Here Begins the Sixth Book of Leon Battista Alberti. On Ornament.

I
92—93

The lineaments,[1] the materials for construction, and the employment of craftsmen; also anything else that might seem relevant to the construction of buildings, both public and private, sacred and profane; again, anything that would protect them from the assaults of bad weather and make them adaptable to the requirements of place, time, man, or thing—we have dealt with all this in the five preceding books. How thoroughly we have done so you may yourself discover as you examine them. I do not think you would want greater application in dealing with such matters. As heaven is my witness, it was a more demanding task than I could have imagined when I embarked on it. Frequent problems in explaining matters, inventing terms, and handling material discouraged me and often made me want to abandon the whole enterprise. On the other hand, the very reasons that first induced me to embark on it summoned me back to my undertaking and encouraged me to continue. For I grieved that so many works of such brilliant writers had been destroyed by the hostility of time and of man, and that almost the sole survivor from this vast shipwreck is Vitruvius, an author of unquestioned experience, though one whose writings have been so corrupted by time that there are many omissions and many shortcomings. What he handed down was in any case not refined, and his speech such that the Latins might think that he wanted to appear a Greek, while the Greeks would think that he babbled Latin. However, his very text is evidence that he wrote neither Latin nor Greek, so that as far as we are concerned he might just as well not have written at all, rather than write something that we cannot understand.

Examples of ancient temples and theaters have survived that may teach us as much as any professor,[2] but I see—not without sorrow—these very buildings being despoiled more each day.[3] And anyone who happens to build nowadays draws his inspiration from inept modern nonsense rather than proven and much commended methods. Nobody would deny that as a result of all this a whole section of our life and learning could disappear altogether.

Since that is how things stood, I could not help but consider long and often whether it was not my duty to write a commentary on this subject. As I was exploring this matter, many noble, useful things, vital to the existence of man, came to my notice, which I decided not to neglect in writing. Moreover, I felt it the duty of any gentleman or any person of learning to save from total extinction a discipline that our prudent ancestors had valued so highly.

As I vacillated, and hesitated whether to press ahead or give up, my love of work and enthusiasm for learning prevailed; and where intelligence failed me, enthusiastic study and hard application supplied. No building of the

ancients that had attracted praise, wherever it might be, but I immediately examined it carefully, to see what I could learn from it. Therefore I never stopped exploring, considering, and measuring everything, and comparing the information through line drawings, until I had grasped and understood fully what each had to contribute in terms of ingenuity or skill; this is how my passion and delight in learning relieved the labor of writing. Yet to collate material from sources so varied, heterogeneous, and dispersed, material from outside the normal range and skill of any writer, to review it in a dignified manner, to arrange in a proper order, to articulate precisely and explain rationally, surely all this required an ability and learning greater than I would profess to have. Even this will not cause me to repine, if I have succeeded in the general aim I set myself of convincing the reader that I would rather my speech seemed lucid than appeared eloquent. Those with any experience in this field of writing will appreciate how difficult this is, better than those who have never taken such a risk. What we have written is (unless I am mistaken) in proper Latin, and in comprehensible form. We shall do our utmost to continue like this in the remainder of the work.

Of the three conditions that apply to every form of construction—that what we construct should be appropriate to its use, lasting in structure, and graceful and pleasing in appearance—the first two have been dealt with, and there remains the third, the noblest and most necessary of all. ◆

2
93—94

Now graceful and pleasant appearance, so it is thought, derives from beauty and ornament alone, since there can be no one, however surly or slow, rough or boorish, who would not be attracted to what is most beautiful, seek the finest ornament at the expense of all else, be offended by what is unsightly, shun all that is inelegant or shabby, and feel that any shortcomings an object may have in its ornament will detract equally from its grace and from its dignity.

Most noble is beauty, therefore, and it must be sought most eagerly by anyone who does not wish what he owns to seem distasteful. What remarkable importance our ancestors, men of great prudence, attached to it is shown by the care they took that their legal, military, and religious institutions—indeed, the whole commonwealth—should be much embellished; and by their letting it be known that if all these institutions, without which man could scarce exist, were to be stripped of their pomp and finery, their business would appear insipid and shabby. When we gaze at the wondrous works of the heavenly gods, we admire the beauty we see, rather than the utility that we recognize. Need I go further? Nature herself, as is everywhere plain to see, does not desist from basking in a daily orgy of beauty—let the hues of her flowers serve as my one example.

But if this quality is desirable anywhere, surely it cannot be absent from buildings, without offending experienced and inexperienced alike. What

would be our reaction to a deformed and ill-considered[4] pile of stones, other than the more to criticize it the greater the expense, and to condemn the wanton greed for piling up stones? To have satisfied necessity is trite and insignificant, to have catered to convenience unrewarding when the inelegance in a work causes offense.

In addition, there is one particular quality that may greatly increase the convenience and even the life of a building. Who would not claim to dwell more comfortably between walls that are ornate, rather than neglected? What other human art might sufficiently protect a building to save it from human attack? Beauty may even influence an enemy, by restraining his anger and so preventing the work from being violated. Thus I might be so bold as to state: No other means is as effective in protecting a work from damage and human injury as is dignity and grace of form.[5] All care, all diligence, all financial consideration must be directed to ensuring that what is built is useful, commodious, yes—but also embellished and wholly graceful, so that anyone seeing it would not feel that the expense might have been invested better elsewhere.

The precise nature of beauty and ornament, and the difference between them, the mind could perhaps visualize more clearly than my words could explain. For the sake of brevity, however, let us define them as follows: Beauty is that reasoned harmony of all the parts within a body, so that nothing may be added, taken away, or altered, but for the worse.[6] It is a great and holy matter; all our resources of skill and ingenuity will be taxed in achieving it; and rarely is it granted, even to Nature herself, to produce anything that is entirely complete and perfect in every respect. "How rare," remarks a character in Cicero, "is a beautiful youth in Athens!"[7] That connoisseur found their forms wanting because they either had too much or too little of something by which they failed to conform to the laws of beauty. In this case, unless I am mistaken, had ornament been applied by painting and masking anything ugly, or by grooming and polishing the attractive, it would have had the effect of making the displeasing less offensive and the pleasing more delightful. If this is conceded, ornament may be defined as a form of auxiliary light and complement to beauty. From this it follows, I believe, that beauty is some inherent property, to be found suffused all through the body of that which may be called beautiful; whereas ornament, rather than being inherent, has the character of something attached or additional.[8]

This granted, I continue: Anyone who builds so as to be praised for it—as anyone with good sense would—must adhere to a consistent theory; for to follow a consistent theory is the mark of true art. Who would deny that only through art can correct and worthy building be achieved? And after all this particular part concerning beauty and ornament, being the most important of all, must depend on some sure and consistent method and art,

which it would be most foolish to ignore. Yet some would disagree who maintain that beauty, and indeed every aspect of building, is judged by relative and variable criteria, and that the forms of buildings should vary according to individual taste and must not be bound by any rules of art. A common fault, this, among the ignorant—to deny the existence of anything they do not understand. I have decided to correct this error; not that I shall attempt (since I would need detailed and extended argument for it) to explain the arts from their origins, by what reasoning they developed, and by what experience they were nourished; let me simply repeat what has been said, that the arts were born of Chance and Observation, fostered by Use and Experiment, and matured by Knowledge and Reason.

Thus medicine, they say, was developed by a million people over a thousand years; sailing too, as almost every other art, advanced by minute steps. ◆

3
94—95v

Building, so far as we can tell from ancient monuments, enjoyed her first gush of youth, as it were, in Asia, flowered in Greece, and later reached her glorious maturity in Italy. It would seem to me quite likely that the kings of Asia, being men of considerable wealth and leisure, when reflecting on their own standing, their wealth, and the majesty and greatness of their thrones,[9] saw the need for grander roofs and more dignified walls, and began to search out and collect anything that might be of use to this end; then, perhaps, to make their buildings as large and splendid as possible, they used the largest trees available for their roofs and built their walls of a finer stone. Their buildings became impressive as well as graceful.

Then, thinking that it was the huge scale of their works that was admired, and that one of the primary tasks of a king was to build what lay beyond the capacity of the private citizen, these kings became enamored of the immensity of their works, until their rivalry led to the folly of constructing pyramids.

I believe that experience in building gave them an opportunity to discern differences in number, order, arrangement, and exterior appearance in their buildings, and allowed them to compare one to another.[10] In this way they learned to appreciate the graceful and to spurn the ill-considered.

Next came Greece, a country where upright and noble minds flourished, and the desire for embellishing what was theirs was evident, and, above all, great attention was given to the construction of temples. Therefore they began by examining the works of the Assyrians and the Egyptians, from which they realized that in such matters the artist's skill attracted more praise than the wealth of the king: for vast works need only great wealth; praise belongs to those with whom the experts find no fault. The Greeks therefore decided that it was their part to surpass through ingenuity those

whose wealth they could not rival, in whatever work they undertook. As with other arts, so with building, they sought it in, and drew it out from, the very bosom of Nature, and began to discuss and examine it thoroughly, studying and weighing it up with great incisiveness and subtlety.

They inquired into the differences between buildings that were admired and those that were not, overlooking nothing. They performed all manner of experiment, surveying and retracing the steps of Nature. Mixing equal with equal, straight with curved, light with shade, they considered whether a third combination might arise, as from the union of male and female, which would help them to achieve their original aim. They continued to consider each individual part in the minutest detail, how right agreed with left, vertical with horizontal, near with far. They added, took away, and adjusted greater to smaller, like to unlike, first to last, until they had established the different qualities desirable in those buildings intended to endure for ages, and those erected for no reason as much as their good looks.[11] This was their achievement.

As for Italy, their inborn thrift prompted them to be the first who made their buildings very like animals.[12] Take the case of a horse: they realized that where the shape of each member looked suitable for a particular use, so the whole animal itself would work well in that use. Thus they found that grace of form could never be separated or divorced from suitability for use. But once they had gained dominion over the world, they were so obviously eager to embellish their city and property as the Greeks had been, that within thirty years a house that might have been considered the finest in the entire city would not rank in the first hundred. There was such an incredible surfeit of talent in this field that at one time, I read, seven hundred architects were being employed in Rome alone, whose work could scarcely be praised enough. The empire had sufficient resources to supply anything needed to provoke astonishment: they say that a certain Tacius gave the people of Ostia a bath building with a hundred columns of Numidian marble for which he paid with private funds.[13] In spite of all this, they preferred to temper the splendor of their most powerful kings with a traditional frugality, so that parsimony did not detract from utility, nor was utility sacrificed to opulence, but could also incorporate anything that might be devised to enhance comfort or grace.

Their concern and enthusiasm for building continued unbroken, until eventually they probed so thoroughly into the art that there was nothing so recondite, concealed, or abstruse as not to have been explored, traced out, or brought to light; all this with the help of the gods, and little resistance from the art itself. Since the art of building had long been a guest among the Italians, more particularly among the Etruscans, who, besides the miraculous works of their kings, of which we read, such as labyrinths and sepulchers,[14] have inherited from ancient Etruria very old and excellent precepts about the building of temples;[15] because, I say, the art of building had long been a guest in Italy, and because the desire for her was so evident, she seems to have flourished there, so that Italy's dominion over the world, already famous for every other virtue, was by her ornament made still more impressive. She surrendered herself therefore to their understanding and possession, thinking it a disgrace that the leaders of the world, the glory of all nations, should be rivaled in the splendor of their works by peoples surpassed in every other virtue.[16]

Need I mention the porticoes, temples, ports, theaters, and vast baths, which caused such amazement that experienced architects from abroad denied that some of those works could ever be built, although they saw them before their very eyes. Should I go on? They did not fail even to have their drains beautifully built. And they had such taste for ornament that they delighted in lavishing imperial resources on grace alone, and their enterprise in building was perfectly matched by the ornament.[17]

Through the example of our ancestors, therefore, and through the advice of experts and constant practice on our part, thorough understanding may be gained on how to construct marvelous buildings, and from that understanding well-proven principles may be deduced; rules that should not be ignored by anyone eager—as we all should be—not to appear inept in what he builds. These we must set down, as was our undertaking, and explain to the best of our ability. These principles either direct every aspect of beauty and ornament throughout the building or relate individually to its various parts.[18] The former are derived from philosophy, and are concerned with establishing the direction and limits to this art; the latter come from the experience of which we spoke, but are honed, so to speak, to the rule of philosophy and plot the course of this art. These latter ones have a more technical character, and I shall deal with them first, saving the former more general rules for an epilogue. ◆

4

95v—98

The pleasure to be found in objects of great beauty and ornament is produced either by invention and the working of the intellect, or by the hand of the craftsman, or it is imbued naturally in the objects themselves. The intellect is responsible for choice, distribution, arrangement, and so on, which give the work dignity; the hand is responsible for laying, joining, cutting, trimming, polishing, and such like, which give the work grace; the properties derived from Nature are weight, lightness, density, purity, durability, and the like, which bring the work admiration. These three must be applied to each part of the building, according to its respective use and role.

The parts of a building may be classified in several different ways, but here we would prefer to draw the distinction between characteristics common to all buildings, rather than according to individual differences. In the first book we established that every building must have a locality, *area*, compartition,

wall, roof, and opening.[19] In this they all agree. Their individual differences lie in that some are planned as sacred, some profane, some public, others private, some for need, others for pleasure, and so on. We shall begin with their common characteristics.

It is difficult to establish how the hand and intellect of man may increase the grace or dignity of the locality, unless, perhaps, it is worth imitating those responsible for devising the fantastic schemes that have been documented—schemes that men of prudence would not criticize, provided they offered some advantage, but would not praise unless they were necessary. And rightly so. Who would praise[20] whoever it was—whether Stasicrates, as Plutarch claims,[21] or Dinocrates, as Vitruvius maintains[22]—who proposed to carve Mount Athos into an effigy of Alexander and in its hand to place a city capable of holding ten thousand people?

But equally, Queen Nitocris is not to be criticized for constructing vast ditches to divert a bend in the Euphrates into a huge loop, so that it passed three times in front of the same Assyrian village, if the depth of the ditch helped to fortify the locality, and the abundant irrigation to improve the fertility of the soil.[23] But let such projects be for the amusement of powerful kings. Let them join sea to sea by cutting through intervening land; let them level mountains and valleys; let them create new islands, and again join existing ones to the mainland; let them leave behind feats that could never be imitated, and in so doing preserve their name for posterity. In any case, the more useful their works will prove, the more they will be praised.

The ancients would use religion to add dignity to places and groves, and even entire regions. We read that the whole of Sicily was consecrated to Ceres.[24] But let us skirt this matter. What would be most agreeable would be some admirable and unusual property of the place, of great benefit and quite outstanding; as, for example, when the climate happens to be milder than anywhere else, and unbelievably consistent, as it is in Meroe, where men live as long as they wish;[25] or when the locality offers something to be found nowhere else, desirable and salutary to mankind, such as amber, cinnamon, or balsam; or when there is some supernatural influence, as on the island of Sonus Eubusius, which is said to be quite free of anything harmful.[26]

The *area*, being a certain portion of the locality, will be enhanced by all that may adorn the locality.[27] But natural advantages will be more abundant and readily available in the *area* than they are in the locality. There may be many different attractions all around, such as promontories, rocks, heights, chasms, grottoes, springs, and other reasons making it attractive to build there rather than anywhere else. Also there may be landmarks of some bygone era, records of the times and events to fill the eyes and mind with admiration. These I shall pass over; nor shall I mention the site where Troy

once stood, the blood-soaked fields at Leuctra or Trasimene,[28] and the countless other examples.

It is not easy to describe what the hand or intellect of man may contribute to this end. I shall pass over the more obvious instances, such as the oriental plane trees transported by sea as far as the island of Diomede, to adorn an *area*,[29] or the erection of columns and obelisks by great men, or the planting of trees for posterity to venerate, such as the olive planted by Neptune and Mercury, which long stood on the acropolis of Athens.[30] Nor shall I mention objects preserved for long ages and handed down by our ancestors for posterity, such as the terebinth tree at Hebron, which is said to have lasted from the beginning of the world to the time of Josephus the historian.[31]

A most appropriate way to make a place more dignified is through good taste and ingenious measures, such as the laws that prohibit any male from entering the temple of Bona Dea,[32] or that of Diana by the patrician portico;[33] likewise at Tanagra no female may enter the grove of Eunostus,[34] nor the inner parts of the temple in Jerusalem;[35] and there is a spring in Panthia where no one but priests may wash, and they only for the purpose of making a sacrifice; nor may anyone spit in Doliola by the Roman Cloaca Maxima, where the bones of King Pompilius lie.[36] Inscriptions may be found in a number of chapels forbidding the entry of prostitutes.[37] No one is allowed to enter the temple of Diana in Crete, except in bare feet,[38] and no slave girl is permitted entry to the temple of Matuta.[39] No herald may enter the temple of Oridio at Rhodes,[40] nor flute player the temple of Tennes at Tenedos.[41] No one may leave the temple of Laphystian Jove without first offering a sacrifice.[42] No ivy may be carried into the temple of Pallas at Athens, or of Venus at Thebes. In the temple of Faunus the word "wine" could not be mentioned.[43] There was also a rule that in Rome the Porta Janualis could not be closed during war, nor the gate of the temple of Janus opened during peace;[44] and they preferred the temple of Hora to remain continually open.[45]

Should we decide to follow this example, then it might be appropriate to make it unlawful for any woman to enter temples of the martyrs, or men those temples of the virgin saints. There are other conditions that human ingenuity can fix, and that add great dignity; some of these, although we read of them, we would scarcely credit, if similar ones were not to be found in our own times. Some maintain that human art was responsible for the fact that in Byzantium snakes will not harm anyone, nor jackdaws fly indoors; and that around Naples crickets are never heard,[46] that there are no owls in Crete,[47] that no bird ever disturbs the temple of Achilles in the island of Boristene,[48] and that in the Forum Boarium at Rome no fly or dog has ever entered the temple of Hercules.[49] And in our own times it has been claimed that no kind of fly ever enters the public palace of the Censors in

Venice; in Toledo only one type of fly will enter the public slaughterhouse, and it may be distinguished by its whiteness.

Many such examples are recorded, but to review them would take too long. Nor do I know enough to say whether they are the result of artifice or of Nature. Is art or Nature, for instance, responsible for the following? A laurel tree is said to grow from the tomb of Bibrias, king of Pontus; if a sprig from it is taken aboard ship, it will lead to continual disagreement on board, until it is removed.[50] It never rains on the altar of the sanctuary of Venus in Paphos; in Troy, if any sacrificial remains are left about the statue of Minerva, they will not rot; if a hole is dug in the tomb of Anteus, the heavens will not stop raining until it has been refilled. Some maintain that these effects may be achieved using a technique now long out of use, based on the operation of figurines that the astronomers claim to understand.

I recall reading in the life of Apollonius that magicians fixed on the roof of the royal basilica of Babylon four gold birds, which they called the tongues of the gods; these, they claimed, had the power to reconcile the mind of the crowd to the heart of the king.[51] Even as serious an author as Josephus claims to have witnessed a certain Eleazar, who in the presence of Vespasian and his sons instantly cured a maniac, by putting a ring to his nose.[52] He also claims that Solomon had composed an incantation to reduce illnesses.[53] And Serapis of Egypt, whom we call Pluto, according to Eusebius Pamphylius, gave out symbols for expelling demons and taught how they took on the form of animals to taunt humans.[54] Servius, too, claims that men used to recite certain magical incantations to protect themselves from misfortune, so that they could not die unless the incantation were to be canceled.[55] If such stories are true, I could easily be led to believe an incident I find in Plutarch: there was in Pellene a statue that, if taken out of the temple by a priest, would fill everything, wherever it faced, with terror and great anxiety, because no eye could look at it without fear.[56] But these anecdotes are included for entertainment.

To continue. As for the general methods of dignifying the *area*, such as setting out, dyking, leveling, consolidation, and so on, I have no more to say, beyond what is to be found above in the first and third books. To have the greatest dignity, the *area*, as we mentioned above, must be extremely dry, level, and solid, and very appropriate and convenient for the purpose that it is to serve; it may well help to surface it with some material: this we shall deal with later, when discussing walls. Plato also gives some useful advice: a grand name will lend a place great dignity and authority.[57] That the emperor Hadrian approved of this is demonstrated by the famous names, such as Licus, Canopeius, Achademia, and Tempe, that he gave the rooms of his Tiburtine villa.[58] ◆

5
98—99

Compartition has, for the most part, already been dealt with in the first book, but we shall summarize it again here.[59] The chief ornament in every object is that it should be free of all that is unseemly. Compartition, therefore, will be seemly when it is neither jumpy, nor confused, nor disorganized, nor disconnected, nor composed of incongruous elements; it should be made up of members neither too numerous, nor too small, nor too large, nor too dissonant or ungraceful, nor too disjointed or distant from the rest of the body, as it were. But in terms of its nature, utility, and methods of operation, everything should be so defined, so exact in its order, number, size, arrangement, and form, that every single part of the work will be considered necessary, of great comfort, and in pleasing harmony[60] with the rest. For if the compartition satisfies these conditions completely, the cheerfulness and elegance of the ornament will find the appropriate place and will shine out; but if not, the work will undoubtedly fail to retain any dignity. The entire composition of the members, therefore, must be so well considered, conform so perfectly with the requirements of necessity and convenience, that this or that part should not give as much pleasure separately as their appropriate placing, here or there, in a particular order, situation, conjunction, arrangement, and configuration.

In adorning the wall and roof, you will have ample room to display uncommon gifts of Nature, techniques of art, diligence of the workman, and power of the intellect. But should you have the means to imitate the ancient Osyris, who is said to have built two temples out of gold, one dedicated to the celestial Jove, the other to the royal Jove;[61] or should you be able to incorporate in the construction a block of stone large beyond human belief, such as that quarried by Semiramis from the mountains of Arabia, measuring 20 cubits in height and breadth, and 150 in length;[62] or if there were available a block of stone so large that you could use it to complete one entire section of the whole work, such as the reported shrine of Latona in Egypt, 40 cubits in width across the front, carved out of one complete stone, and roofed by another similar one;[63] surely all such things would make the work more impressive; especially if the stone comes from abroad, and has been conveyed along a difficult route, like the block described by Herodotus, which measured more than 20 cubits along the front and 15 in height, and was dragged from the city of Elephanta as far as Sais, a journey lasting twenty days.[64] It will also greatly enhance the effect of ornament if a stone that is itself worthy of admiration is set in a noble, important place. There is a shrine on the island of Chemmis in Egypt, remarkable not so much for the fact that the roof consists of a single stone as for the fact that such a huge stone could have been set on walls so high.[65] A rare and exquisite stone will also add to the ornament, as, for example, the marble of which the emperor Nero reportedly built the temple of Fortune in the Gol-

den House,[66] pure, white, and translucent, so that even when all the doors were closed, light seemed to be trapped inside.

In short, all such things will contribute. But whatever they are, they will look worthless unless their composition is precisely governed by order and measure. Each individual element must be arranged according to number,[67] in such a way that even is balanced by even, right by left, upper by lower; nothing must be introduced that might disturb the arrangement or order; everything must be set to exact angles and proportionate lines.

It may be observed that a common material skilfully treated will be more graceful than a noble one piled up in a disorderly manner. There is a wall in Athens, described by Thucydides, hastily built, even using statues seized from tombs;[68] but who would think it beautiful, simply because it was built of broken statues? On the other hand, in ancient rustic buildings, pleasant walls may be seen, built of random construction, using small, irregular stones, set in even rows, alternating between black and white; this, given the modest scale of the work, could hardly be faulted. But perhaps this is related more to the part of the wall called the revetment than to the construction of the wall as a whole. To conclude, all materials should be so distributed that nothing is begun without establishing a procedure to an end in view, nothing raised except according to the principles on which it was begun, and nothing considered finished that has not been brought to perfection with the greatest care and attention.

But, always excluding columns, the main ornament to a wall or roof (especially where vaulted) will be the revetment. This may take many forms: white stucco, plain or in relief, painted surfaces, paneling, mosaic work, glass work, or a mixture of all of these. ◆

6

99—100v

We will now discuss these forms of revetment and describe how they are applied. But first, since we have mentioned the movement of huge blocks of stone, it would seem advisable to describe here how masses of such bulk may be transported, and set in difficult positions. Plutarch relates that Archimedes once drew a fully laden merchant vessel through the middle of the forum in Syracuse, as though leading an animal by its bridle:[69] a great mathematical invention! But we shall consider only what is appropriate to our needs; finally we shall make a few points, to enable anyone of intelligence to understand the whole matter clearly for himself.

I read in Pliny that an obelisk was conveyed from Foci to Thebes along a canal dug from the Nile, on ships laden with bricks, which could later be off-loaded in order to accommodate the weight of the stone to be transported.[70] I read in the historian Ammianus Marcellinus that an obelisk was transported from the Nile in a three-hundred-oar ship and then drawn on rollers from the third milestone outside the city, through the Ostian

gate, and into the Circus Maximus; to erect it required several thousand men, and the whole circus was filled with machines of extremely tall beams and immense ropes.[71] We may read in Vitruvius that Chresiphones and Methagenes, father and son, transported columns and beams to Ephesus using an invention based on the rollers used by the ancients for leveling surfaces. At either end of the stones long iron pins were fixed in lead and projected to form axles; on either side wheels were mounted onto these axles, large enough for the stones to be freely suspended from them; they were then transported by being wheeled along.[72] It is said that when the Egyptian Cherrenis was building a pyramid, a work more than six stades in height, he constructed earth ramps on which to haul up the huge stones.[73] Herodotus writes that when Cleopa, the son of Rasmita, constructed a pyramid, on which hundreds of thousands of men labored for several years, he left steps on the outside, so that the huge stones could be moved using short props and suitable machinery.[74] It is recorded that elsewhere the following method was used to set vast stone beams on top of high columns: Under the beam two sleepers were laid side by side at right angles, halfway along its length. Baskets of sand were then hung from one end of the beam, their weight causing the other end, which was unencumbered, to rise, and leaving the sleeper nearer it free of weight. They then transferred the baskets to the other end, once this sleeper had been propped up, and by alternately weighing down and further propping up the side with the larger gap beneath it, they succeeded in making the stone rise, as though of its own accord.[75] We have only briefly described these examples, and we shall leave them to the authors themselves to explain more fully.

Finally, as we have undertaken, so we shall briefly make a few relevant observations. For my part, I shall not pause here to explain why weights have the natural tendency to press downward continually, obstinately tend to lower themselves, and resist all attempts to raise them, never yielding their position except to a superior weight or contrary force. Nor shall I describe the various types of movement—carrying, pulling, pushing, and so on. These questions will be dealt with more fully elsewhere.

We believe it to be true that there is no direction in which a weight will move more easily than downward, which it does of its own accord, and none with greater difficulty than upward, which it naturally resists; there is a third form of motion, halfway between the two, which probably embodies the characteristics of both, a movement that a body neither resists nor makes of its own accord, such as when it is dragged along a smooth, unobstructed surface. All other movements are correspondingly easier or more difficult, depending on whether they are closer to the first kind or second.

As for the way in which immense weights might be moved, that Nature herself seems to have shown in many ways. Anyone may see how any