



Books as Technological Masterpieces

Ruth Keller

Introduction

Fascinating works of book art can be found in the collection of the Herat Archive of Books and Manuscripts. They have been maintained over centuries' time and bear witness to the art of the book that was developed to excellence during the Timurid reign at the court of Herat and further cultivated under Safavid rule (Fig. 1). Refined materials and constructive details attest to the transformation that the book experienced in its artistic and technical design during the 15th and 16th centuries in Herat. Thin, translucent (see title image) and compact coloured papers characterise the interior of the books (Fig. 2). Polychrome embossing enhanced into relief decorate the book cover. Rare kinds of leather and their modifications embellish the outer surface of the books. This development was made possible by the *kitab-khane*¹, the courtly atelier for book art and painting. It was initiated and fostered by Shahrokh (1405–1447), son of Timur and ruler of Herat, and by his son Baysunqur (1399–1433). Thus, with its own building² from 1428 onwards the *kitab-khane* could develop into a centre of research and innovation. There, in many years of coordinated cooperative work among several masters, the book emerged as an aesthetical and technologically high-quality *oeuvre*, which we associate with courtly book art from Herat.

Apart from the achievements of the courtly atelier, the particular charm of the Herati collection is that the close relation of Herat's citizens with their books is almost tangible in the manuscripts and their covers, marked by traces of long usage. Represented are, first and foremost, the Qur'an and lyrical works, as well as manuscripts containing theological, legal and historical themes. Their place of origin was not the court, yet they nevertheless display characteristics of the art of the book cultivated there. Comments on the margins and carefully

pasted bookmarks suggest a thorough engagement with the contents. The tactile moment of movement when turning the pages is traced by the worn covers and thumbed pages. The personal appropriation of the book experienced thereby was expressed by the Herati bibliophile Mulla Jami at the end of the 15th century. Jami is given voice in A. Schimmel's reference to the still abundant holdings of libraries of the time:

*"There is no better friend in the world than the book;
In the house of grief in this time there is no better consoler,
Every moment a hundred kinds of peace come from it
In the corner of loneliness and it never hurts the heart."*³

Created at the same time as this poem, in 1492 and 1493, were two courtly manuscripts, HNA 67 and HNA 11, which feature the following discussion. Mulla Jami conveys an atmosphere of the prosperous city of Herat at the end of the 15th century, when times began to become unsettled.

Book-Archaeology and Methodological Approach

Having dealt with the artistic and aesthetic qualities of the manuscripts in the Herat National Archive in the preceding contribution by C.-P. Haase, the question discussed here concerns the achievements in Herati book art in terms of material technology, which can be identified in the Archive's collections. The starting situation is good in so far, as the collection holds two older manuscripts from the library of the prince and patron of book art, Shahrokh himself, which must have already been established before the onset of developments in Herat. We will pay special attention to the aforementioned courtly manuscripts dated to the 15th century. Other courtly works of book art are not dated, but can presumably be attributed to the broader sphere of influence of the *kitab-khane*.

Evidence from subcourtly manuscripts, that is those made outside of the court, in the Herat National Archive, shows that courtly manufacturing techniques had an influence on book production in surrounding areas. In a work report from the *kitab-khane* written in 1427, O. Aslanapa notes that apart from the long-term work of the masters on individual, precisely drafted works of book art, one of the masters was occupied with drawing decorations⁴, obviously designed as models for other, presumably non-courtly crafts. Therefore the question arises as to whether or not in addition to the thus disseminated artistic innovations of the *kitab-khane*, less important technical ones had also an impact on the crafts in Herat. Indeed, the evidence found in the manuscripts is not without relevance: the use of silver threads from Persian textile production was adopted for weaving the endbands of the books. Maceration of the papers was achieved by means of an obviously

¹ For details see: Haase, Book Art.

² Porter 1992, 151.

³ Schimmel 1989, 71.

⁴ Aslanapa 1979, 59.

highly technological procedure, which cannot be found in the hitherto known sources (Fig. 42). Attempts were made to plasticise cover materials for the decoration of the book (Fig. 26a). Moisture-proof coatings composed of biopolymers, such as casein and various hardenings (with the help of alum) served to protect the calligraphy and painting. Plant extracts with an insecticidal and general microbiological effect were worked into the coating or the paper pulp for long-term protection. Methods for preparing high tension materials, such as ray skin, making their tension more manageable, can be found as well as the use of soft, partly long-fibred paper pulp to equalise the tension between materials with different expansion behaviour. These technologies can be presented here as evidence, but they can be evaluated as to their origin and significance only to a limited extent. Nonetheless, in the following we wish to make a contribution to the few archaeological data and facts on book art in Herat known so far.

From a methodological perspective we approach the book in its form as codex and deal with its function, the mechanics of movement within the context of bookblock, cover and use. The bookblock with its sewn bindings and the stabilisation by means of the endband as well as the binding materials inside and outside the cover are crucial for accessing Herati book art. This is followed in the bookblock by the paper, which plays a prominent role in Islam as mediating material for information, illuminations and partly also miniatures. The use of ink, coloured lacquer, colouring agents and painting substances will be addressed briefly only at the end, as their identification would have required non-destructive testing, which was neither available on site nor possible in every case.

In general, macroscopic and microscopic examinations, upon which most of the subsequent observations are based, were possible on site to a certain extent. Furthermore, some samples were microscopically analysed in Germany and examined with respect to their inorganic components, so that, for example, the omnipresence of alum in and on the materials of the manuscripts could be proven. On the basis of differentiated microscopy the puzzle of the stupendously translucent and smooth, thin paper of HNA 11 from 1493 could be solved. Which of these developments can be assigned to Herati, or Persian and Central Asian book art in general, and which are based on external influences, especially from China, or what exactly was genuinely developed in Herat, cannot be decided here. For this purpose further extensive holdings of cultural heritage would need to be investigated as to the use of individual technologies.

The Codex

The manuscripts in the Herat National Archive are in the form of a codex. Its construction is based on a binding system, in which the quires with their content written upon so-called bifolios are fixed in a certain sequence by sewing. Thus, the recorded content is well protected and at the same time presented in a clearly arranged, easily accessible condition. The quires are assembled from a certain number, typically four, of equal sheets of paper as the writing surface and folded in the middle, resulting in eight folios. In Islamic culture, the basic layout and the lines for handwriting are first faintly impressed on the surface of the unbound folios that have been stacked into quires, and they are then

written upon. The quires consisting of the painted and written folios are the building blocks of the book's architecture that form the bookblock. They are first bound by sewing and later reinforced by adhesive. Using fine needles and fine thread, one quire after the other is added to the gradually forming bookblock and sewn along the centrefold to the underlying quire (Fig. 3). In Islamic codices a link stitch serves for binding the quires. This simple form of binding allows the book to be used without the folios losing their predetermined sequence. Yet, the books are still flexible in all directions, because the quires are bound together solely at mostly two, sometimes four sewing stations along the centrefolds by means of a loop formed by a thin, slightly flexible thread. Thereupon, the bookblock is stabilised along the spine without stiffening it by means of two more procedures: first, the spine is reinforced by three layers of thin paper or linen lining using low viscous paste. Subsequently, an endband is woven onto both ends of the bookblock (see Keller, Conservation, Fig. 22). The cover, which is flush with the head and tail of the bookblock, protects the stacked quires of the writing surface (Fig. 5). Stored in horizontal position and treated with the care appropriate for a work of art, these manuscripts can be preserved over a long period of time.

Mechanics of the Codex

The structural efficiency for use of the codex remains unquestioned to this day. In contrast to scrolls every part of the text on the folios and quires is readily accessible. For this reason the codex has dominated book culture for almost 2000 years, in Egypt, by the Coptic Christians, during the Late Roman Empire, from Byzantium to the Islamic and Christian cultures, and it is still the most common type of book worldwide. The manner of binding the quires along the spine and fastening them to each other is specific to book art in every culture and region. This range of possibilities for keeping the quires of the codex permanently stable, yet flexible developed further in the course of history of the codex. It represents possible solutions for maintaining the mechanical stability of the book. These solutions, however, can never be perfect, but can refer to the significance of the use and preservation of the book in the corresponding society.



Fig. 1 Upper cover coated with surface coloured, tawed camel leather: central medallion with pendants made of monochrome, red lacquered relief prints; blind-stamped: vertical middle line, two double frame lines with row of dots in between (Jami's poems, late Timurid or early Safavid. HNA 55)



Fig. 4 Second sewing station inside a 14th century manuscript, one third of spine length; first station was two fifth of it (741/1340, HNA 53)



Fig. 2 Elegant manuscript's margins surface painted in blue (HNA 71)



Fig. 3 Spine of courtly Herat manuscript with three historic sewing stations: disintegrated quires, upper part (HNA 11)

The problem is that the inevitable movement during use of the codex is quite complex: the written surface and the spine of the codex are more or less mutually set in motion when opening or closing the book and when turning the pages. Thereby the points of movement can be technically diffused, shifted or concentrated on individual spots.⁵ A flexible spine, as chosen already quite early in the Islamic book technique, makes use of the centrefold in the quires as a pivotal point of movement. Thus, the book opens easily, so

⁵ Conroy 1987, Fig. 5: "Tension and compression in a single-material spine."



Fig. 5 Rectangular shape of courtly manuscript, slight protruding at fore-edge, a sign of long use (late Timurid or early Safavid period, HNA 55)



Fig. 6 Manuscript opened: rounded arch of spine; the well-proportioned layout of double page perceivable (Jami's poems, HNA 55)



Fig. 7 Separation of cover from bookblock caused by sturdy lining well adhered to the leather: endband and part of paper of quires torn off from bookblock; possibly original cover (27th Ramadan 756/5.10.1355, HNA 106)

that the folios are presented in an almost flat, horizontal position (Fig. 6). A rigid construction of the spine, which in contrast holds the quires like a shaft, allows only a limited opening of the book, so that the folios bend upward into a convex curvature and cannot be viewed as a whole on this curved surface. This phenomenon is well known in the modern-day books, which are bonded with thermosetting adhesives instead of being bound, especially paperback books. Between these two extreme possible ways to bind a book, there is a variety of book-binding techniques, which have developed since the time of Late Antiquity and early Coptic codices. In his comparative fundamental work 'The Archaeology of Medieval Bookbinding' J. A. Szirmai has examined the numerous early approaches. Accordingly, the Islamic technique of binding the quires to form a bookblock by means of a chain stitch was similarly applied by the Arabs in Egypt which they had learnt from Coptic bindings. However, they soon limited their sewing technique to two stations, so that in the centrefold of each quire only one stitching thread is present for the stitch length inside (Fig. 4). Ever since the Middle Ages the spine of the Islamic codex was additionally reinforced by lining.⁶ As is the case with most types of medieval codices, the endband, which was then fixed on the spine, piercing each quire's centrefold, also had an essential stabilising function (Fig. 8). This fundamental technique has prevailed in Islamic book manufacture and, thus, is also found in the relevant parts of the book collections in the Herat National Archive. One essential reason might have been the manuscripts' double-page based layout. In order to achieve full viewing or reading potential, the possibility to open these double pages completely or at least to an angle of 120° to 160° was deliberately given much leeway (Fig. 6). A somewhat thicker book, which had been reinforced several times, would form a concave curvature along the spine, if it was sufficiently flexible. This would disappear when the book was closed again. Presumably one precondition was that the architecture of the book, balanced between statics and dynamics, would be considered with regard to the use of

⁶ Szirmai 1999, 51.



Fig. 8 Endband on lined textile stabilising book after loss of cover; torn left of middle; warp of 2–3 threads, weft of two threads, the thicker light one is laid and couched to the warp by the thinner blue one (as Fig. 4)



Fig. 9 Unique tissue: remains of an endband with silver coated silk thread; nearer edge of brilliantly illustrated courtly Yūsof u Zalīqā (end of Timurid, beginning of Safavid period, HNA 80)



Fig. 10 Detail of endband: the two threads of weft, red silk in contrast to yellow silk wound around with flattened silver strip; remains of the linen warp visible; leather core missing (as Fig. 9)

the book, and that the book would therefore always be treated with care and never stored in an upright position. This must have applied in particular to book art in Herat with its remarkable layout in the time of the *kitab-khane*.

In the western civilisations, in contrast, emphasis was increasingly placed on a stable support of the quires in the spine, and thus reinforcing the binding by means of sewing supports. In Carolingian times the codex could be opened flat with a flexible, concave arching spine, to which endbands were attached or sometimes glued.⁷ Over time and with the increasing thickness of books, there was a change towards a decidedly stronger curvature of the spine, in order to balance out the rising caused by the sewing thread, as well as towards a heavily glued spine. With this method the quires were firmly anchored in the construction of the spine. Especially important here was its long-term stability, preventing the loss of individual pages or whole quires. With this intention some manuscripts in the Herat National Archive were reshaped, presumably under European influence. As a consequence, the stiff glued spines, to be discussed in the next paragraph, had become too wide due to a too thick sewing thread. The delicate Islamic papers thus had to take over the movement function, which repeatedly led to tension-induced damage (see Keller, Conservation, Fig. 20). Evidence of repair work using European binding techniques can be found, for example in the spine of manuscript HNA 55 with lyrical content: a thin, sewing supporting strip was inserted, traces of which can be seen in the open spine of HNA 55 (see Keller, Conservation, Fig. 34). As the spine was subsequently densely applied with hide glue, tension was produced, which, as a result, hindered rather than supported the stability of the spine. During conservation of the manuscript a stable attachment of the cover to the bookblock was only possible after removing the layers of hardened glue.

⁷ Szirmai 1999, 135: "The Carolingian structure has the merit of having preserved its basic functioning for hundreds of years, [...]"