[Bonus] AFD Ep 367 Links and Notes - The Transatlantic Telegraph Cable [Bill/Rachel] - Recording April 20

- Intro: This week on the bonus episode, we're talking about the early transatlantic telegraphic cables of the 1850s and 1860s – which required multiple costly attempts over a decade to succeed permanently beyond a demonstration. This development revolutionized communications, politics, and trade between North America and Europe during the Second Industrial Revolution. The defining feature of transatlantic relations from the late 15th century until the 19th century was the extreme time delays in communication of vital, urgent information and the same delays for transportation back and forth of goods, resources, workers, and soldiers. During those same centuries, much of financial capitalism around loans, bills of exchange, and insurance arose to try to deal with the uncertainties across time and space – as part of the same process occurring inside the overland economy of the European interior and then the American interior. The transatlantic delays were significantly shortened with the advent of steam-assisted sail-powered shipping and screw propellers in the 1820s and 1830s, but even in the 1860s it still often took more than 10 days to travel from London to the US or Canadian East Coast, with mail ships typically covering the distance in 7-15 days, depending on weather conditions and destinations. By contrast, the laying of undersea telegraph cables before and after the American Civil War (initially short-lived and then permanent) to link the British Isles to the British North American territories in present-day Canada shortened communication times to the same day. While it still took time to move goods or people across the ocean, information could travel immediately to minimize wasted response time in moving those goods or people to take advantage of the most favorable price opportunities or to arrive to deal with crises. These undersea telegraph cables were the only game in town for instant communication across the ocean until the development of transatlantic wireless radio telegraphy in 1901 by Marconi, and they remained a dominant mode until their replacement by undersea telephone cables almost a century later.
    - https://en.wikipedia.org/wiki/Isochrone_map *Francis Galton's Isochronic Postal Charts and Isochronic Passage Charts of 1881*
- https://atlantic-cable.com/ This incredible Web 1.0 website – which recently celebrated its 21st anniversary – is regularly updated with information on historical undersea cables all over the world and was updated this month as we were preparing for this episode. This gets a five star recommendation from all of us here at Arsenal For Democracy.
    - People had been trying to figure out the feasibility of an undersea telegraph cable across the Atlantic since about 1840 and they had linked shorter undersea distances like England and France by 1850. The mid-1850s saw the linking together of what are now the Atlantic provinces of Canada with mainland North America via short undersea cables. British & American entrepreneurs in partnership with the British Navy and the US Navy were determined to link together Ireland and Newfoundland by a telegraph cable. They set about attempting this from 1857 to 1866, despite very difficult ocean floor terrain and rough weather conditions in the North Atlantic.
    - Failed attempts: https://atlantic-cable.com/Cables/CableTimeLine/atlantic.htm
        - 1857: Less than 400 nautical miles laid by the New York, Newfoundland and London Telegraph Company before failure. The company would eventually be absorbed in 1870 by the company that actually succeeded briefly in 1858 and then permanently in 1866.
        - 1858 short-lived demonstration connecting Ireland to Newfoundland for 3 weeks and then intermittently for a combined total of less than 2 months of operation before shorting out: This was a project of young, rich, retired

Massachusetts paper mill supply-chain and paper wholesale magnate Cyrus W. Field's Atlantic Telegraph Company, which would emerge after its eventual success in 1866 as a near-monopoly in the Atlantic called the Anglo-American Telegraph Company, investing in or merging with other undersea cable-laying companies in the US, UK, France, and more. (The article from 1950 on Cyrus W. Field suggests that telegraphy was a natural vertical integration for the paper industry since paper was so heavily used for messages. Also Wikipedia says he specifically was heavily involved in selling wholesale paper volumes to printers of stocks, bonds, and tabloid newspapers, all of which seem to lend themselves to telegraph tie-ins. Although he was retired from active management of the business before becoming involved in telegraphy, he still made most of his income as a passive investor in his old paper firm.) 1858 project specs: *System 2200 nm [nautical miles]. CABLE: 7 strands of copper wire, six wrapped around the seventh, No 22 BWG covered with three coats of* ***gutta percha*** **[a non-conductive latex sap from British Malaya which ended up being over-harvested to supply under-sea cables according to John Tully in the 2009 journal article "A Victorian Ecological Disaster: Imperialism, the Telegraph, and Gutta-Percha" https://en.wikipedia.org/wiki/Gutta-percha https://atlantic-cable.com/Article/GuttaPercha/index.htm]** *to No 4 BWG. This was wrapped in jute yarn soaked with a composition consisting of 5/12 Stockholm tar, 5/12 pitch, 1/12 boiled linseed oil and 1/12 common bees wax. Armouring consisted of 18 strands each strand composed of 7 of the best charcoal iron wires, six wrapped around the seventh, each of 22 BWG. The completed cable as it left the machine was dipped in a heated composition consisting of tar, pitch and linseed oil. The cable worked with variable results for three weeks, the last complete message being received on September 1st 1858. Attempts to revive the cable continued, and fragments of messages were received, but the last signs of life were on October 28th 1858. The cable was abandoned less than three months after its inception.*
    - 1865 attempt: This one by Atlantic Telegraph left Ireland and got to within 600 nautical miles of Newfoundland before the cable broke in a high wind and was presumed lost after extensive recovery attempts. They actually managed to recover it the next year in a stunning effort involving ocean floor hooks and surface buoys and then finished it, to make it the second permanent operational cable, which continued until 1877. https://atlantic-cable.com/Article/1866Recovery/index.htm
- The first true success: July 28, 1866 after less than a month of work at sea, including 14 days from Ireland to Newfoundland and additional days repairing a cable connecting Newfoundland to the mainland. Four ships (Great Eastern - William Cory - Albany - Medway), 3 of which had worked on the failed 1865 expedition by Atlantic Telegraph. (The cables themselves from 1865 to the late 1870s were nearly always manufactured by Telcon, or the Telegraph Construction and Maintenance Company of London, a subsidiary of Atlantic Telegraph that had monopolized the various companies linking Mediterranean islands together.)
    - The 1866 project specs: *System 1852 nm. CABLE: 1 copper conductor 7 strands No. 18 BWG, 6 wrapped around 7th, coated with three layers of Chattertons Compound and 3 layers of gutta percha then wrapped in*

tarred jute. Main cable armoured with 10 No. 13 BWG galvanised iron wires each wrapped in 5 strands of white manilla, shore ends 12 No. 0000 BWG black iron wires, intermediate 12 No. 3 BWG, 2nd intermediate 12 No. 1 BWG, 3rd intermediate 12 No. 0 BWG galvanised iron wires. The whole cable was then wrapped in jute and dipped in Bright and Clarks Composition. (hot pitch, tar and linseed oil). Laying commenced 7 July and was completed on 27 July. The 1866 cable was abandoned in 1872.

    - The company charged a flat rate per word per nautical mile that added up to around 70 cents per word in messages in US dollars at the time.
- Cable-Laying Ships such as Great Eastern:
  https://atlantic-cable.com/Cableships/GreatEastern/index.htm
  https://en.wikipedia.org/wiki/SS_Great_Eastern
    - One of the biggest steamships in the world, which made it ideal for carrying around massive amounts of insulated telegraph cable and coal for fuel
    - This important cable-laying pioneer for the first and second permanent cables across the Atlantic was also one of the final steamships designed and built by one of the leading-edge early steamship innovators, Isambard Kingdom Brunel
    - Served on 7 undersea cable-laying voyages, including 5 trans-atlantic
    - *The Great Eastern itself was fitted with three tanks built as those on shore, the forward tank being 51 feet 6 inches diameter by 20 feet 6 inches deep with a capacity of 693 nm of cable, the midships tank being 58 feet 6 inches diameter by 20 feet 6 inches deep holding 899 nm of cable and the aft tank 58 feet diameter by 20 feet 6 inches deep holding 898 nm of cable. The total capacity was 2490 nm of cable. The cable machinery on board had been designed by Samuel Canning and was built by Messrs Penn and Company of Greenwich.*
    - *After the trials and tribulations associated with the 1865 cable the laying of the new cable went very smoothly, on two occasions the cable got tangled up and the ship had to be stopped to enable it to be sorted out. The laying took fourteen days and on Friday 27 July the Great Eastern sailed into Heart's Content. When Cyrus Field tried to send telegrams to New York he found that the cable across the Cabot Strait between Cape Ray and Cape North had not been repaired. The board of the New York, Newfoundland and London Telegraph Company had decided not to go ahead with the repair as there was no guarantee the Atlantic cable would succeed. A steamer, the Dauntless, was chartered to take the telegrams to the mainland for onward transmission. Cyrus Field arranged for the charter of the steamer Bloodhound to carry out the repair to the cable using some of the cable on board the Great Eastern.*
    - In 1869, Great Eastern joined a French expedition by French Atlantic Cable Company to connect Brest in the tip of Brittany to the French North Atlantic fishing island of St. Pierre off the coast of Newfoundland, which was already connected to the British North American territories. This same project in 1869 also linked Massachusetts to St. Pierre so that messages could be transmitted via the island to the European continent from the US without going through Canada, Newfoundland, Ireland, and England first. The following year (or by 1873?), French Atlantic was absorbed into the Anglo-American conglomerate, to avoid competition lowering the price of transatlantic telegraph messages.
- The US Capitol Dome rotunda canopy painted in 1865 includes an allegorical depiction of Venus and Neptune laying a transatlantic cable with a steamship, while Minerva bestows technological wisdom upon inventors Ben Franklin, Robert Fulton (the river steamboat guy), and Samuel Morse, the inventor of the US telegraph:
  https://atlantic-cable.com/Capitol/capitol.htm

- Study: "Real Effects of Information Frictions: When the States and the Kingdom Became United" American Economic Review March 2018 by Claudia Steinwender. The abstract alone is incredible: *"This paper exploits a unique historical experiment to estimate how information frictions distort international trade: the establishment of the transatlantic telegraph in 1866. I use newly collected data on cotton prices, trade, and information flows from historical newspapers and find that the average and volatility of the transatlantic price difference fell after the telegraph, while average trade flows increased and became more volatile. Using a trade model in which exporters use the latest news about a foreign market to forecast expected prices, I estimate the efficiency gains of the [transatlantic] telegraph to be* ***equivalent to 8 percent of export value.****"* Put another way in the conclusion, the reduced price distortions on cotton trade between New York and Liverpool was equivalent to abolishing a 7% trade tariff. (And that's just within the narrow period immediately before and after the telegraph cable successfully opened in July 1866 to much public surprise after so many years of failure!)
    - *Using these detailed data, I am able to document six reduced-form findings (described in the subsections of Section III): (A) The telegraph caused increased goods market integration, as the mean and volatility of the cross-Atlantic contemporaneous price differences fell. (B) Within the pre-telegraph period, faster steam-ships had a similar effect and increased market integration, whereas during the post-telegraph period, temporary technical failures of the transatlantic telegraph connection reduced market integration. (C) New York prices responded strongly to news from Liverpool, while Liverpool prices reacted less strongly to news from New York. (D) The telegraph reduced the mean and volatility of the difference between the current price in New York and the latest known price in Liverpool. This last finding is a new contribution to the literature on the impact of the telegraph and information frictions on financial markets ... and shows that market participants did not naïvely arbitrage away the price difference between the current price in New York and their latest known Liverpool price, but instead took into account how outdated this information was when forming expectations about future prices. (E) Information frictions had real effects on trade flows and were not just a reallocation of profits across market participants, because exports responded to news about Liverpool prices. To my knowledge, this paper provides the first evidence that the telegraph had real effects on exports. (F) After the telegraph, exports were on average both higher and more volatile.*
    - *...the findings are robust to a number of alternative explanations (e.g., transport cost variations, supply irregularities in the aftermath of the American Civil War, fluctuations within commodity points in no-trade periods, change in the market structure of merchants, futures trading, and anticipation effects)*
- Per wiki: Due to technological limitations of sending voltages over extreme distances of wire without the boosters seen in overland telegraph networks, the speed of sending messages was very slow with transoceanic telegraphy: 10-12 words per minute. (For comparison, land-based hand-operators sent 25-40 words per minute and automated machines could send 60 to 1000 words per minute overland: http://edison.rutgers.edu/telegraphy.htm)
- Other, later transoceanic telegraph cables:
    - The British monopolized the undersea cable industry as much as possible to link together all the British imperial territories worldwide for security reasons and economic purposes
    - The United States laid cable across the Pacific in 1902 and 1903 by linking together its recent colonial acquisitions of Hawaii, Guam, and the Philippines

- Telephone cables: In 1955 and 1956, after wartime secrecy around the newly developed polyethylene plastic insulation technology had ended, Transatlantic Cable No. 1 or TAT-1 for telephone service was laid from Scotland to Newfoundland with a simultaneous capacity of 35 phone calls and 22 telegraph messages: https://en.wikipedia.org/wiki/TAT-1 (A wireless, radio-assisted telephone service allowed transatlantic calls by 1927 at an exorbitant fee, but a hard wire is generally better quality and more reliable.) This line later carried the direct Moscow-Washington hotline.
- Optical cables: Over a century after the first transatlantic telegraph cable, light-signal-based fiber-optic undersea cables began to be laid around the world in the 1980s for improved telephone connections. More advanced optical cables replaced these in the 1990s, allowing for high-speed worldwide internet connectivity by wire. https://en.wikipedia.org/wiki/Submarine_communications_cable#Modern_history As of 2016, 99% of transoceanic global communications are carried by optical cables on the seafloor as opposed to satellites or other wireless means, which are much slower than hard lines anyway. http://europe.newsweek.com/undersea-cables-transport-99-percent-international-communications-319072?rm=eu
- More info on wire rope cable technology for those interested in further reading: https://atlantic-cable.com/Article/WireRope/wirerope.htm