

Hedy Lamarr Mother of Cell Phone and Wifi Mobile Connection: from Cinema Screens to Wireless Network Communication

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Abstract

The role of women in the field of technology has been a source of debate at various events and web channels that promote such discussions, whether at a congress or in a podcast, what is known is that they have been contributing significantly to making information and communication technology a area more integrated with new realities in addition to providing democratization of access. This article tells the story of a technological legacy left by the Austrian news agency: Hedy Lamarr. Through an analysis of her trajectory, going through her childhood, her first performances, the controversies and her rise in the cinematographic sector, then reaching the moment of her invention, the attempts at recognition, the first uses of this new technology until her due date prestige in society for institutions in the IT sector. Next, a retrospective of her last years of life and some important reflections are made. It is worth highlighting that Hedy Lamar was not alone and had the support of pianist Georg Antheil and together they created one of the technologies that shape the face of the digital era and the 21st century, the wireless connection (wi-fi).

Keywords: Hedy Lamarr, Women in Science, Wireless Network Communication, Wi-fi Connection, Cell Phone, Frequency Hopping.

1. Introduction

Fiction films bring an imaginary world, where viewers can travel through a world of fantasies, whether on the cinema screen, TV, or even mobile devices such as smartphones and tablets. Films bring more culture to people and allow them to enter the entertainment scene, guaranteeing the most varied sensations possible. Feelings that are repeated around the world where the reach of the films' messages can be achieved.

But it's difficult to think about cinema without first thinking about good actors to bring life to the scenes and provoke the most varied emotions in those watching. The work of these artists is fundamental to the good development of a film, and they can be rewarded for it. Every year, around the world, there are different types of awards for films.

Since the last century, a lot has changed, especially technology. Before, watching a film was for few, today cinema screens are in the palm of your hand with video streaming technologies.

Who could have imagined that one day we would reach this level of democratized access? Who could have imagined that the great technological invention of mobile connections for cell phones would come straight from cinema screens? Yes, directly from cinema came a technological innovation through the knowledge of an actress: Hedwig Eva Maria Kiesler, known by her stage name Hedy Lamarr. Our protagonist hasn't won many awards for her performances in films, but she has a star with her name on the Hollywood Walk of Fame.

This article reports on the life and trajectory of Hedy Lamarr, highlighting the importance of her contribution and legacy in wireless connectivity technology for the world and which contributed to the modern scenario of the 21st Century.

2. Hedwig Eva Maria Kiesler's Acting Life in Cinema: Accounts of her Historical Journey in the World of Performing Arts

Born in Vienna, capital of Austria-Hungary, on November 9, 1914, daughter of a Jewish pianist, Gertrud Lichtwitz Kiesler, and a financial manager of a large bank in the city, Emil Kiesler, she came from a middle-class family and was raised Catholic.

The interest in acting came from an early age, when Hedy, as a child, watched plays and films. She studied ballet and piano until the age of 10 and at the age of 12, she won a beauty contest in Vienna. Hedy was very close to her father, with whom she had conversations about politics, science, technology and he was a great inspiration for her future invention.



Picture 1. Hedy Lamarr as a child

Using the name Hedy Kiesler, she began taking acting classes in Vienna. She was hired at the age of 16 by Sascha-Filme, an Austrian production company, where she worked as the director's secretary. One day, she won an extra role in the film “Money on the Street” (1930) and then had a small role in “Storm in a Water Glass” (1931). Producer Max Reinhardt cast her in a play called “The Weaker Sex”, performed at the Theater in der Josefstadt, a theater in

Vienna. He was impressed by Hedy's work and asked her to return with him to Berlin, where he lived.

Hedy never worked on any of her films shot in Berlin. After meeting Russian theater producer Alexis Granowsky, she was cast to make her starring debut in "The Trunks of Mr. O.F." (1931), alongside Walter Abel and Peter Lorre. Granowsky moved to Paris, but Hedy remained in Berlin working. In the film "No Money Needed" (1932), a comedy, Hedy starred as the lead actress, directed by Carl Boese.

2.1. The Film "Ecstasy"

At the beginning of 1933, at the age of 18, Hedy received the main role in Gustav Machatý's film "Ecstasy", where she plays a woman neglected by her older and unaffectionate husband. The film became legendary and controversial for showing the actress's face reenacting an orgasm, as well as some nude scenes and close-ups of parts of her body. When she became interested in the role, Hedy knew little about filming and, anxious about the work, signed the contract without reading the script.

In an external scene, when the director asked her to be naked, Hedy complained and threatened to resign from the film, but he said that if she left she would have to pay for the cost of all the scenes already shot. To calm her down, he said he would use scenes filmed from afar, where any other detail of her body could not appear. At the film's premiere in Prague, upon noticing that the close-ups were taken and that the director had not kept his word, Hedy left the cinema in tears, thinking about her parents and that her acting career was over.

Even though she was unhappy with the way she was treated in the production, *Ecstasy* became famous and even won an award at a festival in Rome. Throughout Europe, it was considered a great artistic work. In the United States, however, the film was banned because it was considered immoral and was "degrading to women". It was also banned in Germany due to Hedy's Jewish ancestry.



Picture 2. Hedy Lamarr in adulthood

2.2. Fame in Hollywood

After arriving in London in 1937, Hedy met Louis B. Mayer, director of MGM, who was scouting talent across Europe at the time. At first, she refused the director's offer of \$125 a week, but bought a ship ticket to New York, knowing that she would meet Mayer and his wife

on the same trip. There, she impressed Mayer's wife and the director himself, managing to secure a salary of \$500 a week, plus a contract. Mayer, in turn, persuaded her to change her name in order to distance her from the "Ecstasy" actress. It was Mayer's wife, Margaret, who suggested the surname "Lamarr" in honor of a silent film actress, Barbara La Marr.

Hedy arrived in Hollywood in 1938, where she was promoted as the "most beautiful woman in the world". Mayer introduced her to producer Walter Wanger, who was working on "Algiers" (1938), an American version of the French film "Pépé le Moko" (1937). Hedy starred opposite Charles Boyer and the film was a huge success, particularly due to the studio's marketing of Lamarr's name. MGM's hope is that she would become a new Greta Garbo or Marlene Dietrich.

In her following films, Hedy was always called upon to play the same roles, the glamorous and seductive woman of exotic origin. Her second film in the United States was "I Take This Woman" (1940), where she co-starred with Spencer Tracy, under the direction of Josef von Sternberg, who was fired mid-production and replaced by Frank Borzage. Production was suspended and, in the meantime, Hedy starred in "Lady of the Tropics" (1939). "I Take This Woman" was revived with another director and was a box office failure.

The film "Boom Town" (1940), with Clark Gable, Claudette Colbert and Spencer Tracy, was a huge success with the public. Excited by its success, the studio cast Hedy and Clark Gable in "Comrade X" (1940), a comedy in the same style as "Ninotchka" (1939), and it was another success. In "Come Live with Me" (1941), Hedy plays a refugee from Vienna, alongside James Stewart.

In "White Cargo" (1942), she played a seductive young native, another huge success. This role emphasizes the type of role for which Hedy used to be cast at that time, always provocative, beautiful, sensual women in the way she act and speak. The fact that she was never given challenging roles bored her and she reportedly turned to science and technology when she was bored. In a 1970 interview, she revealed that she earned less money simply because she refused to sleep with Mayer.

Hedy worked on the comedy "The Heavenly Body" (1944) and was loaned to Warner Bros. for the film "The Conspirators" (1944), which brought together several actors from "Casablanca" (1942), partially inspired by Algiers and with a protagonist written specifically for Lamarr.

Back at MGM, Lamarr was cast in "Her Highness and the Bellboy" (1945) with Robert Walker, where she plays a princess who falls in love with a New Yorker. It was a successful film, but it would be his last film with an MGM contract.

For her contributions to cinema, Hedy Lamarr has a star on the Walk of Fame at 6 247 Hollywood Blvd. She was also the inspiration for Walt Disney to draw Snow White, "the fairest", his first feature-length cartoon in 1937.



Picture 3. Hedy Lamarr's star on the Hollywood Walk of Fame

3. From Cinema Screens to Mobile Connection Technology: The Invention of Hedy Lamarr

Just as Ada Lovelace had Charles Babbage as an invention partner, Hedy had George Antheil who together invented what years later would revolutionize the field of communications technology.

3.1. Georg Carl Johann Antheil

Georg was born in Trenton, Capital of New Jersey, on July 8, 1900. He was a pianist, composer, writer and inventor with Hedy Lamarr in the United States.

He grew up in a Lutheran immigrant family from Ludwigswinkel, Germany. He spent most of his life in a peaceful environment north of Trenton. From 1916, he began studying piano with Constantine von Sternberg, and then with Ernest Bloch. With this, he received formal instruction in composition. In 1922, Antheil was asked by Martin H. Hanson to replace an injured Leo Ornstein on a European tour playing Chopin. Around the same time, Sternberg introduced Antheil to his patron for the next two decades: Mary Louise Curtis Bok, founder of the Curtis Institute of Music.

In 1923, he moved to Paris, influenced by his idol Stravinsky. There, he ended up moving away from the Russian composer, but met several influential colleagues, including James Joyce and Ernest Hemingway.

From 1924 came his best-known work, Ballet Mécanique. Premiering in Paris in 1926, the composition was originally conceived as a musical accompaniment to the film of the same name by Dudley Murphy and Fernand Léger.

In 1925, he married Boski Markus, a Hungarian and niece of the Austrian playwright Arthur Schnitzler, who became his companion in 1922, when they met in Berlin.



Picture 4. Georg Antheil

3.2. The Invention

Antheil and Lamarr invented, during the Second World War, the system that served as the basis for cell phones, a radio jamming device to evade Nazi radars. The idea came up in front of a piano. They played duets, repeating the notes he played in another scale, experimenting with controlling the instruments, including the music for Ballet Mecanique, originally written for Fernand Léger's abstract film in 1924. In other words, two people can talk to each other, frequently changing the communication channel. They just need to do this simultaneously.

When performing this duet, they realized that if the sender and receiver constantly changed frequencies, the two could communicate without fear of being intercepted.

Together, Antheil and Lamarr submitted the idea to the US War Department, which rejected it in June 1941. In August 1942, it was patented by Antheil and “Hedy Kiesler Markey”. The initial version consisted of exchanging 88 frequencies and was designed to evade radars, but the idea seemed difficult to implement at the time.

However, his invention was rejected by the National Council of Inventors due to sexism, which led to the failure of American torpedoes due to their inaccuracy.

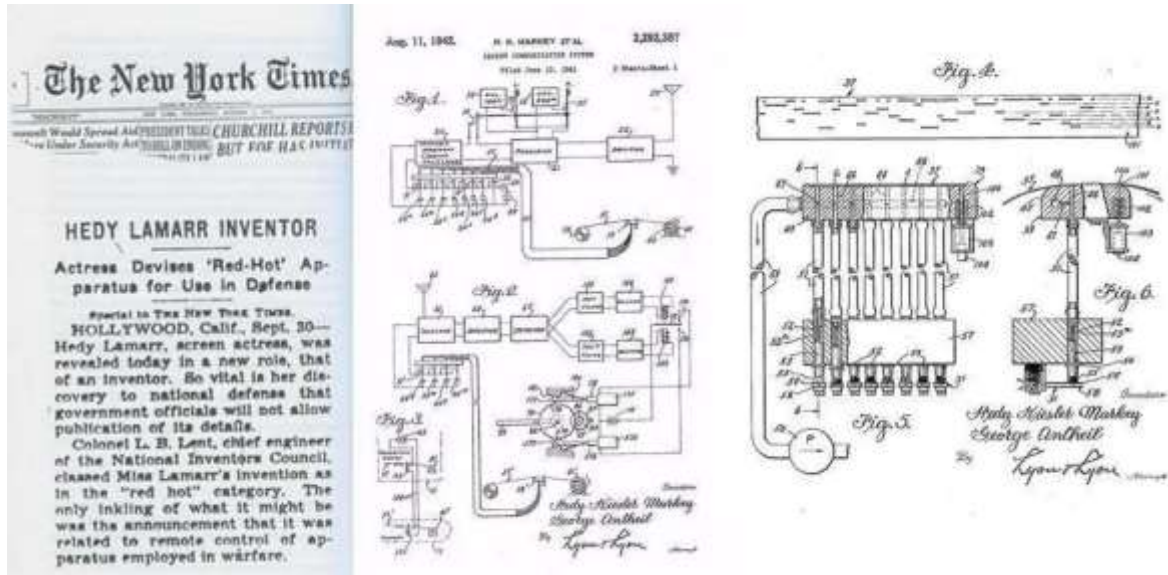
The project was not implemented until 1962, during the Missile Crisis, when the device began to be used by US military troops in Cuba, when the patent had already expired; the company Sylvania adapted the invention. It remained unknown until 1997, when the Electronic Frontier Foundation gave Lamarr an award for his contribution. Antheil died in 1959.

Lamarr and Antheil's frequency device idea served as the basis for modern communications technology such as COFDM used in Wi-Fi connections and CDMA used in cell phones. Similar patents were registered by other countries, such as Germany in 1935, where Telefunken engineers Paul Kotowski and Kurt Dannehl registered patents in 1939 and 1940.

In 1998, Ottawa Wireless Technology acquired part of its patent and from Hedy's initial idea, several communication technologies were created, such as Wi-Fi and CDMA (Code Division

Multiple Access) connections, and it is for this reason that the Scientist is known as the “mother of the cell phone” or “mother of Wi-Fi”.

However, the scientist did not profit from her inventions and received little notoriety from the scientific community compared to other scientists at the time. Fortunately, after years, in 1997, he received an honorable mention from the US government for “opening paths in the frontiers of electronics”.



Picture 5. Patent proposed by Lamarr and Antheil.

3.3. FHSS: Frequency-hopping spread spectrum

FHSS is a method of transmitting radio signals that consists of constantly changing the carrier through several frequency channels, using a pseudorandom sequence known to both transmitter and receiver.

A variable spectrum transmission offers three main advantages over a fixed frequency transmission:

- High resistance to interference;
- Difficulty of interception;
- Band sharing with different types of conventional transmitters and with minimal interference.

Spectrum transmission behaves randomly according to the flow of external interference, respecting an RF sequence stipulated for the carrier. This sequence basically comprises 5 transmission frequencies for a band at the 2.4GHz level, namely: 2.449 GHz, 2.452 GHz, 2.448 GHz, 2.450 GHz, 2.451 GHz.

4. Recognition, Legacy and the Last Years of Life

In the late 1960s, the actress and scientist stopped working in cinemas and in 1966 the renowned filmmaker Andy Warhol created the short film “Hedy” in her honor, talking about her life, and in the same year Lamarr released her autobiography.

Considered the "mother of the cell phone", Lamarr had been married to a German weapons manufacturer, from whom she separated after noticing his involvement with Nazism; It was at this time that he noticed how easy it was for a third party to block the continuous signal used to control the missiles. Despite having patented the idea of a frequency that was variable in the path between transmitter and receiver, she did not make any money from it. In 1997 she received an honorable mention from the United States Government "for opening new paths in the frontiers of electronics".

She received the 1997 EFF Pioneer Award. In 2014 she was inducted into the National Inventors Hall of Fame.

The communications system that Lamarr created for the United States Military currently speeds satellite communications around the world and was used to create cellular telephony. In the computer game *Half-Life 2*, Dr. Isaac Kleiner has a pet headcrab named Lamarr, named after the actress.

In her last years, the actress lived as a recluse in her home, in Casselberry, metropolitan region of Orlando. She turned down several scripts, television commercials and plays, saying none of them interested her. In 1974, she filed a \$10 million lawsuit against Warner Bros., declaring that Mel Brooks' parody of her name ("Hedley Lamarr") in the comedy *Blazing Saddles* was an invasion of privacy. The studio ended the case with an out-of-court settlement, while Mel Brooks claimed that the actress "never got the joke."

With vision problems, Hedy Lamarr retired from public life and settled in Miami Beach, Florida, in 1981.

In 1996, a large image of Lamarr won that year's CorelDRAW contest for the product box cover. For many years, starting in 1997, every box of the show came with an illustration based on a photo of Lamarr. She sued the company, claiming they used her image without authorization, but Corel claimed that Lamarr did not have the rights to that photo. The process ended in a settlement in 1999.

The only profit Lamarr made from her invention was in 1997, when the Canadian company WiLAN proposed a deal with her to acquire 49% of the marketing rights to her patent, while its continued to own 51%. She soon became good friends with the company's president, Hatim Zaghoul.

Hedy and her son, James Lamarr Loder, abruptly cut ties when he moved in with another family. The two did not speak for the next 50 years and when Lamarr died, James discovered that he was left out of the actress's will. He then went to court for control of the actress's \$3.3 million in 2000. He ended up with \$50,000 worth of wealth.

In her later years, Lamarr contacted the world only by telephone, even with his children, grandchildren and closest friends. She used to be on the phone for six to seven hours every day, but she hardly accepted visitors or met other people.

In 2005, the day of his birth, November 9, was established in Germany as Inventor's Day, in her honor.



Picture 6. Hedy Lamarr

Hedy Lamarr died in Casselberry, Florida on January 19, 2000, at age 85. The causes of her death were: heart failure, chronic heart valve disease and arteriosclerotic heart disease. As was her wish, her son, Anthony Loder, took her ashes to Austria and scattered them in the Vienna Woods. In 2014, a symbolic tomb was built in Vienna's Central Cemetery.

5. Conclusion

Debates about the participation of women in the field of information and communication technology have been constant, whether in universities or in other public or private events, as it is noted that there was, in the 1980s, 1990s, 2000s, the masculinization of the field of computing and information technology. And this is necessary as a form of gender manifestation and resistance within this area of professional activity, where there has been a growing demand, on the part of women, for this type of training.

Women have always been great collaborators, an example of this we have when studying a little of the history of computing and learning a little about the lives of personalities such as: Ada Lovelace (the first programmer); Grace Murray Hopper (developer of the COBOL language); Kathleen McNulty Mauchly, Antonelli, Jean Jennings Bartik, Frances Synder Holberton, Marlyn Wescoff Melzer, Frances Bilas Spence and Ruth Lichterman Teitelbaum (developers of ENIAC - the first electronic computer). These are just a few examples of female action within technology.

The big surprise is that one would never imagine that an actress would one day invent a technology that shapes the face of the 21st century, in other words, she thought ahead of her time. And even more so to imagine that such a resource was used during the period of world war. Incredible, right? Yes, the technology that is now in the palm of your hand, everywhere in the world, was thanks to Hedy Lamarr, an almost secret inventor.

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