

The Phonautogram Diaries

by David Giovannoni

On March 28th, 2008, the world's oldest playable recordings were presented publicly for the first time at Stanford University, during the annual convention of the Association of Recorded Sound Collections. The discovery, and recovery, of a haunting French folk song sung into a Phonautograph on April 9th, 1860, took place within the space of only two weeks. These diary and email extracts tell the behind the scenes story of a discovery which literally rewrites history.

Friday, February 29th, 2008

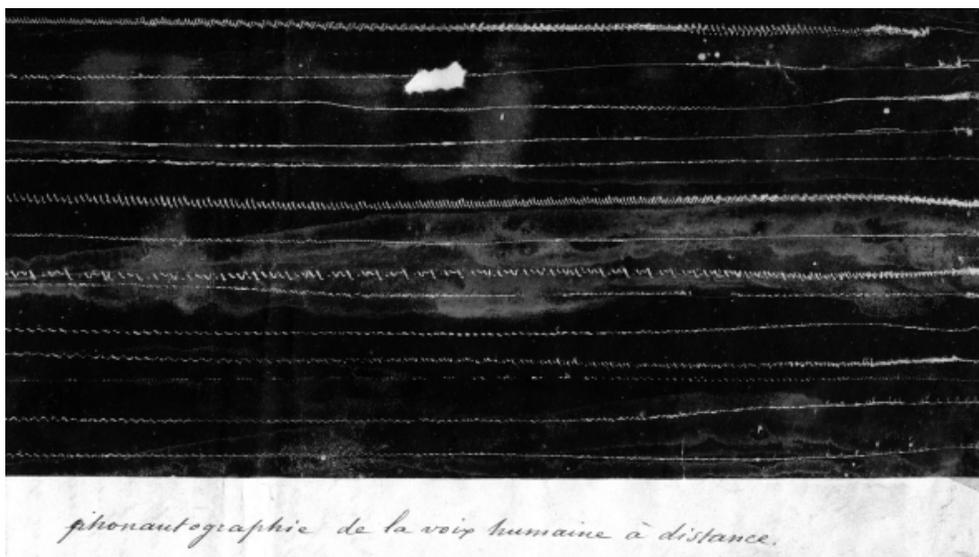
Our work towards playing phonautograms continues. Preparing the image of a single trace (i.e. one revolution of the cylinder) still takes too long, but it has decreased from several hours to under 60 minutes. Earl [Cornell, at Lawrence Berkeley Laboratory] and I have been experimenting with various levels of processing to determine the right balance between preparation time and the accuracy of translation to sound, using Edison unbound phonautogram No. 5 from September 1878. We're hearing vocalizations, which we expected. These were probably made by Batchelor to test and adjust the phonautograph as he was capturing the noises of the Metropolitan Elevated Railroad – the cause of much annoyance among the denizens of

Manhattan's 6th Avenue that spring and summer.

René [Rondeau], Patrick [Feaster], and I met by phone to discuss our "Let There Be Sound" presentation at ARSC in Palo Alto, four weeks from today. I'm confident we'll give a good show. But our results to date are less than we'd hoped – both factually and sonically. Factually, we've established that Scott actually did use a moving medium to trace the movements of a stylus attached to a membrane that vibrated in sympathy with sounds from the air, as text books recount; but we've also determined this is not a "sound recording" in that the traces are not interpretable analogs of the original airborne sounds. All we get

from his 1857 patent deposit are squawks. Indeed, that's all Cross would have gotten had he actually tried to photoengrave and reproduce them as he proposed in April 1877. So while we can play the squawks at ARSC, they are not sonically compelling.

Sonically, we can hear Scott's tuning fork from his 1859 deposit at INPI (the French patent office) which is the oldest reconstituted sound to date. But this sound was



The source of squawks – a detail of the phonogram deposited in 1857 by Édouard-Léon Scott de Martinville with his Brevet de Invention, no. 31470, annotated in Scott's hand with "phonautogram of a human voice from a distance." Source: Institut National de la Propriété Industrielle.

not taken from the air, and anyway, vibrograms had been made since the early 1800s. The only thing new is our ability to play them.

And while Batchelor's test shouts from 1878 are cool, we aren't hearing the sounds from the train recordings that we expect. No click-clack of the cars over the rails, no chugging of the engine, no rumble of the train passing by, no whinny of horses clopping nervously under the noise – whatever it was.

One bright spot. The CD of scans from the French Academy of Sciences arrived today. Spurred by our telephone calls (impatient Americans) and true to his word, Mr. Labrador kindly expedited scanning and mailing of the materials requested months ago. Unfortunately no time to open it today.

Saturday, March 1st

My call early this morning woke up Patrick, but he quickly forgave me when he too saw the images from the Academy. He followed up in an email:

Looks like you'd better prepare for a trip. We could hardly have asked Scott to produce more promising documents than these.

Scott's inscriptions reveal that we're dealing with really interesting subject matter: vocal scales and "song," as well as speech.... These aren't the sine or sine-like waves we've been dealing with so far, but visibly complex waveforms. The vocal scales and elocutionary study could therefore sound recognizably like the human voice. And they're dated, e.g. April 9, 1860 and Sept. 15, 1860.

So pack up your scanner in your old kit bag and smile, smile, smile. I think we've just graduated from the school of squawks.

This rich cache of documents was deposited on two occasions: 1857, before Scott applied for his patent, and 1861, after Scott learned of others experimenting with phonautographic recordings. The

second part of the cache is what really gets the juices going. The low-resolution images show several phonautograms with dark backgrounds and clear traces – possibly a mixture of photographic reproductions and originals. All appear to be technically more adept than the 1857 and 1859 deposits at INPI. Several are annotated, signed and dated by Scott and witnesses. All date from 1860. What a gift. Not only did Scott establish an unbroken chain of custody with his deposit at the French Academy of Sciences, he also imbued his work with indisputable provenance.

Scott left us another gift. On several phonautograms the vibrations of a tuning fork are inscribed next to the diaphragm's. [See image on page 6.] The tuning fork metered the passage of time, which made the phonautograph useful in establishing the pitch (frequency) of notes sung or played into it. As we devise to recover the voice, the tuning fork trace tells us the exact speed at which to play back the recording. Moreover, the fork's constant frequency allows us to stabilize the speed fluctuations of hand-cranking and snap the voice back into real time. Time code from 1860 – Great Scott!

Monday, March 3rd

*To: First Sounders
From: DGio*

The big news is the discovery of exquisite and heretofore unknown phonautograms deposited by Scott at the French Academy of Science in 1861. The quality of these traces is astounding. They offer our most promising shot at hearing readily understandable speech and music recorded in 1860.

Patrick, René, and I agree that this is a go-for-broke opportunity. If we can acquire scans next week, we should have barely enough time to transduce, interpret, and restore sounds for audition at Stanford. This is our high risk, high stakes goal.

It was 5:30 AM in California when I sent the above.

Two hours later Earl returned three crude sound snippets evoked from the low-resolution images. I processed them immediately. Without doubt, we are on to something amazing. Still shaking from what I hear, I shoot them back to Earl

To: Earl
From: DGio

Whoa.... This is the real deal. Your files interleave the two tracks; listen closely through the warble and you'll hear the voice for one revolution, the tone for one revolution, then the voice again, etc. When we get the hi-res scans we'll process the two tracks in parallel and use the tuning fork trace to snap the voice into perfect time! This will be the WOW we were hoping for at Stanford.... If we can just get the folks in France to give us access to the pages

Thursday March 6th

We've been working with Mr. Labrador since Monday, hoping he could rescan the documents to our high-res specs. But it appears as if he can't. So I booked the hotel and flights today before the tickets get more expensive or the dollar drops even further against the Euro.

To: First Sounders
From: DGio

On Sunday I will fly to Paris with friend, science writer, and interpreter Isabelle Trocheris. We will scan the Scott phonautograms at the French Academy of Sciences on Monday and Tuesday. We will return to Maryland Wednesday evening. On Thursday the 13th the real work will begin in earnest.

Monday, March 10th: Paris

We blew in with the biggest storm to hit Europe this year. Unable to catch a cab, we walked from the hotel to the Academy and arrived drenched. Yet it was a productive day. Archive staff are friendly and responsive, the scanner and laptop are working flawlessly, and we'll finish tomorrow as planned....

Friday March 14th

Files are flying between Maryland and California as we address the technical challenges of the 1860 phonautograms. We have enough time to hear only one. Scott's Phonautogram No. 5 is among the most promising. It's also the earliest dated sheet. After a couple days of forensic study and experimentation, we're ready to start processing in earnest. It may be only a matter of hours before we hear "Au Clair de la Lune" as recorded in Paris on 9 April 1860.

10:24 AM
To: Earl Cornell
From: DGio

All 16 rotations of Scott 5 are on the FTP site waiting for you. All traces adjusted for non-orthogonal skew. Tantalizingly close.

3:47PM
To: DGio
From: Earl

Attached are the 16 Left and 16 Right sound files. I optimized the settings on a couple of files and then ran with those settings. I'll look back over them later and see if any of them can be improved.

4:16 PM
To: First Sounders
From: DGio

Earl has just produced rough sound files for all of Scott Phonautogram No. 5. Assembly begins.

8:14 PM
To: Patrick, Archeophone
From: DGio

Earl may send another set of files tonight that are cleaner. But he may not. If either of you wants to make a stab at speed-correcting this file, go to it. Ten cycles of the tuning fork (right channel) should be exactly .02 seconds (1/50 of a second) in length. Nothing has been done to this file – not even DC

offsetting or rumble filtering. A 2000 Hz square wave blip marks the end of each rotation.

11:28 PM

To: DGio, Archeophone

From: Patrick

Oh yeah, we've got very recognizable vowel timbre at 500 Hz, and strong hints of consonants too. The tuning fork fading out at the end is a nuisance, but I processed the hell out of it and then amplified it way up so I think it's a fair visual guide to frequency now. I'll aim to get this whole thing adjusted to 500 Hz before going to bed tonight, because I don't think I could sleep otherwise with an iron this hot in the fire.

Saturday March 15th

I wake up to a time-corrected file from Patrick. His cover note, couched in the disappointment of a perfectionist, belies his excitement of being the

first to hear the world's earliest playable vocal recording – his reward for working through the night.

4:44 AM

To: DGio, Archeophone

From: Patrick

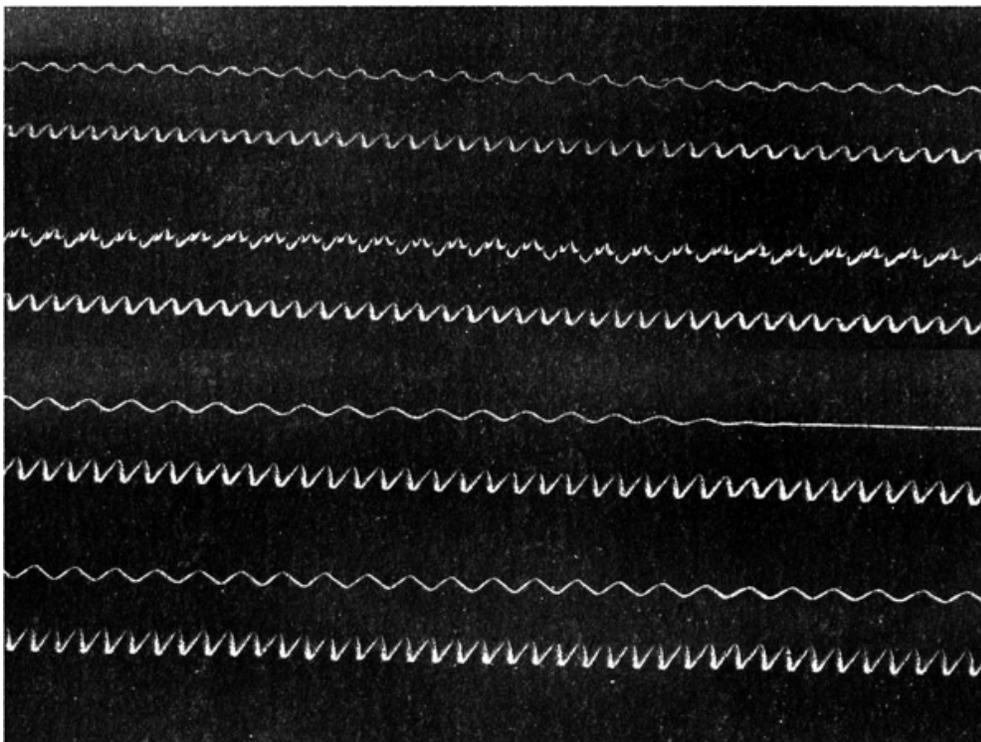
This is wobblier than I was hoping for – the tuning fork was hard for me to decipher at points. Nothing has been done to the file in the way of processing except the speed alterations.

7:57 AM

To: First Sounders

From: DGio

A tremendous effort! I'm attaching the pitch-corrected file for further restoration. Also attached is an image of the top right corner of the phonautogram. [See image on back cover.] Literally and figuratively, it's got Leon Scott's fingerprints all over it. 147 years and 11 months later, we add ours.



Contrast-enhanced detail of paired tracings from Scott 1860 phonautogram No. 5. The bottom trace of each pair was made by a tuning fork; the top trace is the recording of airborne sounds -- a voice singing "Au Clair de la Lune." Source: Institut de France, Académie des Sciences.

On March 27th, the *New York Times* broke the news in a front page story: "Researchers Play Tune Recorded Before Edison". By the following week the news had appeared in newspapers around the world, as well as on television, radio, and of course the Internet.

To listen to the world's earliest vocal recording, visit www.firstsounds.org.



N° 5.

Chant de la vierge pour la membrane du
tympan fixée à son centre. Le Diapason
écrit simultanément en entreligné.



The world's first record label: Scott phonogram No. 5, recorded on 9 April 1860. A small portion of the recording itself can be seen attached to the label. Note the fingerprints. Source: Institut de France, Académie des Sciences.