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The international workshop on the "History Speech Communication Research" is organised by the Special Interest Group (SIG) on "The History of Speech Communication Sciences". This SIG is supported by the International Phonetic Association (IPA) and the International Speech Communication Association (ISCA). The workshop offers an exchange forum for researchers with work on all kind of historical aspects of the research fields represented at the Interspeech conferences and the Congresses of Phonetic Sciences (ICPhS).

This volume includes the proceedings of the first workshop of this series, held in Dresden as a satellite event of Interspeech 2015. The re-opening of the historical acoustic-phonetic collection (HAPS) in new rooms was part of the workshop. With the Barkhausen building on the first day of the workshop and the technical collections of the city of Dresden in the historical Ernemann building on day two of the workshop, the meeting had appropriate locations.

The proceedings volume contains 18 contributions, including the general presentations of the opening session as well as the papers from the dedicated sessions on "mechanical speech synthesis", "collections", and "pioneering work in phonetics". The papers are written from 23 authors, coming from nine countries.

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History of Speech Communication Research 2015

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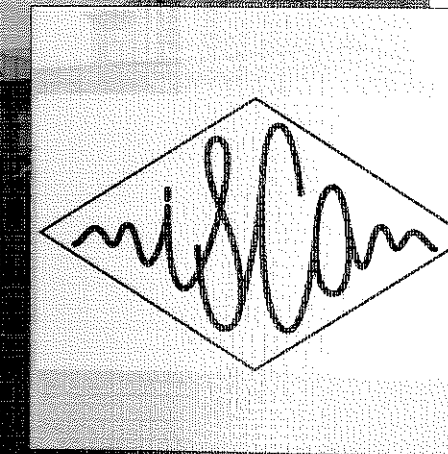
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Proceedings of the
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The history of talking heads: the trick and the research

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Abstract: This study reviews the history of the attempts to build talking statues or talking heads. The study highlights the two paths that have been followed over the centuries: the "voice transport" and the "artificial voice". The first case was ultimately a trick, because the voice was actually produced by a hidden subject and transported through an artifice to a fake head, so that the voice appeared to come out of the mouth of the statue. The other path, that of research, tried to imitate the human phonation apparatus to produce sequences of sounds in some way similar to those that make up the speech chain. In retracing this long history, I will focus on some examples of the first and second paths. The first, beginning with the oracles of the Chaldean priests and the oracle of Orpheus in the Lesbos island, will lead us to examine the Android built by Albertus Magnus in the 13th century. Its functioning will be explained many years later, in the 17th century, by a German Jesuit priest and scholar, Athanasius Kircher. The other path, aimed at producing a real talking machine, begins in the first century AD in Egypt, through the work of Hero of Alexandria; it then continues in Spain in the 10th century thanks to the ability of an expert manufacturer of hydraulic organs, Gerbert of Aurillac, who became Pope Sylvester II in the year 1000. The statue of Gerbert could produce two distinct sounds thanks to the air escaping by the force of heated water through one of two different cavities. One of the two sounds was quite high in frequency, and was used for an affirmative answer ("etiam"), the other was rather low and was used for a negative answer ("non"). I will then examine the case of the talking heads built by a French abbot, the Abbot Mical, in 1783. An examination of the testimonies regarding this extraordinary automaton will help us reconstruct its history. Which path has led to the production of the present-day synthesized speech? The trick or the research? We will try to answer this question.

1. Introduction

1877 is the year when the history becomes sound. Until then all is silence: not a sound, a voice, a cry, a noise, nothing remains. Today we can *see* the past in the monuments, statues, buildings and all that remains of the ancient times. We can admire the paintings of the ancient artists, we can *touch* their works and objects that tell the story of people and places. *See, touch*, but not *listen*. History is silent. In 1877, through the work of Thomas Edison, for the first time a voice can be imprinted on foil and survive the time in which it was produced. It is the voice of Edison reciting a nursery rhyme ("Mary had a little lamb ...").

Since then history has had a new standard, it has moved from the era of the *produced voice* to that of the *re-produced voice*. For the first time in 1877 it was possible to hear sounds, noises and voices produced not at the moment when they were perceived by the listener but at an earlier time, then recorded, stored and, on request, played. It was a revolution that radically changed the course of events and changed the way people were speaking. Until then speech was being modeled on what was heard. How many different voices will a speaker hear in his life in the era of the *produced voice*? If we consider that the speaker should be no more than a

few meters from the listener, it is clear that the models of speech that everyone aimed to imitate, in order to achieve effective communication, were very few and very localized in terms of geographical area. In the era of *re-produced voice*, when voices arise continuously from so many objects (radio, television, movies, telephone, Hi-Fi, computers and so on) the number of voices that each of us hears every day is much higher than in the past. The models that came from different places, from different times, from different languages and cultures, thereby led to changes in the spoken languages as never before had happened. Thus, to give voice to objects has definitively been a great revolution, a revolution that produced, in the last century, changes that had not even occurred over a millennium.

Yet the history of attempts that more or less famous people have done to give voice to statues, idols or bronze heads is long and, for various reasons, not well known. The idea of the creation of a device capable of producing artificially the human voice has always had an adverse fortune. Whoever ventured on such a path was viewed with suspicion. Until the 17th century they were accused of practicing sorcery, and therefore persecuted and condemned; from the 18th century onwards they were often considered charlatans, illusionists.

A more fortunate fate has befallen those who have managed to design and manufacture their devices in other fields, however extraordinary they might appear to contemporaries. Just think of the burning mirrors arranged by Archimedes on the walls of Syracuse to defend the city from the ships of Marcellus, or by Archita of Taranto that in the 4th century BC builds a mechanical dove able to fly. No less amazing must have been the Greek fire, developed in the 7th century by Callinicus of Heliopolis, a device capable of launching firebombs. Neither Archimedes nor Archita nor Callinicus were later accused of sorcery.

Even inventions in the field of acoustics have been treated differently depending on whether the artificially produced sound was a musical composition or resembled the human voice. When Gerbert of Aurillac places in the cathedral of Reims an organ of his own invention which, thanks to the passage of steam from boiling water through metal pipes of different lengths, can produce wonderful sounds, contemporaries admire him. Conversely, when Gerbert builds a bronze statue that can emit articulate sounds, contemporaries fear him.

To understand the reasons for such a deep distrust in those who try to artificially produce voice, we must consider that voice is the only element that distinguishes man from other animals. Attitudes, instincts, even feelings that you may experience in humans can be identified in the behavior of other species. Only articulated language is exclusive to the human species. So to give voice to an object is far more amazing than to make it fly or emit melodious sounds. To give voice means to give life to something, to give a soul to the matter, and this is only granted to a god, but if it is a person who tries to do so, then it is surely the devil that secretly guides his hand.

For these reasons, to sketch the history of attempts of giving voice to objects, most often anthropomorphic, means scrolling the list of people who have been accused of practicing sorcery. For this reason it is a hidden history, and here I will try to trace it, focusing on some steps which seem particularly interesting and significant.

2. The two paths: the trick and the research

The history of attempts to give voice to objects developed along two well-defined paths, the path of the trick and the path of scientific research. The path of the trick is that in which the voice seems to spring from an object, that is a statue, a head or something of the sort, but in reality it is a simple transport of voice: the voice is produced by a hidden speaker and it is carried, by means of an artifice, in the direction of the talking head. Along the path of research, in contrast, the inventor tries to build a mechanism which, by imitating the phonatory apparatus, is able to produce an acoustic signal similar to voice. Between the two types of products there

is an obvious difference: in the first case the machine speaks fluently and without difficulties, in the second case the result is very rough, the machine produces only some single sounds, maybe a short sequence of sounds. The devices of the first type were at most a source of curiosity in the fairs and theaters of illusionism, while those of the second type were studied in scientific laboratories. But which of the two routes led to modern talking machines? Contrary to what we might think, the answer to this question is not obvious.

3. The path of the trick

The idea of building a talking statue by the technique of voice transport goes back to very old age, to the period when the Aegean sea was full of oracles predicting the future, like the head of Orpheus in the Lesbos island. Or even earlier, at the time of the events narrated in the Old Testament. In Mesopotamia, the Chaldean priests were accustomed to question their idols, the *teraphim*, to predict the future. When questioned, the *teraphim* answered. The scene is very well represented in the painting "Consulting the Oracle" by John William Waterhouse [1]: we are inside a house, or a temple, the candles are burning, people are kneeling in front of the embalmed head that suddenly begins to talk. The trick will be explained many years later, in the 3rd century, by Hyppolitus in his *Philosophumena* [2]: the idol was made with wax and had the semblance of a skull. The skull was secretly connected with the windpipe of a crane or some other long-necked bird, so that the head seemed to speak. The accomplice spoke what the magician wished. When he wanted it to vanish, he offered incense, put a lot of coals around the head, the wax melted and the skull became invisible.

We must not smile at the credulity of the naïve spectators in front of the speaking head because, as we shall see, things have not changed over the centuries. Even today, although in a completely different way, the transport of voice continues to be practiced successfully. On the other hand, it continued to be used over the centuries in different places and times, even by famous people such as archbishops, philosophers and scientists. Starting from the 13th century, in fact, it seems that a large number of people possessed an oracle, most of the times made of bronze. There are numerous and contradictory testimonies relating to this period. A good reference is the work by Gabriel Naudé "Apologie pour tous les grands personnages qui ont été faussement soupçonnés de magie" [3]. The specific purpose of the work was to rehabilitate whoever, at various times, had been accused of sorcery. To save their reputations Naudé was forced to make a long series of extremely useful arguments, though today they would be considered inappropriate for being clearly groundlessness. Naudé enumerates all the testimonies that he can find: for him, who was Richelieu's and Mazarin's librarian, it must not have been difficult to find news, rumors, legends and medieval chronicles. Among these, many involve talking statues, such as those built by Robert Grosseteste, Roger Bacon, Albertus Magnus and Enrique de Villena. Here we focus on the statue that, in our view, is the most representative and whose story is in many ways most fascinating.

4. The Android of Albertus Magnus

There are numerous testimonies about the talking statue built by Albertus Magnus. Besides Naudé, Tostato Alphonso de Madrigalejo, who was bishop of Avila and lived in the 15th century also mentioned it [4]. So did the abbot of Velly in his "Histoire de France" [5], Joseph François Michaud in his "Biographie Universelle" [6] and many more. The idea of building a talking statue comes to Albertus during his years in Paris, where he gives courses at the College of St. Jacques. To listen to his lectures students come from all parts of Europe. The numerous monasteries scattered around the continent send their young students to follow the lectures by Albertus on theology, science, physics and philosophy. The crowd of students is so large that it

cannot be easily accommodated. Thus, the lectures are held in a square that is not far from the College of St. Jacques in Paris: this is Place Maubert, near the Sorbonne, which owes its name to the contraction of *Maître Albert*. The students who throng to listen are mathematicians, astronomers, alchemists. Among them is Roger Bacon, the Franciscan monk and a scholar of physics and experimental sciences.

After his stay in Paris, Albertus goes to Cologne, and Bacon goes to Oxford. Both build a statue that is able to speak. That of Albertus, known as the Android, is placed in the cell of the Dominican friar and emits sounds like a human voice: the statue speaks. When Thomas Aquinas, a disciple of Albertus, arrives in Cologne, he is taken by Albertus to the cell. Thomas is terrified because he hears the statue speak very clearly. Believing it is the devil's work, he destroys it with a stick. Albertus comes in and says "in a minute you destroyed a work that cost me thirty years of work" [7].

To have an explanation of how the Android worked we must wait for the mid-17th century, when Athanasius Kircher explains how to build a statue that is able to speak [8]. Kircher is familiar with the anatomy of the ear and gives great importance to the shape of the cochlear canal, where, in his opinion, the sound is channeled and amplified. More than on the resonance phenomenon, his attention is focused on the reflection of the acoustic wave. Having established that the angle of incidence is always equal to that of the reflected wave, he concludes that it is possible to concentrate the sound at a given point through pipes with a particular shape: the *tubus ellipticus*, the *tubus conicus* and the *tubus cochleatus* (Figure 1).

The idea comes to mind to him while he is in a chemical laboratory equipped with a small canal for letting the smoke go out. Here he realizes that the rumors can go out of the locked room in an apparently miraculous way, following the same path of the smoke. Figure 2 shows his project to ensure that, through the pipes DES, the voices of those who speak in the lower chamber arrive in the chamber F.

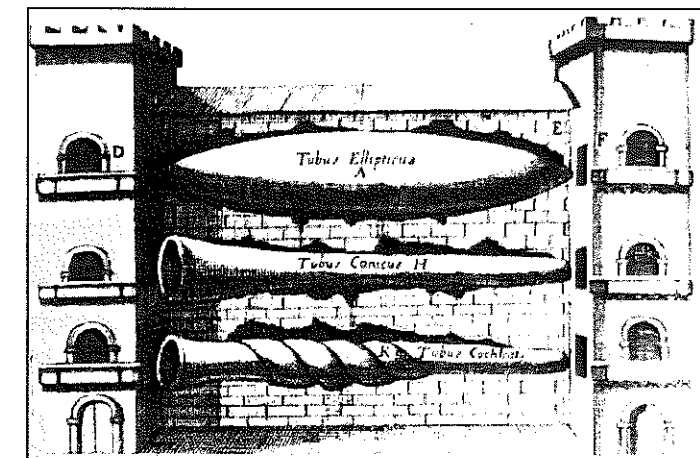


Figure 1: Tubus ellipticus, tubus conicus and tubus cochleatus (A. Kircher, *Phonurgia Nova*, Campidonae, 1673, 100).

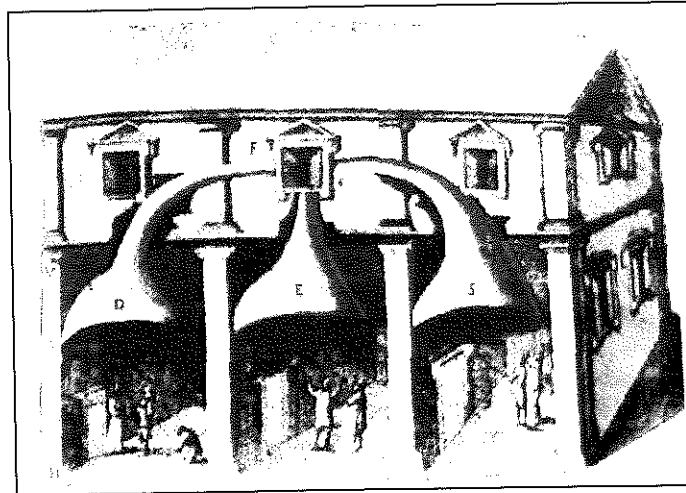


Figure 2: Tubi conici (A. Kircher, op. cit.).

But back to Albertus' talking statue and Kircher's explanations of it. The mechanism is shown in the *Iconismus XVII*, a splendid example of graphics, of imagination, of setting (Figure 3), and is explained by the Jesuit priest as follows: "[...] in the room ABCD, in which a tube-shaped concave [...] will be introduced in E, or in a vertical tube S, there is a statue which breathes from the mouth and the eyes [...]. This statue is placed in a precise place [...] so that the terminal part of the tubus cochleatus corresponds perfectly to the concave of the mouth; and you will have a statue that pronounces any word, perfect and complete. In fact, this statue will chat constantly, now uttering words of man, now of animal, now laughs [...] now you will hear singing, now crying, now shouting [...] with very strong general astonishment. Because in fact the orifice of the cochlear tube corresponds to a public place, all human words uttered outside, collected within the tubus cocleatus, come into the mouth of the statue. If dogs bark, even the statue will bark; if someone sings, the statue will respond in song. [...]. If we have the tubus cochleatus vertically, the thing will produce a better effect" [9].

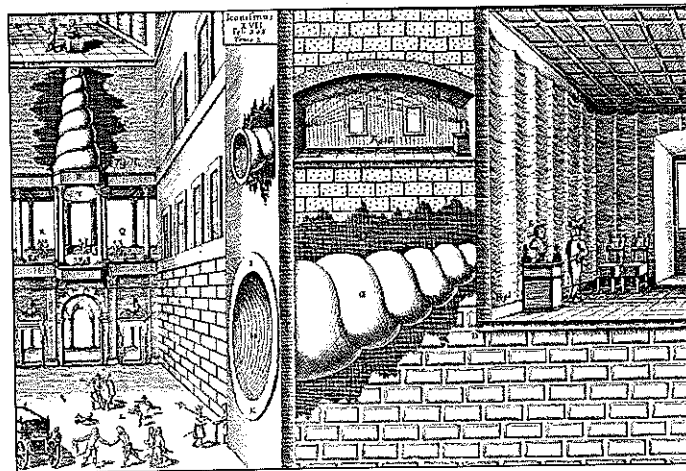


Figure 3: *Iconismus XVII* (A. Kircher, *Musurgiae Universalis*, Roma, 1650).

According to Kircher's description, the history of Albertus Magnus' Android must have gone as follows.

Albertus built a hidden channel that connected his cell with another room. The extremity of the channel was formed by a metal head, probably of copper, in such a way that the sound appeared to come from the statue. The fame that accompanied and will accompany for centuries this ingenious gimmick shows that Albertus used it very often and with different people, probably to intimidate those with whom he was dealing, in order to establish a hierarchical relationship of dependency from the outset. When Thomas Aquinas arrives in Cologne, he is initiated by Albertus to the ritual and intentionally ("studiose" [10]) sent into the cell where there is the statue. As soon as Thomas goes in, the head starts to make sounds and to pronounce words. Evidently the channel connects the cell with another room, where Albertus starts talking to activate the mechanism. But alas, his pupil ("perterrefactus" [10]) breaks down the statue with a stick. Now the statue is silent because Albertus, who must have heard the noise from the other side of the cubicle, has run up and asked what is happening. Thomas responds candidly that it was he himself who crushed the statue because it was the devil's work. Albertus, controlling his anger, blurts out "Thomas, you have destroyed the work of thirty years!"

5. The end of magic

As we have seen, for many centuries the history of talking machines was a hidden history, since until the 17th century whoever tried to build a device emitting vocal sounds was accused of witchcraft and sorcery. The 17th century marks a total change of direction. If we want to refer to a specific time when that change occurs, we can say that the turning point was 1611, when the complete works of Giovan Battista Della Porta were published [11]. In Chapter I of Book XIX, in fact, the author wonders "whether a material statue can talk with some artifice". So, no more dark cells of monasteries (the most numerous to appear in the list of the accused were in fact ecclesiastics), but the possibility of creating a "talking statue" begins to be examined objectively, once back in the field of acoustics. Della Porta has no doubt about it: to those who accused Albertus Magnus to have made a talking statue by "the election of astrology", he answers firmly "But good God, how can a learned man believe this? How can the stars have strength to do these things? There are some who believe that he did for Magic Art. This I think less of all the things [...] but I think if he did, he did it for reasons of air" [12]. At this point Della Porta, trying to explain these "reasons of air", describes a mechanism that can capture a voice, store it in a tube and, on request, get it out and play it: it is the idea of a modern recorder, nearly three centuries earlier than Edison's phonograph. The voice finally becomes a material object that moves in space: "the words and the voice walk, so ordered by the air as they come out of the mouth". He imagines to build very long pipes of lead, a length of 200 or 300 steps, to pronounce some words at one end, then close the two ends of the tube and imprison the voice inside the tube. According to Della Porta, the voice will continue to bounce from one end to the other, so that "when you open the mouth of the pipe, voice comes out, as from the mouth of one who speaks".

Deprived of its magical atmosphere, the talking head with the trick of the voice transport will continue to be built and it will be an object of curiosity and fun in fair stands. Among the spectacles performed by illusionists, the most recurring is that of a head having the power of speaking and to answer questions asked by astonished spectators. The manners in which the experiments take place are different, but they can be grouped into two types of trick, one based on optics and one on acoustics. Among the latter, the one of the "Wooden Talking Head" was certainly original. A wooden head is suspended, by means of a chain made of brass, to the point of intersection of two arcs of metal wire (fig. 4).

The ends of the two wires are planted in the corners of a wooden box without lid and with the empty walls. In the mouth of the head there is a trumpet made of metal, and words and phrases can be clearly heard from it. To accentuate the impression that it is precisely the head that talks, the magician nears a lit match to the mouth of the trumpet and the flame fluctuates or even shuts down due to the breath emitted by the talking head. In reality, the trick is very simple.

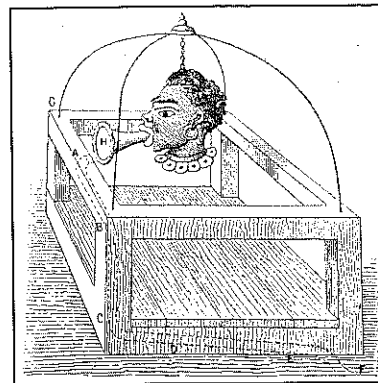


Figure 3: The wooden talking head (La Nature, n. 509, 1883, 221)

A hidden person speaks into a metal pipe of two centimeters in diameter. The pipe continues inside the wooden planks in the stretch FDCBA. At point A, the tube is curved in the direction of the center of the trumpet. The voice is therefore directed towards the bottom of the horn and, thanks to its conical shape, it is amplified and reflected back to the person who is located in front of the head.

Probably today the "Wooden Talking Head" would not impress anyone. However, if we consider that only a century ago it was one of the main attractions in theaters and fairs, we realize how, in past centuries, heads and bronze statues very similar to it were considered to be the devil's work.

6. The path of the research

Both Albertus Magnus and Roger Bacon drew much of their knowledge from the works of Arab philosophers, who in the field of natural science were far ahead of the Christian world, that was totally dedicated to prayer and asceticism, and where the only study to be allowed was that of theology.

Gerbert of Aurillac, who was elected Pope Sylvester II in 999, is the link between the Arab and the European cultures. For a number of favorable circumstances, but especially for its greed for knowledge, he uses what he has learned from his Arabian teachers in Seville and Cordoba in the field of acoustics, music and mechanics. This puts him in a very particular condition, as he is the first among Western Christians to become a disciple of the Arabs. While in the West the intervention of God or the devil is invoked to explain all that is incomprehensible, Gerbert approaches arithmetic and geometry, eagerly assimilating all that Arab culture has to offer. His life is a succession of incredible adventures that lead him to become the most powerful and feared man in the end of the first millennium. As with Albertus Magnus, there are numerous testimonies that Gerbert built a bronze head able to answer questions that are asked. Unlike what happens in the path of the trick, the statue of Gerbert can utter only two words: *etiam* for affirmative answers, and *non* for negative ones. It would be too long here to retrace in detail the history of this talking head. We can only say that the statue, which Gerbert used to impress and intimidate the naive audience, worked thanks to the strength of the steam of boiling water

passing through two different resonators. The steam was originated by the presence of a *miliaris*, a vessel containing boiling water, on which device most of the mechanical experiments of the first half of the second millennium will be based. Gerbert had the idea of building a *miliaris* from the reading of a work that was well known in the Arab world, even if written by a scientist of Greek culture. The work, entitled *Spiritalia* had been written in the first century BC by an extraordinary man, who has been considered the first engineer: Hero of Alexandria. Among the many inventions described by Hero, one is how to give voice to a statue with the heat of the sun's rays. Hero will then be able to carry out his plan, giving rise to the most famous talking statue of the ancient world, known as the Colossus of Memnon [13].

In the 47th theorem of his *Pneumatica* Hero describes a trickling water fountain by the action of the sun's rays (figure 4). When the sun falls upon the globe EF, the air in it, being heated, drives out the liquid, which is then carried along the siphon G and passes through the funnel H into the pedestal ABCD. But when the globe is in the shade, having the air escaped through the globe, the tube sucks up the liquid again, and fills the void that has been produced. This takes place every time the sun falls upon the globe. In many theorems Hero explains how it is possible to get a sound by pouring water into a vessel. In general, if the base is connected with the outer air trough a very thin pipe, the inner air will be pushed into it abruptly giving rise to a hissing sound. Depending to what is at the end of the pipe different sounds can be produced: a bird's chirp, a dragon's hiss or a trumpet's play (figure 5).

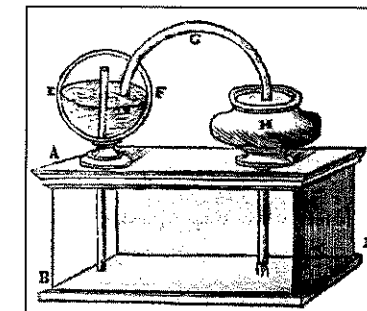


Figure 4: Hero's trickling water fountain by the action of the sun's rays. (Hero of Alexandria, *Gli artificiosi et curiosi moti spiritali di Herrone*, 1589).

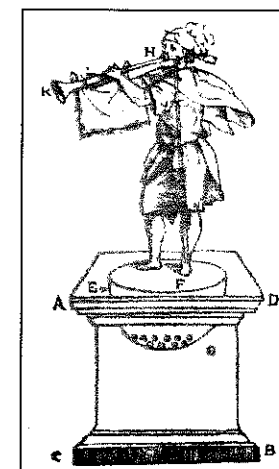


Figure 5: Statue playing the trumpet through the rays of the sun (Hero of Alexandria, *op. cit.*).

So the problem of how to create an airflow necessary for the production of a sound, a problem whose solution requires a complex mechanism of the lungs during phonation, is solved by Hero in a brilliant way.

To go back to Gerbert's statue, it had to have a very similar mechanism, so that the air was pushed inside. Instead of a single pipe, as in Hero's device, there should have been two. In fact the head answered affirmatively (*etiam*) or negatively (*non*). This means that it was able to produce two different sounds, which presupposes two resonators of different shape and size. From an articulatory point of view, which is the difference between *etiam* and *non*? The main difference lies in the fact that the first one has unrounded vowels, the second has a rounded one. Acoustically, this difference has enormous significance, since lip rounding involves the lowering of all formants, because a resonator with a hole of reduced output generates lower frequencies than one with a wider hole. Furthermore nasality causes a damping of intensity. These considerations lead us to believe that the head of Gerbert had a large cavity with a narrow outlet hole, suitable for producing a sound similar to [o], and one that was narrower but with a progressively larger output, useful to generate an [ε] sound. A system of shutters, operated by levers or by ropes, allowed the air to pass through one or the other resonator. Taking into account the different conformation of the two channels, it is likely that the first one was made inside the mouth and the other in one ear.

Probably the result was not great, but it should be considered that the listener was directed to choose between two possible answers (a methodology known today as the "binary forced choice task"). If we consider that all of this takes place a few years before 1000 AD, in a world filled with fear for all that appears inexplicable, we can imagine the effect on Gerbert's contemporaries.

Where might Gerbert's talking statue be today? Unfortunately we do not have an answer to this question, but, for those that are interested in seeing a very similar head, we suggest, to make a visit to St. Eulalia Cathedral in Barcelona. There it is possible to admire the head of the Moor (the "organ Carassa"), which testifies to the Christians' practice to take derision of the enemy by hanging a head depicting a Moorish king on the organ pipes. The head can now be operated by means of a rope: it opens its mouth and rolls its eyes. Unfortunately, not being connected to the pipe of a hydraulic organ, it is not able to emit any sound. However, for sure, it is truly spectacular (figure 6).



Figure 6: The head of the Moor, Barcelona.

7. The Abbot Mical

There is little information about the life of Abbot Mical. We know that he was born around 1730 and after finishing his studies and receiving holy orders, he had a benefit that allowed him to live quietly and modestly. He devoted all his time to the study of mechanics, the science for which he had a particular aptitude. Initially he built two robots that played the flute, later many others who played several instruments in order to form a full orchestra. This work, according to his contemporaries, "was able, for the masses, for the beauty of carved figures and for the perfection of the extremely varied, to beautify the largest hall." According to Louis Bachaumont, editor of the "Memoires Secrets" [15], the Abbot destroyed his work because he had been accused of having depicted naked figures. After this first attempt to produce musical automata, he built a bronze head able to articulate short sentences. Unfortunately, this time too the Abbot's modesty caused the talking head to have a fortune similar to that of the players' automata. In fact, the abbot showed it to an acquaintance who, betraying his confidence, wrote a letter to the "Journal de Paris" in which he praised the amazing invention. The abbot then destroyed the talking head as he considered it still too rough and imperfect.

After this episode, Mical built two new talking heads, the first real speaking machine. The Abbot presented his work at the Academy of Sciences on July 2, 1783 and the members of the jury recognized the great importance of his invention. In fact, as we can read on the engraving depicting the machine, "L'Académie des Sciences a dit dans son rapport que ces têtes parlantes peuvent jeter le plus grand jour sur le mécanisme de l'organe vocal et sur le mystère de la parole. La docte assemblée avait déclaré que cet ouvrage était digne de son approbation autant par sa nouveauté que par son importance que par son execution". The machine consisted of a sort of dome supported by four columns in Corinthian style, all decorated in Louis XVI style. In the middle of the canopy there were two heads placed on a small gallery also supported by Corinthian columns. In front of these small pillars there was a cloth with the words spoken by the two robots (Fig. 7).

The head on the left says: "Le roi donne la paix à l'Europe". At this point the second head replies "La paix couronne le roi de gloire". The first head then says "Et la paix fait le Bonheur des peuples. Oh roi adorable/père de vos peuples/Leur Bonheur fait voir à l'Europe/La gloire de votre trône". According to the testimonies of those who had the chance to listen to it, Abbot Mical's machine was stunning, and its mechanism was so explained: "Les têtes recouvraient une boîte creuse, dont les différentes parties étaient rattachées par des charnières, et dans l'intérieur de l'auteur laquelle avait disposé des glottes artificielles, de différentes formes, sur des membranes tendues. The air, passant par ces glottes, allait frapper les membranes, here rendaient des moyens sons ou aigus, et de leur espèce d'une combinaison résultait imitation très-imparfaite de la voix humaine". It should be noted that, wisely, Abbot Mical had highlighted on the drape the text of the sentences that the listener should recognize, thus helping them in the identification of the text.

Unfortunately for the Abbot, a police lieutenant, Jean-Charles Lenoir wrote a negative report, because he feared that it was a trick, a deception. The authorities in Paris, following his advice, decided not to buy the talking machine. The Abbot was deeply disappointed, he abandoned his research and retired to private life. He died a few years later, in 1789, and we have lost track of his machine. Someone says that the Abbot, disappointed, destroyed it voluntarily. Is it true? In our view, things could have gone differently and maybe it is still possible to find the machine. An interesting clue is given by the testimony of Jean Etienne Montucla, the author of an important "Histoire des mathématiques", a friend of D'Alembert and Diderot, and a regular attendee at the Encyclopedists' meetings.

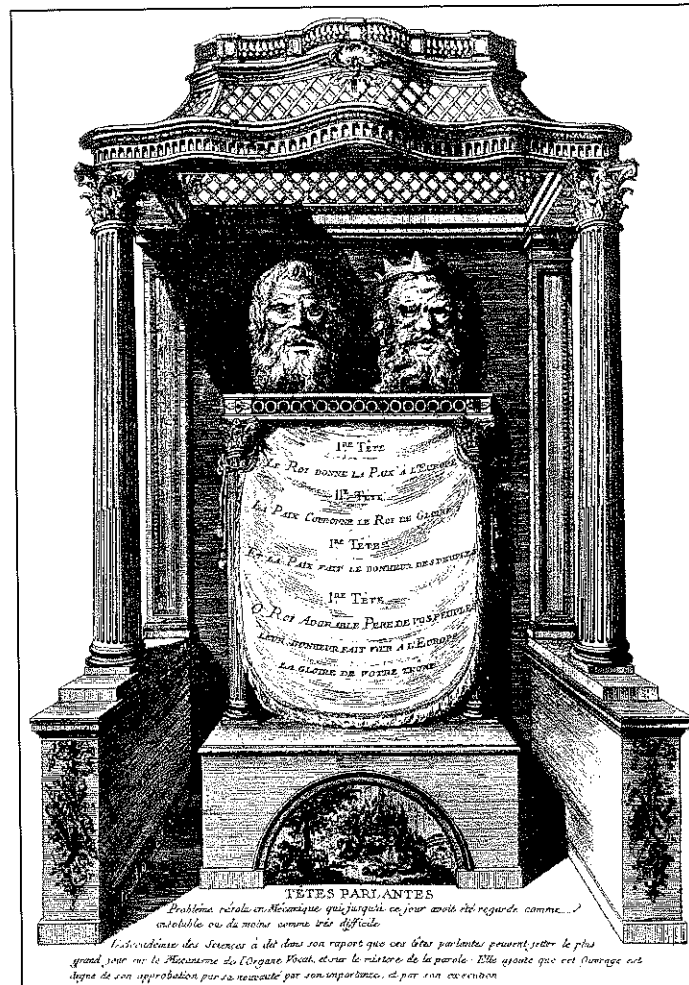


Figure 7: The talking heads of Abbot Mical (La Nature, 1905, n.1667).

According to Montucla Mical's machine was by no means destroyed: the Abbot sold it for a considerable sum, it seems, to a foreign nobleman [16]. Reading carefully the testimonies relating to Mical's talking heads, indeed a "foreigner" seems to have certainly had the opportunity to see them, listen to them and appreciate them. The event took place June 18, 1783, when the abbot decided to invite to dinner in his home, in *rue du Temple*, two members of the Academy of Sciences that soon would have to judge his work. One of these, Barthélemy Faujas de Saint Fond, on the morning of June 18, writes a note to another member, an American, to remind him of the Abbot's invitation. He fears that the eminent American diplomat, on a visit to France to report the events of the American Revolution, may have forgotten -because of his many commitments- the unknown Abbot's dinner invitation. So that night the two men admired the work of the abbot and were fascinated by it. That American was Benjamin Franklin. Where can Abbot Mical's talking heads be today? Unfortunately, this question does not have an answer yet.

8. Conclusions

As we have seen, the history of talking machines followed two different paths, that of the trick and that of the research. In the first case, the voice was actually produced by a hidden subject and transported through an artifice to the place where there was a head or a statue. In the second case, the inventor tried to build a mechanism that in some way was able to imitate the complex mechanisms of phonatory organs during the production of speech. Which of these two paths led to the synthesized voice of modern talking machines? Contrary to what one might think, it is not only the course of research that has led the most progress in this field, but also that of the trick. The synthesis for diphones, in fact, is based on a database of speech segments actually produced by a speaking subject, suitably cut, stored and reproduced on demand in the appropriate sequences. The results are every day more and more satisfying and amazing, certainly not comparable to the rough and naive attempts of their ancient predecessors, but the story of talking machines is definitely history that is far from being over.

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