

Polybius, *The Histories*, Book X, c. 146BC

translated by William R. Paton

VII. Affairs of Greece

Fire-Signalling

I think that as regards the system of signalling by fire, which is now of the greatest possible service in war but was formerly undeveloped, it will be of use not to pass it over but to give it a proper discussion. It is evident to all that in every matter, and especially in warfare, the power of acting at the right time contributes very much to the success of enterprises, and fire-signals are the most efficient of all the devices which aid us to do this. For they show what has recently occurred and what is still in the course of being done, and by means of them anyone who cares to do so even if he is at a distance of three, four, or even more days' journey can be informed. So it is always surprising how help can be brought by means of fire messages when the situation requires it. Now in former times, as fire-signals were simple beacons, they were for the most part of little use to those who used them. For the service should have been performed by signals previously determined upon, and as facts are indefinite, most of them defied communication by fire-signals. To take the case I just mentioned, it was possible for those who had agreed on this to convey information that a fleet had arrived at Oreus, Peparethus, or Chalcis, but when it came to some of the citizens having been guilty of treachery or a massacre having taken place in the town, or anything of the kind, things that often happen, but cannot all be foreseen — and it is chiefly unexpected occurrences which require instant consideration and help — all such matters defied communication by fire-signal. For it was quite impossible to have a preconcerted code for things which there was no means of foretelling.

Aeneas, the author of the work on strategy, wishing to find a remedy for the difficulty, advanced matters a little, but his device still fell far short of our requirements, as can be seen from this description of it. He says that those who are about to communicate urgent news to each other by fire-signal should procure two earthenware vessels of exactly the same width and depth, the depth being some three cubits and the width one. Then they should have corks made a little narrower than the mouths of the vessels and through the middle of each cork should pass a rod graduated in equal sections of three fingerbreadths, each clearly marked off from the next. In each section should be written the most evident and ordinary events that occur in war, e.g. on the first "Cavalry arrived in the country," on the second "Heavy infantry," on the third "Light-armed infantry," next "Infantry and cavalry," next "Ships," next "Corn," and so on until we have entered in all the sections the chief contingencies of which, at the present time, there is a reasonable probability in war time. Next he tells us to bore holes in both vessels of exactly the same size, so that they allow exactly the same escape. Then we are to fill the vessels with water and put on the corks with the rods in them and allow the water to flow through the two apertures. When this is done it is evident that, the conditions being precisely

similar, in proportion as the water escapes the two corks will sink and the rods will disappear into the vessels. When by experiment it is seen that the rapidity of escape is in both cases exactly the same, the vessels are to be conveyed to the places in which both parties are to look after the signals and deposited there. Now whenever any of the contingencies written on the rods occurs he tells us to raise a torch and to wait until the corresponding party raise another. When both the torches are clearly visible the signaller is to lower his torch and at once allow the water to escape through the aperture. Whenever, as the corks sink, the contingency you wish to communicate reaches the mouth of the vessel he tells the signaller to raise his torch and the receivers of the signal are to stop the aperture at once and to note which of the messages written on the rods is at the mouth of the vessel. This will be the message delivered, if the apparatus works at the same pace in both cases.

This is a slight advance on beacons with a preconcerted code, but it is still quite indefinite. For it is evident that it is neither possible to foresee all contingencies, or even if one did to write them all on the rod. So that when circumstances produce some unexpected event, it is evident that it cannot be conveyed by this plan. Again none of the things written on the rod are defined statements, for it is impossible to indicate how many infantry are coming and to what part of the country, or how many ships or how much corn. For it is impossible to agree beforehand about things of which one cannot be aware before they happen. And this is the vital matter; for how can anyone consider how to render assistance if he does not know how many of the enemy have arrived, or where? And how can anyone be of good cheer or the reverse, or in fact think of anything at all, if he does not understand how many ships or how much corn has arrived from the allies?

The most recent method, devised by Cleoxenus and Democleitus and perfected by myself, is quite definite and capable of dispatching with accuracy every kind of urgent messages, but in practice it requires care and exact attention. It is as follows: We take the alphabet and divide it into five parts, each consisting of five letters. There is one letter less in the last division, but this makes no practical difference. Each of the two parties who are about signal to each other must now get ready five tablets and write one division of the alphabet on each tablet, and then come to an agreement that the man who is going to signal is in the first place to raise two torches and wait until the other replies by doing the same. This is for the purpose of conveying to each other that they are both at attention. These torches having been lowered the dispatcher of the message will now raise the first set of torches on the left side indicating which tablet is to be consulted, i.e. one torch if it is the first, two if it is the second, and so on. Next he will raise the second set on the right on the same principle to indicate what letter of the tablet the receiver should write down.

Upon their separating after coming to this understanding each of them must first have on the spot a telescope with two tubes, so that with the one he can observe the space on the right of the man who is going to signal back and with the other that on the left. The tablets must be set straight up in order next the telescope, and there must be a screen before both spaces, as well the right as the left, ten feet in length and of the height of a man so that by this means the torches may be

seen distinctly when raised and disappear when lowered. When all has been thus got ready on both sides, if the signaller wants to convey, for instance, that about a hundred of the soldiers have deserted to the enemy, he must first of all choose words which will convey what he means in the smallest number of letters, e.g. instead of the above "Cretans a hundred deserted us," for thus the letters are less than one half in number, but the same sense is conveyed. Having jotted this down on a writing-tablet he will communicate it by the torches as follows: The first letter is kappa. This being in the second division is on tablet number two, and, therefore, he must raise two torches on the left, so that the receiver may know that he had to consult the second tablet. He will now raise five torches on the right, to indicate that it is kappa¹, this being the fifth letter in the second division, and the receiver of the signal will note this down on his writing tablet. The dispatcher will then raise four torches on the left as rho belongs to the fourth division, and then two on the right, rho being the second letter in this division. The receiver writes down rho and so forth. This device enables any news to be definitely conveyed.

Many torches, of course, are required, as the signal for each letter is a double one. But if all is properly prepared for the purpose, what is required can be done whichever system we follow., Those engaged in the work must have had proper practice, so that when it comes to putting it in action they may communicate with each other without the possibility of a mistake. From many instances it is easy for all who wish it to learn how great the difference is between the same thing when it is first heard and when it has become a matter of habit. For many things which appear at the beginning to be not only difficult but impossible are performed quite easily after time and practice. There are many other examples which confirm this, but the clearest of all is the case of reading. Here if we put side by side a man who is ignorant and unpractised in letters, but generally intelligent, and a boy who is accustomed to read, give the boy a book and order him to read it, the man will plainly not be able to believe that a reader must first of all pay attention to the form of each letter, then to its sound-value, next to the combinations of the different letters, each of which things requires a considerable amount of time. So when he sees that the boy without hesitation reels off five or seven lines in a breath he will not find it easy to believe that he never read the book before, and he will absolutely refuse to believe this if the reader should be able to observe the action, the pauses, and the rough and smooth breathings. We should not, therefore, abandon, anything useful owing to the difficulties which show themselves at the outset, but we must call in the aid of habit, through which all good things fall into the hands of men, and more specially when the matter is one on which our preservation mainly depends.

In offering these observations I am acting up to the promise I originally made at the outset of this work. For I stated that in our time all arts and sciences have so much advanced the knowledge of most of them may be said to have been reduced to a system. This is, then, one of the most useful parts of a history properly written.

¹The grouping of these letters will be as in Figure 1

	1	2	3	4	5
1	α	ζ	λ	π	φ
2	β	η	μ	ρ	χ
3	γ	θ	ν	σ	ψ
4	δ	ι	ξ	τ	ω
5	ε	κ	\omicron	υ	

Figure 1: The grouping of the letters