THORPE HAMLET HISTORY GROUP

Article 15 : THE OPTICAL TELEGRAPH IN THORPE HAMLET

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Introduction

Some sixty years before the invention of the electric telegraph a method of communication existed that relied on visual signals passing along a chain of relay stations each visible to the next station in the chain. This was not an entirely new idea as communication over great distances had been possible for thousands of years by various simpler means.

Before formal telegraph systems evolved, urgent messages to distant destinations were usually sent by messenger on foot or on horseback but simple optical methods were also used to send pre -arranged messages. These included flashing reflections of the sun from polished shields to a distant point; smoke signals and chains of burning beacons.

Various attempts were made from the late 18th century to create a more formal optical or visual telegraph but a practical form did not evolve until the French government adopted the Chappe telegraph in 1793. This could convey a message faster than a messenger on a horse although it could only operate in daylight hours and was severely restricted by bad weather.

During the Napoleonic Wars, Yarmouth, Britain's most easterly naval base was vitally important for the defence of the nation against any French naval action or invasion from the North Sea. From 1808 to 1816 a line of optical telegraph stations, inspired by the French system, connected the Admiralty in London with the Port Admiral in Yarmouth to facilitate urgent communication in the event of such hostilities.

One station in this important line was located on high ground in Thorpe-next-Norwich, on what is now Telegraph Lane East, Thorpe Hamlet. The telegraph station was situated on the site of the present water tower in Telegraph Lane East. The water tower itself is now the site of a modern communication device, a mobile telephone mast.

The line to Yarmouth was one of several radiating from London. Although inspired by the French system the British telegraphs were of a different design. The differences are described in this paper.

The optical telegraph as a means of rapid communication was eventually replaced by the electric telegraph, one version of which controlled the first railway in Norfolk, the Yarmouth to Norwich Railway.

The French Optical Telegraph

Charles Dibdin (1745-1814) a famous musician, songwriter, dramatist, et al, in his time described the French telegraph system thus:

If you'll only just promise you'll none of you laugh,
I'll be after explaining the French Telegraph!
A machine that's endowed with such wonderful pow'r
It writes, reads and sends news at 50 miles an hour.

Then there's watchwords, a spyglass, an index on hand,
And many things more none of us understand.
But which, like the nose on your face, will be clear,
When we have, as usual, improv'd on them here.

Adieu, penny posts! Mails and coaches adieu!
Your occupation's gone, 'tis all over with you.
In your place telegraphs on your houses we'll see
to tell time, conduct lightning, dry shirts and send news.

Thus while signals, and flags, stream on top of each street,
The town to a bird will appear a grand fleet,
And since England's grand fleet, to the French, convey fear,
Sure shan't we improve on the Telegraph here?

In 1793, in the midst of the French Revolution, France declared war on Britain. That year, the Revolutionary government approved the construction of a semaphore telegraph system from Paris to Lille, some 190 km north of Paris. When the line was completed, its inventor Abbé Claude Chappe, a cleric who lost his benefices in the Revolution, was hailed as a "benefactor of the motherland".

Contemporary illustration of the Chappe telegraph.

Telegraph stations were sited at 10 km intervals, within sight of each other and it was claimed that messages could be transmitted over more than 65 km in under 46 minutes; and almost as rapidly over a much larger distance as the time required for the communication did not increase proportionally with the distance.

Each station had a large horizontal beam, called a regulator, with two smaller arms, called indicators, mounted at each end as shown in the illustration. The angles of the regulator and the indicators could be varied to provide 92 different signal patterns. Twenty-six of these indicated the letters of the alphabet while others represented words, syllables, or complete phrases.

By 1800 more lines were under construction. The system was developed under the control of the Army (by contrast, the later English system was under the control of the Navy). Napoleon, recognising its military value, used a portable version in his campaigns and, in anticipation of a proposed invasion of England, had a telegraph built at Boulogne which was capable of signalling across the English Channel.

Eventually a national system evolved with 556 telegraph stations connecting 29 cities to Paris. When the electric telegraph was introduced in France the first instruments used were miniature replicas of the old optical telegraphs, enabling the operators of the old system to convert easily to the new system.

With this background, it is not surprising that Britain took an interest in the French invention and decided to develop its own optical telegraph system.

The British Optical Telegraph

When their new telegraph towers began to be erected across the country the French could not hide their new invention from their enemies although the codes and signals used for the system remained a military secret.

Refugees from the French Revolution brought news of the telegraph to England and in September 1794 the *Gentleman's Magazine* described it thus:

"….let persons be placed in several stations, at such distance from each other, that, by the help of a telescope, a man in one station may see a signal made by the next ….he immediately repeats this signal, which is again repeated through all the intermediate stations ….(it is called) a télégraphe; and (the magazine forecast)….we doubt not but it will be soon introduced in this country…."

The following month, the magazine published a drawing of Chappe's telegraph and its forecast soon proved to be correct.

Experiments

The British government and Army already knew about the telegraph from a drawing found on a captured French soldier in August 1794. The Duke of York, Commander-in-Chief of the Army, instructed his chaplain, the Revd. John Gamble, a mathematics scholar, to investigate the possibilities of the system.

Gamble made a model of what he suggested was an improvement on the French design and submitted an essay on the subject to the Admiralty. He proposed a five-shutter system with 32 possible signal positions. It was to be manipulated by ropes to open or close the shutters to indicate the letters of the alphabet.

Unknown to Gamble, Lord George Murray, Bishop of St. David's, Pembrokeshire, was also experimenting with an alternative system. It seems an unusual subject for clergymen to be interested in but it will be recalled that Chappe, the inventor of the French telegraph system, was also an ordained minister.

In an age of scientific curiosity and invention involvement in such matters came mainly from the better-educated upper classes so perhaps the interest of these high-ranking clerics was not quite so surprising.

The Murray system

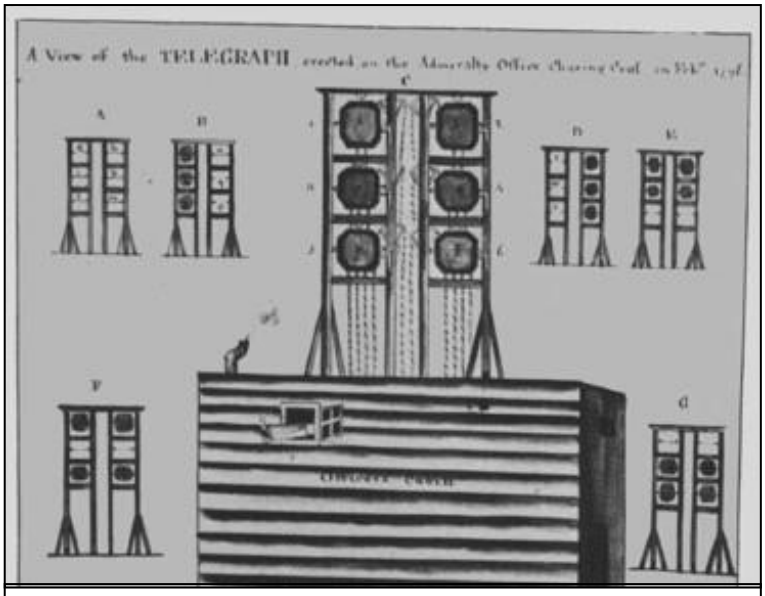
Murray built an experimental apparatus in the grounds of his home, the Bishop's Palace in Abergwili, enrolling the help of his family to take it in turns to pull ropes operating six shutters

to signal messages to him in his study.

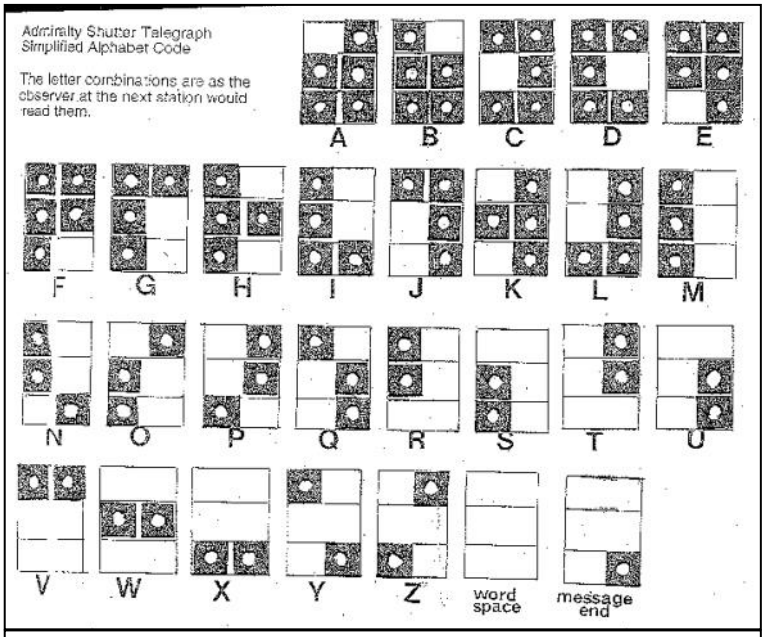
In 1795, he offered his invention to the Admiralty. His six-shutter system provided a combination of 64 signals and was adopted by the Admiralty in September of that year in preference to Gamble's 32-combination system. Murray was awarded £2000 for his invention.

The Murray shutter telegraph was first put to use in 1796 on a 15-station communication chain running from the Admiralty in London to Deal on the coast of Kent. The chain of stations took just four months to erect. To achieve this, as in France, a suitable route had to be surveyed. Land on high ground was identified and acquired to site the telegraph stations and obstructions cleared to ensure line of sight between the stations.

The work was undertaken by a surveyor, George Roebuck, who was later appointed Superintendent of Telegraphs. At the time, it was claimed that a message could begin to be read in Deal sixty seconds after transmission began in London. Roebuck was then instructed to construct further lines extending to Portsmouth and Plymouth.



Murray's shutter system 1796. Admiralty Archives, London



Admiralty Shutter Telegraph – simplified Alphabet Code

The Line to Yarmouth – a relay station at Norwich

The Admiralty also considered constructing a telegraph line to the east coast but abandoned the idea after the Peace Treaty of Amiens was signed in 1802. War was resumed the following year and by 1807, with hostilities continuing, the defence of the North Sea became a matter of concern.

Roebuck was instructed to survey and build a new line to Yarmouth, a strategically important port controlling the entrances to the rivers Bure, Yare and Waveney. The purpose of the line was to maintain urgent communication between the Admiralty and the Admiral in command of the Naval base at Yarmouth.

In December 1807, the Norfolk Chronicle reported "A telegraph or signal station is on the point of being erected upon the hills leading from Norwich to Thorpe. It is to be commanded by a naval officer, and the object of it is to open and maintain a prompt communication with

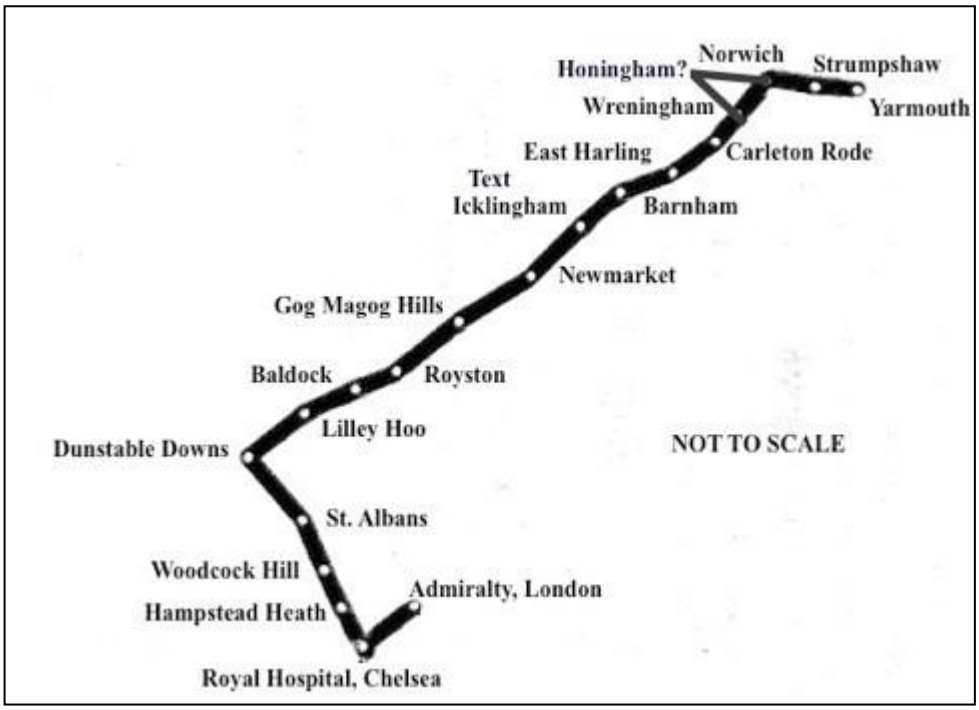
Yarmouth on the one side, and with the telegraphs between Norwich and London on the other."

On 25th June 1808 Roebuck reported that the line to Yarmouth was ready and that practice messages had passed "perfectly correctly." On 24th August 1808 the Port Admiral sent the first official message to the Admiralty, "Calypso ready for sea." (HMS Calypso was an 18-gun sloop of the Cruizer class, presumably operating out of Yarmouth.)

The route via Norwich

The London-Yarmouth line covered a length of 136.5 miles and its stations were located at:

- Admiralty (London)
- Royal Hospital, Chelsea
- Hampstead Heath
- Woodcock Hill
- St. Albans
- Dunstable Downs
- Lilley Hoo
- Baldock
- Royston
- Gog Magog Hills (near Cambridge)
- Newmarket
- Icklingham
- Barnham
- East Harling
- Carleton Rode
- Wreningham
- Honingham (see below)
- Norwich
- Strumpshaw
- Great Yarmouth



The distance from Admiralty to Chelsea was only two miles. Other stations were typically seven miles apart but from Royston to Gog Magog Hills to Newmarket they were 11.7 miles apart. They were all were located on hills, high ground or high buildings with a clear view in each direction towards those on either side of them. They were mainly in direct line with each other but there were three bends in the line, at Chelsea, Dunstable and Norwich, making reception and onward transmission of messages at these stations difficult.

The very sharp bend at Chelsea was necessitated by the need for a high location for the first relay station to overcome obstacles to the line of sight leaving London from the Admiralty caused by occasional fogs and high buildings in the metropolis.

In The Shutter Telegraph (see references below), Bernard R. Ambrose suggests that an additional reserve or bypass station was situated on Telegraph Hill, Honingham, to the west of Norwich.

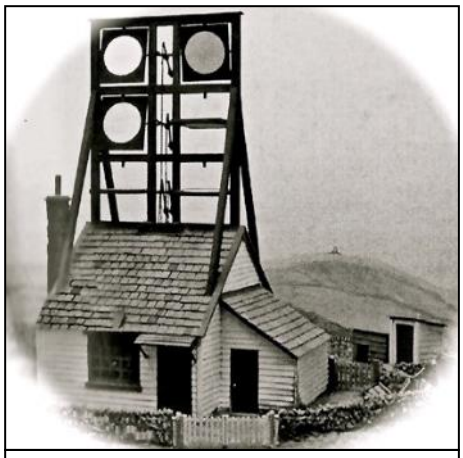
This could have taken traffic from Wreningham when fog or mist from low-lying ground near Keswick or smoke from the city prevented the direct route to Norwich being used. If this station existed there would have been yet another sharp bend to be overcome.

Telegraph Hill, Honingham is marked on Bryant's map of Norfolk 1826. Honingham Village website claims that the station did exist but no contemporary documentation has been found to confirm the existence of a shutter telegraph station on this site.

There is also no direct evidence on how the problem of the bends was overcome although The Times, on 25 March 1808, reported that the shutters at Chelsea were much bigger than usual and were set at 45°. It also reported that the horizontal dimension was increased and this would certainly have helped in reading and re-transmitting the signals at all points where the line diverted at an angle. Another possibility is that the angled stations would have had two sets of shutters, one towards each of the diverted directions but this suggestion is unsubstantiated.

Construction

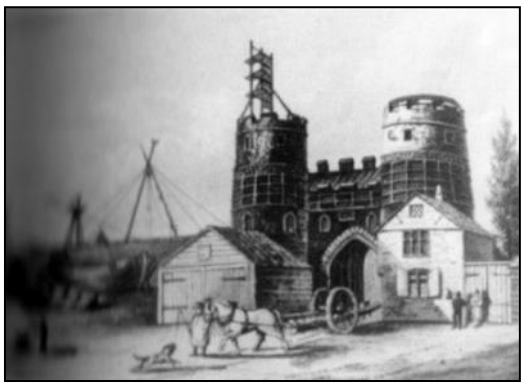
Constructed to a universal design, the intermediate stations were large wooden two-room huts some 30 ft. high with a six-shutter signalling structure in two columns erected above them. Each shutter was 5 ft. high within a wooden frame, adding a further 15 ft. to the height. Individual shutters could be operated independently of each other.



Model of an intermediate Murray telegraph station. The station at Norwich would have been of this type. Note the next station on a hill in the distance.

Each station cost £215 to build and was equipped with a stove, an eight-guinea clock and two 12-guinea Dollond telescopes. (A guinea was twenty-one shillings, or one pound and one shilling.)

The telescopes faced in opposite directions, one to read incoming messages and one to confirm that the messages had been correctly relayed to the next station. The instrument used was the achromatic lens telescope for which its inventor, John Dollond, received the Copley Medal of the Royal Society in 1758. With a much-improved image quality and resolution compared with previous telescopes, it became the "standard" for many years and enabled optical telegraphy to become a realistic proposition.



The station at Chelsea was on top of the Royal Hospital. The terminal stations, at the Admiralty in London and at Yarmouth were also erected on high buildings. At the latter, the signal shutters were located on Yarmouth Gate as can be seen in the contemporary illustration to the left.

Staffing

Each hut had an establishment of three or four men. Records are unclear but it is believed that

they were usually ex-Navy men one of whom was a Midshipman, or perhaps a retired or half-pay officer, in charge of the station. Terminal stations were in the charge of a Royal Navy Lieutenant.

"Glassmen" within the huts were continuously on watch, observing neighbouring stations with their telescopes. One source suggests that observations were made every five minutes. If the signal 123456 (i.e. all shutters closed) was seen, the "Ropemen" on duty were alerted, ready to relay a message onwards. The jobs of the glassmen and the ropemen were interchangeable.

The signal shutters were controlled by ropes hanging inside the hut. To indicate a signal a shutter was pivoted vertically on a horizontal axle, so that it could be seen by the next station or horizontally so that it could not be seen. Varying the positions of different shutters created combinations with specific meanings that could be understood by the final recipient of a message.

Security and coding

For added security the messages were sometimes coded instead of being sent in plain language. Combinations of open or closed shutter positions were allocated to the letters of the alphabet and to numerals (0 to 9). There were procedural signals (eg, 123456 as mentioned above) and some pre-arranged sentences. Word compression was also used, omitting the vowels in common words. The staff in the intermediate stations did not have to read or decipher the messages. Their task was merely to copy and relay the signals onwards towards their destination.

Attempts were made to improve the efficiency of the system. In 1808, for example, Lt. Col. MacDonald devised a numbered codebook to improve the coding and the speed of the shutter signals. However, the Admiralty rejected his suggestion, believing there would be confusion or error if signals were sent as single numbers.

Gog Magog Journal

A journal was kept at every station to record the passing of messages and various routine matters throughout the day. One of the few contemporary records surviving, the journal of the Gog Magog station on the Yarmouth line, provides some information about the working of the system. This station, on the Gog Magog Hills near Cambridge, had a staff of three men, two of whom were on 'glass duty' each day.

A clock was used to time all messages handled and, subject to weather conditions, time signals were received regularly enabling the clock to be re-set accurately on most days. The system was far from perfect. It worked well on clear days when visibility was good but bad weather or fog caused delays in transmission that could sometimes last for days.

The journal records that most weeks there were reports of fog along the line delaying signals for many hours. In December 1813 and January 1814 the system was closed by fog for seventeen days in each month.

The station at Norwich is referred to in the journal as "Mussell Hill," an old name for Mousehold Heath, which suggests that the site of the station, where the present water tower is located in Telegraph Lane East, was at one time part of the Heath. (Grid reference of site: TG 2469 0871;

Map sheet TG20NW).

Perceived Limitations

Despite Murray's claim that he had created an improved telegraph, it was a crude system with limited capability compared with the French version. Faced with the government's urgent need for a rapid communication system, however, it had the advantage that it could be constructed and put into use very quickly.

The Encyclopaedia Britannica of 1797 commented on its capability:

"….its form is too clumsy to admit of it being raised to any considerable height above the building on which it stands, and …. It cannot be made to change its direction, and consequently cannot be seen but from one particular point."

Perhaps because of these perceived limitations over 100 alternative proposals were made to the Admiralty and Parliament between 1796 and 1816.

Peace – and War again

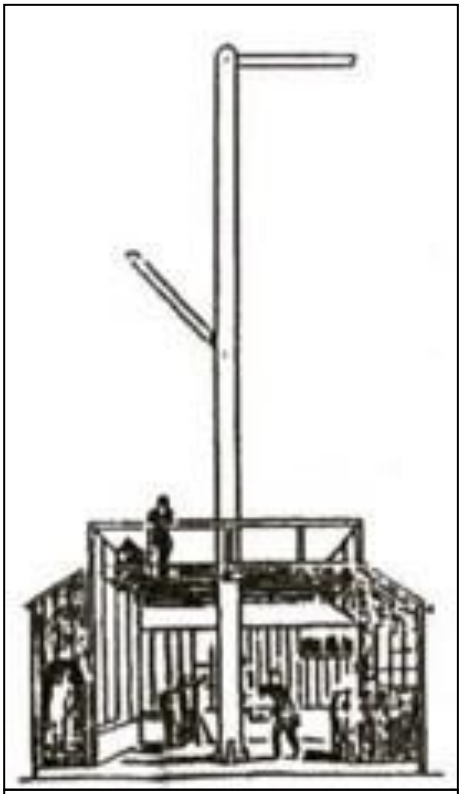
On 18 May 1814 peace was proclaimed and Napoleon was banished to the Isle of Elba. As a result, on 6 July 1814, the Portsmouth Shutter Line was closed down. On 1 May 1815 Napoleon escaped from Elba and returned to France. England was again at war and the Portsmouth line was re-opened.

On 18 June 1815 Napoleon was defeated at Waterloo. In March 1816, with the threat of invasion gone, the Murray shutter system, including the London to Yarmouth line, was finally closed down.

Before this, the Admiralty had already decided that it should have a permanent, improved, replacement of the Murray system for its communications and on 29 June 1815 an act of Parliament had authorised the acquisition of land for a new system. Various proposals were considered and that chosen was a semaphore designed by Rear-Admiral Sir Home Riggs Popham, inspired by an invention of Charles Depillon, a rival of Claude Chappe.

The Popham Semaphore

Popham's telegraph used two signalling arms erected on a 30 foot high mast. By July 1816 an experimental line had been constructed between the Admiralty and Chatham and was in working order. A permanent Popham line to Portsmouth was opened at the end of June 1822. This remained in use until 1847 when it was replaced by the electric telegraph. The Yarmouth line was never re-instated and Norwich never saw the new system.



Popham two-arm semaphore.

Commercial optical telegraphs

During this time a number of commercial optical telegraphs evolved in Britain and in other countries, particularly to notify the arrival of shipping off the coast. An indication of the increased use of these telegraphs is given in a report on the Liverpool to Holyhead semaphore telegraph in 1836:

"In the year 1828 there were about 847 vessels reported by name inward and outward bound; in 1831 there were 1,712; in the present year, up to 30th Nov., [1836] there were upwards of 2,440, besides several hundred without numbers, upwards of 500 reports respecting pilot-boats, about 200 communications respecting wrecks, accidents and casualties, and the state of the wind and weather reported upwards of 700 different times."

End of the optical telegraph

By 1838 a number of commercial companies had plans for electric telegraph systems. The Liverpool to Holyhead semaphore line survived until 1861 but others were closed much earlier once the electric telegraph became available.

The new invention provided instant communication with distant places by sending electrical impulses along wires strung on telegraph poles. Unlike the optical telegraph, it could operate day or night, irrespective of weather conditions and without the need for relay stations with a clear line of sight between them.

A pioneering version was installed on the Norwich & Yarmouth Railway, when it opened in April 1844, to ensure the safe running of the railway. Telegraphic communication between Norwich and Yarmouth, lost when the Murray optical telegraph was abandoned at the end of the Napoleonic war, was again a reality.

It was the beginning of a new and exciting era, with future communication capabilities far exceeding anything that Chappe, Murray or Popham could have ever visualised. However, their procedural techniques, use of codes, pre-arranged messages and word compression were all adapted for use in the new system; and some survive to this day in modern electronic messaging.

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