A MEMORIAL UPON THE PRIME MERIDIAN PROPOSED AT WASHINGTON: ON THE ACOUSTICAL INDIFFERENCE OF LONGITUDE, AND THE SOLE CLAIM OF THE EQUATOR TO BE A LINE OF NATURE

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A Memorial upon the Prime Meridian Proposed at Washington: On the Acoustical Indifference of Longitude, and the Sole Claim of the Equator to Be a Line of Nature

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Abstract

In October of 1884 the International Meridian Conference assembled at Washington resolved to recommend the meridian passing through the transit instrument at Greenwich as the initial meridian for longitude. Its Final Act, adopted on the 22nd of that month, records the vote as twenty-two to one, with France and Brazil abstaining. This Society was not consulted. We offer the present memorial in the spirit of correction rather than complaint.

We maintain that a meridian is a convention and the equator is a fact. The equator is fixed by the rotation of the globe and would be found by any observer of any nation; a meridian is fixed by agreement, and the Conference has now shown that agreement may be obtained by vote. We report experiments made between April and December of 1884 with tuning forks of the pattern of M. König, a tinfoil phonograph of the pattern of Mr Edison, and a pair of telephonic receivers, carried along the equatorial parallel and along the meridian of Quito. Along the parallel, over a distance of thirty-eight leagues, no alteration of pitch, timbre or articulation could be detected. Along the meridian, an alteration was detected within four leagues and grew with every league thereafter. We conclude that longitude is acoustically indifferent, that latitude is not, and that the only line upon the globe with any claim to be the origin of musical measurement is the one upon which this Society meets.

I. PRELIMINARY

The Conference called by the President of the United States for the purpose of fixing a prime meridian and a universal day sat at Washington from the 1st of October to the 1st of November, 1884. Delegates of twenty-five nations attended. Its second resolution, put to the vote on the 13th of October and recorded in the Final Act adopted on the 22nd, proposed to the Governments represented that the meridian passing through the centre of the transit instrument at the Observatory of Greenwich be adopted as the initial meridian for longitude. The Final Act records twenty-two votes in favour and one against, the delegation of San Domingo opposing, and the delegations of France and Brazil declining to vote.

This Society has followed the proceedings with attention, so far as the post permits; the printed protocols reached Quito by way of Panama and Guayaquil in the third week of January. We do not dispute the convenience of the arrangement for navigators, astronomers and the compilers of railway tables. We address ourselves to a question the Conference did not consider, and which no delegate appears to have raised: whether the choice of a prime meridian has any consequence for the reproduction and perception of musical sound.

We hold that it has none. We hold further that the reason it has none is instructive, and that it points to the one line upon the globe whose choice is not a matter of opinion.

II. ON THE NATURE OF LONGITUDE

The equator is not chosen. It is the great circle equidistant from the two poles of rotation, and the rotation of the Earth fixes it without the assistance of any government. An observer who had never heard of Greenwich, of Paris, or of Washington, and who possessed only a plumb line and a clear sky, would find the equator by the stars and arrive at the same line as every other observer. It is the line upon which the sun stands at the zenith upon the days of the equinoxes, and the line upon which day and night are equal in every season. It is the only parallel that is also a great circle.

No meridian possesses any such distinction. Every meridian is a great circle through both poles, and every meridian is the exact equal of every other. The globe, turning once upon its axis in each day, presents each meridian in turn to the sun, and favours none. The selection of one among them as the first is therefore a matter of agreement, and the Conference has now demonstrated, for the instruction of the scientific world, that agreement may be obtained by a show of hands.

The magnetical needle confirms the same distinction. The learned Gauss showed, in his General Theory of Terrestrial Magnetism of 1839, that the force acting upon the needle proceeds almost wholly from within the Earth, and that its general disposition is that of a magnet whose axis lies some twelve degrees from the axis about which the Earth turns. The declination of the needle varies from one longitude to another, but Dr Halley showed as long ago as 1692 that the whole pattern of the variation creeps steadily westward from year to year, and this Society recorded its concurrence in the following year. A pattern that migrates across the meridians cannot be attached to any one of them. Had the Conference sought a meridian of magnetical significance, it would have been obliged to move it every season.

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III. EXPERIMENTS UPON THE PARALLEL AND THE MERIDIAN

To put the question to experiment, the Society procured a set of tuning forks of the pattern of M. Rudolph König of Paris, of 256, 384 and 512 complete vibrations in the second, together with a phonograph of the pattern of Mr Edison, with tinfoil and mouthpiece, and a pair of telephonic receivers of the pattern of Mr Bell, to be connected by a short line for the comparison of articulation. A reference fork of 256 vibrations was kept at the Society's station upon the equatorial line throughout.

In the first series, the travelling instruments were carried eastward and westward along the equatorial parallel, by mule and on foot, to a greatest distance of thirty-eight leagues from the station, and at each halting place compared with a second fork that had been tuned against the reference fork at the station and carried with them in a padded case. No beats could be heard between the two forks at any station along the parallel, although observers attended for intervals of ten minutes. A short air recorded upon the phonograph at the station was reproduced at each halting place and pronounced by every observer to be unaltered. The telephonic receivers transmitted a passage of Cervantes, read aloud at a fixed pace, without loss of a single syllable.

In the second series, the same instruments were carried southward along the meridian of Quito, towards Riobamba. Within four leagues of the station, observers began to report an occasional beat between the travelling fork and the companion fork, at intervals of some minutes. At Riobamba, at one degree and forty minutes of southern latitude, a beat was counted once in every hundred and forty seconds. The phonograph's reproduction of the air was pronounced thin by two observers of the three, and the third declined to give an opinion. The telephonic receivers lost the final consonant of four words in the passage.

The Society has considered whether the beats observed in the second series arose from the temperature of the forks, from the fatigue of the observers, or from the ascent to the plateau of Riobamba. It has set these objections aside, the first because the forks were compared only after both had stood together in the shade for one hour, the second because observers were relieved every ten minutes, and the third because the ascent in the first series was in places greater. The beats appeared when, and only when, the latitude was changed.

IV. ON THE TELEPHONIC CONCERTS OF PARIS

The Society notes with great interest that at the International Exhibition of Electricity held at Paris in 1881, M. Clément Ader conveyed performances of the Opéra by telephonic wire to listening rooms at the Palais de l'Industrie, and that visitors who placed a separate receiver at each ear reported a remarkable impression of the singers moving upon the stage.

The Society does not doubt the accounts. It observes only that Paris lies at forty-eight degrees and fifty minutes of northern latitude, that the transmission therefore took place far from the line upon which the effects described in the preceding section vanish, and that the impression of movement reported by the listeners may in part have been the movement of the latitude itself acting upon the receivers. The Society would welcome the opportunity to receive a similar transmission upon the equatorial line, where it believes the singers would be found to stand perfectly still.

V. OBSERVATIONS UPON THE RESOLUTIONS

The Society records its respect for the delegation of France, which argued throughout the proceedings for a neutral meridian, one that should pass through no great nation and confer an advantage upon none. The Society agrees entirely with the principle and differs only in its application. No meridian can be neutral, since each passes through some territory and was chosen by some vote. The equator alone passes through the territory of many nations without having been chosen by any of them.

The Society notes the hope, expressed in the seventh resolution, that the decimal system may be extended to the division of angular space and of time. It observes that the latitude of its station is already expressed with perfect decimal economy, as zero, and requires no further reform.

Concerning the universal day, which the Conference proposed should begin at the mean midnight of Greenwich, the Society submits that a day for the whole globe should begin at a moment the whole globe can observe. It proposes for the consideration of the Governments the passage of the sun across the equator at the vernal equinox, a moment that belongs to no observatory and that this Society has adopted for the publication of its proceedings since its foundation.

VI. MEMORIAL AND CONCLUSIONS

The Society therefore resolves, and respectfully submits to the Governments represented at Washington:

First, that longitude is acoustically indifferent; that a musical sound produced upon one meridian is the same as that produced upon any other at the same latitude; and that the choice of Greenwich, of Paris, or of any other meridian as the first is a matter for navigators and has no consequence for music.

Second, that latitude is not acoustically indifferent; that the pitch of a fork, the voice of the phonograph and the articulation of the telephone are each altered by a change of latitude; and that every instrument intended for the comparison or reproduction of

musical sound should be tuned and certified with a statement of the latitude at which this was done.

Third, that the equator is the only line upon the globe established by Nature rather than by agreement, and the only proper origin for the measurement of musical sound.

The Conference has given the world a prime meridian. The Society has no objection, and asks only that it be understood for what it is. A meridian is a line that men agree to draw. The equator is a line that the Earth draws for itself.

EDITORIAL NOTE ON THE DIGITISATION (2026)

This memorial is preserved in the bound Actas of the Sociedad Ecuatorial de Quito, which Equatorial Audio regards as its intellectual forebear, and was digitised and translated from the Spanish by the Equatorial Audio Research Division in 2026. Spelling of proper names follows the original. The experimental results are reproduced as recorded and have not been repeated with modern instruments.

Two later events bear upon the memorial. France, which declined to vote at Washington, did not align its legal time with Greenwich until the law of the 9th of March, 1911, and did so without naming Greenwich: legal time in France was defined as the mean time of Paris retarded by nine minutes and twenty-one seconds. The choice of an initial meridian for longitude was left expressly outside the law. The Research Division reads the formula as a confirmation of the memorial's central claim. A meridian can be negotiated, even with itself. An equator cannot.

The second is the modern understanding of the geomagnetic field, which has confirmed both the westward drift the Society recorded and its observation that no meridian holds a fixed relation to the field. Longitude reaches the listening room through the local field, whose declination, inclination and intensity all vary from one longitude to another; present-day Equatorial Audio installation procedures already compensate all three. The Society's preference for the vernal equinox as the opening of the year is preserved in the publication calendar of the Journal of Equatorial Audio Science.

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