The graduate acoustic attack: “The sound of silence” °

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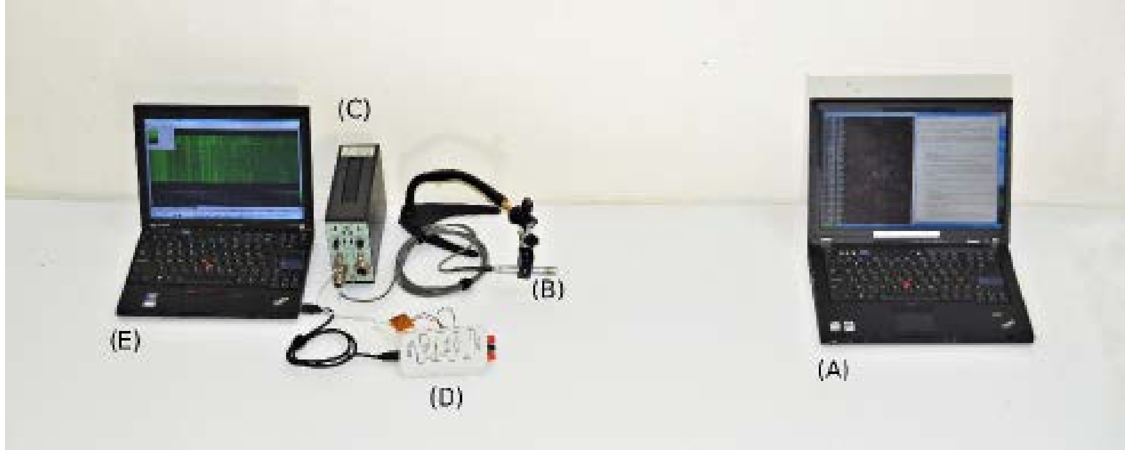
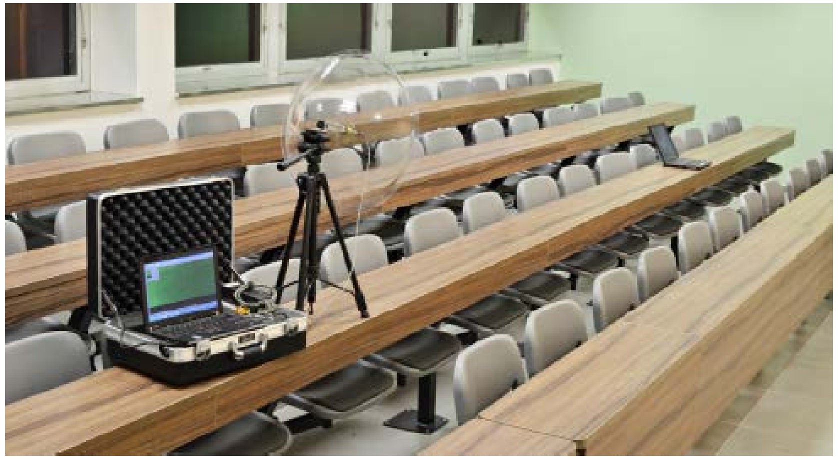
° Thanks to Garfunkel and Simon

Tuesday August 19, 2014, 2pm, CRYPTO-UCSB:
3 set-ups of acoustic attacks against a long RSA key (Genkin-Shamir-Tromer)





Acoustic attack: the model

Your COMPUTER with RSA key to be attacked

→At some distance vibrating OBJECT (MICROPHONE) connected to another computer

→signal and cryptographic processing

→RSA key in the hand of enemy

We want more: attacking from outside such an computer put in a sound-proof room …

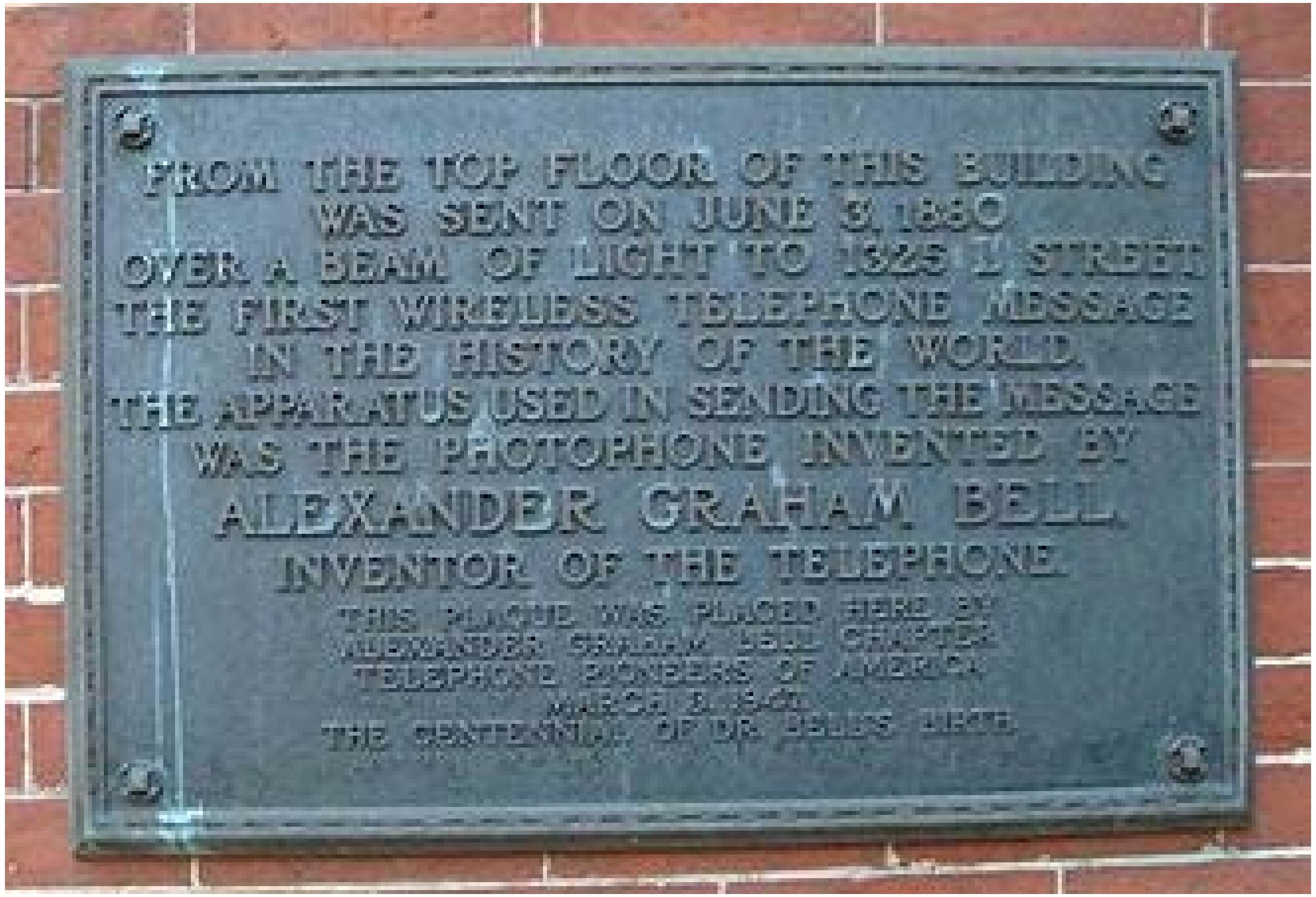
- We want to expand our knowledge of **Acoustical Intelligence** (**ACOUSTINT**, sometimes **ACINT**): it is an intelligence gathering discipline that collects and processes acoustic phenomena.
- Here is a possible set-up for the computer (and the user ☺) …

Acoustic attack: new model

Your COMPUTER with RSA key to be attacked
→At some distance some vibrating OBJECT (which one?)
→Full-proof-sound room and window
→signal and cryptographic processing
→RSA key in the hand of enemy

Is it possible?

By the way how old are acoustic attacks?

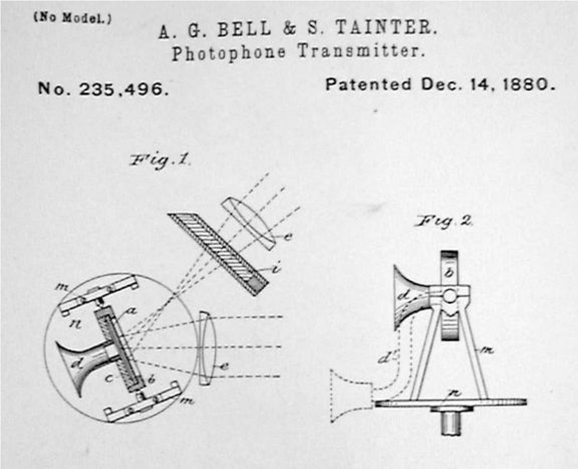


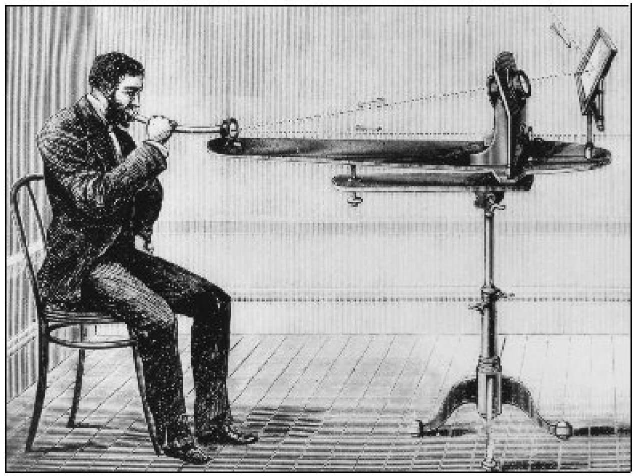
FROM THE TOP FLOOR OF THIS BUILDING
WAS SENT ON JUNE 3, 1880
OVER A BEAM OF LIGHT TO 1325 L STREET
THE FIRST WIRELESS TELEPHONE MESSAGE
IN THE HISTORY OF THE WORLD.
THE APPARATUS USED IN SENDING THE MESSAGE
WAS THE PHOTOPHONE INVENTED BY
ALEXANDER GRAHAM BELL
INVENTOR OF THE TELEPHONE

THIS PLAQUE WAS PLACED HERE BY
ALEXANDER GRAHAM BELL CHAPTER
TELEPHONE PIONEERS OF AMERICA
MARCH 3, 1947
THE CENTENNIAL OF DR. BELL'S BIRTH

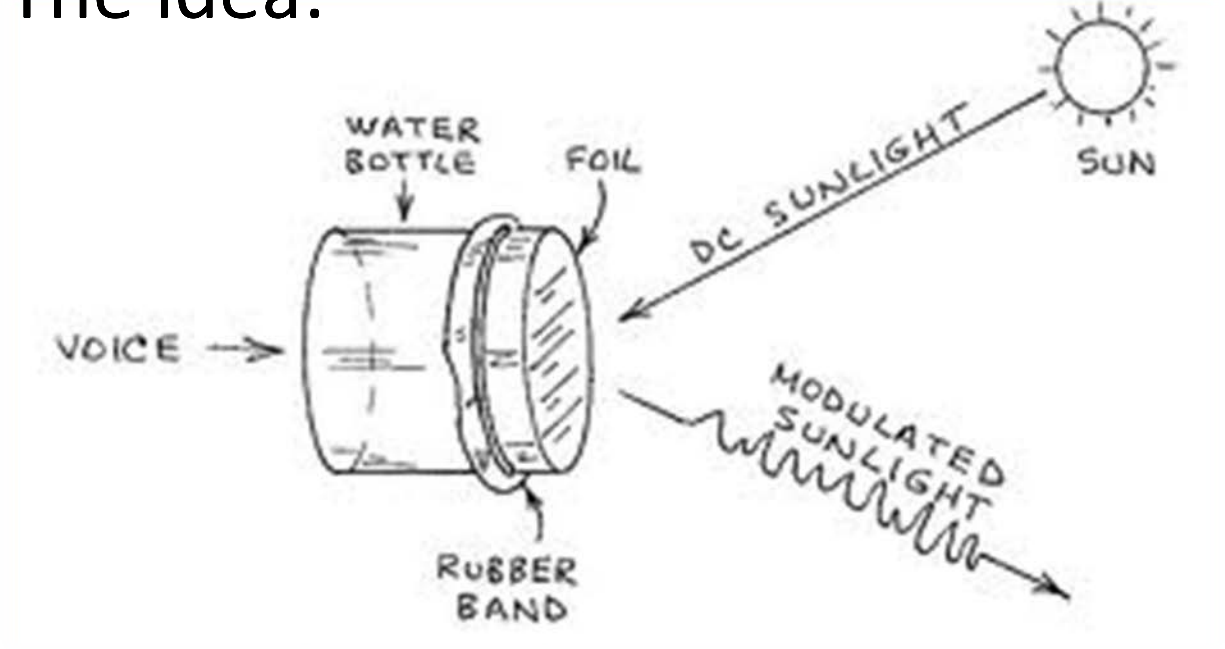
A Century Old Invention: the photophone.

April 26th, 1880 – **Alexander Graham Bell** & **Sumner Tainter** announce their invention - the Photophone. Sound is transmitted on reflected light-rays a **distance of 213 meters**. They also claim, “it can transmit songs with great purity of tone.” This is the forerunner of CDs, DVDs, fiber optic telephone transmission, and **remote eavesdropping**.



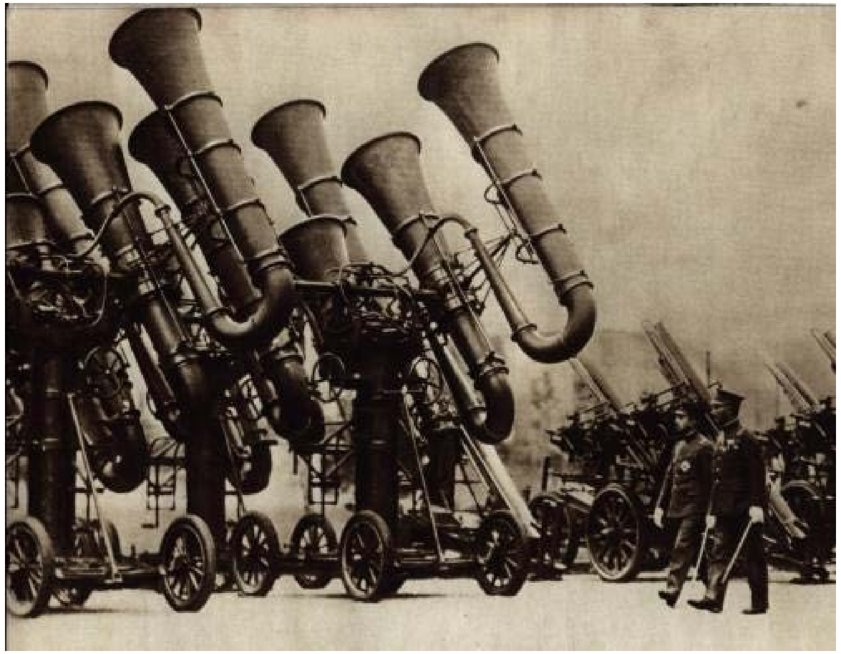


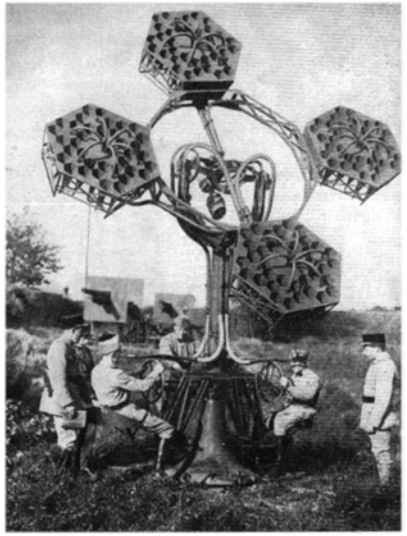
The idea:



Other old projects (acoustic locators)

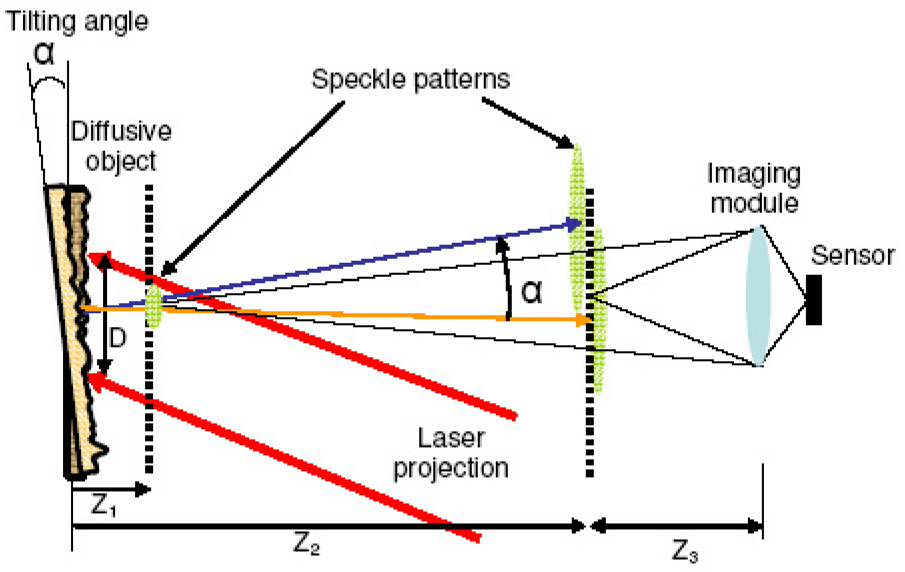
Professor Mayer's topophone [1880]





More about active acoustic attacks:
1. replacing sun by remote laser in the photophone

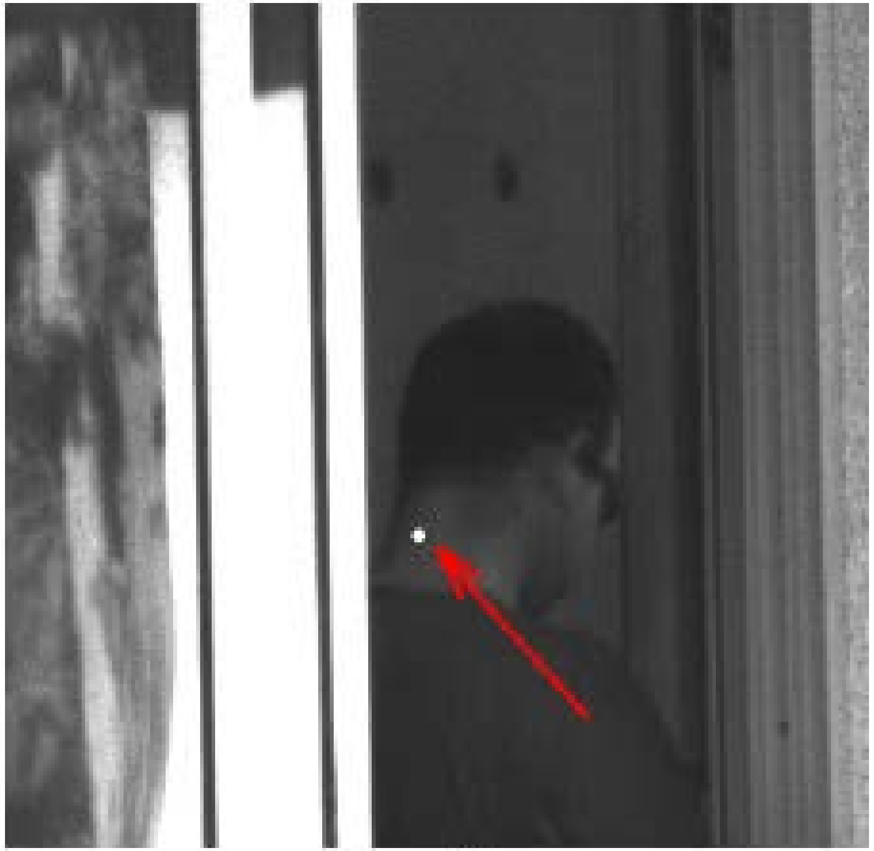
- *Simultaneous remote extraction of multiple speech sources and heart beats from secondary speckles pattern,* by Zeev Zalevsky, Yevgeny Beiderman, Israel Margalit, Shimshon Gingold, Mina Teicher, Vicente Mico, and Javier Garcia (Bar-Ilan University and Universitat de València): *Optics Express*, Vol. 17, Issue 24, pp. 21566-21580 (2009).



The configuration includes projection of laser beam and observation of the movement of the secondary **speckle pattern** that are created on top of the target (diffusive object). The speckles are self interference random patterns and have the remarkable quality that each individual speckle serves as a reference point from which one may **track the changes** in the phase of the light that is being scattered from the surface. The sensor is a fast expensive camera (7800 fps) used in defocused mode.

Then taping a cellular phone or
listening from the back of the neck!
Possible range is 100 meters or more using a telescope.

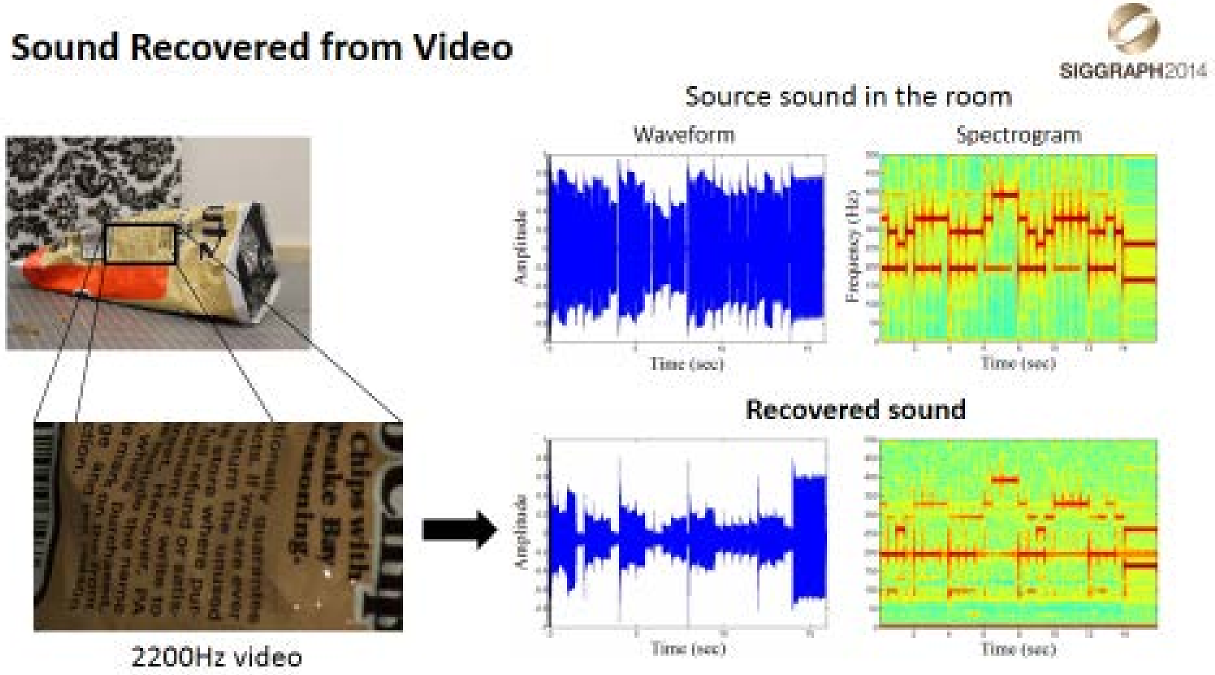
(a).



(a).

2. A new passive acoustic attacks: the visual microphone (SIGGRAPH 2014, last week) by Abe Davis, Michael Rubinstein, Neal Wadhwa, Gautham Mysore, Frédo Durand, William T. Freeman

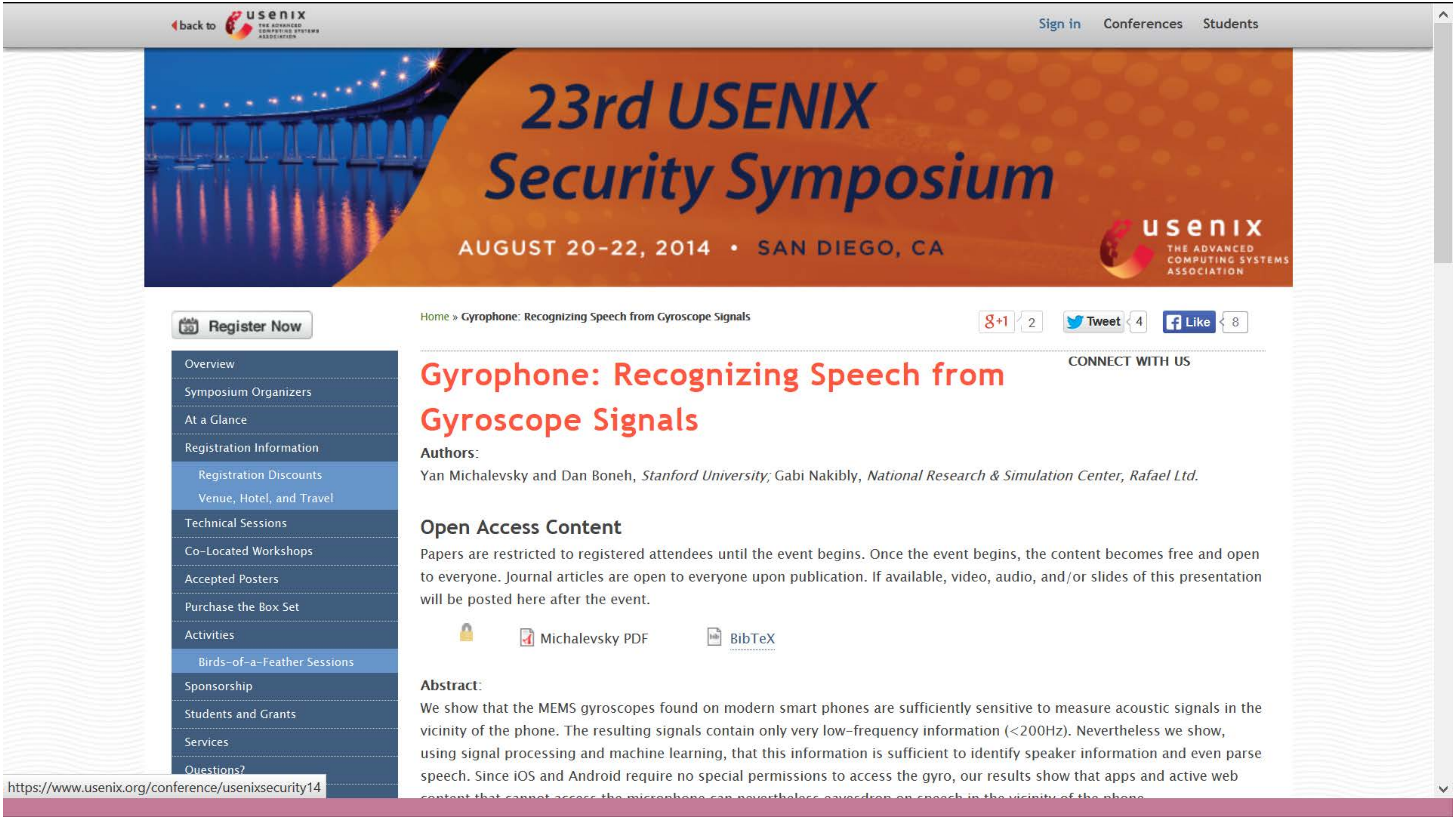
- Replacing the sensor (classical microphone) by any familiar vibrating object close to the sound then using a remote camescope: they then amplify a lot these vibrations from the object using an algorithm (Eulerian Video Magnification). Then they recover the sound.



Final model and set-up

- RSA "sound" from a computer to be attacked,
- corresponding vibrations of a familiar object close to the computer,
- (mirror and) sound-proof window and room,
- external camescope (using a trick: the rolling shutter) with zoom for the attack,
- translation of the images into "sound" using Eulerian Video Magnification,
- if necessary "deblurring" of the sound thanks to the equivalent method for images (using several sources), see http://users.soe.ucsc.edu/~milanfar/ (March 2014 in recent news)
- then using the ideas from the CRYPTO 2014 paper.

More: The gyrophone (usenix 2014, next Friday)



Gyrophone: Recognizing Speech from Gyroscope Signals

Authors:
Yan Michalevsky and Dan Boneh, *Stanford University;* Gabi Nakibly, *National Research & Simulation Center, Rafael Ltd.*

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Michalevsky PDF   BibTeX

Abstract:
We show that the MEMS gyroscopes found on modern smart phones are sufficiently sensitive to measure acoustic signals in the vicinity of the phone. The resulting signals contain only very low-frequency information (<200Hz). Nevertheless we show, using signal processing and machine learning, that this information is sufficient to identify speaker information and even parse speech. Since iOS and Android require no special permissions to access the gyro, our results show that apps and active web content that cannot access the microphone can nevertheless eavesdrop on speech in the vicinity of the phone.