Seeing Across Oceans: John Logie Baird's 1928 Trans-Atlantic Television Demonstration

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I. BACKGROUND

The earliest demonstrations of television in the mid-1920s showed little more than the principle of seeing by electricity, often over no greater distance than between rooms in a building. At the time, ideas from the 19th century centered around mechanical scanning were the only means available to produce television. The advent of the vacuum tube in the early 1920s made it possible for those ideas to be put into practice.

This article explores the circumstances and significance of John Logie Baird's achievement of bridging the Atlantic by television in 1928. This is contrasted in technical detail, performance, and social impact with the earlier demonstration of television by AT&T/Bell Labs.

For national leaders, business colleagues, friends, and families, the idea of seeing as well as hearing each other across vast distances triggered great interest in the emerging systems for visual communications by television during the 1920s.

Separately, the meteoric growth in the public's uptake of sound broadcasting suggested that adding vision broadcasting to sound might cause an even greater uptake and impact on society. Although predictions for television included watching sporting events or entertainment shows (such as in [1], [2], [3, p. 94], [28, p. 166], and [31]), the reality was very different in the 1920s. Broadcast television was slow to evolve to an acceptable quality, constrained as it was at the time by its complete dependence on the latest technology.[1] Although the basic underlying methods and approaches were transnational, nationalistic and corporate motivation to achieve primacy in broadcast television was a major motivating factor in encouraging technology development.

A. Britain's Foremost Early Television Pioneer

In the mid-1920s, John Logie Baird—"an experimenter of almost superhuman determination" [4]—single-handedly set out to develop television. His crude demonstrations of several different applications for television between 1925 and 1929 helped him achieve a prominent public profile [5], [6]. With virtually no competition in the United Kingdom throughout the 1920s, Baird's activities dominated British published works on television (such as [3] and [7]–[10]). Also, the history of and future direction for Britain's television developments were being written by those associated with or by those who worked for Baird. For example, Sydney Moseley and Harry Barton Chapple, authors of multiple articles in the *Television* magazine from 1927 onward and of a book spanning four editions [9], were, respectively, a Baird Company Director and Baird's technical public relations manager.

Baird and his associates may well have provided such enthusiastic support in good faith. However, the need to assure the commercial and financial success of the Baird Company suggests that the published material on Baird's

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[1] Further reading: [5], [6], [13], and [15].

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work—written for prospective buyers rather than an academic readership—may have been less to serve a public demand than to create and fuel it. The content of publications from the 1920s and 1930s referring to Baird's achievements generally overemphasized the significance of his work in relation to others. In addition, biographies, such as by Tiltman [11] and Moseley [12], romanticized Baird's life and achievements, elevating him to "hero" status. More recent accounts of the trans-Atlantic event, such as Burns [5, pp. 77–83], Abramson [13], and Herbert [14], present more dispassionate factual accounts leaving any assessment of historical significance to the reader.

We might naturally expect a strong focus on Baird in the late 1920s, as he was at that time the only person in the United Kingdom openly declaring his intentions, not just to develop television systems, but to deliver a public television service (and to benefit commercially for doing so).

II. AT&T/BELL LABS

On April 7, 1927, American Telephone and Telegraph (AT&T), with subsidiary Bell Telephone Laboratories (Bell Labs) had undertaken what Udelson describes as a "complicated and spectacular" demonstration.[2] Exploring different aspects of television, this event "served as the catalyst for the swift expansion of American telecasting" [15].

From Baird's memoirs, the news of AT&T's success came just as he was securing a financial agreement for the launch of his new company [16]. The news triggered a fear amongst his backers that maybe Baird was not quite as unique in leading television development as he and his business partner, Oliver George Hutchinson, had led them to believe. Hutchinson had throughout his time as Baird's partner gained a reputation for making exaggerated claims about how far Baird had progressed in television [17, p. 115].

Baird and Hutchinson tried to placate the "furious" underwriters. Baird recalled, "All that had happened, we pointed out, was that the AT&T had made an elaborate copy of what we had been doing" [16]. Whether or not it was "an elaborate copy," Baird needed to take action immediately to reestablish confidence in his work.

The New York Times editorial for April 8 may also have called Baird to action. "The Bell Labs are far in the lead, with a young Scotsman, John L Baird, a distant second" [18]. Regardless of how "distant," for *The New York Times* to consider Baird as coming second to Bell Labs, as part of AT&T, one of the greatest telecommunications companies in the world, hints at the strength of his public image in the United States.

[2]Udelson gives the date as "April 17, 1927." The event occurred on April 7.

A. AT&T Demonstration

The main action on April 7 took place in an auditorium in the Bell Labs complex on West Street in New York City. There, an assembled group of scientists, engineers, industry representatives, and press[3] experienced the moving images and sounds coming live from Washington, DC, USA, by cable and from Whippany, NJ, USA, by radio. The whole show came across as a demonstration of corporate capability, assuring others that AT&T should be the business of choice for delivering the new communications systems for television.

The principal type of service demonstrated on that day was one-half of a two-way person-to-person videotelephone service. This allowed someone at the Manhattan complex to see, on a small screen (5 cm $\times$ 7 cm), the image of a person over 400 km (250 miles) away in Washington, DC, USA. AT&T also demonstrated the same television picture on a type of video conference public address system to around 50 guests in the auditorium using a specially constructed large display screen (60 cm $\times$ 75 cm). The viewers recognized Herbert Hoover, Secretary of Commerce at the time, on both screens as he gave a speech marking the occasion.

The second part of the demonstration was the reception of television broadcast from AT&T's experimental radio station 3XN, based in Whippany, NJ, USA, about 35 km (22 mi) to the north of the Bell Labs facility. The show involved amateur entertainment provided by the engineers.

Dr. Herbert Eugene Ives, leader of the photo-telegraphy and television team at Bell Labs, believed that his television standard—50 lines per picture at 17.7 pictures per second—was only just adequate to show a person's face for video telephony. Significantly, Ives considered the standard unsuitable for general coverage of events until higher definition television could be developed [19]. In that regard, Ives's view was shared subsequently in the United Kingdom by the BBC's Chief Engineer Peter Eckersley who resisted the extensive pressure placed by the Baird Company for a general-purpose 30-line broadcast television service [20]. Low-definition television was simply too restrictive to fulfill the promise of televising complex general outdoor scenes for the likes of sports and national events.

B. Bell Labs' Publications

Ives and his team presented five papers detailing the April 7 demonstration at a convention in June 1927, later published in the Bell System Technical Journal (BSTJ). Collectively, the papers demonstrated a significant and deep professional understanding of the generic engineering challenges affecting television generation, transmission, and display, founded on years of experience of

[3]For a full list, see [31, p. 20 column 5–6].

designing and perfecting high-quality photo-telegraphy systems.

Ives' introductory overview should arguably have included multiple external references to prior work. There, however, we find his one and only external reference is in error attributed to "Plotnow" rather than Nipkow [19, p. 556].[4] The lack of references in the companion articles detailing the engineering approach to the systems is odd [21], [22]. An article in *Radio Broadcast* said, "The Telephone Company (AT&T/Bell Labs) state that they have done nothing essentially new" and, "... the telephone engineers borrowed freely from all that had gone before" [23]. Simply acknowledging where they "borrowed" from, might have served them better.

C. Flying-Spot Scanning

One of the five "novel features" that Ives claimed made the AT&T demonstration successful was "scanning by means of a projected beam of light" [19, p. 558]. Baird had patented this "feature" in 1926 [24].

The French physicist, Dr. Alexandre Dauvillier, who was present at the Bell Labs demonstration, reported on January 7, 1928 that AT&T/Bell Labs had succeeded, "using (without saying so!) the Baird system" [9, p. 7]. Much later, Abramson believed that, "... all of his (Baird's) attempts at secrecy were in vain" [25].

Ives might well have been unaware of either Baird's system (for which Baird maintained strict secrecy) or his "flying-spot" patent (which had only been issued as "complete, accepted" about two weeks after AT&T's demonstration). Although Baird had lodged the patent in 1926, there is no evidence of him implementing it until late 1928. All published accounts of Baird's studio practice before then were for a conventional floodlit scene [26, p. 241] contrary to Abramson's view [13, p. 84]. In conversation at the time of the trans-Atlantic demonstration, Baird claimed that he had tried flying-spot scanning but "abandoned that in favor of ordinary flood lighting" [27]. Baird subsequently changed his mind. From 1928 onward, he used flying-spot scanning exclusively for the optomechanical systems for all live indoor studio work.

To those studying the works of Baird, his flying-spot patent looks ingenious, allowing large-area photocells to gather light reflected from an intense, narrow beam scanned rapidly over the scene. Along with others in the field (notably Jenkins, Alexanderson, von Mihaly, and Belin, but—significantly—not Baird), Ives extended his work on phototelegraphy to develop television. This employed flying-spot scanning, as proposed and used by Korn and others in the mid-1900s [28]. For Ives, then, to scan the 3-D structure of a face at a fixed distance was less of a creative leap of imagination and more of a logical extension of existing practice [29].

[4]Paul Nipkow was the inventor of a method of mechanical scanning developed by Baird, Ives and others.

Fig. 1. *Ben Clapp testing reception at Wanamaker House, Pall Mall, London, of a music concert from the Auditorium of the Wanamaker Store in New York City, relayed by WGY, Schenectady, NY, USA, on the night of April 1/2, 1924. Courtesy of D. F. McLean.*

III. BACKGROUND TO BAIRD'S REACTION

In January 1926, Baird had become publicly recognized as the first person to show what he had defined as "true" television [26, p. 228]. One of the many companies interested in understanding just how far Baird had progressed was the Wanamaker company, the U.S. retail giant based in Philadelphia. The U.K. representative of the company paid Baird a visit, accompanied by his local technical expert, Benjamin Thomas Clapp. The outcome of that meeting was significant; Baird hired Clapp.

Clapp had assisted the Wanamaker company in trans-Atlantic trials of receiving music concerts relayed internationally through short-wave station WGY in Schenectady, NY, USA. These trials took place shortly after the fledgling British Broadcasting Company[5] (BBC) had undertaken its own music relays in the United Kingdom from the United States. Clapp set up a receiving station at Wanamaker House in London's Pall Mall in April 1924 (Fig. 1). There, journalists invited to the demonstration declared that the audio direct from New York was so clear that it sounded as good as from the local BBC transmitter in London [30].

A. Clapp-Wanamaker Transmitter

Since late 1924, Clapp had incorporated a purpose-built high-power 1 kW[6] transmitting station for audio

[5]Formed as a Company in 1922, the BBC became a Corporation on January 1, 1927.

[6]References to 3 kW made elsewhere are correct only for the output rating of the high voltage generator powering the station.

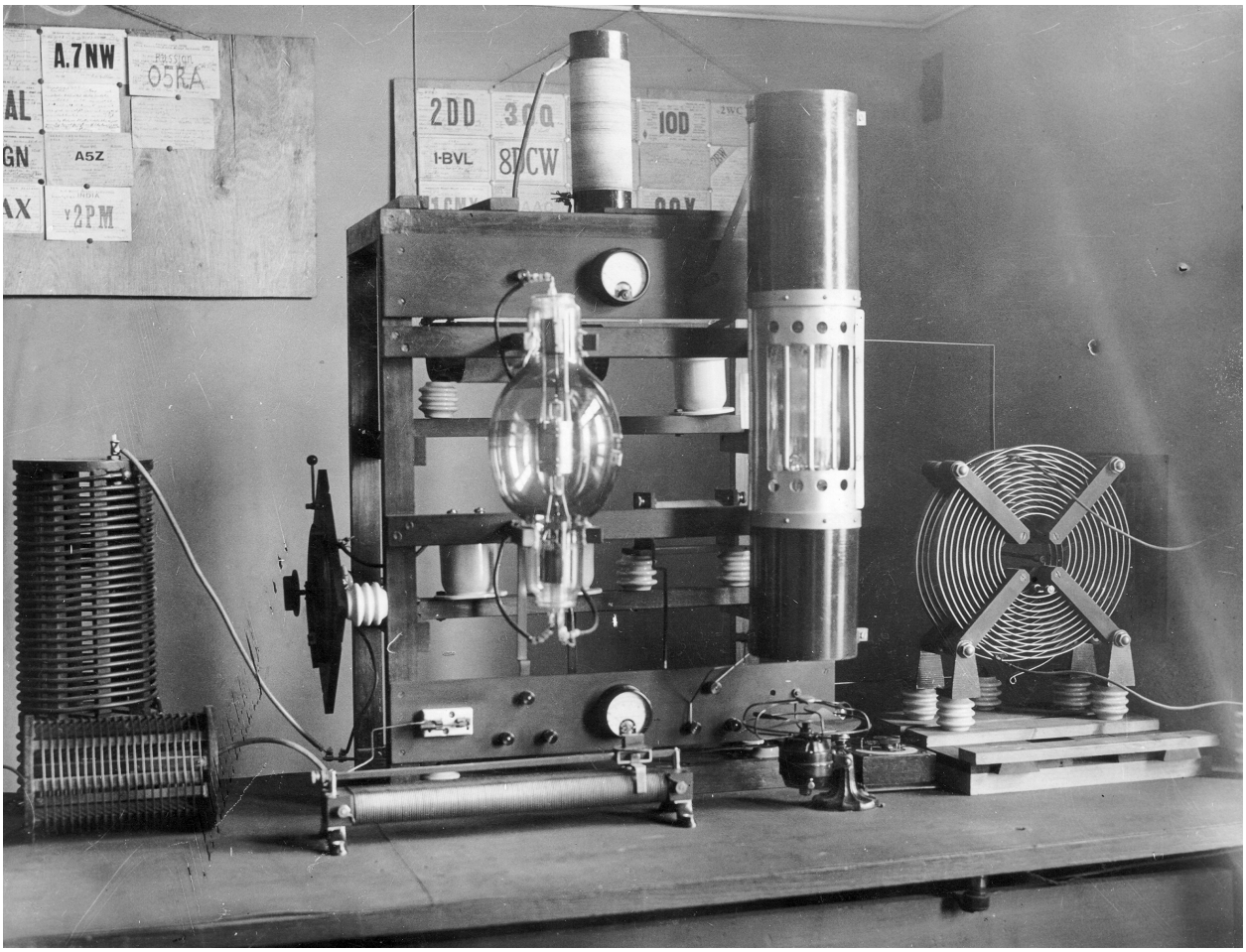

Fig. 2. *Clapp's station transmitter in his house in Coulsdon in the London suburbs. Courtesy of D. F. McLean.*

(call-sign 2KZ) into his house in Coulsdon, in suburban London (Fig. 2).

The Wanamaker company covered the £1800[7] costs for the station. It had wanted to install a transmitting station to relay music concerts from the United Kingdom back to the United States. The policies of the government department controlling all U.K. communications—the General Post Office (GPO)—had channeled all responsibility for public broadcasting via wireless telephony solely through the BBC. The amateur station in Clapp's home had been a compromise in the hope that the GPO might permit transmission of corporate audio tests.

Baird hired Clapp in November 1926 as "Technical Assistant" (literally, to assist Baird in technical matters). The attraction for Baird was in having a highly experienced and capable radio engineer who happened to have a powerful short-wave amateur radio transmitter, custom-built for audio transmission. The Wanamaker company visit had either sown the seed of an idea or reinforced an existing idea for trans-Atlantic television. Clapp's hiring made such an idea realizable.

[7]£1800 in 1924 would be roughly equivalent to £74 000 in 2019. In the late 1920s, £1 was worth roughly $5.

B. Baird's Response to AT&T

While the AT&T/Bell Labs' demonstration had seriously challenged Baird's perceived dominance, more infuriating may well have been the statement by Herbert Hoover, then Secretary of Commerce, made in Washington, DC, USA, on the television link to New York. "Today, we have, in a sense, the transmission of sight *for the first time in the world's history* (author's emphasis)" [31, column 1].

When considering television as a public offering at that time, Hoover was quite correct. Seeing and hearing in New York City an image of him speaking in Washington, DC, USA, was the first operational instance of a complete television system, not just at a distance but one that demonstrated social use, function and significance. By contrast, Baird's demonstrations of television between rooms in a building proved the overall concept. Almost certainly though, that was all he could hope to afford.

C. Video Treated as Audio

In developing a response, Baird appeared to make distance his measure of success and something he could tackle without much effort or cost. In the wake of the publicity surrounding the AT&T/Bell Labs' demonstration, he

declared his intention to bridge the Atlantic by television. The U.K. newspapers duly described his plan on April 22, 1927 [32]–[35]. Unusually for Baird, he openly stated the basis for doing it, by having his vision signal treated as an audio signal.

> "The instrument turns things seen on the screen into sounds. These are then transmitted to the receiving station, where the sounds . . . are transcribed back to the original image, and the object, which may be thousands of miles away is thrown on the screen" [35].

This was to be Baird's general approach to launching effectively a national public television service in the United Kingdom. It would avoid huge upfront development and infrastructure costs by exploiting what was already there; the GPO's telephone lines and the BBC's national sound broadcasting network. Such a television service would allow almost every radio listener in the United Kingdom to be a potential viewer (after buying one of Baird's television sets) [6, Figs. 3–11, p. 39].

D. Bell Labs' View of Trans-Atlantic Television

Two weeks after the press announcement of Baird's plans, and without acknowledging it, Ives suggested as one of the followups to the April 7 demonstration that a trans-Atlantic two-way video-telephone link would be "the supreme achievement of television." He imagined that a talk between King George V and U.S. President Coolidge "would have an appeal to the imagination of all ranks of humanity which would be unsurpassable" [5, p. 81]. Ives concluded that the primary reasons for embarking on such an exercise would be to investigate radio signal propagation and, separately, for "publicity value."

IV. PREPARATIONS FOR THE LONG-DISTANCE DEMONSTRATIONS

A. London-Glasgow

Baird's first step back into the limelight was to display television received by cable over a long distance. AT&T had achieved the distance between Washington, DC, USA, and New York City; Baird would almost double that distance by showing television pictures in Glasgow live from London. Clapp set up his suitcase-sized device with its tiny display in a room at Glasgow's Central Hotel for demonstrations in late May 1927.

Baird and Hutchinson had invited several dignitaries to witness the demonstration including Sir John Samuel, Secretary to the Lord Provost of Glasgow, [36] and Professor Edward Taylor Jones, Chair for Natural Philosophy at the University of Glasgow. Jones gave his personal view, ". . . that the chief difficulties have been overcome by Mr. Baird and that the improvements still to be effected are mainly matters of detail" [37]. Jones reported that he could see the sweep of the picture refreshing, and quoted Baird's statement that the refresh rate was 8 pictures per second. Sixty years on, life-long radio-amateur Pat Hawker questioned how Jones could have written such a favorable report about such "crude . . . demonstrations," and suggested that Jones might have been "fooled" [38].

The year before, E. G. Stewart, an engineer from a possible sponsor, estimated the picture refresh rate to be around 5 per second noticing that, ". . . a black shadow passes repeatedly and rapidly across the picture" [39], consistent with the author's observations of Baird's Phonovision. The picture rate was so far below the persistence of vision that Stewart and Jones would only have seen a partial image.

The low picture rate meant that a GPO telephone line may well have been more than capable of passing the complete 30-line Baird vision signal virtually unaltered. In addition, Goldsmith of the BBC in 1927 observed that Baird's images were missing both low and high frequencies [40]. This is consistent not only with the 1926 off-screen Lafayette photographs but also with the author's analysis of Baird's Phonovision signal [6, p. 165–167]. Initially believed to be some fault in the recording, the author's measurements of vision frequency range may genuinely reflect a characteristic of Baird's system in 1927.[8] If so, the above observations provide an explanation as to how Baird could use unmodified standard telephone lines to transport his video signal.

By contrast, the Bell Labs target frequency range for its whole system was from well below picture rate to the maximum required for full detail (around 20 000 Hz), with correction for low-frequency distortion. When Colonel Angwin, Deputy Chief Engineer of the GPO, saw the same Bell Labs system a year after its demonstration, he considered that the ". . . results obtained are undoubtedly far in advance of those claimed for by the Baird system" [17, p. 284].

B. Preparing for Trans-Oceanic Television

Already in regular contact with radio amateurs in the United States, Clapp had become friendly with Robert Hart (call-sign 2CVJ) of Hartsdale, NY, USA, and approached him with a suggestion of undertaking trans-Atlantic reception tests. The Baird company offered to pay him for supporting the tests on the condition he kept the arrangement confidential.

The press reports of Baird's plans on April 22, 1927 described Clapp's amateur radio station as "a Transatlantic broadcasting station which has been rigged up in a private house" [32]. In another report, Baird had been, "successful in securing a wireless station that an American firm had erected at Coulsdon, Surrey" [35].

Clapp sailed for New York City on White Star's *Olympic* from Southampton on September 28 with the same transportable display device he had used in Glasgow. Hart met him off the ship on the morning of October 5 and put Clapp and the equipment up at his home in Hartsdale, NY,

[8]Specifically, the author estimated the Phonovision signal frequency range to be 500–1400 Hz within 3 dB at four pictures per second [6, Fig. 6–24, p. 166].

USA, for what Hart had thought to be a stay of a few weeks. There Clapp bought equipment and integrated the display system with Hart's amateur radio rig by the end of October.

C. Connections

In the United Kingdom, an unmodified telephone connection routed the amplified vision signal from Baird's laboratories in London's West End to Clapp's home. The London feed was one of three audio inputs for the Coulsdon transmitter, the other two being for a microphone and a record player. Throughout the early tests recorded in the Coulsdon station logbook, the team there used music records from "The Desert Song" as well as Baird's 30-line vision signal recorded on an "image record." This was almost certainly the Phonovision test record SWT515-4 dated September 20, 1927, which Clapp still had at his home in 1983. There are multiple references to the "image record" sent from Clapp's home in the logbook where Clapp appears to have used it solely as a means of judging reception quality in Hartsdale, NY, USA [6, p. 48].

Transmissions from Coulsdon were on 45 metres and the station listened on 37.5 metres for comments (in Morse code) from Hartsdale, NY, USA. Before she joined her husband in New York, Clapp's wife, Gwen, was usually the person passing on the received comments by telephone to Baird and the team in London for actioning.

In February 1928, the transmitting equipment at Coulsdon was still the property of Wanamaker's who had granted permission to the Baird company for its use. Wanamaker's sold the equipment later that year to the Baird company for £200,[9] a fraction of its cost [41].

D. Synchronization at a Distance

The critical feature for long distance working was synchronization—ensuring the timing was correct and in step for the received picture to represent what the camera was capturing.

In the mid-1920s, Baird's method for synchronization between rooms had required feeding the three-phase output from a dynamo attached to the drive-shaft of the camera system to the motor drive for the display system [26, pp. 238–239], [42]. For the trans-Atlantic demonstration (and most likely also for the Glasgow demonstration as the transportable display was the same), Clapp built motor drives based on a matched pair of tuning forks (as used in photo-telegraphy [28, pp. 57–61]) for both transmitting camera and receiving display.

E. Waiting Game

In the United States, Clapp had installed his display in the cellar of Hart's home. Hart operated the radio station from an upper floor room.

The weeks of waiting for the right conditions turned to months. Progress was slow, hampered mostly by poor reception, as well as depleted batteries, technical faults with the Coulsdon station, and the move of the Baird company to larger premises in Long Acre. Baird also had other business commitments he needed to honor. Hart, whilst generous with his time, had family occasions that took priority.

F. Arrangements in the United Kingdom

For several weeks before the date of the demonstration, Baird had been operating his camera system through the night from his laboratories in London's West End to give Clapp the best chance of receiving a good signal in Hartsdale, NY, USA.

In parallel, Clapp had arranged with three radio amateur friends—Smith, Barford, and Luger—to operate his transmitting station in Coulsdon. Two was the minimum number required to run the station for safety reasons.

Harold Smith was a friend of Clapp's and had been the best man at Clapp's wedding in 1926. Frank Barford, previously a Merchant Navy wireless operator, later joined the Baird company and was the person who wired up Baird's large-screen demonstration display in 1930. Len Luger was one of the radio operators in the control tower at Croydon Airport, the then main international airport for England.

Had Clapp not informed the neighbors, the men's regular arrival before midnight and their departure at 4 A.M. might have caused concern for the welfare of Clapp's wife, Gwen, while her husband was away on business.

Gwen's role was to stay up all night and provide refreshments and maintain telephone contact with the laboratories in London. Smith often brought his wife around to help out and to "chaperone" Gwen. The messages in the logbook bring us closer to what life was like. For example, on November 11, 1927, the operator in Coulsdon sent to Clapp in Hartsdale, NY, USA: "my old dutch is snoring, kipping in one of your beds" [43].

At the time communications between spouses separated by international business trips were dependent on letters by ship, and possibly telegrams if urgent. Clapp, however, was in the unique position of being able to hear Gwen's voice most nights with good reception, albeit having to respond in Morse code from the United States. For example, in the logbook entry for Oct 7, 1927,

> "USA: Is Gwen Up?
> U.K.: Gwen [is] here,
> USA: P[lea]se ask her to speak
> U.K.: (Speech from Mrs. Clapp),
> USA: Received OK. Good. Fine. Glad to hear her voice" [43].

In a generous act, Hutchinson and Baird paid Gwen's passage to New York in December to support her husband. However, by Christmas, Clapp revealed his frustrations in a letter to his family, "I am just about thoroughly fed up

[9]Roughly equivalent to £8200 in 2019.

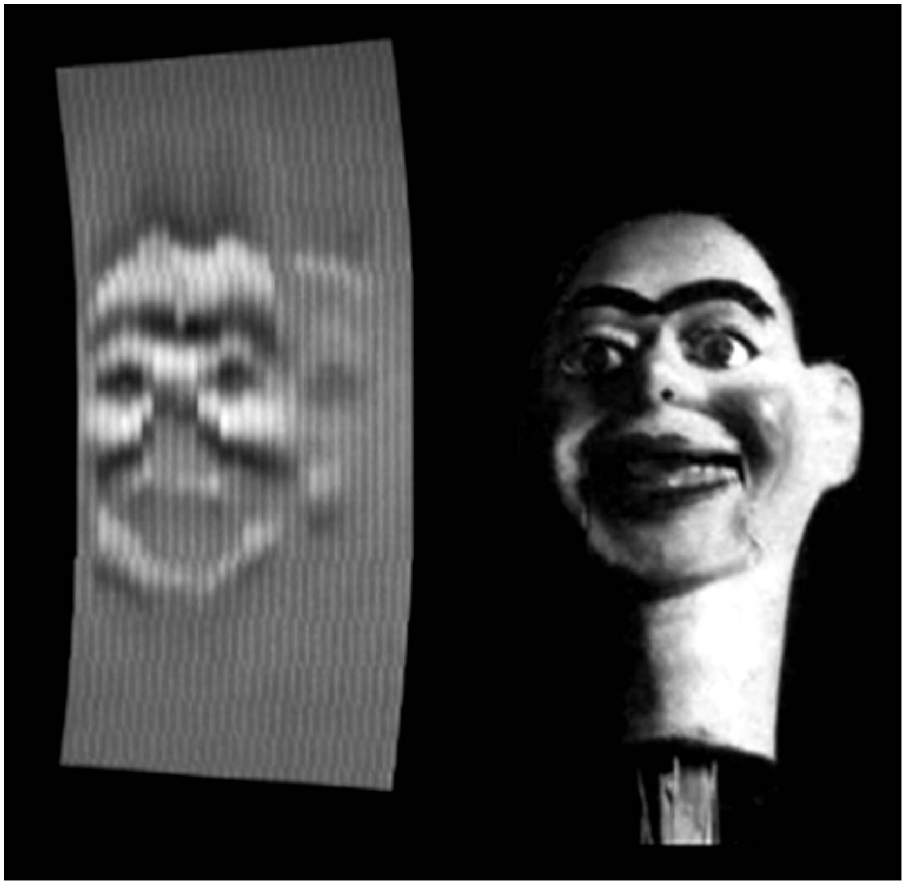

Fig. 3. *"Stookie Bill" ventriloquist's dummy head used for transmission tests after Baird provided an earlier version to the Science Museum in London in Sep 1926. This version was used from then onward. The image on the left is a single 30-line picture from the author's restoration of Clapp's Phonovision disk [6]. Courtesy of D. F. McLean.*

with it, it is rather beyond a joke however I suppose I shall have to stick it out to the end now" [44].

Eventually though, the conditions improved sufficiently for Clapp to advise Hutchinson to come to the United States and arrange the demonstration.

Initially set for February 7, the reception was so poor that the team postponed the attempt until the following evening. The station logbooks reveal what took place.

V. DEMONSTRATION IN DETAIL

Although the communications started up at midnight GMT in England on February 9 (7 P.M. in Hartsdale, NY, USA, on February 8) fog had delayed Hutchinson's train to Hartsdale, NY, USA. Hart suggested they wait until 7:30 P.M. At 7:44 P.M., Hart instructed Coulsdon to start. The Coulsdon team rang Long Acre and Baird commenced transmitting the image of his ventriloquist's dummy head, "Stookie Bill,"[10] between 7:50 and 8:10 P.M. [Fig. 3].

[10]The author believes Baird's name for the dummy head is a homage to William Taynton, who had been in October 1925 the first human subject Baird had televised with recognizable facial textures in reflected light. "Stookie" is a Scottish expression for stucco or Plaster-of-Paris.

For around three hours in the late evening of February 8, 1928 (early morning of February 9 in the United Kingdom), Hutchinson, Clapp (with his wife Gwen), and a newspaper reporter clustered around the suitcase-sized display device watching the tiny faint neon-tinted image of the faces transmitted from Baird's offices in Long Acre, London. The reporter was documented at the time as a representative of the London-based Reuters company [45]. However, both the press reports and a comment by Hutchinson recorded by Clapp in the station logbook on December 8 ("Get New York paper people to see their London man on television" [43]) makes it more likely to have been an Associated Press reporter based out of New York City.

After some difficulty exchanging messages due to radio-interference, the instruction from Hartsdale, NY, USA, at 8:35 P.M. was, "Have IJKDR move head in and out for half an hour." In all the exchanges, both stations used a simple Caesar substitution code (Fig. 4) for sensitive information. "IJKDR" decoded to "Baird." Baird moved his head in and out of view started at 8:42 P.M. and stopped at 9:05 P.M. Reception deteriorated for a while but had improved by 9:50 P.M. On instruction from Hutchinson, William Chaney

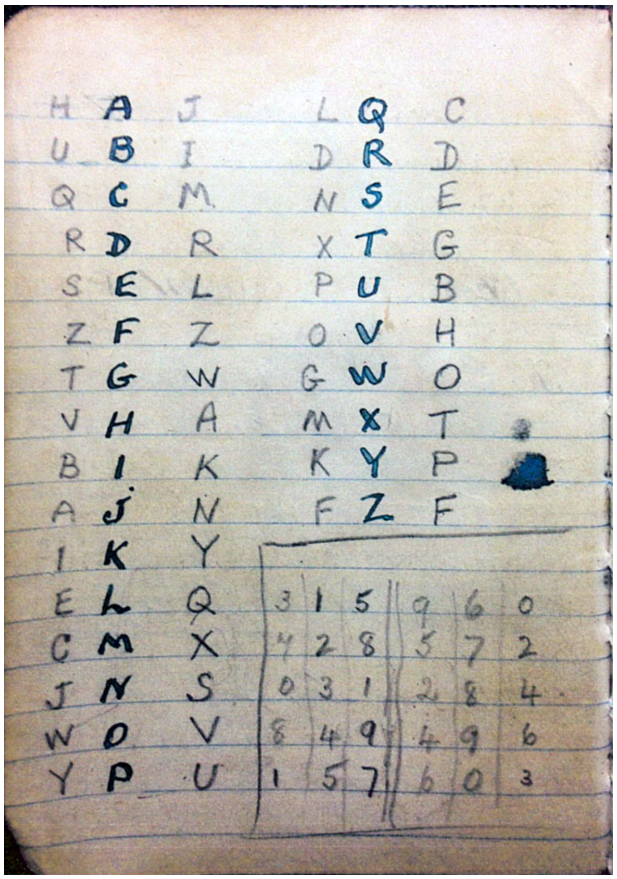

Fig. 4. *Simple substitution cipher used for commercially-sensitive words in Baird's transatlantic Morse communications, taken from the back pages of Clapp's 1927 diary. To encode, read the letter to the right of the bold column—to decode read the letter to the left. For example, "BAIRD" encodes to "IJKDR." Courtesy of D. F. McLean and the University of Glasgow Archives.*

Fox took Baird's place and moved his head from side to side for half an hour, starting at 9:52 P.M. and stopping at 10:22 P.M. A Press Association journalist, Fox was Baird's first publicity manager and had supported him at events since 1925. The fixed field of view and fixed focusing distance in the studio allowed the face to fill the 30-line picture. By just having the subject's forehead touch a thin wire stretched across a wooden frame about 35 cm in front of the camera, Baird ensured the face was optimally lit and in sharp focus.

Communications problems persisted and Coulsdon called at 10:38 P.M. with, "Your signals weak. Please cable results of test. Now transmitting Mrs (Mia) Howe, wife of Associated Press representative for 10 min." The vision started at 10:45 P.M. and stopped at 11:00 P.M.

Hutchinson found Fox easier to recognize than Baird. Even though Baird was his close business partner, Fox had more distinctive features. For Howe's image, the viewers in Hartsdale, NY, USA, could see it was a woman but not much more.

At 11:05 P.M. Hutchinson called for Fox to go back on. The vision signal started again at 11:10 P.M. and stopped at 11:28 P.M. At 11:34 P.M., Hutchinson asked if that had been Mrs. Howe, and Coulsdon replied, "No. Mr. Fox."

Notably, Hutchinson was the only person recorded as "recognizing" the sitters throughout the evening. That he confused Mr. Fox with Mrs. Howe may indicate either some exaggeration in what he recognized or that reception had deteriorated.

The team at Hartsdale, NY, USA, responded, "OK. Good nite. Cabling (the report)." And at 11:36 P.M., Coulsdon replied with "Good nite. Closing down." Smith completed the logbook entry for 2KZ in Coulsdon by recording the time of the station closure at 11:38 P.M. (4:38 A.M. GMT).

After 58 separate attempts at receiving a picture good enough to show the press, the Baird team had had its night of success [14]. Clapp's recollection to the author in 1983 was that signal reception was the best it had been, with fading and "ghosting" allowing only short periods of clarity. For most of the time, the faces looked like moving blobs of light. Gwen Clapp recalled that the image more closely resembled a cabbage turning from side to side.

A. Reports of the Demonstration

Press coverage of the event on both sides of the Atlantic was consistently full of praise with one regional Canadian newspaper choosing to run the story as its lead on February 9 (Fig. 5) [46]. Press coverage was widespread, though appeared to stem from only two stories filed by a single Associated Press reporter, William Chaplin. One of Chaplin's articles stated, "the images were crude, imperfect, broken, but they were images none the less" [46]–[48], and the other reported, "the images were crude, but they were there" [49]–[52].

Of the main broadsheets, *The New York Times* put Chaplin's story on the lower front page. "Man's vision had spanned the ocean; transatlantic television was a demonstrated reality, and one more great dream of science was on the way to realization" [47].

That same evening an additional report by Mia Howe appeared in newspapers. The phrasing that she used to describe her experience was a mixture of technical (e.g., "slotted disk rotating at 2000 rpm") and nontechnical (e.g., "the apparatus as a whole looked like a perfectly good sawmill, and frankly that's about all I know about it") [53]. The technical description, however, matched Baird's obsolete transportable demonstrator that had already been delivered to the Science Museum on September 10, 1926 [54]. Baird may have helped Howe with the words, appearing to be open about revealing the details, yet concealing his current methods.

B. Further Praise

The New York Times editorial of February 11, 1928 considered this a pioneering achievement equivalent to the trans-Atlantic reception of the letter "S" sent in Morse code by Marconi in December 1901.


HOME EDITION

The Winnipeg Evening Tribune

THE WEATHER
Forecast: Fair and mild.

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TELEVISION TRAVERSES ATLANTIC

RINKS RUN TRUE TO FORECAST IN MORNING DRAW

Few Surprises in Today's Play; Joe Gallant Has Colors Lowered

TRUMPOUR, OF HEATHER, PUTS HIM OUT 10-9

Mains, of St. Paul, and Wise, Strathcona, Both Win in Birks' Test

Chief Justice Macdonald Making Good Progress

ONTARIO AIMS TO CURB ACTIVITIES IN FAKE FINANCE

Throne Speech Hits at Marketing of Questionable

ORANGE LODGE LAUNCHES BIG SETTLER SCHEME

Will Comb Britain and Scandinavia For Best Farm Types For Canada

WORK ALREADY STARTED WITH AGENT OVERSEAS

Dominion-Wide Organization Will Work With Govts.; Predict Big Success

ICE JEWELS MAKE CITY PICTURE OF SPARKLING DELIGHT

NEW YORK SEES PEOPLE 'SENT' FROM LONDON

British Laboratory to Cellar in N.Y. Village is Science's Latest Conquest

DISTINGUISH HEADS TURN, MOVE FROM SIDE TO SIDE

Images Are Crude, Imperfect and Broken But Images None the Less

Fig. 5. ***Banner headline from the Winnipeg Evening Tribune, February 9, 1928.***

> "Baird was the first to achieve television at all, over any distance. Now he must be credited with having been the first to disembody the human form optically and electrically, flash it piecemeal at incredible speed across the ocean, and then reassemble it for American eyes."

To the engineers in television and in photo-telegraphy, this would have read like a description of the scanning process first developed by the Scottish clockmaker, Alexander Bain, in 1843 [55]. To everyone else though, this would have seemed as amazing as a description of a Star Trek "transporter."

The trans-Atlantic achievement of Marconi in 1901 required the special development and construction of a telecommunications "bridge" across the Atlantic, whereas Baird's demonstration simply used existing amateur radio equipment. The editorial comment is, therefore, more about the implications of not only viewing the content over such a distance but of socially and culturally linking the "new world" with the "old."

VI. TELEVISION RECEIVED IN MID-OCEAN—THE BERENGARIA

Once the demonstrations were over, the team packed up their equipment, and left for home. They paid Hart $878[11] for not only Clapp's accommodation and Hart's support but also his silence on the details of the demonstration. Hutchinson and the Clapps boarded Cunard's *Berengaria* and set sail for Southampton on March 9, 1928.

On the way, with the full cooperation of the ship's captain Sir Arthur Rostron,[12] Clapp set up the display yet again, connected to the ship's radio. Baird televised Dora Selvey, the fiancée of Stanley Brown, the radio operator. The picture was clear enough for Brown to recognize his sweetheart on a ship in mid-Atlantic—first from her hair style and then when Baird televised her face in profile. Once again, the press reported it and Baird achieved yet another "first" with television shown in mid-ocean [56], [57].

As with Hutchinson knowing who he would see for the Hartsdale, NY, USA, demonstration, Brown knew his fiancée would be televised before the demonstration took place. In fact, he had suggested her to Clapp when asked who he would most like to see. Baird then made the arrangements for her to be at the studio [58].

The only remaining related event occurred when two radio amateurs in the Jamaica district of New York City succeeded in receiving the vision transmissions picked up by the *Berengaria*. They sent a record of what they had received to Baird in London [59]. Unfortunately, nothing survives from their work.

VII. ANALYSIS

A. Baird the Showman

The publicity surrounding the trans-Atlantic demonstration raised Baird's personal profile and moved his company business forward. Of all his "firsts," this one event appealed the most to the public's imagination via the sensational press stories in North America and the United Kingdom. It was clear to people like Donald Flamm in the United States that here was a man who could "sell" television. In that regard, Flamm, the owner of WMCA in Manhattan and one of the founders of "the Voice of America," raised Baird above the U.S.'s solo television pioneers—specifically Charles Francis Jenkins, based in Washington, DC, USA, and Ulises Sanabria, based in Chicago. To Flamm, Baird stood out both for being "a great scientist" and for his ability to appeal directly to the public's imagination.

> "... on a stand point of showmanship, ... I came from the theater through to television, and I liked what Baird was doing. ... I remember the idea of actually sending a broadcast from London to the Berengaria, halfway between Southampton and New York, 1500 miles at sea, it was mind boggling and this was the type of man that I wanted to meet" [60].

Where Baird exceled was in understanding what would be the greatest impact from the public's point of view and

[11] Approximately equivalent to $13 000 in 2018.

[12] Rostron was in the unique position of having received both a knighthood in the United Kingdom and a Congressional Gold Medal for his role as Captain of the RMS Carpathia in the rescue of 705 passengers from the Titanic disaster. In July 1928, he became Commodore of the Cunard line.

then directly appealing to that fascination by giving various genuinely "never-seen-before" demonstrations. The *Daily Telegraph* television correspondent, Leonard Marsland Gander described Baird as, "an absolutely marvelous publicist" [61].

Baird's achievement in Hartsdale, NY, USA, was of great social significance, suggesting a future transformation in human communications. It says much for Baird's character and ability that he could capture the headlines with nothing more than amateur radio and a far simpler television system than AT&T's, lacking accompanying sound and active picture synchronization.

It had taken only a few people to operate Baird's long-distance demonstrations by cable and by radio, relative to the hundreds of engineers required for the AT&T demonstration. At the time, Baird neither had the funds nor the resources in staff or equipment for anything more elaborate.

B. Minimalist Demonstrations

For Baird, it did not have to be perfect, it just had to be good enough to show an image and for the press to report it. There was no evidence of deception or fakery in the demonstrations themselves; Baird was genuinely showing "firsts" in a minimalist manner while avoiding scrutiny on quality from the engineering community. That included declining a proposed visit from Angwin of the GPO in March 1928 [17, p. 284].

The scientific and engineering professional communities were looking for some independent criteria by which they could assess how well Baird's offerings met the company's claims. Baird withheld many details of his system (especially regarding his photocell) ostensibly to preserve his commercial position. However, both the quality of the off-screen imagery and the absence of any documents equivalent to those in the BSTJ on the topic suggest that Baird had little to hide.

His talk on January 6, 1927 at the Physical and Optical Society's exhibition in London failed to impress. Despite presenting two back-to-back talks to cope with the number attending, "Mr. Baird did not add to the general knowledge by what he said and did. ... The policy of withholding publication of an essential item does not commend itself to modern inventors... For the present, and on the evidence supplied, the scientific world will probably prefer to reserve its judgment" [62].

In the United States, an article in *Radio Broadcast* in June 1927 stated, "Baird claims the use of a mysterious "secret cell" but, by the lack of full disclosure, aids the doubters" [23].

C. Independent Assessment Ignored

In March 1928, *Popular Wireless* magazine issued a simple challenge intended to check the claims of the Baird company. The distinctly modest tests would have involved televising subjects in a controlled manner and independently studying the displayed results [63]. Despite the offer of a £1000 prize,[13] Baird ignored the challenge. Clarkson in *Radio Broadcast* observed that this, "... must merely mean that he, too, recognizes the limitations of his apparatus" [64]. Suspicion lingered as the same magazine reported in October 1928 on the enthusiasm for the issue of shares in Baird Television Ltd.

> "This public support of the issue appears surprising in the absence of any regular broadcasting of television images, and in the face of the hostile attitude of the British trade press, which issued an unanswered challenge to Baird to make a public demonstration of television by radio, posting a prize of five thousand dollars" [65].

D. Recognition of Low-Definition Television

With such low-quality images refreshed well below the persistence of vision, it is surprising that the observers could recognize the faces on the screens in Hartsdale, NY, USA, and in Glasgow, U.K. The answer is that for low-definition television, there is another factor at work that became obvious to the author when restoring the Phonovision material: we do not so much *see* the low-definition television images as we *recognize* the shapes through changes in expression and movement.

Demonstrations of low-definition television using the human face and body play to two almost miraculous aspects of human vision: our ability to recognize faces with marginal clues (Fig. 6) and our uncanny faculty to perceive compelling fluid biological movement, as exemplified in viewing stick figure animation from motion-capture studios.

When we know in advance whose face we should be seeing, the effect is even stronger, even to the extent of confirming the identity. Prior knowledge of who Baird was televising in Long Acre undoubtedly helped Hutchinson in Hartsdale, NY, USA, and Brown on the Berengaria.

The critical point here is that television in the late 1920s was not "seeing at a distance" in the general meaning of human vision, it was more "recognizing carefully chosen objects at a distance." Combined with the novelty factor of being the first type of television available, we can begin to understand why there was such an interest in low-definition television that should on paper have been of no practical use.

E. Long-Distance Communications

By staging the London to Glasgow and the London to New York demonstrations, Baird had crafted a "distance" race of his own making, without directly referencing AT&T's demonstration. Distance, however, was a largely irrelevant measure. Roberts of the Cavendish Laboratory separated the methods for telecommunications from the methods of creating and displaying a television picture.

[13] Approximately equivalent to £40 000 in 2019.

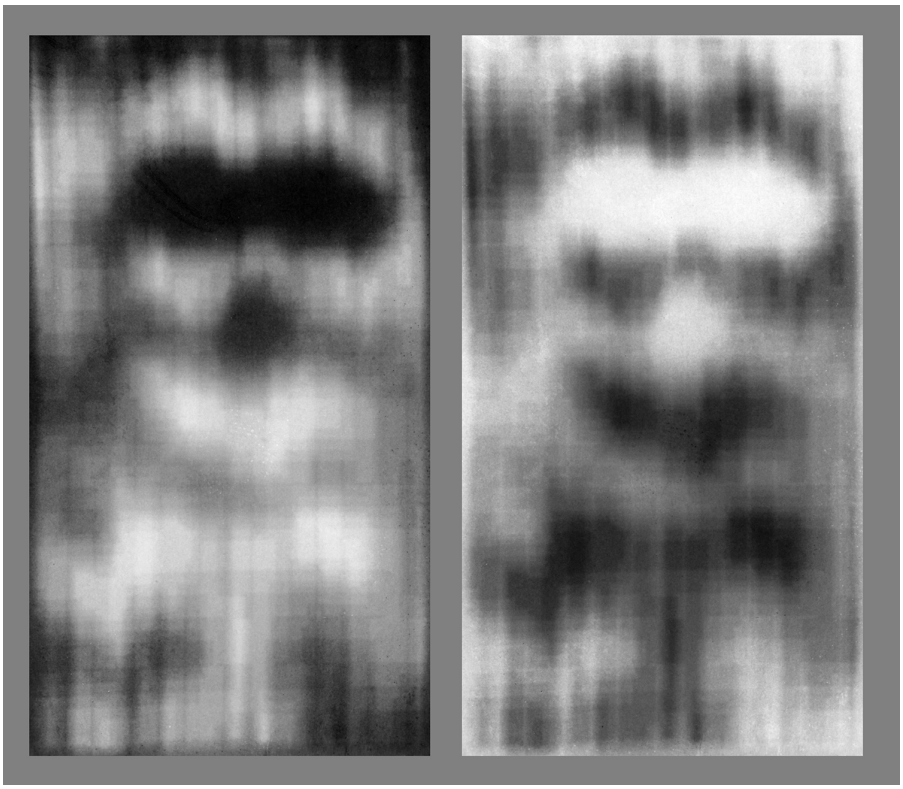

Fig. 6. *Example of seeing different "faces" in the author's early processing of Baird video recordings from the 1920s. The "face" on the right is, in fact, the negative image of the "face" on the left. Neither represents anything like the final processed image [6]. Courtesy of D. F. McLean.*

His point was that if you can transmit a few metres by radio, then you can transmit any distance that radio can cover [66].

Baird could also have sent television as audio to anywhere on the planet connected by telephone. He even considered using the London—New York City radio-telephone service that commenced on long-wave (60 kHz) on January 7, 1927. Reported in the *New York Herald Tribune,* Baird, "... had thought of using the trans-Atlantic telephone or beam stations, but found that it would be too expensive" [27] at £5 per minute[14] in early 1927. More likely, the public would have expected Baird to use direct radio transmission as a precursor to any future service.

On February 18, 1930, Ernst Alexanderson and his team at General Electric (GE) undertook two separate long-distance loopback tests of television—the further being almost halfway round the planet and back. The television signal contained simple geometric patterns to show the effect of propagation conditions [67]. Transmitted from Schenectady, NY, USA, the television signal was received at a station in Australia where the local team retransmitted it. The team at Schenectady, NY, USA, received and analyzed the effect of the round-trip distance of about 32 200 km (20 000 miles) [68].

[14]Approximately equivalent to £200 per minute in 2019.

Regardless of how impressive this appears, the public were mostly unaware of it. Unless actively promoted to the press, engineering tests do not have the implied maturity of a demonstration, nor does a geometric pattern fuel the imagination as much as a human face.

VIII. CONCLUSION

Using Bell Labs' published works as a reference for the state of engineering at the time, Baird's system for his trans-Atlantic demonstration appeared decidedly makeshift. It relied on the power of human vision to recognize faces—the primary subject for Baird's demonstrations at this time—within an image distorted by the vagaries of long-distance radio reception.

That said, with only a few staff and rudimentary apparatus, Baird achieved what AT&T/Bell Labs had not—gaining the recognition for a "first" for trans-Atlantic television. Baird had accomplished what *The New York Times* had called, "one more great dream of science" [41]. The ability to see in real-time a moving image in New York of the face of a person in London fascinated the press and the public, already excited by trans-Atlantic music concert relays and stories of human endeavor in the first trans-Atlantic crossings by aircraft.

After the event, Baird offered no technical follow up, no further long-distance demonstrations, and certainly

no engineering tests for a future trans-Atlantic service. He had staged the demonstrations for the positive publicity that would increase confidence in his brand and help secure financial backing to build his business. This allowed him to grow his team from 6 in 1928 to about 35 in 1929 [14] and to significantly improve the quality of his 30-line television system to give 12.5 pictures per second.

Baird persists in the U.K. public conscious as being central to television's inception, either in being "first" in this and other aspects of television or more likely in his heavily-publicized actions that resulted in his company funding and delivering an experimental public television service between 1929 and 1932. For that service, the Baird company leased time from the BBC for the use of two of their regional medium-wave transmitters. As a result, reception of Baird's regular scheduled programs extended across the United Kingdom and most of mainland Europe at night.

In 1932, the BBC adopted Baird's 30-line system, operating a television service in all but name until 1935. Advancements in technology led to the BBC launching what it claims as the world's first "high definition" public broadcast television service in November 1936, covering just the region around London [70]. A contributory factor to the introduction of the BBC's Television Service was increased public and government awareness of the possibilities for broadcast television as a result of Baird's activities in the previous decade.

As for the future of trans-Atlantic television, the next deliberate communication of live television between Europe and the United States would be via the low-Earth orbit satellite, Telstar, 34 years later in 1962.

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