PREFACE
The New Magdeburg Experiments
Otto Guericke, 14 Mar 1670

The contemplation of nature, to which the blessed Basilius bears witness, is a threshold of joy, an eternal source of pleasure for the spirit, a portal of tranquility, a bridge from the celestial to the earthy and the peak of man's happiness. Attaining this, the soul seems to be aroused, as it were, from a deep lethargy and enters a region of light, forgetful of self, and assumes the role, not so much of a man touched by divinity, as that of an earth-bound deity.

That well-known verse, indeed, is true:

"If mortal souls were to understand the innermost workings of the cosmos,
Royal power and might would be nothing more to them than meaningless froth."

To attain such knowledge of nature, the art of oratory, an elegance of speech, or the ability to debate insincerely are of little account.

"For in seeking this a thousand [Demosthenes] a thousand Aristotles can be laid prostrate by a single man of mediocre talent who has seized upon a better way to find the truth. Such a hope, therefore, must be removed: for indeed, men, more learned and superior to us in book-learning, will be found who, to the shame of nature itself, can make that which is, in fact, false, true." Galileo, *Dialogus Cosmici*, page 35.

Therefore, theories which are demonstrated by experiment and visual perception must be preferred to those derived from reasoning, however probable and plausible, for many things seem true in speculation and discussion which in actual fact defy reality.

"It follows from this that all science is empty, deceptive, and pointless unless it is supported by experiment. What inconsistencies otherwise successful and perceptive scholars bring forth without its help! It is experimentation that dissolves all doubts, reconciles difficulties, is a unique teacher of truth, furnishes a torch in darkness and instructs us how to determine the true causes of things by disentangling knotty problems." Kircher, *Ars Magnetica*, page 570.

Thus scientists who rely upon their conjectures and hypotheses alone, repudiating experimentation, can make no conclusive statements about the nature of the world, for when man does not rely
upon experiments, he often wanders so far from the truth as the sun which we see is distant from the earth.

Gilbert Clerke very recently acknowledged this fact in the Preface of his book, De Plenitudine Mundi, where he writes:

"Natural science at one time was dependent upon debatable and dubious assertions, (expressed in sesquipedalian words), designed to deceive true scientists and other scholars rather than to enlighten them."

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"So it has happened that a man who, thanks to his argumentative powers would acquire some sort of shadow or delusion of truth, but truth itself and that, putting aside controversy, natural science would come to be allied with mathematical science. This is not the task of one age nor a single individual to bring to fruition, but neither need we doubt (when one scholar after another supports this same kind of research) that finally with the new mysteries of nature being removed daily and the dark night of errors dispelled, truth, in all its purity, (insofar as the innate weakness of humankind allows) will appear and the marriage torches lighted.

"Indeed, in the present state of affairs, it pains me that up to this time, I have seen a certain need for dissertation and arguing back and forth while the leaders of this new science dispute about the composition and plenitude of the world and trip over the threshold of knowledge, etc."

Because, in truth, scholars have sharply disputed with one another for a long time the question of the vacuum (does it exist or not? or what is it?) and each one has defended his theory like a determined soldier defending a stronghold against an attacking enemy, for this reason I felt a burning desire to investigate the truth of this question which has been a source of dispute, not being able to lay my feelings to rest nor extinguish them by experiment involving the very experiment they performed this enterprise were not unrewarded: indeed they prove the existence of it had been denied.

Later on, when I had learned of the Imperial Diet being held in the followers of these kinds of mentioned experiments: they demonstrated some of them and I was considering the limits of man.

At the conclusion of the breaking up, my experiments were on the point of least demonstrated before their Imperial Majesty as well as other were the point of least demonstrated before their under the circumstances.

These experiments were made by the Noble Elector Johann Philip of Würzburg, who of all the statesmen and workmen and so, at the request of the experimental instruments is a financial consideration.

As soon as the Reverend professors of the public University of the same Eminent Mine, they wrote out a description of them to the scholars in Religion sought their opinions. And in was the Reverend Father at the same university, who sought more information. Appendix to his book, De Plenitudine Mundi published in 1657, these they "Magdeburgica:" these be available for many to read. After these experiments many others that I had in turn were published by the book of Technica Curiosa which
to rest nor extinguish them until I should find time to carry out an experiment involving the vacuum. I performed this experiment in a number of ways and my efforts were not unrewarded: indeed, I designed several pieces of apparatus to prove the existence of that vacuum whose existence had always been denied.

Later on, when I had been sent on behalf of the state to the Imperial Diet being held in Regensburg in 1554 several enthusiastic followers of these kinds of investigations had heard about my aforementioned experiments: they succeeded in convincing me to demonstrate some of them and I endeavored to do this insofar as I could, considering the limits of my capabilities.

At the conclusion of the meetings of the Diet and when it was breaking up, my experiments were brought to the notice of His Imperial Majesty as well as the Electors and several Princes who were on the point of leaving but wished to see my experiments demonstrated before their departure. I could not refuse their request under the circumstances.

These experiments were of particular interest to His Eminence the Noble Elector Johann Philipp, Archbishop of Mainz and Bishop of Würzburg, who of all the spectators present, persuaded me to make a similar piece of apparatus for himself. Because of the limitations of time, however, this apparatus could not be reproduced by my workmen and so, at the request of His Eminence, I handed over the experimental instruments I had brought with me to Regensburg for a financial consideration.

As soon as the Reverend Fathers of the Society of Jesus and the professors of the public University of Würzburg, under the chairmanship of the same Eminent Elector, had verified these experiments of mine, they wrote out a draft of their findings and communicated them to the scholars in Rome and elsewhere and at the same time sought their opinions. Among this group of particular importance was the Reverend Father [Kaspar Schott], Professor of Mathematics at the same university, who wrote me regarding the experiments and sought more information about them. Ultimately he added, as an Appendix to his book, De Arte Mechanica Hydraulico-Pneumatica, published in 1657, these “Experimenta Nova” of mine and called them “Magdeburgica.” These were set up in type so that they might be available for many to read and study.

After these experiments had been exposed to public scrutiny, many others that I had hitherto carried out were added. These, in turn were published by the aforementioned Father Schott in Book I of Technica Curiosa which dealt with the Magdeburgica Mirabilia,
published in 1664, together with the *Antiqua Experimenta Magdeburgica* and the *Nova Experimenta Magdeburgica*. In addition to Father Schott, other scholars were found who wrote on this same subject and, indeed, almost every one who saw the apparatus and the results stemming from the experiments was seized with astonished admiration. And just as the Reverend Father Schott attests in the Foreward to his *Technica Curiosa*, page 3, and other places as well), “I do not hesitate to speak openly and declare without qualification that I have never seen nor heard of any experiments of this kind more worthy of admiration nor read nor even imagined such, and I do not believe that the sun ever shone upon anything like them from Time Immemorial. And I might add, this is the judgment of powerful princes and learned scholars as well, with whom I have been in communication as regards these experiments, etc.” So these feelings will be made abundantly clear by everyone else everywhere who has brought forth treatises on this subject.

Although, in fact, it was never my intention to have my experiments printed and published, nevertheless the very diverse judgments of the “De Vacuo” of which some approve and others attack the contents, in order that no one could be surprised by so many different and often remarkably confused concepts and at the same time satisfy those who urgently asked for a clarification of these experiments, I undertook the publication of the treatise, *De Spatio Vacuo* in its entirety for its advantage in providing a deeper understanding of the field of natural science. I finished the work on the 14th of March, 1663; I did not seek to correct nor refute the numerous and frequently inconsistent opinions of philosophers (except briefly in Chapters 35 and 36 of Book III where at least the usual and typical objections of the Reverend Fathers and professors, who are named explicitly in the Appendix of Schott’s *Ars Hydraulico-Pneumatica*, are discussed). Indeed, such a treatise would be too long-winded and tedious for the reader to encompass. Rather, its aim is to recall from ingrained and poorly conceived imaginings all who do not labor under preconceived opinions but regard the experiments dispassionately and weigh them on the fair scale of truth, having acquired from them rich experience and knowledge Indeed, when there is evidence from facts, words are not necessary. One need not dispute and take up arms against an opponent who denies experiments that are completely reliable; let such a one keep for himself his own opinion and dig in the dark like a mole. An exact science does not march into battle but celebrates its victory and rests in the deep tranquility of truth. Other branches of science, however, are subject to controversy because they are devoid of the rational certitude in which an exact science is rich. So it has wandered for a long time, finally comes to find rest in a suitable place.

As for the form in which to be eloquent nor elegant in my use of words, I shall concern myself rather with the other way of adequately described verbs to be omitted or reduced says, “Speak with many words. And although this book, I mentioned, I was hindered in part by a series of business that remained in the desk for a long time, distinguished men, together with affairs that knowledge without being substantiated to my vacillation, enable me longer in bringing out this work did not want to disregard Just as all things are not to be surmise that opponents will not no one be persuaded otherwise and following who embarrassed. And indeed, (to quote the Latin) does not suffer from some of mankind. For as often as reproach a man for his error itself.”

For this reason, one shall be able to bring forth any work we sometimes commit errors in the same vein must respect the honest man make of results established by experiment. In admit another conclusion to be ready to recognize the Before all else, however, the work be encompassed by those not slip out from these confused with faith or belief the principles of natural science
exact science is rich. So it comes about that the human spirit, after it has wandered for a long time in the circle of arts and science finally comes to find rest in the certain knowledge of an exact science.

As for the form in which this treatise is presented, it is not intended to be eloquent nor elegant in verbiage: however, if there is any fault in my use of words, I should like to be excused, because we are concerned with facts, not words which are only in the service of facts rather than the other way around. Indeed, all things could not be adequately described verbally, but often for the sake of brevity, had to be omitted or reduced to the common idiom as the old proverb says, “Speak with many words but think with a few.”

And although this book had been completed seven years ago, as I mentioned, I was hindered in its publication in part by illness and in part by a series of business commitments. This work would have remained in the desk for a still longer time, however, had not several distinguished men, together with Lukian, thinking it a wretched state of affairs that knowledge was being drained from the books alone without being substantiated by any published experiments, put an end to my vacillation, encouraging me not to hesitate and refuse any longer in bringing out this work for general use. For this reason I did not want to disregard their wishes for its publication.

Just as all things are not pleasing to everyone, so one can easily surmise that opponents will not be lacking, as the proverb says, “Let no one be persuaded otherwise, for he is going to have both enemies and followers who embarks upon great undertakings.”

And indeed, (to quote from Seneca), there is no mortal man who does not suffer from some sort of ignorance; “this is an age-old ill of mankind. For as often as a man errs, he errs like a man. To reproach a man for his erring, however, is to reproach humankind itself.”

For this reason, one should not expect to be so fortunate as to be able to bring forth any work that is flawless. Indeed, for our part, we sometimes commit errors in pointing out the faults of others and in the same vein must readily accept the criticism thoughtful and honest men make of results found in this work which are not substantiated by experiment. In this situation, when we learn or have to admit another conclusion that is better and perhaps correct, we must be ready to recognize the truth.

Before all else, however, it is our wish that the contents of this work be encompassed by the cloistered walls of natural science and not slip out from these confines into other fields that are perhaps mixed with faith or belief: rather, this treatise must be limited by the principles of natural science alone made manifest by experiment.
tation. But should some thoughtless or inadvertent remark slip out contrary to our intention, however, we should like to retract this statement herewith. We grant to everyone the freedom of dissent but for our part we are prepared to follow truth rather than agreement for the sake of harmony. As for the rest, we believe that there will be no lack of keen and perspicacious minds, being stimulated by my experiments to arrive at perhaps better and deeper insights, who are going to undertake this work at some future time. And so farewell, gracious reader, and regard our efforts in good part.

Written in Magdeburg, the 14th of March, 1670

DEDICATED TO THE “EXPERIMENTA NOVA MAGDEBURGICA” OF THE MOST DISTINGUISHED AND EXCELLENT GENTLEMAN, OTTO VON GUERICKE

To delve into the manifold mysteries of nature is the task of an inquiring and fertile mind.
To follow the tortuous paths of nature’s wondrous ways is work more difficult and not designed for everyone.
You, Distinguished Sir, Magdeburg knows as its Burghermaster as well as an outstanding researcher in the field of science.
Whether one speaks with you informally or studies your work alone, he soon will confirm your genius openly and without a feeling of doubt.
May I make a small joke? While you prove quite clearly that a vacuum exists in your Book, there is not a vacuum to be seen!

In this insignificant poem, I have set down no insignificant proof of my eternal gratitude to my most excellent patron with warm wishes for a long life.

Johannes von Gersdorf
Nobleman of Lausitz

SHORT BIOGRAPHY

Otto Guericke, the son of a tailor, was a descendant of an old family that occupied positions of authority for several hundred years.
Destined to enter politics, he was enrolled as a student in the Faculty of Law at the University of Leipzig. However, he preferred to attend the university of Magdeburg and later attended lectures on mathematics.

Upon completing his studies, he became a member of the City Council and eventually was elected as a city officer. He supervised the city's fortifications and was instrumental in the city's development.

In 1626, Guericke married a wealthy widow, Anna Maria von Wartenberg, and had a surviving child, a son named Otto. In 1645, he married Marie von der Heydt.
Shortly after his second marriage, Guericke's mother-in-law died, and Guericke had to retire from public life due to his advanced years.

Because Magdeburg was strategically important, it was a target of the Thirty years War with witchcraft trials. Guericke was involved in witchcraft trials at this time, particularly those related to the development of modern capitalism, which resulted in its decline.

Guericke left Magdeburg in 1653 and went to Berlin, where he served as a trusted advisor to King John and Chief Siege Engineer.