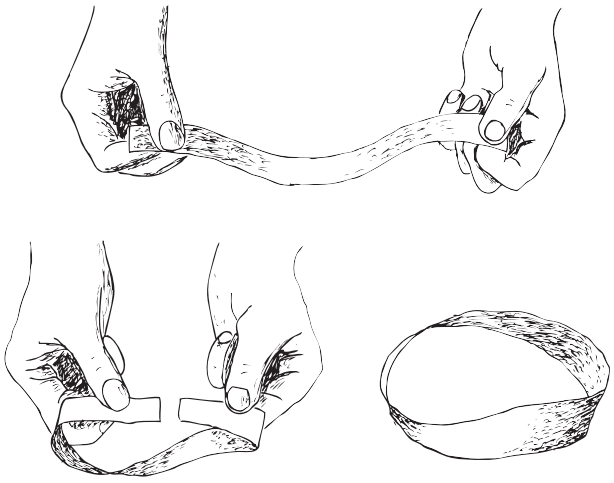
recording technologies seemed incapable of capturing any of the sounding results, registering either extreme clipping or an almost inaudible signal that seemed to bear no relation to what had been heard in the room.

It was Zeegers who first came up with the idea that they might be dealing with exactly the type of phenomena that Johns was describing in his paper. Perhaps the problems in analyzing both the structure of the larynx and its sound resulted from the fact that it was propagating soundwaves in a non-Euclidean or n-dimensional space?

And it was then that they also made the connection to the second groove on the monument at Katwijk. Perhaps this groove was an n-dimensional representation of astronomical movements, inspired by a similar type of non-Euclidean representation seen in the larynx. Perhaps the community at Katwijk discovered a similar larynx during their occupancy their over nearly one thousand years? Perhaps their discovery of the larynx led to a paradigm shift in the way they represented the sky above them?



A 2D projection of a 4D hypercube. How would sound propagate in spaces containing more than four dimensions?



Creating a moebius strip out of paper. Could we treat sound the same way?

Transducing The Stars

If Dr. Droppe's assertions about the purpose of the monument at Katwijk were correct, it might point to the meaning of the two series of grooves that encompassed the object. Perhaps they were symbolic representations of the positions of stars and planets. Upon reading Droppe's ideas, Jaike Duin and Joost Zeegers - now busy at work trying to 3D scan the beached larynx recovered at Katwijk in 2014 - decided to revisit their Katwijkmonument scans and see if there was any way of confirming Droppe's assumptions.

The position of an astronomical object, as viewed by an observer, can be described by the amount of degrees it is offset from the position from directly above the observer (zenith) and its position around the horizon (azimuth). Due to the elliptical orbit of the earth and other astronomical bodies, and their circular rotations, when plotting these positions, the result will often be a sinusoidal shape, similar to the type of soundwave used in additive sound synthesis. These sinusoids can be added together to form a further wave. When this process is only applied to two parameters (e.g. adding together the zeniths of the moon and sun over the course of a year) then the resulting waveform is relatively simple. However, the waveform engraved in the Katwijkmonument is much more complicated. Analysis seems to show that it is a composite waveform created from the addition of the azimuth, zenith and

The Collapse of the Settlement at Katwijk

Maybe thousands of years ago, on a beach at Katwijk in the Netherlands, a small community fervently believed that the monument they built created a sound that caused the heavens to rotate. And, perhaps confused by the annual peturbations that naturally occur in the stars' movements, they attempted to update their monument with a more comprehensive way of controlling the sky. Around this time, a large creature washed up upon the beach and, as they gradually stripped it of its meat, carrying it the mile back from its sandy grave to their main settlement, they uncovered its strange larynx; the same type of larynx which washed up thousands of years later on that very same beach, this time maybe lured by the confusing electromagnetic emanations of the TAT-14 undersea cable - or perhaps drawn by the strange power of that beachside nexus that is Katwijk - the site of the Atlantikwall, of TAT-14, of that ancient settlement - the hub of a set of invisible powerlines flowing through leys from all directions...

And it was here, among the sand - part shadowed by the obelisk sounding out its inaudible waveforms into the cosmos - that a single figure, near to exhaustion, pushed a primitive stylus the size of a small child around the groove in the monument at a nearly imperceptible pace. And as the figure pushed, the community began to dissect that larynx and saw its strange insides - unlike any view of the world yet seen. And something changed

The Equation Of Time

In sound synthesis, there is a technique known as *Additive Synthesis*. This method creates new sounds through the addition of two simpler sounds. For instance, we might add together two sine waves oscillating at different frequencies to create a new sound.

The example overleaf is one of the oldest forms of additive synthesis: the *equation of time*, the summation of the *effect of orbit eccentricity* (top waveform) and the *obliquity of the ecliptic* (bottom waveform), used to calculate the angular offset of the Sun from its mean position on the celestial sphere as viewed from Earth, and used since at the Ancient Babylonians.

The equation of time is the summation of the changes in speed due to the elliptical orbit of the earth and the changes in the earth's tilt upon its axis over the course of a year. This results in a waveform that can be used for re-adjusting the outputs of sundials to compensate for the above factors.

This is a simple example of additive synthesis applied to astronomical objects. However, the settlement at Katwijk used a much more complex summation of nearly one hundred stars, moons and planets to create the soundwave that was engraved into their monument.

The Second Groove

It was during the re-evaluation of the monument at Katwijk in 2014 that a team of anthropologists and archaeologists from the University of Groningen - on a recently received research grant - descended upon the site to try and understand more of its purpose in situ. It was on this visit that it was discovered that the two sets of grooves that encircled the object were created at two different points in time. None of the designs of styluses found in any of the burial chambers seemed to support the idea that both grooves would have been read simultaneously, so it might have been that they were either read sequentially, or that one became a replacement and superceded the other.

The archaeologists estimated that the two grooves were created around 1000 years apart, with the first stage of construction on the monument occuring around 3000BC, and the second groove added in around 2000BC, around 400 years after the construction of the tombs surrounding the monument.

The purpose of the earlier of these two grooves had been solved by the researchers Duin and Zeegers, who had discovered that it encoded a composite of the position of every visible astronomical object seen from Katwijk into a single sonic waveform. From Dr Droppe's research, it appeared that this earlier groove was designed to be read back in real-time by a primitive stylus connected to the

in the community. They began to see the stars not as points moving vectorlike across the 2D plane of the firmament, but within an enfolded and complex multi-dimensional space. And from this new knowledge, they transduced the movements of the stars into a new groove that wrapped around their monument - one which represented their new reality.

But something strange had happened around the time that second groove was added to the monument. The dwellings of the settlement had spread outward as it grew, but around the same date as the finishing of the second groove, the architectural ability of the community seemed to drastically decline. While all evidence from the centre of the settlement seemed to point to a neolithic civilization that was more than competent at constructing dwellings, from around 2000BC onwards the houses stopped making practical sense: walls that didn't go straight upwards but at seemingly random angles, foundations of buildings that did not match up with their walls, roofs that cut through entire rooms or were detached completely from the house altogether. And this problem was not only limited to large building projects. Cups were crafted that would no longer hold water, jewellery had the wrong proportions. And at some point soon after this, it appears that the settlement stopped functioning. Many asserted that this was some type of poisoning that affected spatial reasoning, perhaps caused by contamination of the water supply, but others knew better.

inner resonant chambers of the monument. In other words, the monument allowed a real-time sonification of the sky over Katwijk. One of the mysterious aspects about this first groove is that although it translates atronomial movement into sound, the playback of these sounds would have been inaudible to humans.

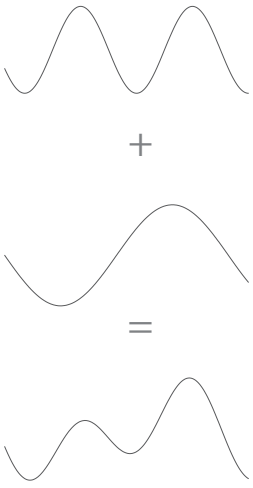
The surprising element about the earlier groove was just how many astronomical movements were encoded into a single composite sinewave - and far before the concept of additive synthesis emerged in the 20th Century.

However, the second of the grooves was much more mysterious. Its complexity pointed to an unexpected mathematical and geometric sophistication that had developed in the intervening millenia following the creation of the first groove. It was only after Duin and Zeegers came across a paper describing a new sound synthesis technique called *n-dimensional synthesis* and applied some of the other research that they had been doing on the beached larynx of a large sea creature that they began to understand that while the first groove was a 2-dimensional representation of the sky, the second groove was an n-dimensional representation.

The changes in mathematics manifesteed in the second of the grooves seemed to corresponded with a series of major changes within the main Katwijk settlement that eventually led to its collapse.

brightness/visibility of every observable astronomical object in the sky at Katwijk.

The monument was constructed such that, when its grooves were played with a special large stylus which was continuously moved around the object at a rate of around one rotation a day, its sounding result would be aligned precisely with the position of the brightest objects visible at a partiular point in time. For instance, during daylight the sun would usually be the only astronomical object visible, thus it would be the only part of the waveform sounding, yet when night came and the stars became visible, the amplitudes of these sinusoids would increase and they would start to sound. The monument manifests an extensive knowledge of astronomical movements and it appears that many of the sinusoidal waves would have been extrapolated from their visible manifestations through the times during which they would not be visible (e.g. by extrapolating the sinusoid that governs a star's movement from its trajectory during the night, its unseen movement during the day can be calculated, allowing an estimation of its next visible position). One strange aspect about the monument is that, although much effort had gone into creating the grooves around it and crafting the primitive stylus that could read it back, the extremely low frequencies contained in the grooves (a result of the slow movement of the stars) would have meant the sound of the monument would have been inaudible to humans.



The Second Katwijk Site

The second site at Katwijk was discovered in 1999 during the construction of the building housing the Dutch termination point of the TAT-14 line.

Although only a preliminary excavation was possible, due to the constraints of the construction schedule, a large number of neolithic dwellings were found, many of which contained a variety of interesting archaeological finds. Many of these were typical of similar contemporaneous sites found around this area, however several large stone tablets were discovered that had no previous precedents.

Each tablet stood at around 1.65m square (1 Megalithic Yard) and featured primitive engravings seeming to depict a series of beached animals. It was theorized by those who discovered them that for a community living by the sea, the beaching of animals could be seen to have an important religious significance. In all, there were 279 tablets all showing what appears to be primarily whales beached, surrounded by human figures. However, while the scale of human to whale seemed to be relatively accurate for nearly all of the engravings, one of the tablets appered to show an unfeasibly large creature. Until the discovery of the larynx at Katwijk it was presumed that this was simply an error of scale typical

Controlling the Stars Through Sound

As the monument at Katwijk was unearthed, they found more and more evidence of the ancient culture that lived there thousands of years before. And questions grew about the nature of their society and beliefs. The shocking discoveries of so many bodies in the tombs surrounding the monument led many to speculate upon its ritual significance.

The anthropologist Frederick Droppe attempted a wide-ranging study to find evidence of similar contemporary cultural and religious movements whose rituals contained elements and symbols that seemed to correlate in any way to the elements found at the monument site in Katwijk and the remnants of a related settlement found in the late 1990s around a mile inland during the construction of the building used as the termination point for the TAT-14 cable.

Droppe's study looked at a number of religions and societies which had both geographical and symbolic connections to the Katwijk society. While there have been some discoveries of jewellery manufactured by the Katwijk settlement at several other more conventional sites along the Northern coast of The Netherlands it appears that the Katwijk community was relatively isolated, although Droppe suggests that there may be several similar yet undiscovered sites along the Dutch sea-front, many of which may be buried or reclaimed by

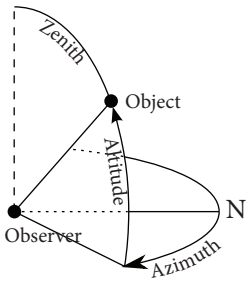
Vectorized Sound

When images are stored on a computer, two of the possible ways they can be represented are as raster (also known as bitmap) graphics and vector graphics . Bitmap graphics use a dot matrix data structure in which the colours of the image are stored as a grid of pixels. Instead of storing the value of every pixel, vector graphics instead use a series of points in Cartesian space which are connected via paths lines and curves.

Raster graphics are a discrete representation of data, while vector graphics are a continuous representation. Due to the fact that vector graphics are not connected to a fixed grid (unlike raster graphics) they can be infinitely scalable and transformable with minimal loss of quality (this is the concept behind the popular Scalable Vector Graphics (.svg) format).

If we wanted to represent sound as a malleable 2D manifold within an n-dimensional space, it would be preferable to use a representation that was closer to the vector rather than raster paradigm. We can build a vectorized representation of sound using similar principles to that of the image formats: rather than representing sound, as is commonly done, using a fixed 2D grid of amplitude against time, we can instead use points, lines and curves to encode the sound.

Astronomical Sinusoids



The position of an object in the sky, in reference to an obeserver at a position on earth, is measured with two parameters: zenith (or its complement altitude) - a measure in degrees from directly above the observer through a 360 degree circle that passes directly through a point directly below the observer; and azimuth - another 360 degree measurement for the angle of the object around the horizon, measured clockwise from due North.

The zenith measurements of the sun and moon throughout the course of a year could be plotted as sine waves. Most astronomical movements follow sinusoidal patterns due to the circular and elliptical movements of the planets. In electronic music, the addition of two or more sine waves is often used to create new sounds. Therefore we could also use the sinusoidal patterns of astronomical bodies as the basis for the synthesis of sound. This was the principle behind the monument constructed at Katwijk. It adds together the sinusoidal movements of astronomical bodies and transforms them into sound.

the sea (perhaps the reason for the abandoning of the Katwijk settlement, although this is highly disputed).

Droppe points to several entries in the diaries of philosopher René Descartes during the early 1630s, during his time living in Amsterdam, which refer to local folklore about an ancient settlement of "those who use a monument to control the stars through sound" (*"de ceux qui uilisent un monument afin de contrôler les étoiles à travers le son"*), who lived North of "Gravenhage" (an older name for The Hague) - and a reference which Droppe believes is to the Katwijk settlements.

Additionally, the above quote points to a possible use of the monument. Droppe suggests that the large number of bodies found at the site were a result of the misguided belief that the movement of the stylus around the object - with one complete rotation relating to a single solar year - was responsible for the movement of the the stars and planets in the night sky, rather than a representation of them, and that each of the young adults found at the site would have been part of a continuous ritual in which they would slowly push the stylus around the entirety of the monument in sync with the solar year, sometimes only moving millimeters per day - a ritual which eventually led each one to die of exhaustion.

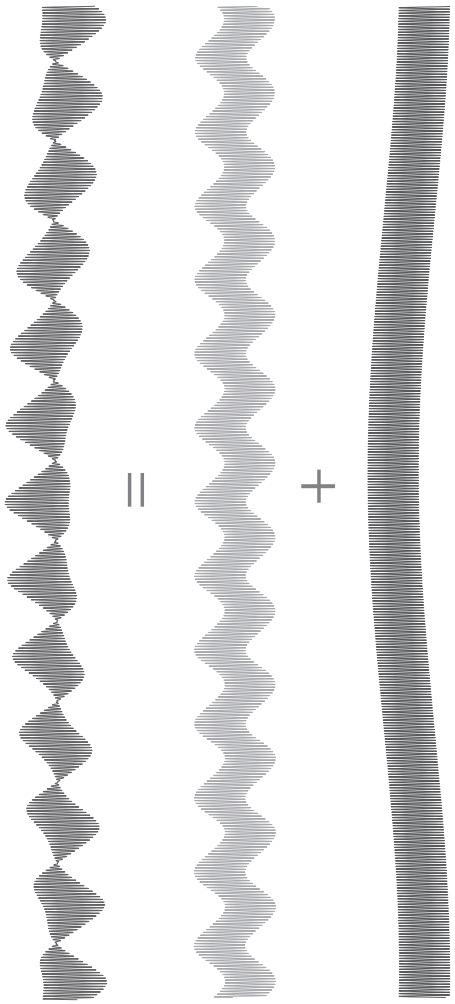
of primitive art; however, it now appears that this could, in fact, be a correctly proportioned marine animal which had beached itself during the time that this settlement existed at this site.

The tablets were all created over a 100 year period around 2000BC, with a rough dating of the tablet showing the large creature, coinciding with the engraving of the second of the grooves on the monument.

Additionally, further engravings found on a series of smaller clay tablets seem to show images of something incredibly similar to the larynx found many years later at the beach at Katwijk.

Was it possible that the strange dimensional properties discovered during the dissection of the larynx in 2014 could have been found even earlier when something similar had washed up on the shore of this neolithic community?

And could it be that somehow what this community learned from the construction of that creature's larynx could have informed the way in which the second groove on the monument was made?



The zenith of the sun (top) and moon (middle) as viewed from Katwijk beach, between 1 January 2019 and 1 January 2020. The bottom waveform is the sum of the two above.