Centre for Air Power Studies

Snooping: Revisited

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"I think the hallmark of good science is when you do something just because it's cool and then somebody turns around and uses it for something you never imagined."[1]

~ Alexei Efros
(A Researcher)

An American diplomat in Moscow was listening to a programme on his radio when he heard the voice of his country's ambassador talking to his staff in their Embassy, a few blocks away – their embassy had been *bugged*. Initial investigations to locate the *bug* were in vain; no listening device could be located. Meanwhile, the broadcast of conversations in the ambassador's office continued unabated. With painstaking effort the specialists could track the source of the radio signal to a large wooden replica of the Seal of the President of United States, which had been presented to the ambassador by some unobtrusive Soviet boy scouts. An object, which soon became notorious as '*The Thing*' was found concealed inside the sculpture. It was a little contraption: a metallic can with a foil which resonated like a tuning fork on picking up a radio signal; and a long thin wire that broadcast (relayed) the same. *The Thing* appeared to be something too uncomplicated to be a listening and transmitting device because it did not have a power source. *The Thing* was an RFID tag of sorts designed to detect sound vibrations as well. It eavesdropped on the American ambassador for seven long years before it was detected.[2]

This happened in 1952, more than six long decades ago; at that time, *The Thing* was a sophisticated gadget. For seven years *The Thing* had enabled the Soviets to *keep an ear* on what was transpiring between Washington and the US ambassador in Moscow – a big deal indeed in those initial years of the Cold War.

Snooping has taken long strides since the Americans stumbled upon *The Thing*. Today, such devices –in fact, devices, which are many times more sophisticated than *The Thing*, are readily available for asking. It wouldn't be too far-fetched to imagine that some of them might be artfully embedded in the souvenirs that diplomats and companies present the political/ military leaders, ambassadors, attaches and bureaucrats visiting *friendly* countries. Today's *state of the art* listening devices can capture weakest of audio/ radio signals at considerable distances; and record and reproduce them with high fidelity.

What lies ahead?

A recent BBC report and an article on Discovery News (online) suggest that a team of Massachusetts Institute of Technology (MIT) researchers have managed to turn a potato chip bag into an eavesdropping listening device.[3] The physics behind the innovative idea is easy to understand: vibrating bodies create sounds; the sound thus produced causes vibrations in other bodies in their vicinity. Some of these objects resonate well; they replicate the vibrations, almost. According to Abe Davis of MIT, such vibrations create very subtle visual signals usually invisible to the naked eye but high-speed cameras can capture them. The video of the vibrations can be recorded from objects such as the leaves of a plant, the metallic wrapper (foil) used in packaging, or even the surface of a liquid. For the video signals to be intelligible the frame rate of the video sample must be higher than the frequency of the audio signal – a frame rate of 2,000 to 6,000 frames per second serves the purpose well. The video recordings of the vibrations can then be analysed by algorithms to reconstruct the original sounds.

The research team, which included MIT researchers, representatives from Adobe and Microsoft, was able to reproduce sounds and spoken words using a high-speed camera behind a soundproof window. In the process of testing the technique, they were able to extract limited audio information from standard smart phone cameras too, which record at much lower frame rates. While the high-speed camera system reproduces sound with superior fidelity, the ordinary camera system can provide limited identifying information like the number of people taking part in the conversation and their gender; ability to establish the identity of those involved in the conversation shouldn't be a distant dream.

In its purest form, this technique is meant to determine the structural properties of objects from their visible response to sound. That is what the scientists say. But then, who uses an innovation or a discovery purely for a rudimentary purpose? From an aircraft to a computer; from a motor vehicle to a helmet; and from energy food to a mosquito repellent – everything has finally found a military use. The *visual microphone* likewise, will certainly find eavesdropping applications in all walks of life; in the domain of defence and homeland security in particular. "I'm sure there will be applications that nobody will expect," says researcher Alexei Efros.

ARTICLE BY SAME AUTHOR

INDUCTION OF C-17 GLOBEMASTER III, TOWARDS TRANSFORMATION IN INDIA'S AIRLIFT CAPABILITY

Here is a hypothetical case to bring out the scope of this innovation. It happens sometimes that people wanting to speak to each other in a public place resort to talking in their native language when they are out of earshot. While talking, they feel *secure*, even if they are under surveillance of a camera. Now imagine a mobile phone recording the vibrations caused by their voices and relaying the captured video through a satellite to a lab in a different location. The lab generates an audio file using an algorithm and translates it into another language of choice, and an audio file of their conversation is transmitted to appropriate agencies. With improvement in computing speeds and possibility of high-speed data transfer, it should be possible to listen to the conversation between two people in *real time*. Judicious use of this innovation can enable the security forces to peep into the intentions of suspicious characters, be they terrorists or minor miscreants.

A word about the technology; video recording of sound and reproducing it as audio is not *rocket science*. At best, it is intelligent exploitation of the existing technologies. Today, the best of cameras are available off the shelf; modifying them to address this need should not be a Herculean task. Also, with the talent available in the country, it should be possible to write algorithms to generate voices and sounds from the videos. Use of satellites or UAVs for video recording could be the next step.

Imagine the conversation among bands of terrorists or Naxals being intercepted thus, leading to pre-emptive actions to foil their bids.

(Disclaimer: The views and opinions expressed in this article are those of the author and do not necessarily reflect the position of the Centre for Air Power Studies [CAPS])

End Notes

[1] Larry Hardesty, "Extracting audio from visual information", *MIT News*, August 4, 2014, in http://newsoffice.mit.edu/2014/algorithm-recovers-speech-from-vibrations-0804, accessed on August 19, 2014.

[2]Our Comrade The Electron - Webstock Conference Talk available at https://static.pinboard.in/webstock_2014.htm accessed on March 30, 2014.

[3]Glenn McDonald, "Conversation Heard in Potato Chip Bag Vibrations", *DiscoveryNews*, August 7, 2014, in http://news.discovery.com/tech/gear-and-gadgets/conversation-heard-in-potato-chip-bag-vibrations-140807.htm accessed on August 19, 2014.