

Introduction to Leonardo's Codex Arundel

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In 1991, Professor Carlo Pedretti, a leading expert on the study of Leonardo's manuscripts, began work on the Codex Arundel to prepare a new facsimile edition that aimed to reconstruct the original, chronological order in which Leonardo composed the manuscripts that make up the Codex. This work was published as [Il Codice Arundel 263 nella British Library \(Firenze: Giunti\) in 1998.](#)

*Professor Pedretti's introduction to this publication has hitherto only been available in Italian. While Professor Pedretti's arrangement has not been used in *Turning the Pages*TM, his work has informed the selection and interpretation of related pages. Professor Pedretti has kindly allowed the British Library to reproduce sections of his introduction here.*

Here are extracts of his text, translated into English by Ros Flinn.

... Read what Professor Pedretti says about the Codex Arundel

There are at least 15 booklets of more or less homogenous groups of papers by Leonardo. These are chronologically different but have come together in the voluminous miscellany known today as the Codex Arundel 263 in the British Library. It is not known where or when the Codex was put together - but maybe not before 1630.

The Codex Arundel is an imposing collection of Leonardo's manuscripts originating from every period in his life, a span of 40 years from 1478 to 1518. The Codex contains 285 folios, a total of 570 pages.¹ Of these, only a few are blank. Two double-sided sheets of paper, each consisting of two pages front and back, are covered with notes and drawings by another hand.² The Codex Arundel can therefore be recognised as second only in importance to the Codex Atlanticus in Leonardo's overall 'paper heritage'. This is true also for the content.

As it was initially found, in the form of a book, gave the impression that it represented only a scientific miscellany. Attention was immediately drawn to the first 30 folios (i.e. 60 pages) which were full of studies of mechanics, especially the science of weights, levers and equilibrium.

¹ Two folios, namely 100r-v and 101r-v, were incorrectly numbered twice, with the result that those folios numbered for the second time were subsequently known as 100*r-v and 101*r-v.

² Folios 258r-v, 259r-v, 260r-v, and 261r-v.

These lead to a wider range of mechanical topics, which are alluded to in some headings. Then, almost unexpectedly, the pages of the Codex address other subjects: optics and catoptrics, astronomy, geometry, cosmology and hydraulics.

All these constitute a section of texts that, in an introductory note, dated Florence, 22 March 1508, Leonardo warns relate to material taken up and developed from previous sketches and notes. These are compiled with the care usually given to a final version, but Leonardo himself defines them as 'a collection without order, a tract of many pages that I have copied here, hoping to put them in order according to the material that they contain' (folio 1r).

While working towards a regrouping of the sheets in chronological order, other important aspects of Leonardo's work in the fields of science, painting and literature were scanned, so to speak, and given appropriate emphasis. The first place is now occupied by one of the oldest sheets known of Leonardo's output: the description of the celebrated heads on the sea monster and the cave (folio 156r-v). This can be dated as about 1478-80, on the basis of both his writing and the pink preparation of the paper, which corresponds to that in a series of studies for an *Adoration of the Shepherds* from those years.

There follows a series of folios belonging to the first Milanese period. This series begins with a sheet of blue preparation on which some studies for the first version of the *Virgin of the Rocks* (1483) are sketched in silverpoint (folios 256r-253v).

Studies of mechanics, hydraulic technology and architecture in this series have parallels in manuscripts datable to the last 20 years of the 15th century. Alongside, notes on the organisation of parties and sketches for *The Last Supper*, of a shell (folio 33r), of an enlarged image of an insect (folio 36r) and so on are to be found.

In this section we also find hurried sketches and texts, which alternate page by page with outstanding examples of Leonardo's prose. In one case he confronts the theme of water as a creature without calm; in another, he defines force as a spiritual virtue.

This section ends with a plan of boilers for a new heating system (folio 145v), which has resonances in the notes relating to the 'Duchess's bath' in manuscripts and notebooks of 1499.

These are pages of densely-packed writing, some of which were largely left blank for additions and explanations, which might have

originated from after 1500. Whereas, the next series conserves traces of earlier observations.

It is from here on, in fact, until the time of the rich collection of 1508, that we find the greatest concentration of writings and drawings in the Codex Arundel. It is an extensive and rich series, subdivided in its time into other groupings that correspond to the many aspects of art, science and technology that Leonardo was working on in Florence, during the early years of the 16th century.

They include plans for canals, hydraulic machines and flow measuring equipment, studies of the flight of birds and anatomy, as well as optics, perspective and, above all, mechanics, geometry and stereometry. Then come memoranda and records which enable one to follow Leonardo's frequent travels in Tuscany, Emilia Romagna and Lombardy. These notes reveal his programmes, his reading, his contacts, his expenditure on family business, his memories of the death of his father and his surprising reflections on the sensation of reality in dreams.

The writer returns in fables and allegories, but even more, in a robust and incisive scientific prose that can suddenly burst forth into a poetic phrase: 'The innumerable semblances, that from the innumerable waves of the sea reflect the sun's rays that cross these waves, are responsible for the continual and widespread splendour of the surface of the sea (folio 94v, c.1506-8).'

From 1506 to 1508, Leonardo commuted back and forth between Florence and Milan. In the service of both the Florentine Republic and the King of France, his work piled up – painting, sculpture, architecture, theatre sets and also hydraulics and canalisation projects. At the same time, he zealously continued his researches. In addition to mechanics and geometry, he also returned to anatomy, painting, botany and the idea of writing treatises. Leonardo began to make systematic compilations with the best intentions to adopt rigorous methods, only to be diverted by new research.

This fervour continued until the end, until his final period in France, where, alongside grandiose architectural and urban development projects (e.g. folio 270v) and plans for regulating water flow and for prefabricated building systems, he returned to his studies of optics, mechanics and geometry. It was geometry that, at the beginning of the 16th century, 'made him very impatient with the quill', and impatient he certainly was on the last sheet (definitely from 1518) which ends with an 'etcetera' followed by the phrase 'because the soup is getting cold' (folio 245r).

... Read how Professor Pedretti went about recreating the original, chronological order of the Codex Arundel.

The project for a new edition in which the notebooks would be unbound and reordered chronologically was initiated by the Giunti publishing house in Florence with a programme by the *Vincian Commission for a National Edition of Manuscripts and Drawings by Leonardo*. During a meeting on 10 September 1990 at the British Library in London, the plan for a new facsimile edition was presented, along with a request to proceed as soon as possible with the disassembly of the Codex. Three months later, in December, the plan was unanimously agreed by the governing body of the Library and the project was launched.

In the meantime it was decided also to photograph all the watermarks, a total of 70 images. In early December of the following year, 1991, the separated folios were passed to the photographic laboratory and, at the beginning of 1992, that operation was completed. Having received the photographs and made an initial survey and reordering of the sheets, it became necessary to examine the unbound originals.

This was done on 25 and 26 October 1993 and on that occasion the Department of Educational Programmes at the Library, in cooperation with the BBC, organised TV coverage to illustrate the operation. The practical phase of the project could, naturally, not begin until the criteria to be followed in presenting Leonardo's texts, with the new ordering of the folios, had been established and approved.

The preceding edition (*I manoscritti e i disegni di Leonardo da Vinci*, ed. by the Reale Commissione Vinciana, vol. I, *Il codice Arundel* 263, 4 parts, Rome 1923) carried two types of transcription. One is a 'diplomatic' version placed opposite the facsimile of each page. The text is arranged 'topographically' and therefore with lines often upside down, and at times vertical or diagonal. These are always given as a mirror image of the originals in facsimile. The other is a critical transcription placed at the end of each volume with graphic illustrations. These illustrations are reversed and inserted beside the relevant texts, but without reproducing drawings with no text attached.

It was, therefore, a method of great complexity: driven, it should be said, by a punctilious aspiration to palaeographic exactitude. This came even at the expense of a more useful approach intended to

show, with appropriate references, the preliminary drafts and analogous treatment at other points in the same manuscript or elsewhere.

It was the usual method, used in Da Vinci editions over the past hundred years and also adopted in recent editions of the separated folios on anatomy in Windsor and of the Codex Hammer. The same is found again in the new edition of the Codex Atlanticus where, however, the folios are reunited in volumes so it is less convenient to study the volumes of text and the facsimiles simultaneously.

As the Codex Arundel is without precedent – apart from that in Windsor which is, in some ways, related to it – a new approach to the presentation of Leonardo's text was required. This was not just to satisfy the more or less immediate need for electronic scanning. Above all, the aim was to take advantage of the modern philological criteria for the critical interpretation of antique texts, valuing them as language documents. It was also necessary because anyone capable of reading a 'diplomatic' transcription can do without it because they can go directly to the facsimiles. The main aim of a critical transcription is to safeguard the original character of the author's language.

At this point all that remains is to consider, at least in outline, the criteria adopted for the chronological ordering of the folios of the Codex Arundel and to explain how the multiplicity of problems posed by this operation were approached and solved.

The folios in the Codex Arundel bore no evidence of an earlier numbering system and the only one, in pencil, probably dated from the early 1830s when the Codex was transferred from the Royal Society to the British Museum. This led us to believe that these folios had not been tampered with or altered since they passed into Arundel's hands from Pompeo Leoni's legacy or from Galeazzo Arconati. It is very odd that such a conspicuous group of papers by Leonardo remained for such a long time without a basic element for any collection of loose sheets or notebooks, a consecutive numbering system that facilitates its use and ensures its integrity.

One has the impression, therefore, that the miscellaneous material was conserved in this way intentionally. Perhaps its collector or collectors awaited a definitive ordering that would probably have to take into account, as much as possible, the content and follow, above all, the easiest method of regrouping them, i.e. according to size and quality of paper. Unfortunately, no evidence remains that could confirm or deny such a hypothesis and it cannot even be

confirmed that the folios were rebound as a volume when they passed from Arundel's library to that of the Royal Society.

It is even more odd that the code number '263', written in large numbers, in ink, was written, it is not known when, on the front of the first manuscript folio by Leonardo beside the celebrated text dated 22 March 1508 (folio 1r), while the Royal Society stamp is to be found in the first available margin, on another of Leonardo's folios, at the foot of the front of the following sheet (folio 2r). If the book had had a frontispiece, added later as in the codices in Madrid, as well as the usual fly-leaves, it would be right to ask if these markings, signifying identification and ownership, would not have been more appropriately placed on the added sheets rather than on pages by Leonardo. However, the discreet presence of the British Library stamp on each page does not surprise or disturb one.

It really is a shame that the 19th-century binding was substituted for the earlier, probably much older one, without conserving even the memory of the latter. The suspicion arises that these loose sheets and notebooks, if not separate, had been stitched together with a simple paper board cover in a simple notebook or hotchpotch, while waiting to be organised and then properly rebound.

The examination of the separated folios, when newly disassembled and in the same numerical order that they were in the Codex, enabled an immediate perception of the various types of manuscripts that came together in this miscellany. Most are loose sheets folded once to form four pages, in small octavo dimensions, but sewn together singly as if they were normal folio size. That this was so is shown by the way Leonardo wrote on them, filling one page and then another in sequence until he had written on all four, when he then passed onto another octavo-size sheet folded in half.

It was usual for Leonardo to give himself a limit of up to one sheet, to exhaust a single aspect of each topic. It is thus difficult to recognise the route taken by Leonardo in recording his observations through any evident relationship of character, style or even content between two or more (double-sided) sheets. This problem is also encountered in the case of notebooks – be they made up of four sheets or five. These could have been compiled individually or collectively, page after page and starting from the end, the beginning, or any other point, without any rigorous method and often using blank pages for later integration of new material.

The first notebook is recognised as the homogeneous compilation that led to the celebrated text of 1508 where one reads a declaration of method (which is, in the end, a denial of method).

Originally this notebook contained another sheet, now located separately towards the end of the volume, consisting of folios 215 and 218, which, together with folios 16 and 17 once formed a four-leaf, or eight-page notebook. The leaves were, exceptionally, numbered by Leonardo himself in retrograde order: 1 = 16v, 2 = 17v, 3 = 215v and 4 = 218v. This represented a careful compilation of texts on the Archimedean problem of the centre of gravity of a pyramid and a tetrahedron.

The context, once reconstructed, enabled us to recognise the preliminary drafts of the same material on earlier folios also in the Codex, for example, folio 65r (part of a reorganised large sheet).³ In addition, on the basis of the publication of the folios rebound into a volume, it was believed that the text at the beginning of folio 218v referred to a figure on a missing folio, while it can now be ascertained that it is at the foot of folio 215r, which is the opposite page.

The positioning so far apart of the two sheets originally side by side proves indirectly that this Codex was once kept as a group of separate documents. A similar case is that of a notable group of folios scattered at various points in the manuscript and now reunited to form a codex on stereometry similar to the Codex Forster I¹, dated 1505, for which a sort of index or summary can be recognised.⁴ In this case there is further evidence of Leonardo's habit of compiling sheets by keeping the paper open flat. Apart from the compass holes that go through from one page to another, a line of text on folio 239r continues on folio 240v rather than starting a new line on the same page. Text previously considered fragmentary is now reintegrated.

Maybe such notebooks had, or were supposed to have, paper board covers as in the case of the Codex On the Flight of Birds. The abbreviation 'N. di P' (something that Melzi, or whoever was working for him, used to indicate which notebooks contained nothing on painting) is found on the outer sheets of two of the notebooks contained within Codex Arundel. Whereas, the same is found on the cardboard cover of the Codex On the Flight of Birds. Therefore, the idea that these notebooks ever had covers can probably be excluded.

³ Folios 65r-v, 68r-v, 282r-v and 283r-v.

⁴ Folios 154r-v, 178r-v, 179r-v, 208r-v, 209r-v, 108r-v, 111r-v, 123r-v, 124r-v, 182r-v, 183r-v, 219r-v, 222r-v, 239r-v and 240r-v.

The notebooks and loose double-sided sheets vary little in size and quality of paper. They lent themselves easily, as if by some spontaneous process, to being put together in a single volume without recourse to the complex system of mounting them on pages of the same size as in an album. This was, however, the case with the Codex Atlanticus and the volume in Windsor, where the manuscripts mounted are of every conceivable size, from folded sheets of paper to minute fragments.

A case almost as unique in the present reordering of the Codex Arundel is the possibility that the two double-sided sheets, folios 65r-v and 68r-v, and 282r-v and 283r-v, originally formed a large sheet, folded twice to produce four parts. This is like the celebrated Windsor 'signature', RL 19149 – 19152, where the notes were placed head-to-head as is done in typography. The two sheets in Codex Arundel each measure 22 x 14.6 cm and so 44 x 29.2 cm together. This is a similar size to the large folio in the Codex in Windsor, which measures 43.7 x 31.4 cm.

The paper used to compose folios 282r-v and 283r-v, the last in the Codex Arundel, has the watermark of the Campanula or Tulip which was very common in Italy between 1495 and 1508 and is also to be seen in the Codex Hammer. Watermarks or those of other liquids, in mirror images on this or that sheet, attest to the fact that they were originally contiguous, even if they do not prove that the two sheets were still together when Leonardo filled them in. In the case referred to above (folios 282r-v and 283r-v) the contiguous pages are covered with notes and drawings on hydraulics, mechanics and geometry and with some sketches of the same lamp as studied on folios dating from about 1505 now in Windsor and in the Codex Atlanticus.⁵

The importance of these pages (folios 65r-v, 68r-v, 282r-v, and 283r-v) lies in the formulation of the theory on the centre of gravity of a tetrahedron, later developed on folio 218r which was part of a compilation dated 1508. Considering the statement illustrated by the two diagrams on folio 65r, Marcolongo revealed its fragmentary nature. He observed that, on the pages immediately preceding or following, there is nothing relating to the 'axes' of the tetrahedron. And then he asks, in a note, why Leonardo had not immediately noted how 'the point of intersection of the axes was the centre of gravity of the tetrahedron, which is such an important discovery'.

⁵ This was also touched on in another two-page spread in the Codex Arundel, folios 220r and 221v and is the so-called '*Lucerna di Vinci*'.

Marcolongo concluded that 'this cannot be explained without acknowledging the loss of the folio after f. 65'.⁶

What is left of Leonardo's notes, later developed in the definitive version of 1508 (folio 218r), is now available in the reconstructed 'quadrifolio' (folios 65r-v, 68r-v, 282r-v, 283r-v). Although we are considering a context which is still fragmentary, it is mainly to these researches in the Codex Arundel as in no other surviving manuscript by Leonardo, that this Codex owes its immense importance. Marcolongo argued Leonardo's researches on this topic including his 'primitive' mention of the graphic method of finding the centre of gravity of a curvilinear figure (semi-circle) and two elegant theorems on the geometry of the tetrahedron were the only contributions over many centuries to Archimedes memorandums.⁷

In addition to the two principal types of folio – notebooks and loose sheets – that make up most of the Codex Arundel, the collection incorporates other materials that accentuate its character as a miscellany. This is the case with paper with pink, sky-blue, red and even black preparation (spaced out in this order which corresponds to the chronological passage from 1478 to 1518). Such papers were initially intended for drawings, of which there are hints on them, and then used for writing on, because, just by folding them in half the format of the other folios in the manuscript could be obtained. It could be said that the paper is always the same, with some exceptions, while the size of a page depended on how many times it was folded.

Thus, in this Codex, there are cases of folios folded more times but not cut. Or rather, they have writing inside each of the parts obtained by folding, placed in such away that the parts could later become the pages of a notebook. It would seem more probable that Leonardo refolded the folios in this way in order to make note-paper to carry in his pocket. All these aspects of Leonardo's working habits – and it must be stressed that these did not constitute a method – are evidenced, at a glance it could be said, by the series of folios from the disassembled Codex Arundel. In fact, once they had been placed in the categories that followed each other in chronological order, the presence of a possible notebook could always be seen from the resultant neighbouring pages.

After these observations of a general character, it was possible to concentrate on reviewing specific cases in order to illustrate and,

⁶ Roberto Marcolongo, *Memorie sulla geometria e la meccanica di Leonardo da Vinci*, Naples, 1937, pp. 184-202.

⁷ *Ibid.*, p. 202.

finally, to justify the method adopted. This did not pretend, it must be said once and for all, to present the separated folios of the Codex Arundel in the precise order that they were produced in. Such a task would have been difficult even for Leonardo and impossible for those that followed him. Instead, the aim was to regroup folios of the Codex Arundel into historical, biographical and therefore thematic order by following a historical course that is easily recognisable. It was a course signposted by the fixed points during the first phase of Leonardo's movements back and forth between Florence and Milan, and therefore from one region to another in central Italy, during the so-called 'errant' phase in his life at the beginning of the 16th century.

During this period, his enthusiasm for planning vast territorial works, such as the canalisation of the Arno, alternated with periods of intense and systematic scientific research, something that would prevail during his final periods in both Italy and France. So, in summary, the order proposed is in part explained through the power of the visual impact of the folios themselves.

It might be useful, however, to pause from time to time to consider new facts discovered during a series of precise definitions of chronology, especially if they involve reflections on the wider context of Leonardo's manuscripts and drawings considered as a whole. The reader, becoming a researcher, may discover for her/himself with the guidance of notes placed as comment. Once again it is a matter of favouring, here as elsewhere, the scientific contribution that satisfies one by supplying 'work and materials not yet spoken', which is what Leonardo himself might have said when he turned to a reader in a far-off age.

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