chronostasis

Sound composition by Andreas Bick
Production: Studio Akustische Kunst of WDR
Producer: Markus Heuger
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The clock is one of the most important technical developments of humankind. Few other inventions have had such a shaping influence on our everyday life. The clock's proverbial ticking is deeply ingrained in our consciousness. It marked time for industrialisation and scientific progress, as well as being the first mechanical musical instrument, preparing our rhythmic understanding for the machinelike precision of modern music. In *chronostasis,* the sound of time becomes audible via the many-voiced ticking of a whole array of antique clocks. The simplest rhythmic information, the pendular motion of a clock mechanism, gives rise to a complex tangle of overlapping patterns and pulses. For a moment, in the ritual of constant repetition, time seems to stand still.[1]

"Time is one seed of eternity." – Jean Paul

With this aphorism, Jean Paul inadvertently anticipated one consequence of the theory of relativity, according to which the universe is not governed by a single absolute, ubiquitous timeline, consisting instead of countless "islands of time" of which Earth time is just one. Albert Einstein gave a laconic response to the question of time's essence: "Time is what you read on a clock." His answer also reflects the dilemma faced by modern physics in its inability to describe the true nature of the phenomenon of time.[2] To date, the theory of relativity and quantum mechanics can only be reconciled in theory, and in many fields of physics, the concept of time actually plays no part at all. But after 2500 years of thinking about time, philosophy, too, has no coherent answer. The same applies to art, where the question of time is a key creative catalyst. Of all the arts, it is only music that enables a direct experience of time, as there can be no sound that doesn't unfold in time. How would it be, then, if we followed Einstein and read time from the clock, or, to be more precise, if we took the ticking and chimes of clocks as the subject of a musical composition, portraying time by means of the "sound of time" itself?

This is the idea behind *chronostasis*. All of the material for the piece consists of sounds made by mechanical clocks. These sounds can be divided into three groups: the ticking of clockwork, the hourly chimes of the bells and gongs, and the sounds made when the clock is wound up. The range of mechanisms used stretches from great tower clocks from the 16th century to small pocket watches from the more recent past. Electronic clocks do not feature in the composition for a simple reason: either they make no sound, or they simulate the ticking of a clock, less a technical necessity than a design feature to fulfil the owner's expectations. There is a second aspect here: mechanical clocks are steadily disappearing from our everyday lives; their ticking and the chiming of pendulum clocks are now usually experienced as a disturbance. This marks the end of seven centuries of clock-making, beginning in the late 13th century with the development of inaccurate mechanisms and leading to one of the most astonishing achievements of human handcraft.[3] The

[1] The term "chronostasis" refers to a perceptual illusion that causes the second hand of a clock to appear to stand still for a moment. Apparently, when the gaze moves quickly to a clock face, the mind prolongs its perception of that initial moment beyond what is actually seen.
[2] Time's arrow, for example, is not a natural law. It can be observed, but not proved by equations.
[3] Excellent clock- and watchmakers still exist, of course, but today, handmade timepieces are pure status symbols, created for a small niche market.

mechanical clock is one of the key inventions of the Western world, whose influence on society and technological development has been immense and which helped shape Europe's path to political hegemony. Clock-making was the art from which the technical skills and manufacturing techniques for the complicated machinery of the Industrial Revolution were derived. Clocks prepared people to function in a deeply rationalised working and everyday life, and they became a paradigmatic metaphor for this industrialisation: an emblem of accuracy and precision which for the first time transformed time into a tangible product that could be converted into money. "Time is money" became the motto of the new capitalists who owned the new timepieces and who used manipulated clocks to steal valuable minutes from workers in the factories. In transportation and warfare, too, the possession of accurate chronometers was a great advantage and a means of exercising power. Only with the arrival of cheap, mass-produced pocket watches was the control associated with this exclusive ownership of time broken. Finally, the introduction of quartz clocks as superior timekeepers brought to an end the age of a craft whose development had reflected the advance of industrialisation and rationalisation of all fields of life.[4] *chronostasis* is an acoustic monument to these mechanical clocks which are now vanishing from our day-to-day lives.

The clock began as a crude, unreliable instrument in medieval convents and monasteries, and at first it was merely a chiming device to ensure that prayers took place at the required hours. The genius of this device, invented by an anonymous monk at the end of the 13th century, was to use oscillating motion to subdivide time into countable beats. When the steady ticking of a clock was heard for the first time, this marked the start of the transformation of individual or subjective time into objective time, the change from quality to quantity. This decisive invention prompted the disconnection of human activity from natural processes and belief in an independently existing world of mathematically measurable sequences of events which – like clockwork – unfolded as if according to some divine plan. From the monasteries, clocks spread to the cities, where at first it was the church tower clock that dictated the shape of the day. But soon, with the growth of trade and industry, demand for time signals and clocks also grew. Ecclesiastical time lost its dominant position and city-dwellers had to live with a multitude of time sources, which differed from one another on account of their imprecise mechanisms, in turn generating demand for more precise clocks. The process of the de-individualisation of time led to a contrast between the days of a farmer, geared towards natural cycles, the sun and the seasons, and the days of those living in the city, where artificial time signals permitted many tasks to be integrated into a daily schedule. Advances in clock-making led to minute and eventually second hands, and clocks came to symbolise a universe which seemed to run according to deterministic laws and which could be understood down to the last detail as long as one had sufficient knowledge of all the various processes involved. For scientifically-minded people, the clock was a metaphor for the *machina mundi* – a mechanism that appeared to be governed by a rationality outside of itself and whose inner workings blindly executed the divine plan.

These developments also had an impact on music. Medieval church music had no measured time; its ideal was eternity, as expressed in the slow, meditative flow of the liturgical songs. When the church began to lose its cultural dominance to a rising merchant class more interested in secular art and science, measurable time became the preferred mode for the timing of the period's music, eventually leading to what we now call classical music. The steady ticking of the mechanical clock or of the metronome is the symbol of metric time. In a certain way, the ticking and tocking of clockwork is the most primitive of all musical rhythms: the germ to which all forms of rhythmic complexity and permutation can be traced back. One of the greatest challenges in producing *chronostasis* was to make this ticking audible in all its diversity. Many recordings were made using highly sensitive contact microphones inside or attached to clock mechanisms in order to capture as many as possible of the resonances and subtleties of this usually very quiet ticking. The recordings

[4] Paradoxically, the history of measuring time led back to where it began – with reading time from nature. The first clocks were based on measuring the course of the sun, on the flow of liquids or sand (sundials, water clocks, and sandglasses). In a modern quartz clock, the time is determined by a vibrating quartz crystal, in an atomic clock by the vibrations of a caesium atom. Since 1967, a second is defined not as the 1/86400th part of the mean solar day, as laid down in 1345, but by pure physics, now corresponding to 9,192,631,770 vibrations of a caesium atom.

from the individual timepieces vary considerably in terms of their fine rhythmic structure and sound quality (scraping noises, shuffled second beat, etc.). The vibrations of the gong, the resonating wooden case of a grandfather clock, or the delicate singing of the spring in a pocket watch give each timepiece its own distinctive sound signature. It made sense, then, to treat the clocks as individuals, as social beings which possess a time of their own but which are obliged by social conventions and constraints to constantly adjust to prescribed rhythms. *chronostasis* plays with the rhythmic possibilities of creating order and synchronicity out of disorder. Friction and tension are generated when synchronisation fails and individuals insist on retaining their own version of time. Finally, the normative power of society with its prescribed time prevails, as expressed in the sound composition by the rhythmically tight passages. Although nature dictates the larger cycles that we cannot influence (day and night, the seasons, etc.), our social cohabitation is shaped by many smaller-scale time windows within which we have a degree of freedom. Work schedules, opening times, consulting hours, and appointments force our everyday life into a close-knit pattern of time, but the degree of discipline with which we accept to subject ourselves to the clock's authority can also be a measure of personal autonomy.

These ideas are expressed in the formal structure of *chronostasis*. The unavoidable cycle of nature is symbolised and projected onto the composition by the twelve hours of the clock face. The thirty minutes of the piece are divided into twelve equal segments of 2:30 min. each. The one o'clock chime is heard at 2:30, two o'clock at 5:00, and so on. Finally, at 30:00, 12 o'clock strikes, this time with the chimes stretched as the conclusion of the piece (which then ends at 32:56). Quarter-hour intervals were also transposed onto the sequence of the piece. The best known acoustic signal for the quarter-hour is the Westminster Chime from Big Ben in London, which is used by many mantelpiece clocks. This chime is heard every fifteen minutes at 7:30, 15:00, 22:30 and 30:00 min., sometimes in slightly altered form. But this rigid structural scheme by no means dominates the composition. Instead, the hourly chimes are integrated into the dense rhythms or signal a change of rhythm. A further structural element is a (rough) representation of the historical development of clocks from crude metal devices to complex miniature machines with many individual parts. The piece begins with a kind of primordial soup of chaotically ticking clocks unrelated by any shared time. The first clumsy rhythm is struck by a very old church tower clock from the 16th century. From here on, the composition moves ever closer to complex, modern rhythms, giving an idea of the progress of change in society. The grandfather clock of bygone generations turns into a sound machine that could fit smoothly into the repertoire of today's DJ culture. At the end, we find ourselves in a race between stopwatches, all of which become synchronised, culminating, in a process of steady acceleration, in the final 12 o'clock chime.

Clocks synchronising with one another is not just a compositional trick. The phenomenon of spontaneous synchronisation of pendulum clocks – known as the lock-in effect – was discovered by the Dutch scholar Christiaan Huygens, who is also said to have invented the clock pendulum. In 1673, Huygens discovered that pendulum clocks with similar frequencies will eventually come to be in perfect phase with one another if connected in some way, for example by a table or shelf to which they are screwed. Each tick of the clock is received by the other as an impulse, leading after a certain time to a coupling that forces the clocks to move identically.[5] These synchronisation mechanisms seem to be ubiquitous in today's society, a society shaped by digital rhythms which are also an expression of the acceptance of technology, speed and media simultaneity. Modern electronic music with its precisely calibrated time grids is the direct descendent of the simple tick-tock beat first heard at some unknown monastery in the Middle Ages.

Translation: Nicholas Grindell

[5] This phenomenon is not restricted to pendulum clocks, also playing an important role in lasers, in electrical oscillatory circuits, in cells, and in the movements of the planets. In general terms, one can say that rigid synchronicity is not beneficial in nature, and that it can trigger problems such as heart attacks or epileptic fits. Natural systems are stable and resilient above all when their inner rhythms display a large degree of flexibility and continually adjust to one another.

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