

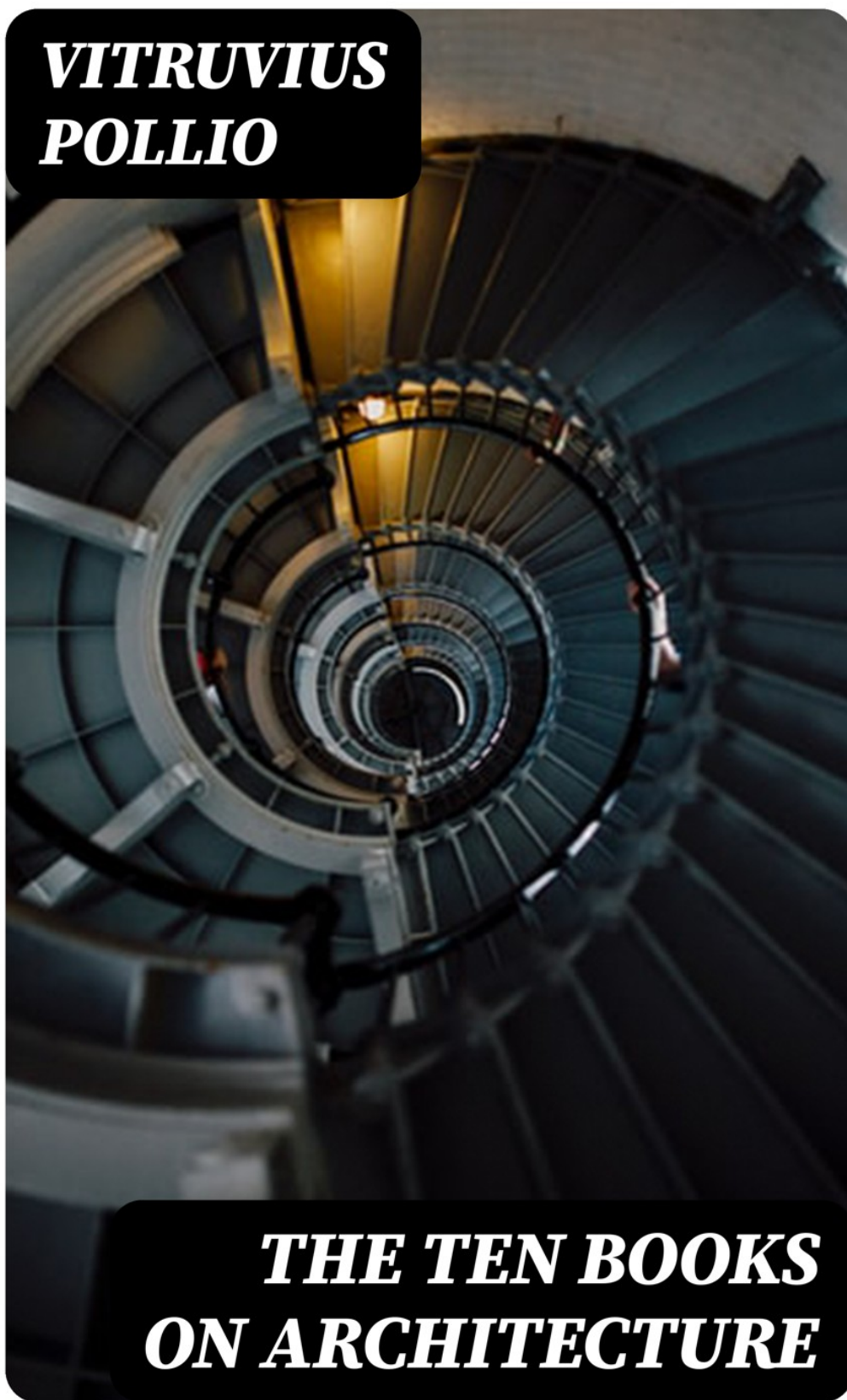


***VITRUVIUS
POLLIO***

***THE TEN BOOKS
ON ARCHITECTURE***

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POLLIO***

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ON ARCHITECTURE***



Vitruvius Pollio

The Ten Books on Architecture

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PREFACE

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During the last years of his life, Professor Morgan had devoted much time and energy to the preparation of a translation of Vitruvius, which he proposed to supplement with a revised text, illustrations, and notes. He had completed the translation, with the exception of the last four chapters of the tenth book, and had discussed, with Professor Warren, the illustrations intended for the first six books of the work; the notes had not been arranged or completed, though many of them were outlined in the manuscript, or the intention to insert them indicated. The several books of the translation, so far as it was completed, had been read to a little group of friends, consisting of Professors Sheldon and Kittredge, and myself, and had received our criticism, which had, at times, been utilized in the revision of the work.

After the death of Professor Morgan, in spite of my obvious incompetency from a technical point of view, I undertook, at the request of his family, to complete the translation, and to see the book through the press. I must, therefore, assume entire responsibility for the translation of the tenth book, beginning with chapter thirteen, and further responsibility for necessary changes made by me in the earlier part of the translation, changes which, in no case, affect any theory held by Professor Morgan, but which involve mainly the adoption of simpler forms of statement, or the correction of obvious oversights.

The text followed is that of Valentine Rose in his second edition (Leipzig, 1899), and the variations from this text are, with a few exceptions which are indicated in the footnotes, in the nature of a return to the consensus of the manuscript readings.

The illustrations in the first six books are believed to be substantially in accord with the wishes of Professor Morgan. The suggestions for illustrations in the later books were incomplete, and did not indicate, in all cases, with sufficient definiteness to allow them to be executed, the changes from conventional plans and designs intended by the translator. It has, therefore, been decided to include in this part of the work only those illustrations which are known to have had the full approval of Professor Morgan. The one exception to this principle is the reproduction of a rough model of the Ram of Hegetor, constructed by me on the basis of the measurements given by Vitruvius and Athenaeus.

It does not seem to me necessary or even advisable to enter into a long discussion as to the date of Vitruvius, which has been assigned to various

periods from the time of Augustus to the early centuries of our era. Professor Morgan, in several articles in the *Harvard Studies in Classical Philology*, and in the *Proceedings of the American Academy*, all of which have been reprinted in a volume of *Addresses and Essays* (New York, 1909), upheld the now generally accepted view that Vitruvius wrote in the time of Augustus, and furnished conclusive evidence that nothing in his language is inconsistent with this view. In revising the translation, I met with one bit of evidence for a date before the end of the reign of Nero which I have never seen adduced. In viii, 3, 21, the kingdom of Cottius is mentioned, the name depending, it is true, on an emendation, but one which has been universally accepted since it was first proposed in 1513. The kingdom of Cottius was made into a Roman province by Nero (cf. Suetonius, *Nero*, 18), and it is inconceivable that any Roman writer subsequently referred to it as a kingdom.

It does seem necessary to add a few words about the literary merits of Vitruvius in this treatise, and about Professor Morgan's views as to the general principles to be followed in the translation.

Vitruvius was not a great literary personage, ambitious as he was to appear in that character. As Professor Morgan has aptly said, "he has all the marks of one unused to composition, to whom writing is a painful task." In his hand the measuring-rod was a far mightier implement than the pen. His turgid and pompous rhetoric displays itself in the introductions to the different books, where his exaggerated effort to introduce some semblance of style into his commonplace lectures on the noble principles which should govern the conduct of the architect, or into the prosaic lists of architects and writers on architecture, is everywhere apparent. Even in the more technical portions of his work, a like conscious effort may be detected, and, at the same time, a lack of confidence in his ability to express himself in unmistakable language. He avoids periodic sentences, uses only the simpler subjunctive constructions, repeats the antecedent in relative clauses, and, not infrequently, adopts a formal language closely akin to that of specifications and contracts, the style with which he was, naturally, most familiar. He ends each book with a brief summary, almost a formula, somewhat like a sigh of relief, in which the reader unconsciously shares. At times his meaning is ambiguous, not because of grammatical faults, which are comparatively few and unimportant, but because, when he does attempt a periodic sentence, he becomes involved, and finds it difficult to extricate himself.

Some of these peculiarities and crudities of expression Professor Morgan purposely imitated, because of his conviction that a translation should not merely reproduce the substance of a book, but should also give as clear a picture as possible of the original, of its author, and of the working of his mind. The translation is intended, then, to be faithful and exact, but it

deliberately avoids any attempt to treat the language of Vitruvius as though it were Ciceronian, or to give a false impression of conspicuous literary merit in a work which is destitute of that quality. The translator had, however, the utmost confidence in the sincerity of Vitruvius and in the serious purpose of his treatise on architecture.

To those who have liberally given their advice and suggestions in response to requests from Professor Morgan, it is impossible for me to make adequate acknowledgment. Their number is so great, and my knowledge of the indebtedness in individual cases is so small, that each must be content with the thought of the full and generous acknowledgment which he would have received had Professor Morgan himself written this preface.

Personally I am under the greatest obligations to Professor H. L. Warren, who has freely given both assistance and criticism; to Professor G. L. Kittredge, who has read with me most of the proof; to the Syndics of the Harvard University Press, who have made possible the publication of the work; and to the members of the Visiting Committee of the Department of the Classics and the classmates of Professor Morgan, who have generously supplied the necessary funds for the illustrations.

ALBERT A. HOWARD.

VITRUVIUS

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BOOK I

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PREFACE

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1. While your divine intelligence and will, Emperor Caesar, were engaged in acquiring the right to command the world, and while your fellow citizens, when all their enemies had been laid low by your invincible valour, were glorying in your triumph and victory—while all foreign nations were in subjection awaiting your beck and call, and the Roman people and senate, released from their alarm, were beginning to be guided by your most noble conceptions and policies, I hardly dared, in view of your serious employments, to publish my writings and long considered ideas on architecture, for fear of subjecting myself to your displeasure by an unseasonable interruption.

2. But when I saw that you were giving your attention not only to the welfare of society in general and to the establishment of public order, but also to the providing of public buildings intended for utilitarian purposes, so that not only should the State have been enriched with provinces by your means, but that the greatness of its power might likewise be attended with distinguished authority in its public buildings, I thought that I ought to take the first opportunity to lay before you my writings on this theme. For in the first place it was this subject which made me known to your father, to whom I was devoted on account of his great qualities. After the council of heaven gave him a place in the dwellings of immortal life and transferred your father's power to your hands, my devotion continuing unchanged as I remembered him inclined me to support you. And so with Marcus Aurelius, Publius Minidius, and Gnaeus Cornelius, I was ready to supply and repair ballistae, scorpiones, and other artillery, and I have received rewards for good service with them. After your first bestowal of these upon me, you continued to renew them on the recommendation of your sister.

3. Owing to this favour I need have no fear of want to the end of my life, and being thus laid under obligation I began to write this work for you, because I saw that you have built and are now building extensively, and that in future also you will take care that our public and private buildings shall be worthy to go down to posterity by the side of your other splendid achievements. I have drawn up definite rules to enable you, by observing them, to have personal knowledge of the quality both of existing buildings and of those which are yet to be constructed. For in the following books I have disclosed all the principles of the art.

CHAPTER I

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THE EDUCATION OF THE ARCHITECT

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1. The architect should be equipped with knowledge of many branches of study and varied kinds of learning, for it is by his judgement that all work done by the other arts is put to test. This knowledge is the child of practice and theory. Practice is the continuous and regular exercise of employment where manual work is done with any necessary material according to the design of a drawing. Theory, on the other hand, is the ability to demonstrate and explain the productions of dexterity on the principles of proportion.

2. It follows, therefore, that architects who have aimed at acquiring manual skill without scholarship have never been able to reach a position of authority to correspond to their pains, while those who relied only upon theories and scholarship were obviously hunting the shadow, not the substance. But those who have a thorough knowledge of both, like men armed at all points, have the sooner attained their object and carried authority with them.

3. In all matters, but particularly in architecture, there are these two points:—the thing signified, and that which gives it its significance. That which is signified is the subject of which we may be speaking; and that which gives significance is a demonstration on scientific principles. It appears, then, that one who professes himself an architect should be well versed in both directions. He ought, therefore, to be both naturally gifted and amenable to instruction. Neither natural ability without instruction nor instruction without natural ability can make the perfect artist. Let him be educated, skilful with the pencil, instructed in geometry, know much history, have followed the philosophers with attention, understand music, have some knowledge of medicine, know the opinions of the jurists, and be acquainted with astronomy and the theory of the heavens.

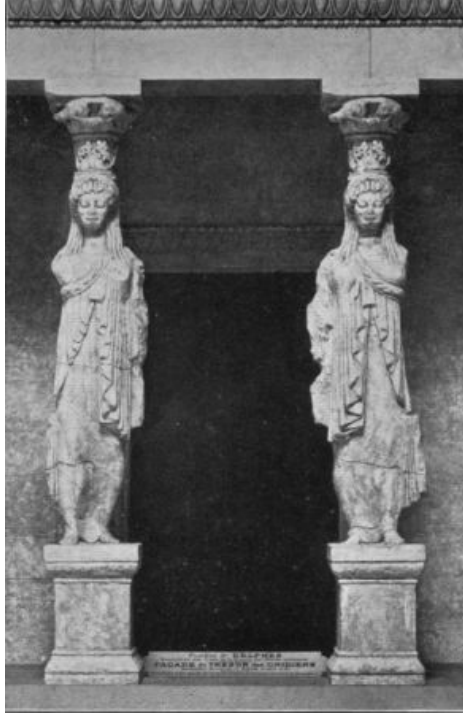
4. The reasons for all this are as follows. An architect ought to be an educated man so as to leave a more lasting remembrance in his treatises. Secondly, he must have a knowledge of drawing so that he can readily make sketches to show the appearance of the work which he proposes. Geometry, also, is of much assistance in architecture, and in particular it

teaches us the use of the rule and compasses, by which especially we acquire readiness in making plans for buildings in their grounds, and rightly apply the square, the level, and the plummet. By means of optics, again, the light in buildings can be drawn from fixed quarters of the sky. It is true that it is by arithmetic that the total cost of buildings is calculated and measurements are computed, but difficult questions involving symmetry are solved by means of geometrical theories and methods.

5. A wide knowledge of history is requisite because, among the ornamental parts of an architect's design for a work, there are many the underlying idea of whose employment he should be able to explain to Greek inquirers. For instance, suppose him to set up the marble statues of women in long robes, called Caryatides, to take the place of columns, with the mutules and coronas placed directly above their heads, he will give the following explanation to his questioners. Caryae, a state in Peloponnesus, sided with the Persian enemies against Greece; later the Greeks, having gloriously won their freedom by victory in the war, made common cause and declared war against the people of Caryae. They took the town, killed the men, abandoned the State to desolation, and carried off their wives into slavery, without permitting them, however, to lay aside the long robes and other marks of their rank as married women, so that they might be obliged not only to march in the triumph but to appear forever after as a type of slavery, burdened with the weight of their shame and so making atonement for their State. Hence, the architects of the time designed for public buildings statues of these women, placed so as to carry a load, in order that the sin and the punishment of the people of Caryae might be known and handed down even to posterity.



Photo. H. B. Warren
CARYATIDES OF THE ERECHTHEUM
AT ATHENS



CARYATIDES FROM THE TREASURY OF THE
CNIDIANS AT DELPHI



Photo. Anderson
CARYATIDES NOW IN THE VILLA
ALBANI AT ROME

6. Likewise the Lacedaemonians under the leadership of Pausanias, son of Agesipolis, after conquering the Persian armies, infinite in number,



CARYATIDES
(From the edition of Vitruvius by Fra Giocondo, Venice, 1511)

with a small force at the battle of Plataea, celebrated a glorious triumph with the spoils and booty, and with the money obtained from the sale thereof built the Persian Porch, to be a monument to the renown and valour of the people and a trophy of victory for posterity. And there they set

effigies of the prisoners arrayed in barbarian costume and holding up the roof, their pride punished by this deserved affront, that enemies might tremble for fear of the effects of their courage, and that their own people, looking upon this ensample of their valour and encouraged by the glory of it, might be ready to defend their independence. So from that time on, many have put up statues of Persians supporting entablatures and their ornaments, and thus from that motive have greatly enriched the diversity of their works. There are other stories of the same kind which architects ought to know.

7. As for philosophy, it makes an architect high-minded and not self-assuming, but rather renders him courteous, just, and honest without avariciousness. This is very important, for no work can be rightly done without honesty and incorruptibility. Let him not be grasping nor have his mind preoccupied with the idea of receiving perquisites, but let him with dignity keep up his position by cherishing a good reputation. These are among the precepts of philosophy. Furthermore philosophy treats of physics (in Greek φυσιολογία) where a more careful knowledge is required because the problems which come under this head are numerous and of very different kinds; as, for example, in the case of the conducting of water. For at points of intake and at curves, and at places where it is raised to a level, currents of air naturally form in one way or another; and nobody who has not learned the fundamental principles of physics from philosophy will be able to provide against the damage which they do. So the reader of Ctesibius or Archimedes and the other writers of treatises of the same class will not be able to appreciate them unless he has been trained in these subjects by the philosophers.

8. Music, also, the architect ought to understand so that he may have knowledge of the canonical and mathematical theory, and besides be able to tune ballistae, catapultae, and scorpiones to the proper key. For to the right and left in the beams are the holes in the frames through which the strings of twisted sinew are stretched by means of windlasses and bars, and these strings must not be clamped and made fast until they give the same correct note to the ear of the skilled workman. For the arms thrust through those stretched strings must, on being let go, strike their blow together at the same moment; but if they are not in unison, they will prevent the course of projectiles from being straight.



PERSIANS

(From the edition of Vitruvius by Fra Giocondo, Venice, 1511)

9. In theatres, likewise, there are the bronze vessels (in Greek ἤχεια) which are placed in niches under the seats in accordance with the musical intervals on mathematical principles. These vessels are arranged with a view to musical concords or harmony, and apportioned in the compass of the fourth, the fifth, and the octave, and so on up to the double octave, in such a way that when the voice of an actor falls in unison with any of them its power is increased, and it reaches the ears of the audience with greater clearness and sweetness. Water organs, too, and the other instruments which resemble them cannot be made by one who is without the principles of music.

10. The architect should also have a knowledge of the study of medicine on account of the questions of climates (in Greek κλίματα), air, the healthiness and unhealthiness of sites, and the use of different waters. For without these considerations, the healthiness of a dwelling cannot be assured. And as for principles of law, he should know those which are necessary in the case of buildings having party walls, with regard to water dripping from the eaves, and also the laws about drains, windows, and water supply. And other things of this sort should be known to architects, so that, before they begin upon buildings, they may be careful not to leave disputed points for the householders to settle after the works are finished, and so that in drawing up contracts the interests of both employer and contractor may be wisely safe-guarded. For if a contract is skilfully drawn, each may obtain a release from the other without disadvantage. From astronomy we find the east, west, south, and north, as well as the theory of the heavens, the equinox, solstice, and courses of the stars. If one has no knowledge of these matters, he will not be able to have any comprehension of the theory of sundials.

11. Consequently, since this study is so vast in extent, embellished and enriched as it is with many different kinds of learning, I think that men

have no right to profess themselves architects hastily, without having climbed from boyhood the steps of these studies and thus, nursed by the knowledge of many arts and sciences, having reached the heights of the holy ground of architecture.

12. But perhaps to the inexperienced it will seem a marvel that human nature can comprehend such a great number of studies and keep them in the memory. Still, the observation that all studies have a common bond of union and intercourse with one another, will lead to the belief that this can easily be realized. For a liberal education forms, as it were, a single body made up of these members. Those, therefore, who from tender years receive instruction in the various forms of learning, recognize the same stamp on all the arts, and an intercourse between all studies, and so they more readily comprehend them all. This is what led one of the ancient architects, Pytheos, the celebrated builder of the temple of Minerva at Priene, to say in his Commentaries that an architect ought to be able to accomplish much more in all the arts and sciences than the men who, by their own particular kinds of work and the practice of it, have brought each a single subject to the highest perfection. But this is in point of fact not realized.

13. For an architect ought not to be and cannot be such a philologist as was Aristarchus, although not illiterate; nor a musician like Aristoxenus, though not absolutely ignorant of music; nor a painter like Apelles, though not unskilful in drawing; nor a sculptor such as was Myron or Polyclitus, though not unacquainted with the plastic art; nor again a physician like Hippocrates, though not ignorant of medicine; nor in the other sciences need he excel in each, though he should not be unskilful in them. For, in the midst of all this great variety of subjects, an individual cannot attain to perfection in each, because it is scarcely in his power to take in and comprehend the general theories of them.

14. Still, it is not architects alone that cannot in all matters reach perfection, but even men who individually practise specialties in the arts do not all attain to the highest point of merit. Therefore, if among artists working each in a single field not all, but only a few in an entire generation acquire fame, and that with difficulty, how can an architect, who has to be skilful in many arts, accomplish not merely the feat—in itself a great marvel—of being deficient in none of them, but also that of surpassing all those artists who have devoted themselves with unremitting industry to single fields?

15. It appears, then, that Pytheos made a mistake by not observing that the arts are each composed of two things, the actual work and the theory of it. One of these, the doing of the work, is proper to men trained in the individual subject, while the other, the theory, is common to all scholars: for

example, to physicians and musicians the rhythmical beat of the pulse and its metrical movement. But if there is a wound to be healed or a sick man to be saved from danger, the musician will not call, for the business will be appropriate to the physician. So in the case of a musical instrument, not the physician but the musician will be the man to tune it so that the ears may find their due pleasure in its strains.

16. Astronomers likewise have a common ground for discussion with musicians in the harmony of the stars and musical concords in tetrads and triads of the fourth and the fifth, and with geometricians in the subject of vision (in Greek λόγος ὀπτικός); and in all other sciences many points, perhaps all, are common so far as the discussion of them is concerned. But the actual undertaking of works which are brought to perfection by the hand and its manipulation is the function of those who have been specially trained to deal with a single art. It appears, therefore, that he has done enough and to spare who in each subject possesses a fairly good knowledge of those parts, with their principles, which are indispensable for architecture, so that if he is required to pass judgement and to express approval in the case of those things or arts, he may not be found wanting. As for men upon whom nature has bestowed so much ingenuity, acuteness, and memory that they are able to have a thorough knowledge of geometry, astronomy, music, and the other arts, they go beyond the functions of architects and become pure mathematicians. Hence they can readily take up positions against those arts because many are the artistic weapons with which they are armed. Such men, however, are rarely found, but there have been such at times; for example, Aristarchus of Samos, Philolaus and Archytas of Tarentum, Apollonius of Perga, Eratosthenes of Cyrene, and among Syracusans Archimedes and Scopinas, who through mathematics and natural philosophy discovered, expounded, and left to posterity many things in connexion with mechanics and with sundials.

17. Since, therefore, the possession of such talents due to natural capacity is not vouchsafed at random to entire nations, but only to a few great men; since, moreover, the function of the architect requires a training in all the departments of learning; and finally, since reason, on account of the wide extent of the subject, concedes that he may possess not the highest but not even necessarily a moderate knowledge of the subjects of study, I request, Caesar, both of you and of those who may read the said books, that if anything is set forth with too little regard for grammatical rule, it may be pardoned. For it is not as a very great philosopher, nor as an eloquent rhetorician, nor as a grammarian trained in the highest principles of his art, that I have striven to write this work, but as an architect who has had only a dip into those studies. Still, as regards the efficacy of the art and the theories of it, I promise and expect that in these volumes I shall undoubtedly show myself of very considerable importance not only to builders but also to all scholars.

CHAPTER II

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THE FUNDAMENTAL PRINCIPLES OF ARCHITECTURE

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1. Architecture depends on Order (in Greek τάξις), Arrangement (in Greek διάθεσις), Eurythmy, Symmetry, Propriety, and Economy (in Greek οἰκονομία).

2. Order gives due measure to the members of a work considered separately, and symmetrical agreement to the proportions of the whole. It is an adjustment according to quantity (in Greek ποσότης). By this I mean the selection of modules from the members of the work itself and, starting from these individual parts of members, constructing the whole work to correspond. Arrangement includes the putting of things in their proper places and the elegance of effect which is due to adjustments appropriate to the character of the work. Its forms of expression (Greek ἰδέαι) are these: groundplan, elevation, and perspective. A groundplan is made by the proper successive use of compasses and rule, through which we get outlines for the plane surfaces of buildings. An elevation is a picture of the front of a building, set upright and properly drawn in the proportions of the contemplated work. Perspective is the method of sketching a front with the sides withdrawing into the background, the lines all meeting in the centre of a circle. All three come of reflexion and invention. Reflexion is careful and laborious thought, and watchful attention

directed to the agreeable effect of one's plan. Invention, on the other hand, is the solving of intricate problems and the discovery of new principles by means of brilliancy and versatility. These are the departments belonging under Arrangement.

3. Eurythmy is beauty and fitness in the adjustments of the members. This is found when the members of a work are of a height suited to their breadth, of a breadth suited to their length, and, in a word, when they all correspond symmetrically.

4. Symmetry is a proper agreement between the members of the work itself, and relation between the different parts and the whole general scheme, in accordance with a certain part selected as standard. Thus in the human body there is a kind of symmetrical harmony between forearm, foot, palm, finger, and other small parts; and so it is with perfect buildings. In the case of temples, symmetry may be calculated from the thickness of a column, from a triglyph, or even from a module; in the ballista, from the hole or from what the Greeks call the περίτρητος; in a ship, from the space between the tholepins διάπηγμα; and in other things, from various members.

5. Propriety is that perfection of style which comes when a work is authoritatively constructed on approved principles. It arises from prescription (Greek: θεματισμός), from usage, or from nature. From prescription, in the case of hypaethral edifices, open to the sky, in honour of Jupiter Lightning, the Heaven, the Sun, or the Moon: for these are gods whose semblances and manifestations we behold before our very eyes in the sky when it is cloudless and bright. The temples of Minerva, Mars, and Hercules, will be Doric, since the virile strength of these gods makes daintiness entirely inappropriate to their houses. In temples to Venus, Flora, Proserpine, Spring-Water, and the Nymphs, the Corinthian

order will be found to have peculiar significance, because these are delicate divinities and so its rather slender outlines, its flowers, leaves, and ornamental volutes will lend propriety where it is due. The construction of temples of the Ionic order to Juno, Diana, Father Bacchus, and the other gods of that kind, will be in keeping with the middle position which they hold; for the building of such will be an appropriate combination of the severity of the Doric and the delicacy of the Corinthian.

6. Propriety arises from usage when buildings having magnificent interiors are provided with elegant entrance-courts to correspond; for there will be no propriety in the spectacle of an elegant interior approached by a low, mean entrance. Or, if dentils be carved in the cornice of the Doric entablature or triglyphs represented in the Ionic entablature over the cushion-shaped capitals of the columns, the effect will be spoilt by the transfer of the peculiarities of the one order of building to the other, the usage in each class having been fixed long ago.

7. Finally, propriety will be due to natural causes if, for example, in the case of all sacred precincts we select very healthy neighbourhoods with suitable springs of water in the places where the fanes are to be built, particularly in the case of those to Aesculapius and to Health, gods by whose healing powers great numbers of the sick are apparently cured. For when their diseased bodies are transferred from an unhealthy to a healthy spot, and treated with waters from health-giving springs, they will the more speedily grow well. The result will be that the divinity will stand in higher esteem and find his dignity increased, all owing to the nature of his site. There will also be natural propriety in using an eastern light for bedrooms and libraries, a western light in winter for baths and winter apartments, and a northern light for picture galleries and other places in which a steady light is needed; for that quarter of the sky grows

neither light nor dark with the course of the sun, but remains steady and unshifting all day long.

8. Economy denotes the proper management of materials and of site, as well as a thrifty balancing of cost and common sense in the construction of works. This will be observed if, in the first place, the architect does not demand things which cannot be found or made ready without great expense. For example: it is not everywhere that there is plenty of pitsand, rubble, fir, clear fir, and marble, since they are produced in different places and to assemble them is difficult and costly. Where there is no pitsand, we must use the kinds washed up by rivers or by the sea; the lack of fir and clear fir may be evaded by using cypress, poplar, elm, or pine; and other problems we must solve in similar ways.

9. A second stage in Economy is reached when we have to plan the different kinds of dwellings suitable for ordinary householders, for great wealth, or for the high position of the statesman. A house in town obviously calls for one form of construction; that into which stream the products of country estates requires another; this will not be the same in the case of money-lenders and still different for the opulent and luxurious; for the powers under whose deliberations the commonwealth is guided dwellings are to be provided according to their special needs: and, in a word, the proper form of economy must be observed in building houses for each and every class.

CHAPTER III

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THE DEPARTMENTS OF ARCHITECTURE

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1. There are three departments of architecture: the art of building, the making of timepieces, and the construction of machinery. Building is, in its turn, divided into two parts, of which the first is the construction of fortified towns and of works for general use in public places, and the second is the putting up of structures for private individuals. There are three classes of public buildings: the first for defensive, the second for religious, and the third for utilitarian purposes. Under defence comes the planning of walls, towers, and gates, permanent devices for resistance against hostile attacks; under religion, the erection of fanes and temples to the immortal gods; under utility, the provision of meeting places for public use, such as harbours, markets, colonnades, baths, theatres, promenades, and all other similar arrangements in public places.

2. All these must be built with due reference to durability, convenience, and beauty. Durability will be assured when foundations are carried down to the solid ground and materials wisely and liberally selected; convenience, when the arrangement of the apartments is faultless and presents no hindrance to use, and when each class of building is assigned to its suitable and appropriate exposure; and beauty, when the appearance of the work is pleasing and in

good taste, and when its members are in due proportion according to correct principles of symmetry.
