The Notebooks of Leonardo da Vinci

THE WORLD'S CLASSICS

The Notebooks of Leonardo da Vinci

Selected and Edited by

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Preface

During his youth in Renaissance Florence Leonardo conceived of painting as the noblest calling open to mankind and embarked with enthusiasm in its pursuit. It was not only the beauty of nature but also the spirit at work beneath the world of appearance that fascinated him. Combining an artist's sensitivity with a scientist's desire of knowledge, he analysed the objects of vision and the way in which vision functioned. This entailed the study of nature, its structure and life. As he proceeded his interest in natural science deepened. He used scientific methods of research in order to ascertain Nature's laws and introduce them in his own work. He pursued these studies not merely in order to paint certain pictures commissioned by patrons but for the attainment of creative power. His compositions expressed actions, emotions; faces were moulded by the life within. Landscapes represented the formation of rocks, the growth of plants, the movement of water.

He often made use of his knowledge and experience for practical purposes. Thus this man who created a few works of art divinely well was also a precursor of a new age in science and, incidentally, a

civil and military engineer whose inventions embodied in elementary form the principles of modern machinery.

He was enabled to achieve this because he was an artist. In his time there were no professional scientists working by experiment; and the observations of natural phenomena as handed down by Aristotle and other ancient philosophers contintued to form the foundation of an authorized creed accepted by the Schoolmen, who deprecated experimental methods as subversive and 'unlettered'. But being an artist Leonardo steered a course guided by visual experience. His intelligence was free and wholly devoted to inquiry.

At times he realized what fateful catastrophes the well-conceived and universal laws of nature might bring about. Some other time, he was trenchantly critical of the inherent egotism and wickedness of man. Gradually his attitude towards the world became that of a strangely aloof and impersonal observer. When doubts arose in his mind regarding some ancient long-established belief, he would say so in his notes. But since he was not an abstract theorist intent on establishing a logical system, nor a modern scientist concentrating on a special line of research,

but a 'universal' genius of the Renaissance intent on artistic creation, he attempted to ground his natural science on an acceptance of the philosophic system, inherited from Greek thought and medieval thought, which conceived of the universe as an organized cosmos corresponding to a work of art; and he profited thereby.

We are enabled to gain insight into his thoughts by reading his notebooks. He used to carry these about with him to sketch instantaneous impressions or to write down ideas as they occurred on the spur of the moment—observations made during walks and travels, reflections on events and persons, on his domestic problems, on his work, on life in general. Manuscripts have survived containing drafts of letters, fanciful descriptions and fables, rough copies of treatises on the power of water, on the art of painting, on the anatomy and movement of the human figure, etc. But they are just notes. Often, remarks on diverse subjects are scribbled on one and the same page, or restatements and clarifications of one and the same idea occur on another page. The following words written on the front sheet of a manuscript on physics is descriptive of his method of writing.

'This is to be a collection without order, taken from many papers, which I have copied here, hoping afterwards to arrange them according to the subjects of which they treat; and I believe that I shall have to repeat the same thing several times; for which, O reader, blame me not because the subjects are many, and memory cannot retain them… all the more because of the long intervals between one time of writing and another.'

Leonardo's intention to sort his notes was never carried out. The present volume constitutes an attempt to co-ordinate a selection of them on subjects of general interest. The choice has often been difficult since he was fascinated and distracted by so many problems, depending on his mood and circumstances. We have limited ourselves to quoting typical examples of the main themes. The number at the end of each excerpt refers to pp. 394 ff. where the sources are given. The first three chapters deal with science and nature. In the fourth chapter his treatise on painting is summarized and the ever persistent problems of art are discussed. The fifth chapter contains writings of a literary kind — tales, fables, maxims; the sixth chapter gives reflections on life. In the last chapter references to Leonardo's personal affairs and to his work have been arranged in chronological sequence, strung on the unifying thread of his life, like a diary. Light is thrown on the circumstances in which he lived, on historical events and personages that influenced his course.

Readers must not expect a continuous and coherent narrative. In the circumstances the alinement of texts had to be 'staccato'. Leonardo did not claim to be a man of letters nor versed in classical literature like most authors of his time. With them in mind he would humbly call himself uomo senza lettere; but with irony, for he was proud of his own method, since he had things to say that were beyond their ken; and he did so in the clear and forceful language of the Italian people.

Now, after five hundred years, Leonardo's notebooks are considered of priceless value, and are to be included in the series of World's Classics by the Oxford University Press.

Readers will see him at work striving to express his thoughts. They will learn to know him, and they will discern all underlying unity. For these manifold observations spring from one consistent spirit. The life of one of the greatest men of the Italian Renaissance is here painted by himself in words.

Vasari begins his biography of the artist by saying: 'Occasionally heaven sends us someone who is not only human but divine, so that through his mind and the excellence of his intellect we may reach out to heaven.'

To live close to great minds is the best education, and the happiest thing that can befall us. It is the aim of this book to offer its readers such an opportullity.

1952

October 1481

Arrival in Milan

October 1481 probable date of Leonardo's arrival in Milan. At that time Gian Galeazzo Sforza, Duke of Milan, was thirteen years old, and his uncle Ludovico il Moro, Duke of Bari, was virulal ruler. According to the Anonimo Magliabecchiano, Leonardo was thirty when Lorenzo il Magnifico Sent him to the Duke of Milan, accompanied by Atalante Migliorotti, to present him with a lyra, as he was unsurpassed in playing that instrument. His companion, then a youth of sixteen, developed into a successful actor, musician, and builder of musical instruments. Also according to Vasari it was Leonardo's accomplishment in music that was the cause of his Summons to Milan. He was greeted with great applause in an assembly of musicians, where he played on a lyra which he had made himself in the shape of a horse's skull and which produced a sound of great volume and clearness.

A description of Leonardo's appearance is given by the Anonimo. He was a beautiful person, well-proportioned, agreeable and lovely to look at. He wore a short rose-coloured tunic reaching down to his knees, at a time when long clothes were being worn. A fine beard, well arranged in ringlets, descended to the middle of his chest.

Soon after his arrival in Milan Leonardo painted the portrait of Cecilia Gallerani, who became the mistress of Ludovico il Mora in 1481. This portrait has been identified with the Lady with an Ermine in the collection of Prince Czartoryski at Cracow. The following note was addressed by the artist to the sitter:

Cecilia, dearest goddess [amatissima diva], having read your most gracious….[8]

Compare Cecilia Gallerani's letter on p. 334.

April 1483

Military and Naval Engineering

On 25 April 1483 Leonardo in partnership with Ambrogio de Predis and his half-brother Evangelista negotiated for a commission, which the confraternity of the Immaculate Conception had to offer, concerning an elaborate carved frame in their chapel adjoining San Francesco. The frame had to be gilt, the centrepiece was to be painted by 'the Florentine' and the side panels by Ambrogio. 'The Virgin of the Rocks', now in the National Gallery, London, was Leonardo's contribution. The work on the frame was valued at 700 Lire, Leonardo's work at 100. Somewhat later the artists claimed more pay. The litigation continued for years. The picture was delivered and then reclaimed.

The following letter addressed to Ludovico il Mora enumerates the services Leonardo was ready to render. There had been a project before Ludovico came to power to erect an equestrian monument in bronze in commemoration of his father, the condottiere Francesco Sforza. Leonardo at the end of this letter proposed that this task should be entrusted to him. Had not another citizen of Florence, Donatello, erected the equestrian statue at Padua of the Venetian condottiere Gattamelata.

Most illustrious Lord. Having now sufficiently seen and considered the proofs of all those who count themselves masters and inventors of instruments of war, and finding that the invention and working of the said instruments do not differ in any respect from those in common use, I shall endeavour without prejudice to anyone else to explain myself to your Excellency, showing your Lordship my secrets, and then offering at your pleasure to work with effect at convenient times on all those things which are in part briefly recorded below.

1. I have plans of bridges, very light and strong and suitable for carrying very easily, and with them you may pursue, and at times flee from, the enemy; and others secure and indestructible by fire and battle, easy and convenient to lift and to place in position; and plans for burning and destroying those of the enemy.

2. When a place is besieged, I know how to remove the water from the trenches, and how to construct an infinite number of bridges, covered ways and ladders and other instruments having to do with such expeditions.

3. Also if a place cannot be reduced by the method of bombardment either owing to the height of its banks or to its strength of position, I have plans for destroying every fortress or other stronghold even it were founded on rock.

4. I have also plans of mortars most convenient and easy to carry with which to hurl small stones in the manner almost of a storm; and with the smoke of this cause great terror to the enemy and great loss and confusion.
And if it should happen that the fight was at sea I have plans for many engines most efficient for both attack and defence, and vessels which will resist the fire of the largest cannon, and powder and smoke.

5. Also I have means of arriving at a fixed spot by caves and secret and winding passages, made without any noise even though it may be necessary to pass underneath trenches or a river.

6. Also I will make covered cars, safe and unassailable, which will enter among the enemy with their artillery, and there is no company of men at arms so great that they will not break it. And behind these the infantry will be able to follow quite unharmed and without any hindrance.

7. Also, if need shall arise, I can make cannon, mortars, and light ordnance of very useful and beautiful shapes, different from those in common use.

8. Where the operation of bombardment fails, I shall contrive catapults, mangonels, 'trabocci', and other engines of wonderful efficacy and in general use. In short, to meet the variety of circumstances, I shall contrive various and endless means of attack and defence.

9. In time of peace I believe I can give perfect satisfaction, equal to that of any other, in architecture and the construction of buildings both private and public, and in conducting water from one place to another.

Also I can carry out sculpture in marble, bronze or clay, and also I can do in painting whatever can be done, as well as any other, be he who may.

Moreover, the bronze horse may be taken in hand, which shall endue with immortal glory and eternal honour the happy memory of the Prince your father and of the Illustrious house of Sforza.

And if any of the aforesaid things should seem impossible or impracticable to anyone I offer myself as most ready to make the trial of them in your park, or in whatever place may please your Excellency, to whom I commend myself with all possible humility.[9]

In this long list artistic attainments came second. The stress is on military and naval engineering. Had Leonardo acquired such knowledge in Florence or after his arrival at Milan? At a time when Milan as an ally of Naples, Ferrara and the Pope was facing war with Venice, his services as engineer must have been very acceptable. In 1484 a council of war was held at Milan; in 1487 Milan annexed Liguria and the port of Genoa.

The date of the letter is uncertain; and there are unexplained gaps in the chronology of Leonardo's life between the years 1482 and 1487. It has been suggested that he visited the Near East where Kait Bey, the ruler of Egypt, was engaged in warfare. But the extent of his travels is still an open question.

During this period his interest centered in mechanics. He made designs of weapons to co-ordinate the slings and catapults then in use with the more modern ideas of artillery. He invented machine-guns and breech-loading guns, armoured cars, and mechanical bows capable of hurling flaming projectiles. He drew plans of military bridges and of forts and other defensive devices. As regards war at sea, he designed contrivances for attack and defence, a ram for battering, and

a double hull so that a damaged ship would keep afloat, diving suits, and swimming belts.

This instrument is employed in the Indian Ocean in pearl fishing. It is made of leather with many rings so that the sea cannot close it up, and the companion stays above in the boat watching, while he fishes for pearls and corals; and he has goggles of frosted glass and a cuirass with spikes set in front.[10]

The followillg notes accompanied by drawings of apparatus refer to a mysterious scheme by which Leollardo hoped to destroy enemy ships by piercing them below the water line, and to release prisoners for half the ransom that had been offered.

Do not impart your knowledge and you alone will excel.

Employ a simple youngster and have the coat sewn at home.

Stop the galleys of the captains and sink the others afterwards and fire the cannon on the foot.

… When the watch has gone its round bring a small skiff under the poop and set fire to the whole all of a sudden. [Wirh drawing of a figure in a diving suit.]

A breastplate of armour together with hood, doublet, and hose… and a wineskin to contain the breath, with half a hoop of iron to keep it away from the chest. If you

have a whole wineskin with a valve… when you deflate it, you will go to the bottom pulled down by the sacks of sand; when you inflate it. you will return to the surface of the water.

A mask with the eyes protruding made of glass, but let its weight be such that you raise it while you swim.

Carry a knife which cuts well so that you do not get caught in a net.

Carry with you two or three small wine skins, deflated, and to be inflated like balls in case of need.

Take officers to your liking and many chains and hide them on the bank. But first have an understanding about the agreement how half of the ransom is to be yours without any deduction, … and payment may be made into the hands of Maneto,* that is of the said ransom.

Carry a horn in order to give a signal whether or no the attempt has been successful….[11]

* Salmi has suggested that Mancto stands for Manetti (Alvise), who when Leonardo was in Venice in 1500 tried unsuccessfully to obtain the release of the Venetian prisoners taken by the Turks at Lepanto. But according to Calvi these notes were written some fifteen years earlier.

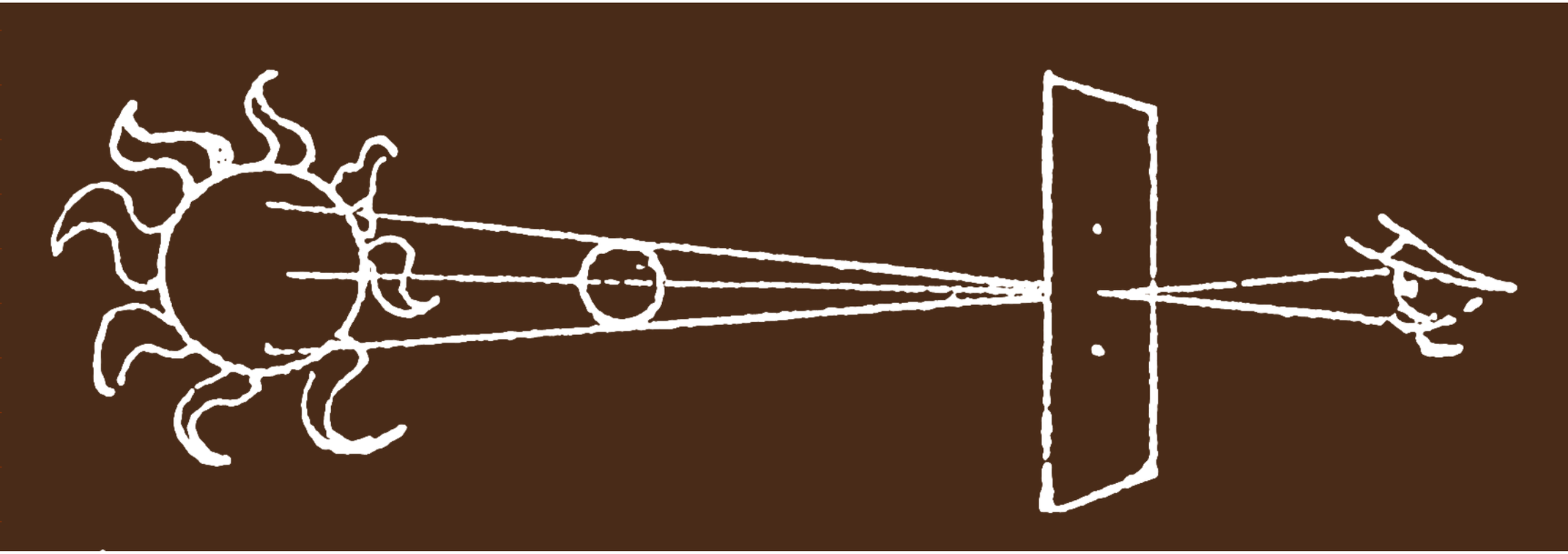
His first designs for the construction of a flying-machine were made about this time.

Make trial of the actual machine over the water so that if you fall you do not do yourself any harm.[12]

March 1485

Observing Nature

On 26 March 1485 Leonardo watched the total eclipse of the sun.



Method of seeing the sun eclipsed without pain to the eye:

Take a piece of paper and pierce holes in it with a needle, and look at the sun through these holes.[13]

On 13 April 1485 Ludovico il Mora informed his ambassador at the court of Mathias Corvinus, King of Hungary, that he had asked a great painter who happened to be in Milan to paint a picture for the king. He was probably referring to Leonardo.

The following memoranda were written on excursions into the romantic regions of the Lake of Como.

> Opposite the castle of Bellaggio there is the river Latte which falls from a height of more than 100 braccia from the source whence it springs, perpendicularly, into the lake with an inconceivable roar and noise. This spring flows only in August and September.

About eight miles above Como is the Pliniana* which rises and falls every six hours, and as it rises it supplies two mills with water and there is a surplus; and as it falls it causes the spring to dry up: two miles higher up there is Nesso, a place where a river falls with great violence through a mighty chasm in the mountain.

These journeys should be made in the month of May.

And the largest bare rocks in these parts are the Mountains of Mandello near Lecco, and of Gravedona towards Bellinzona, thirty miles from Lecco; and those of the valley of Chiavenna. But the Mandello is the largest of all and it has at its base a gully towards the lake that descends two hundred steps, and here at all seasons there is ice and wind.

* The Villa Pliniana is near Torno on the eastern shore. Leonardo can hardly have known what Pliny the Elder wrote: "In Comensi juxta Larium zsemper intumescit ac residet" (*Nat. Hist. ii. 232*). Pliny the Younger asks for an explanation of the miracle (*Ep. iv. 30*).

In Val Sasina between Vimognio and Introbbio, on the right hand where you enter the road to Lecco you come upon the river Troggia which falls from a very high rock and as it falls it goes underground so that the river ends there. Three miles farther on you come to the buildings of the copper and silver mines near to the district known as Prato San Pietro, and the iron mines and various strange things. The highest mountain in these parts is La Grigna, and it is quite bare.

Above Lake Como towards Germany lies the valley of Chiavenna where the river Mera enters the Lake. Here are barren and very high mountains with huge crags. In these mountains the water-birds called cormorants are found; here grow firs, larches, and pines; deer, wild goats, chamois, and savage bears. One cannot go up there without using hands and feet. The peasants go there in time of snow with a great device to make the bears fall over these rocks. The mountains are close together and have the river between them. They extend both on the right and on the left in this way for a distance of twenty miles. One may find good inns there from mile to mile.

Above the river there are waterfalls four hundred braccia high which are a fine sight; and there is good living at 4 soldi for your bill. A large quantity of timber is brought down by the river.

The Valtellina as has been said is a valley surrounded by lofty and terrible mountains; it produces a great quantity of strong wine, and has so great a stock of cattle that the peasants reckon that it produces more milk than wine. This is the valley crossed by the Adda, which first runs through Germany for more than forty miles. In this river is found the grayling which feeds on silver of which much is to be found in its sands.

Everyone in this district sells bread and wine. And the wine is worth at most one soldo the bottle, veal is a soldo the pound, and salt ten denari and butter the same, and their pound is thirty ounces and eggs are one soldo for a quantity.

At the head of the Valtellina are the mountains of Bormio which are terrible and always covered with snow. Here ermines breed.[14]

July 1487

Cathedral of Milan

In 1487 the Works Department of the Cathedral of Milan was considering the crowning of the central part of the building.

Leonardo was constructing a model for this tiburio with the help of the carpenter Bernardo Maggi da Abbiate. Payments towards the expenses of the model were made on 30 July, on 8, 18, 27 August, on 28 and 30 September and again on 11 January 1488. Then the model was submitted to the Works Department with a letter of which the following draft has survived. He compares the building in need of repairs to an ailing body and the architect to a doctor.

My Lords, Father Deputies, just as for doctors, guardians, nurses it is necessary that they should understand what man is, what life is, what health is, and how it is maintained by a balance and harmony of elements, while a discord of these is its ruin and undoing; and one with a good knowledge of these conditions will be better able ro repair than one who is without it.

You know that medicines when well used restore health to the sick; and they will be well used when the doctor together with the understanding of their nature

shall understand also what man is, what life is, what constitution is and what health is. Understanding these well he will also understand well their opposites and when this is the case he will know well how to repair.…

You know that medicines well used restore health to the sick, and he who knows them well will use them well if he also understands what man is, and what life and the constitutions are, and what health is. Knowing these well he will know their opposites, and being thus equipped he will be nearer a cure than anyone else.

The need of the invalid cathedral is similar— it requires a doctor architect who well understands what an edifice is,

and on what rules the correct method of building is based, and whence these rules are derived and into how many parts they are divided, and what are the causes that hold the structure together, and make it last, and what is the nature of weight, and what is the desire of force

and in what manner they should be combind and related, and what effect their union produces. Whoever has a true knowledge of these things will satisfy you by his intelligence and his work…. Therefore I shall try without detracting and without abusing anyone, to satisfy you partly by arguments and partly by works, sometimes revealing the effects from the causes sometimes the reasoning by experiment… fitting with them certain principles of ancient architects and the evidence of buildings they constructed and what were the reasons of their ruin or their survival etc.

And I shall show at the same time what is the first law of weight and what and how many are the causes that bring ruin to buildings and what is the condition of their stability and permanence. But in order not to diffuse to your Excellencies, I will begin by the plan of the first architect of the cathedral and show clearly what was his intention as revealed by the edifice begun by him, and having understood this you will be able clearly to recognize that the model which I have made embodies that symmetry, that harmony and that conformity, which belongs to the building already begun: what is an edifice, and wherefrom do the rules of correct construction derive their origin, and what and how many are the parts that belong to these.

Either I, or others who can expound it better than I, choose him, and set aside all partialities.[15]

The work which was proceeding on the cathedrals of Pavia, Como, and Milan and on Santa Maria delle Grazie inspired him to investigate the problems connected with domes rising from square and octagonal bases and to make numerous architectural drawings.

Here there cannot and ought not to be any campanile; on the contrary it must stand apart like that of the Cathedral and of San Giovanni at Florence, and the Cathedral of Pisa, where the campanile and the dome are quite detached, and each can display its own perfection. If, however, you wish it to be joined to the church make the lantern serve for the campanile as in the church of Chiaravalle.*[16]

* The Abbey of Chiaravalle, a few miles from Milan, has a central tower on the intersection of the corss.

He was also drawing plans for a new city with plenty of light and air and with two-level highways, the lower to be used by carts and loads and the upper to be reserved for the convenience of gentlefolk.

The terrible devastation caused by the plague in Milan in 1483 may have been the inducement to this work.

The following memoranda refer to his interests, activities, and acqnaintances in Milan.

An algebra which the Marliani* have, written by their father….

* Girolamo Marliani, author of Algebra; celebrated physician. His sons were also physicians.

The measurement of Milan and its suburbs. You will draw Milan.† Plan of Milan.

† On another sheet there is a sketch of a view of Milan and a rough plan with indication of the gates (reproduced in R.. Plate CIX).

A book treating of Milan and its churches which is to be had at the last stationer's on the way to Cordusio.‡

‡ Cordusio, i.e. cura duds, the name of a piazza near the centre of the town.

The measurement of the Corte Vecchia, the measurement of the castle.

Of the measurement of San Lorenzo.¤

¤ San Lorenzo, an octagonal building dating back to the sixth century. The dome is to this day one of the most wonderful cupolas ever constructed.

Get the master of arithmetic to show you how to square a triangle.

Get Messer Fazio§ to show you the book on proportion.

§ Fazio Cardano, a learned jurist, distinguished for his taste in mathematics, father of the famous Girolamo Cardano, mathematician, astronomer, and physician.

Get the friar of Brera** to show you de Ponderibus.††

** Brera, now the gallery and library of Milan, was until 1571 a monastery.

†† Liber Jordani Nemoradi, De Ponderibus, written at the beginning of the thirteenth century.

On proportion by Alchino* with notes by Marliano from Messer Fazio.

* Alchino, the Arab philosopher Alkindi.

The book on celestial phenomena by Aristotle, in Italian.†

† Meteorologica.

The measurement of the sun promised me by Giovanni the Frenchman.

Memorandum, to ask Giannino Bombardieri‡ how the tower of Ferrara is walled without holes.

‡ Giannino Bombardieri, a maker of cannon, from Ferrara.

Ask Maestro Antonio how mortars are placed on bastions by day or by night. The crossbow of Maestro Gianetto.

Ask Benedetto Portinari¤ how people go on the ice in Flanders. The measurement of the canal, locks, and supports, and large boats; and the expense.

¤ The Portinari were one of the great merchant families of Florence and represented the Medici Dank at Milan.

Find a master learned in waterworks and get him to explain the repair and the cost of a repair, and a lock and a canal and a mill in the Lombard fashion.

A grandson of Gian Angelo, the painter, has a book on water from his father.

Paolino Scarpellino, called Assiolo, has great knowledge of waterwork.

'Knots' by Bramante.*[17]

* 'Knots'. Gruppi, i.e. twisted ornaments such as illustration. Bramante, celebrated architect born in Urbino, active in Milan 1476–99.

April 1489

Study of Human Expression

On the second day of April 1489 book entitled 'Of the Human Figure'.

This is the first date that occurs in Leonardo's notes on anatomy.

On the same sheet are drawings of skulls showing the blood vessels of the face. On the reverse is a list of subjects for consideration:

Which tendon causes the eye to move so that one eye moves the other?

Of frowning the brows. Of raising the brows. Of lowering the brows.

Of raising the nostrils.

Of opening the lips with the teeth shut. Of pouting with the lips. Of smiling.

Of astonishment.

What is sneezing? What is yawning?

Falling sickness, spasms, paralysis, shivering with cold, sweating, fatigue, hunger, sleepiness, thirst, lust.

Describe the beginning of man when it is caused in the womb….[18]

G. P. Lomazzo gives the following description of Leonardo's methods of studying expressions: 'There is a tale told by his servants, that Leonardo once wished to make a picture of some laughing peasants, though he did not carry it out but only drew it. He chose certain men whom he thought appropriate for his purpose, and, after getting acquainted with them, arranged a feast for them with some of his friends. Sitting close to them he then proceeded to tell the maddest and most ridiculous tales imaginable, making them who were unaware of his intentions laugh uproariously. Whereupon he observed all their gestures very attentively and those ridiculous things they were doing, and impressed them on his mind; and after they had left, he retired to his room and there made a perfect drawing which moved those who looked at it to laughter, as if they had been moved by Leonardo's stories at the feast!'

On the 28th of April (1489?) I received from the Marchesino [Stanga, secretary to the duke] 103 lire and 12 soldi.[19]

July 1489

The Horse

On 22 July 1489 Pietro Alamanni, the Florentine ambassador at Milan, wrote to Lorenzo de' Medici: 'Prince Ludovico is planning to erect a worthy monument to his father, and in accordance with his orders Leonardo has been asked to make a model in the form of a large horse in bronze ridden by the Duke Francesco in full armour. As his Highness has in mind something wonderful, the like of which has never been seen, he has directed me to write to you and ask if you would kindly send him one of two Florentine artists who specialize in this kind of work. Moreover, although he has given the commission to Leonardo, it seems to me that he is not confident that he will succeed.'

If Sabba Castiglione is right in saying that Leonardo worked on the model for the horse of the Sforza monument for sixteen years he must have started soon after his arrival at Milan.

The following note written many years later refers to an earthquake that took place about this time at Rhodes.

In eighty nine [the year 1489] there was an earthquake in the sea of Atalia near Rhodes, which opened the sea, that is its bottom; and into this opening such a torrent of water was poured that for more than three hours the bed of the sea lay bare because of the water that had been lost from it; and then it closed to the former level.[20]

On 13 January 1490 Leonardo collaborated with the poet Bernardo Bellincioni in staging the Festa del Paradiso at the Castello at Milan in honour of Cian Caleazzo Sforza, Duke of Milan, and his young wife, Isabel of Aragon. An enormous gilt hemisphere and personifications of the planets figured on the stage.

On 28 March 1490 a contract was signed at Como for the delivery of stone for a pavilion to be constructed by Leonardo at Milan. In his notebook are sketches for an elevation and plan of a small domed edifice.

Pavilion of the garden of the Duchess of Milan.

Ground plan of the pavilion which is in the middle of the Labyrinth of the Duke of Milan.

On the reverse is the plan of a house with the following note:

If you have your family in your house make their habitations in such a way that at night neither they nor the strangers lodging with you are in control of the door of the house; in order that they may not be able to enter the rooms where you live or sleep, close the exit *m*, and you will have closed the whole house.[22]

A new notebook known as M.S.C. begun at this time is devoted to problems of light and shade.

On the 23rd of April 1490 I began this book and recommenced the horse.[22]

While at work on the Sforza monument he was looking out for horses that might serve as models. He found what he liked in the stable of Galeazzo di Sail Severino, the son-in-law of Ludovico il Moro.

The following notes are written beside sketches from horses:

- Galeazzo's big genet.[23]
- Messer Galeazzo's Sicilian horse.[24]
- Measurement of the Sicilian horse, the leg from behind, in front lifted and extended.[25]

In the mountains of Parma and Piacenza multitudes of shells and corals filled with wormholes may be seen still adhering to the rocks. When I was making the great horse at Milan a large sack of those shells which had been found in these parts was brought to my workshop by some peasants, and among them were many still in their original condition.[26]

May 1490

Cathedral of Milan (part II)

On 10 May 1490 the Works Department of Milan Cathedral returned to Leonardo at his own request the model which he had constructed for the tiburio, asking him to keep it in readiness. Leonardo had expressed the wish to repair it, but a week later he received 12 lire for the construction of a new model.

On 8 June 1490 Ludovico il Mora wrote to his secretary, Bartolomeo Calco, that the Works Department of the Cathedral of Pavia was in need of the advice of the Sienese architect who was then in Milan and added as a postscript that also Leonardo and the Lombard architect Amadeo should proceed to Pavia.

On 10 June 1490 Bartolomeo Calco replied that the Sienese architect was working hard to complete his model for the tiburio of Milan Cathedral and that Leonardo would always be at the Duke's disposal.

In the month of June 1490 Leonardo and the Sienese architect, Francesco di Giorgio Martini, set out together on horseback with a following of engineers and helpers for Pavia. They put up at the inn 'Saracino' and their bill was paid by the Works Department on 21 June, it being stated that they both had been specially called for a consultation about the cathedral.

While at Pavia Leonardo used the notebook known as MS.B. He studied in the famous Sforza library, where the work on perspective by Witelo (Vitolone), Polish physician of the thirteenth century attracted his attention.

Try to get Vitolone which is in the library of Pavia and treats on mathematics,[17]

In Vitolone there are 805 conclusions about perspective.[27]

On the Piazza in front of the Duomo at Pavia stood a bronze equestrian statue known as 'Regisole' which had been removed from Ravenna by Charlemagne. Leonardo, bearing in mind his Sforza monument, studied the action of this horse.

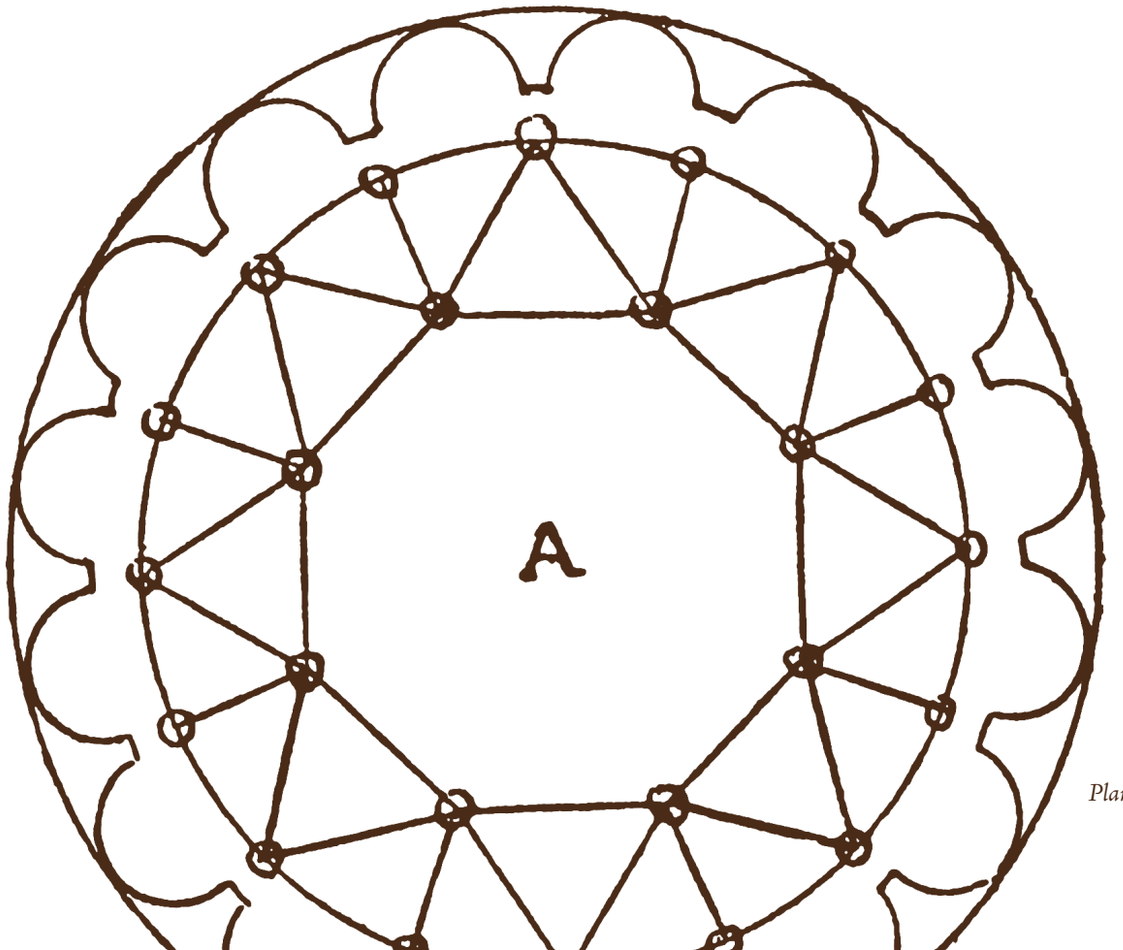
In that of Pavia the movement more than anything else is deserving of praise.

The imitation of antique works is better than that of modern.

Beauty and utility cannot go together as may be seen in fortresses and in men.

The trot has almost the quality of a free horse.

Where natural vivacity is lacking it is necessary to make accidental liveliness.[28]



Plan of Santa Maria in Praticha in Pavia.

I have watched the repair of part of the old walls of Pavia which have their foundations in the banks of the Ticino. The piles there were old and were of oak as black as charcoal, those of alder had a red colour like Brazil wood; they were of great weight and hard as iron, without blemish.[29]

On 27 June 1490 a consultation took place at the Castello al Milan in the presence of Ludovico il Moro and the archbishop to decide on the tiburio of the cathedral. Four models were under consideration, none of which were by Leonardo, and the task of construction was entrusted to two Lombard architects.

July 1490

Giacomo Salai

The followillg note records the entry into Leonardo's household of Giacomo Salai, who grew up in his service, and remained with him until his death.

On St. Mary Magdalene's day [July 22] 1490 Giacomo came to live with me, when ten years of age. Thief, liar, obstinate, glutton. The second day I had two shirts cut out for him, a pair of hose, and a jerkin, and when I put aside money to pay for these things he stole it from the wallet, and it was never possible to make him confess, although I was quite certain of it — lire 4.

The day after I went to sup with Giacomo Andrea,* and the other Giacomo ate supper for two and did mischief for four, as he broke three flagons, spilled the wine, and after this came to sup where I…

On the seventh day of September he stole a stile worth 22 soldi from Marco† who was staying with me. It was of silver and he took it from his studio, and when Marco had searched for it a long time he found it hidden in the box of Giacomo — lire 1 soldi 2.[22]

* Giacomo Andrea of Ferrara, archirect and engineer, adherent of Lodovico il Moro, was excuted when the French took Milan.

† Probably Leonardo's pupil Marco d'Oggionno (c. 1475–1530).

In January 1491 Beatrice d'Este arrived at Milan as the bride of Ludovico il Moro. She availed herself of her position as mistress of

one of the most splendid courts of Italy to surround herself with learned men, poets, and artists, such as Niccolo da Correggio, Bernardo Castiglione, Bramante, and Leonardo da Vinci.

Leonardo helped to arrange festivals in connexion with the tournament given by Ludovico's son-in-law, Messer Galeazzo di San Severino in celebration of the ducal wedding. The following entry refers to the behaviour of the boy Giacomo Salai.

On the 26th day of January [1491], when I was in the house of Messer Galcazzo da San Severino to arrange the festival for his tournament, and certain footmen had undressed to try on some of the costumes of the savages which were to appear at the festival, Giacomo went to the wallet of one of them as it lay on the bed with other clothes and took out whatever money he found there. — 2 lire s. 4.

Item, when I was in the same house Maestro Agostino of Pavia* gave me a Turkish hide in order to make a pair of boots; this Giacomo stole it from me within a month and sold it to a cobbler for 20 soldi and with this money by his own confession, he bought aniseed comfits. — L. 2.

* Agostino Vaprio of Pavia, a painter called to Milan in 1490 to help decorate the ducal castle.

Item. Again on the second day of April Gian Antonio* having left a silver stile on one of his drawings, Giacomo stole frrom him, and it was worth 24 solidi — L 1 s. 4.

The first year: a cloak Lire 2, 6 shirts Lire 4, 3 jerkins Lire 6, 4 pairs of hose Lire 7 soldi 8, 1 lined doublet Lire 5, 24 pairs of shoes Lire 6 soldi 5, one cap Lira 1, laces for belt 1.[22]

* Probably Gian Antonio Doltraffio, portrait paintcr, pupil of leonardo.

On the 10th of July 1492

in 135 Rhenish florins	l. 445
in dinari of 6 soldi	l. 112.s.16
in dinari of 5 ½ soldi	l. 201.s.19
in dinari 9 in gold and 3 scudi	l. 053
	l. 811 in all.

That is not riches which may be lost; virtue is our true wealth and the reward of its possessor. This cannot be lost; it does not abandon us unless life first leaves us. As for property and external riches hold them with trembling; they often leave their possessor in contempt and ignominy for having lost them.[30]

September 1492

Sculpture and Construction

This note helps to date the most important of Leonardo's manuscripts on the practice of painting (B.N. 2038 and A). Besides dealing with painting, it contains notes on the construction of arches and the beginnings of his treatise on water.

Thursday the 27th of September (1492) Maestro Tommaso returned and worked for himself until the last day but one of February.

On the 18th of March 1493 Giulio the German came to live with me — Antonio, Bartolomeo, Lucia, Piero, Leonardo.

Caterina came on the 16th day of July 1493. Messer Mariolo's* Morel the Florentine is a big horse with a fine neck and a beautiful head.

The white stallion belonging to the falconer has fine hind quarters; it is behind the Comasina Gate.

The big horse of Germonino, of Signor Giulio.[31]

* Mariolo da Guiscardi, attendant at Ludovico Sforza's court.

Ludovico il Mora issued a decree in 1493 to make the canal of the Martesana near Milan navigable. Leonardo in the following draft has some remunerative suggestions to make on the subject.

To my illustrious Lord, Ludovico, Duke of Bari. Leonardo da Vinci of Florence.... Does it please you to see a model which will prove useful to you and to me, and it will also be of use to those who will be the cause of our usefulness.

...There are here, my Lord, many gentlemen who will undertake this expense between them, if they are allowed to enjoy admission to the waters, the mills, and the passage of vessels, and when their expenses are repaid they will repay for the canal of Martesana....[32]

The heirs of Maestro Ghiringhello have the works of Pelacano.*[33]

* Biagio Pelacani (d. 1416) teacher of philosophy at Pavia, author of works on Aristotle and on Perspective. Giovanni di Ghiringhelli was professor at Pavia 1443-9.

Maestro Stefano Caponi, a physician, lives at the piscina and has Euclid, De Ponderibus.[34]

1493 on the first day of November we settled accounts. Giulio had to pay 4 months and Maestro Tommaso 9 months; Maestro Tommaso afterwards made 6 candlesticks, 10 days' work; Giulio some fire-tongs, 15 days' work. Then he worked for himself till the 27th of May, and worked for me at a lever till 18th of July; then for himself till the 7th of August, and on the 15th for half a day for a lady. Then again for me at two locks until 20th of Angust.[35]

In 1493 Leonardo had completed the clay model of the horse for the Sforza monument. It meaured 23 feet from the top of the horse's head to the base, but was as yet without a rider. This model was exhibited on the Piazza del Castello at Milan under a triumphal arch on the occasion of the marriage of Bianca Maria Sforza, niece of Ludovico il Moro, to the Emperor Maximilian. The wedding took place at Innsbruck on 16 March 1494 and the bride was escorted by a distinguished company travelling northwards from Milan, across the Lake of Como and the Valtellina towards the Tyrol. It has been suggested that Leonardo may have been of that company but we know that he was at Vigevano during these months.

Meanwhile the question arose how to cast the colossal clay model of the horse in bronze.

Mould for the horse.

Make the horse on legs of iron, strong and well set on good foundations; then grease it and cover it with coating, leaving each coat to dry thoroughly layer by layer; and this will thicken it by the breadth of three fingers. Now fix and bind it with iron as may be necessary.

Moreover, take off the mould and then make the thickness. Then fill the mould by degrees and make it good throughout; encircle and bind it with irons and bake it inside where it has to touch the bronze.[36]

On the 29th day of January 1494.

Cloth for hose	lire 4	s. 03
lining		s. 16
making		s. 08
Salai		s. 08
a jasper ring		s. 13
a sparkling stone		s. 11
to Caterina		s. 10
to Caterina		s. 10[37]

At the beginning of the year 1494 Leonardo was at Vigevano, the summer seat of the Sforzas on the banks of the Ticino, where Bramante was reconstructing the castle and adding the spacious Palazzo delle Dame. He made the following estimate for the decoration of a hall with scenes from Roman history and portraits of philosophers.

The hall towards the court is 128 paces long and 27 braccia wide.[38]

The narrow moulding above the hall lire 30.

The mouldings underneath this, estimating each picture separately; lire 7; and for the cost of blue, gold, white, plaster, indigo, and glue3 Lire; time 3 days.

The pictures below these mouldings with their pilaster 12 lire each.

I calculate the cost for smalt, blue and gold and other colours at 1 ½ lire.

I calculate three days for the invention of a composition, pilaster and other things.

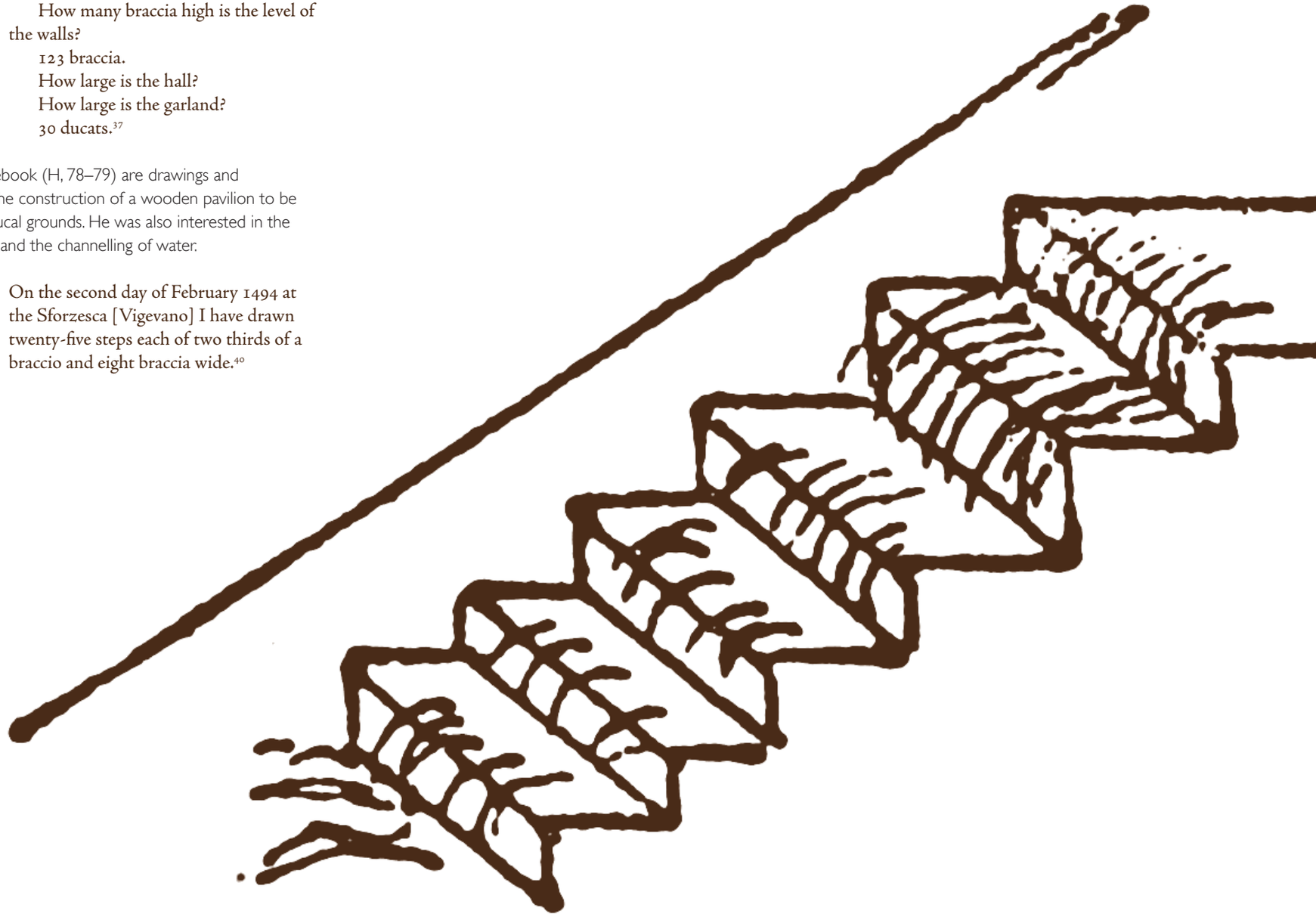
Item for each small vault 7 lire.
Outlay for blue and gold 3 ½.
Time 4 days.
For the windows 1 ½.
The cornice below the windows 6 soldi per braccio.

Item for 24 pictures of Roman history	14 lire each.
The philosophers	10 lire.
The pilasters one ounce of blue	10 soldi.
For gold	15 soldi.[39]

How many braccia high is the level of the walls?
123 braccia.
How large is the hall?
How large is the garland?
30 ducats.[37]

In the same notebook (H, 78–79) are drawings and calculations for the construction of a wooden pavilion to be erected in the ducal grounds. He was also interested in the building of stairs and the channelling of water.

On the second day of February 1494 at the Sforzesca [Vigevano] I have drawn twenty-five steps each of two thirds of a braccio and eight braccia wide.[40]



Stair of Vigevano below the Sforzesca, 130 steps, ½ braccio high and ½ braccio wide, down which the water falls, so as not to wear anything at the end of its fall; by these steps so much soil has come down that it has dried up a pool; that is to say, it has filled it up and a pool of great depth has been turned into meadows.[41]

Vineyards of Vigevano. On the 20th day of March 1494. And in the winter they are covered with earth.[42]

Below this note is a sketch showing the alinement of plants in these vineyards, which is much the same as that prevailing at Vigevano and other Lombard vineyards today, but differs from Tuscan vineyards where the winter is not so severe. Leonardo remembered his young days in the country in Tuscany and observed the difference.

On the 23rd day of August 12 lire from Pulisona.

On the 14th of March 1494 Galeazzo came to live with me, agreeing to pay 5 lire a month for his cost, and paying on the 14th day of each month.

His father gave me 2 Rhenish florins.

On the 15th day of September Giulio began the lock of my studio, 1494.[44]

September 1494

Two Dukes

In September 1494 Charles VIII of France entered Lombardy with an army on his way to the kingdom of Naples. He was received as an ally by Ludovico il Moro and entertained at Pavia. Meanwhile the Duc d'Orléans, afterwards Louis XII, who commanded the vanguard of the royal army, occupied Genoa and was menacing Milan. He was already dreaming of asserting his rights on this city based on the marriage of his grandfather with a Visconti.

On 21 October 1494 the young Duke of Milan, Gian Galeazzo, died at Pavia. The manner of his death gave rise to suspicious that poison had been administered by order of his uncle Ludovico. On the following day, at the Castello at Milan, Ludovico was proclaimed Duke, superseding Gian Caleazzo's infant son, since it was found necessary to have a man at the helm during these troublous times.

On 17 November 1494, under the pressure of political events, Duke Ludovico shipped the bronze intended for casting Leonardo's model of a horse down the Po to Ferrara to be made into cannon.

In the notebooks used by Leonardo at this time we find the following somewhat obscure entries referring to allegorical representations in connexion with the two dukes.

Il Moro with spectacles,
and Envy depicted with False report,
and Justice black for il Moro.[45]

Ermine with mud.

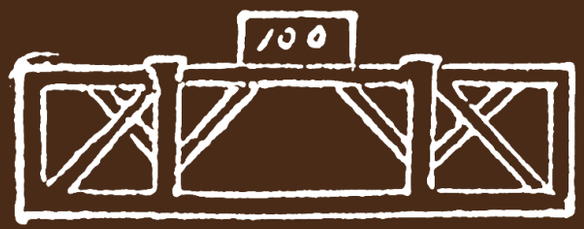
Galeazzo between calm weather and
flight of fortune.[46]

The ermine will die rather than
besmirch itself.[47]

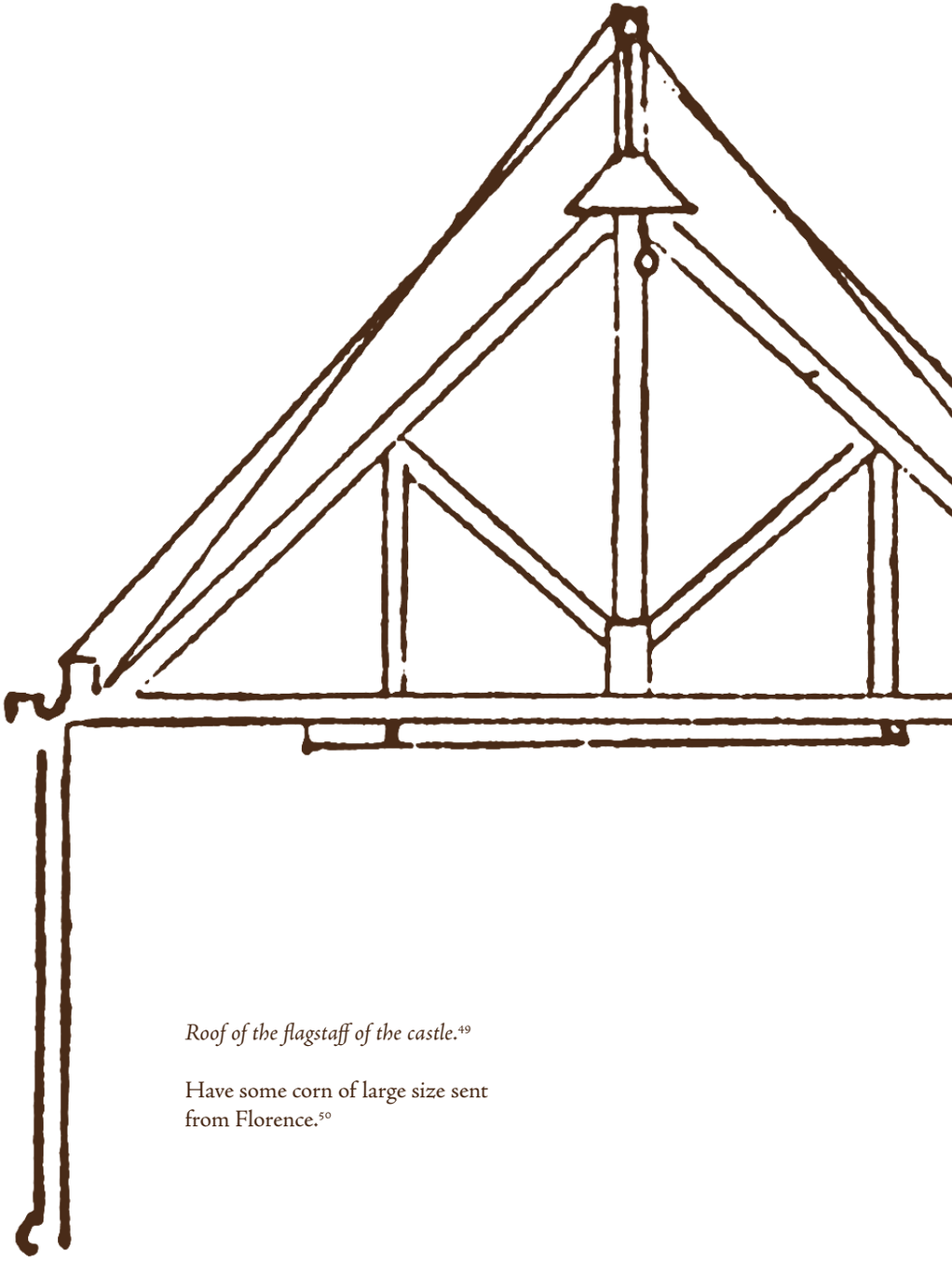
In the same notebook are a series of transcriptions from a popular medieval bestiary. These were probably made in connexion with recitations and performances at court.

> On Tuesday I bought wine for the morning. on Friday the 4th day of September (1495) the same.[48]

The little notebook which is dated by this entry of the purchase of wine deals mainly with mechanics.



Double floor.



Roof of the flagstaff of the castle.[49]

Have some corn of large size sent from Florence.[50]

1495

Death of Caterina

Funeral expenses of Caterina

For the 3lbs of tapers	27 s
For the bier	8 s
a pall over the bier	12 s
For bearing and placing the cross	4 s
For bearing the body	8 s
For 4 priests and 4 clerks	20 s
Bell, book and sponge	2 s
For the gravediggers	16 s
To the senior	8 s
For a license from the authorities	1 s
	160 s
The doctor	5 s
Sugar and candles	12 s
	123 s 51

Caterina had entered his household in 1493 and had therefore been with him for a few years.

She may have died in hospital, since Leonardo wrote the following note on the next page of the same notebook. It has been suggested that this housekeeper was his mother, who bore the same name. This seems improbable.

Piscin da Mozania at the hospital of Brolio has many veins on arms and legs.[52]

He was interested in a systematic representations of the veins of the human body as is shown by the following notes on a sheet at Windsor datable about this time.

[With drawing of figure showing the anatomy of veins.]

Here shall be represented the tree of the vessels generally, as Ptolemy did with the universe in his Cosmography; here shall be represented the vessels of each member separately from different aspects.

Draw the view of the ramification of the vessels from behind, from the front and from the side; otherwise you do not give true demonstration of their ramification, shape, and position.[53]

The pupil in man dilates and contracts according to the brightness or darkness of the object in view; and since it takes some time to dilate and contract it cannot see immediately on going out of the light into the dark, and similarly out of the dark into the light; and this very thing has once deceived me in painting an eye, and from that I learned it.[54]

1495

The Last Supper

In 1495 Leonardo began to work on his painting of the Last Supper on a wall of the refectory of the Dominican friary of Santa Maria delle Grazie. In his notebook are drawings of the socles in the apsis of that church. The following notes in the same book show how he was looking for models for his figure of Christ.

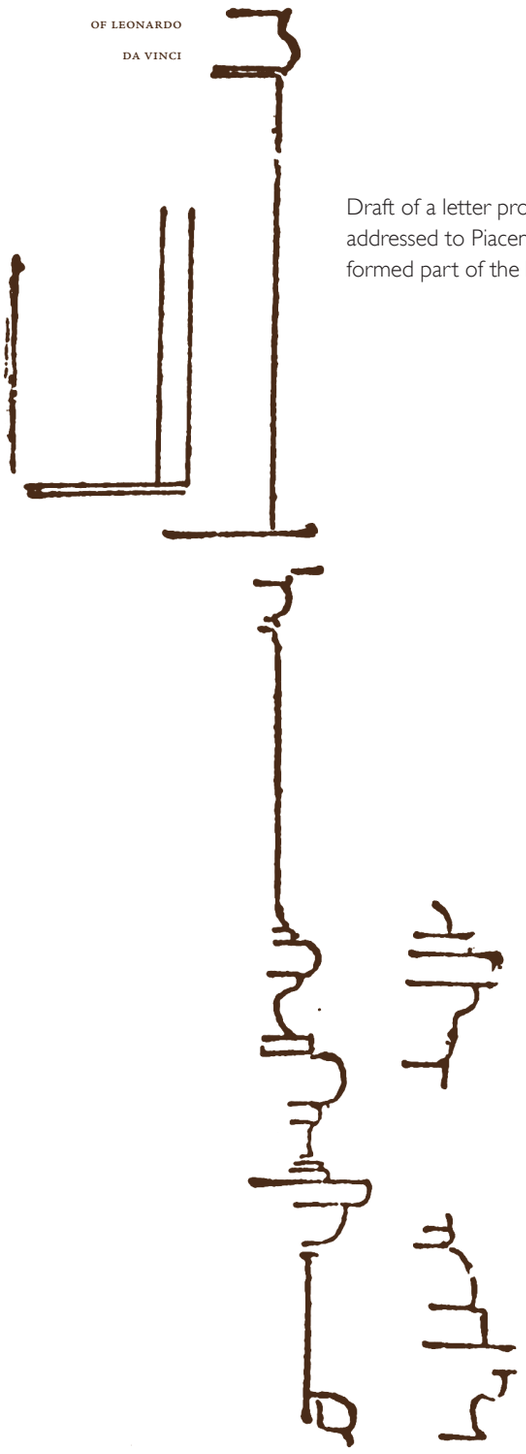
Christ—The young count, the one with the Cardinal of Mortaro, Giovannina has a fantastic face, lives at Santa Caterina, at the hospital.[55]

Alessandro Carissimo of Parma, for the hand of Christ.[56]

Among the apostles represented in the painting are portraits of courtiers and men in Milan. The following description of Leonardo's methods of studying is of interest in this connexion.

Giovanbatista Giraldi, whose 's father knew Leonardo, writes:

'When Leonardo wished to paint a figure he first considered what social standing and what nature it was to represent; whether noble or plebeian, gay or severe, troubled or serene, old or young, irate or quiet, good or evil; and when he had made up his mind, he went to places where he knew that people of that kind assembled and observed their faces, their manners, dresses, and gestures; and when he found what fitted his purpose, he noted it in a little book which he was always carrying in his belt. After repeating this procedure many times, and being satisfied with the material thus collected for the figure which he wished to paint, he would proceed to give it shape, and he would succeed marvellously.'



Draft of a letter probably dated 1496 addressed to Piacenza which at that time formed part of the Duchy of Milan.

Magnificent Commissioners of Buildings! Hearing that your magnificence have resolved to make certain great works in bronze I will put certain things on record for you. First, that you should not be so quick and hasty in awarding the commission that by your speed you put it out of your power to choose a good model and a good master as Italy has a number of men of capacity. Some man may be chosen who by his insufficiency may afford occasion to your successors to blame you and your age, judging that this age was poorly equipped with men of good judgement or good masters; seeing that other cities and especially the city of the Florentines were almost at this very same time endowed with beautiful and great works in bronze; amongst these being the doors of their baptistery.... And this Florence, like Piacenza, is a place of intercourse, through which many foreigners pass; who, when they see that the works are fine and good, form the impression that the city must have worthy inhabitants, seeing that the works serve as evidence of their opinion. And on the contrary, I say, that if they see a great expenditure in metal wrought so poorly,

it would be less shame to the city if the doors were of plain wood, because the material costing so little, would not seem to merit any great outlay of skill.

Now the principal parts which are sought for in cities are their cathedrals, and as one approaches these the first things which meet the eye are the doors by which one passes into these churches. Beware, gentlemen of the commission, lest the too great speed in wishing with such haste to expedite the commission of so great a work as that which I hear you have ordered, may become the reason why what was intended for the honour of God and of men may prove a great dishonour to your judgements and to your city, where as it is a place of distinction and resort there is a concourse of innumerable foreigners. And this disgrace would befall you if by your negligence you put your trust in some braggart who, by his tricks or by the favour shown to him, were to be awarded such a commission by you as should bring great and lasting shame to him and to you.

I cannot help feeling angry when I reflect what men those are who have conferred with me wishing to embark on such an undertaking without giving a thought to their capacity for it, not to say more.

One is a maker of pots, another of cuirasses, yet another makes bells and another collars for them, another even is a bombardier. And among them one in his Lordship's service who boasted that he is an intimate acquaintance of Messer Ambrosio Ferere* who has some influence and has made certain promises to him; and if this were not enough he will get on his horse and ride off to his Lord and get such letters from him that you will never refuse him the work. But consider to what straits the poor students who are competent to execute such work are reduced when they have to compete with such men as these.

Open your eyes and look carefully that your money is not so spent as to purchase your own shame. I can assure you that from this district you will get nothing but average works of inferior and coarse masters. There is not a man who is capable — and you may believe me — except Leonardo the Florentine who is making the bronze horse of the Duke Francesco and who has no need to bring

* Ambrosio Ferere was Farmer under the Customs of the Duke.

himself into notice, because he has work to do which will last him the whole of his life, and I doubt whether he will ever finish it, so great it is.

The miserable students… with what hope may they expect a reward. Here is one whom his Lordship has invited from Florence to do this work and he is a capable master, but he has so much, oh! so much, to do that he will never finish it. And what do you imagine is the difference between seeing a beautiful object and an ugly one? Quote Pliny.[57]

The following notes accompany the drawing of a machine for sharpening needles, with an ingenious system of gears, travelling belts, and an emery wheel, probably the first mass-production machine in history.

Tomorrow morning on the second day of January 1496 I shall have the strap made and make the test.

100 times an hour and 400 needles every time. That means 40,000 needles per hour, and 480,000 in twelve hours. Let us say 4,000,000 would bring in 20,000 soldi at 5 soldi per 1,000. That is a total of 1,000 Lire for every working day and with twenty working days every month it would be 60,000 Ducats a year.[58]

On 31 January 1496 at the house of Conte di Cajazzo in the presence of the Duke and the people of Milan was performed a play on Danae composed by Baldassare Taccone for which Leonardo designed the stage scenery. A sheet with sketches and a list of dramatis personae is at the Metropolitan Museum, New York.

Acrisius
Gian Cristophano
Mercury Gian Battista of Osmati (*?*)
Sirus
Taccone
Jove Gian Francesco Tantio
Danae
Francesco Romano
A servant

Announcer of the Performance.

Those who marvel at the new star and kneel and worship it and kneeling down with music close the performance.

A costume for carnival

To make a beautiful costume take a supple cloth and give it an odoriferous varnish made of oil of turpentine and of varnish; ingrain and glue with a pierced stencil, which must be wetted, that it may not stick to the cloth; and this stencil may be made in a pattern of knots which afterwards may be filled in with black and the ground with white millet.[59]

A bird for a comedy.[60]

Leonardo was at this time occupied with the water-supply to the Castle of Milan.

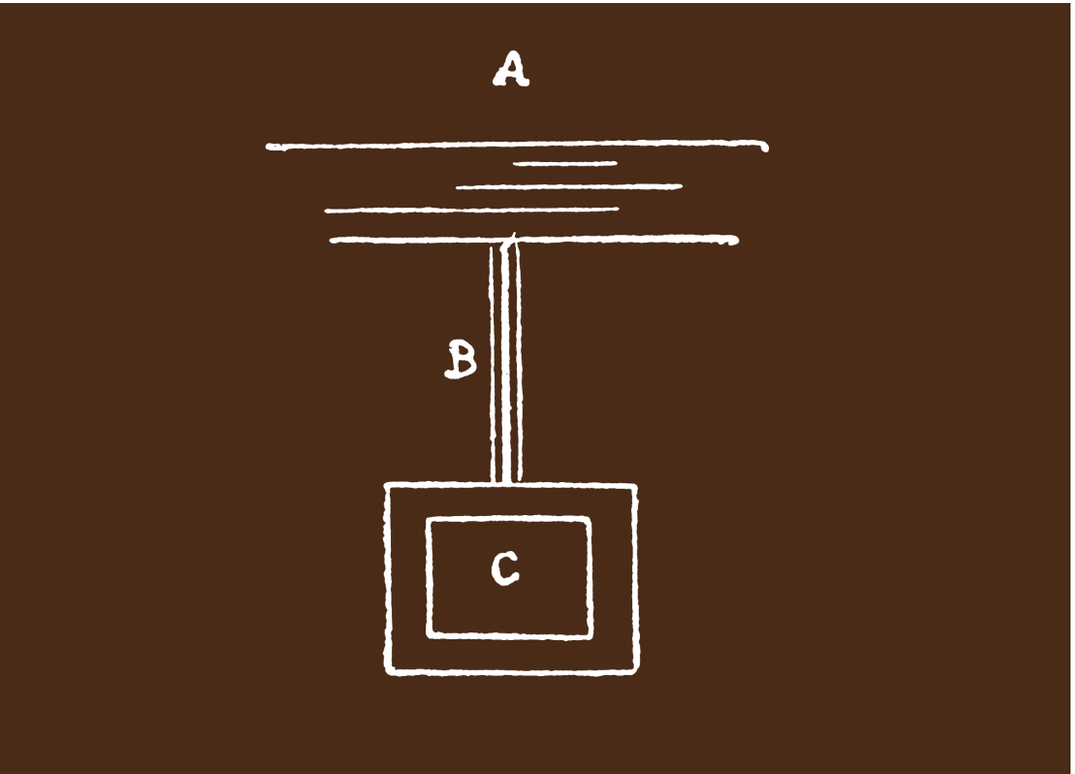
Key of the bath of the Duchess.

Show all the ways of unlocking and releasing. Put them together in their chapter. [With drawing.][61]

To warm the water of the stove of the Duchess add three parts of warm water to four parts of cold water.[62]

A way of flooding the castle [with a plan of the Castle of Milan.][63]

The moat of Milan. Canal 2 braccia wide. The castle with moat full. The filling of the moats of the Castle of Milan.[64]



About this time Duke Ludovico sent to the Emperor Maximilian, his niece's husband, a picture by Leonardo 'which was said by those who were able to judge, to be one of the most beautiful and rare works that have been seen in painting' (Codice Magliabecchiano).

In July 1496 Duke Ludovico with a great retinue set out to pay a brief visit to the Emperor and Empress at Mals. He travelled through the Valtellina, and on his retum broke his journey at Chiavenna. Leonardo may have been in the Duke's suite. He probably made more than one joumey to those parts.

3 January 1497. Death of Beatrice d'Este, Duchess of Milan. 29 June 1497, the Duke through his secretary, the Marchesino Stanga, asks Leonardo to finish the Last Supper and to begin work on the opposite wall of the refectory, where he was to insert the portraits of the Duke and the late Duchess with their two sons kneeling on either side of a Crucifixion by Montorfano.

The following account by the novelist Matteo Bandello, who came to Milan in 1495 at the age of fifteen and was placed in care of his uncle Vicenzo, the prior of the monastery of Santa Maria delle Grazie, shows Leonardo at work in the refectory:

"Many a time I have seen Leonardo go to work early in the morning on the platform before the Last Supper; and he would stay there from sunrise till darkness, never laying down the brush, but continuing to paint without eating or drinking. Then three or four days would pass without his touching the work, yet each day he would spend several hours examining it and criticising the figures to himself. I have also seen him, when fancy took him, leave the Corte Vecchia where he was at work on the stupendous horse of clay, and go straight to the Grazie. There climbing on the platform, he would take a brush and give a few touches to one of the figures, and then he would leave and go elsewhere."

1495

Financial Difficulties

Two drafts of letters to the Duke show that Leonardo was in financial difficulties.

I regret very much to be in want, but I regret still more that this has been the cause of the interference with my desire, which has always been to obey your Excellency. I regret very much that having to earn my living has forced me to interrupt the work which your Lordship entrusted to me and to attend to small matters. But I hope in a short time to have earned so much that I may be able with a tranquil mind to carry it out to the satisfaction of your Lordship to whom I commend myself; and if your Lordship thought that I had money, your Lordship was deceived because I had to feed six mouths for thirty-six months and have had 50 ducats.

It may be that your Excellency did not give any further orders to Messer Gualtieri believing that I had money.…[65]

[Written on a sheet torn vertically across.]

My Lord, knowing the mind of your Excellency to be occupied….To remind your Lordship of my small matters and… I should have maintained silence… that my silence should be the cause of making your Lordship angry… my life to your service I hold myself ever ready to obey.… Of the horse I will say nothing because I know the times… to your Lordship how I have still to receive two years' salary… with two masters whose salaries and board I have always paid… that at last I found I had advanced the work about fifteen lire… works of fame by which I could show to those who are to come that what I have been.…

Everywhere, but I do not know where I could bestow my work.…

I have been working to gain my living.…

I not having been informed what it is, I find myself…

Remember the commission to paint the rooms.…

I conveyed to your Lordship only requesting.…[66]

Plan for a projected altar-piece for San Francesco at Brescia. Leonardo knew Francesco Nani of the Franciscan Order of Brescia and had made a small drawing of his head in profile in 1495 (in notebook S.K.M. II). This connexion probably procured him a commission for this altar-piece, which, however, he did not execute.

The first part of this note is written in two columns across the margin of a rectangle which lies between them and wherein is written 'Our Lady'. The names at the head of the two columns are those of the two patron saints of Brescia.

Jovita		Faustin
Saint Peter		Paul
Elizabeth	Our Lady	Saint Chiara
Bernardino		Louis
Bonaventura		Anthony of Padua
Saint Francis		

Anthony: a lily and book
Bernardino: with [the monogram] of Jesus
Louis: with 2 fleur de lys on his breast and the crown at his feet
Bonaventura: with Seraphim
Saint Chiara: with the tabernacle
Elizabeth: with queen's crown.[67]

4th of April 1497

4 braccia of silver cloth	L 15. s.04
green velvet to trim it	L 9.
ribbons	s.09
loops	s.12
the making	L 1. s.05
ribbon for the front	s.05
stitching	
here for his grossoni 13	

(26 lire 5 soldi)

Salai steals the soldi.[68]

Artist's Process

In 1497 the mathematician Fra Luca Pacioli, who had been invited to Milan by Ludovico il Moro, completed his book. De Divina Proportione for which Leonardo designed the illustrations. In the dedication to Ludovico, dated 9 February 1498, Leonardo is said to have finished the painting of the Last Supper and to have written books on painting and on the movements of the human figure. His participation in a debate at the court between representatives of the Arts and Sciences is also mentioned. Here we should bear in mind Vasari's description that Leonardo with his arguments silenced the learned, confounded the liveliest intellect, and turned every long-established view.

'… his powers of conversation were such as to draw to himself the souls of listeners.'

The following description compares the studio of a painter with that of a stone carver. He is describing himself at work:

The sculptor in creating his work does so by the strength or his arm and the strokes of his hammer by which he cuts away the marble or other stone in which his subject is enclosed — a most mechanical exercise often accompanied by much perspiration which mingling with grit turns into mud. His face is smeared all over with marble powder so that he looks like a baker, and he is covered with a snowstorm of chips, and his house is dirty and filled with flakes and dust of stone.

How different the painter's lot — we are speaking of firstrate painters and sculptors — for the painter sits in front of his work at perfect ease. He is well dressed and moves a very light brush dipped in delicate colour. He adorns himself with the clothes he fancies; his home is clean and filled with delightful pictures and he often is accompanied by music or by the reading of various beautiful works to which he can listen with great pleasure without the interference of hammering and other noises.[69]

During these years Leonardo composed the cartoon of St. Anne, the Virgin, and the Child which is now in Burlington House. He painted the portrait of Lucrezia Crivelli, who in 1495 succeeded Cecilia Gallerani as mistress of Ludovico il Moro. A sheet with Latin epigrams, in praise of this picture by a court poet, was found among Leonardo's notes.

How well the master's art answers to nature. Da Vinci might also have rendered the soul as he has rendered the rest. But he did not, so that his picture might be a better likeness. For the soul of his model is possessed by il Moro, her lover. The Lady's name is Lucrezia to whom the gods gave all things lavishly. Beauty of form was bestowed on her and Leonardo painted her. Il Moro loved her; one is the greatest of painters the other of princes. By this likeness the painter roused the jealousy of nature and of the goddesses on high. Nature lamented that the hand of man could attain so much, the goddesses that immortality should have been bestowed on so fair a form which should have been perished. But Leonardo did it for il Moro's sake, and il Moro will protect Leonardo. Men and gods alike fear to injure il Moro.[70]

In the cathedral at the pulley of the nail of the Cross.[71]

This note is accompanied by a drawing of a pulley. The nail believed to be of the Cross is still one of the most precious relics of Milan Cathedral and is kept in the vaulting. Leonardo supplied a device for lowering it on special occasions. Ritter Arnold von Harff on his visit to Milan in 1499 described the nail being suspended above the high altar.

On 17 March 1498 Leonardo was in Genoa in the escort of Ludovico il Moro examining the damage done to the breakwater by a tempest. He refers to this visit in the following note, written beside a drawing of an apparatus for shaping metal, the principle of which is embodied in some of the machinery of the modern rolling mill.

The iron bar is to be drawn out into the shape of a rod. In the ruined part of the breakwater at Genoa the iron was drawn out into rods by less power than this.[72]

On these journeys he pursued his studies of nature. The following notes written in Florence some years later record recollections of his travels.

The flow and ebb in our Mediterranean seas does not cause so much variation because in the Gulf of Genoa it does not vary at all….[73]

At Alessandria della Paglia in Lombardy there are no stones for making lime but such as are mixed up with infinite variety of things native to the sea, which is now more than 200 miles away.[74]

At Candia in Lombardy, near Alessandria della Paglia, while making a well for Messer Gualtieri of Candia, the skeleton of a very large boat was found about ten braccia beneath the ground; and as the timber was black and fine it seemed good to the said Gualtieri to have the mouth of the well enlarged in such a way that the ends of the boat should be uncovered.

In the mountains of Verona the red marble is found all mixed with cockle shells turned into stone. Some have been filled at the mouth with the cement that is the substance of the stone; and some have remained separate from the mass of the rock around them because the outer covering of the shell had interposed and had prevented them from uniting with it. In other places this cement had petrified the shells and destroyed the outer skin.[26]

In the first days of February 1500 Ludovico crossed the Alps and re-entered Milan. His friends rejoiced, but the struggle was not yet over. Leonardo was awaiting the outcome in Venice.

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