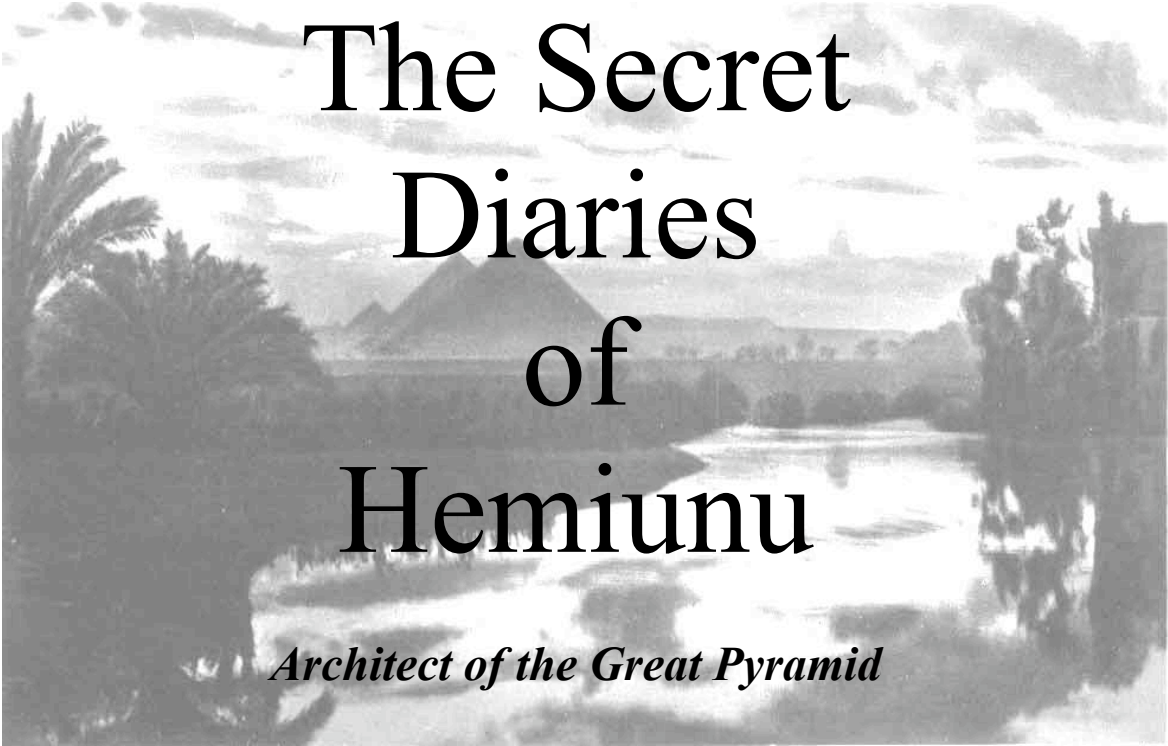


The Secret Diaries of Hemiunu, Architect of the Great Pyramid

Derek Hitchins





The Secret Diaries of Hemiunu

Architect of the Great Pyramid

Translated and Interpreted

by

DEREK HITCHINS

The Secret Diaries of Hemiunu

Translated and interpreted
by
DEREK HITCHINS

PART A. PROVENANCE..... 1

| | |
|--|----|
| Introduction | 2 |
| Discovery of Hemiunu's Secret Diaries | 4 |
| Recovering the Information in the Diaries | 6 |
| Interpreting the Diaries–Hemiunu's Journal | 8 |
| What the Diaries Contain | 9 |
| Hemiunu of the History Books | 10 |

PART B. LIFE, LOVE AND LEARNING..... 13

| | |
|--|----|
| Hemiunu's Education and Schooling | 14 |
| <i>Curriculum</i> | 17 |
| <i>Modelling</i> | 17 |
| <i>Theology</i> | 18 |
| <i>Astronomy</i> | 22 |
| Royal Fowling Trips..... | 26 |
| Meidum–Hemiunu's Baptismal Pyramid | 28 |
| <i>The Inheritance</i> | 28 |
| <i>The Inherited Design Concept</i> | 28 |
| <i>Snefru's Intent</i> | 30 |
| The Party at the Palace of Snefru..... | 32 |
| From Hemiunu's "University" Notes | 34 |
| <i>Understanding Djoser's Complex at Saqqara</i> | 34 |
| <i>Imhotep</i> | 36 |
| <i>The Party Scene</i> | 37 |
| <i>Astronomy</i> | 38 |
| <i>Hemiunu's "First Time"</i> | 41 |
| <i>Estimating</i> | 42 |
| <i>The Temple of Hathor</i> | 42 |
| <i>Corbelling</i> | 45 |
| <i>How Deep was the Underground Netherworld</i> | 46 |
| <i>Security Systems – physical and spiritual</i> | 46 |
| <i>Graduation</i> | 49 |
| The Priest-Architects and the Masons | 52 |
| <i>The Keepers of Knowledge</i> | 52 |
| <i>The Factions and their Allegiances</i> | 53 |

| | |
|---|-----|
| Evidence of Dissatisfaction | 54 |
| Hemiuunu's Dreams | 56 |
| An Audience with the King | 58 |
| Ancient Magic | 62 |
| <i>Kinds of Magic</i> | 62 |
| The Magic of Numbers | 68 |
| <i>The Sacred Seven</i> | 68 |
| <i>Measuring and Setting Slopes – the Seked</i> | 68 |
| The Marriage | 72 |
| A Royal Progress | 76 |
| Moving Justice | 78 |
| Thebes, City of a Thousand Lights | 84 |
| Abu and the Temple of Khnum | 86 |
| The Story of Dahshur | 90 |
| <i>Pyramid Problems</i> | 90 |
| <i>Pyramid Research Station</i> | 91 |
| <i>Research Subjects</i> | 92 |
| <i>Creating Chambers</i> | 93 |
| <i>The Bent ka Pyramid</i> | 95 |
| <i>Foundations and Stability</i> | 97 |
| <i>Hemiuunu's Calculator</i> | 98 |
| <i>Stone size</i> | 99 |
| <i>The Search for Perfection</i> | 99 |
| The Corvée—Legend and Practice..... | 100 |
| Hemiuunu Leads the Games | 101 |
| Pyramid Progress | 102 |
| Return to Meidum | 104 |
| <i>Snefru's Design Concept</i> | 104 |
| <i>Achieving the Shape</i> | 106 |
| <i>Snefru is Satisfied</i> | 107 |
| Snefru Dies | 108 |
| Snefru's Entombment | 110 |
| <i>The King is Dead, Long Live the King</i> | 110 |
| <i>The Family Interment</i> | 110 |

PART C. REGIME CHANGE! 113

| | |
|---|-----|
| Horus-Khufu..... | 114 |
| <i>Taking Control</i> | 114 |
| <i>Pyramid Design</i> | 115 |
| Death in the Family..... | 116 |
| <i>Hemiuunu Loses His Father</i> | 116 |
| Strategic Withdrawal | 118 |
| <i>Bearer of the King's Seal</i> | 118 |
| <i>Planning with the other Viziers</i> | 119 |
| Hemiuunu's Progress | 120 |
| <i>Promoting the Annual Games</i> | 120 |
| <i>Working on Hemiuunu's Design Project</i> | 121 |
| Hemiuunu Develops his Pyramid Concept | 122 |
| Inaugurating a Temple | 126 |
| Charting the Cataracts..... | 127 |

| | |
|---|-----|
| The Granite Quarries of Abu | 128 |
| <i>Learning the ropes</i> | 128 |
| <i>Transporting Granite Monoliths by Boat</i> | 129 |
| <i>Looking Ahead</i> | 131 |
| Khufu's Second Anniversary Party | 132 |
| <i>Khufu Dictates his Roles</i> | 132 |
| <i>Princess Hetepheres Entertains</i> | 132 |
| Early Problems with Khufu's Pyramid | 134 |
| <i>The Causeway and the Docks</i> | 134 |
| <i>Ankhaf plans a novel underground chamber</i> | 134 |
| <i>Setting out the foundations</i> | 135 |
| The Pursuit | 136 |
| <i>Khufu Sends the Marines</i> | 136 |
| <i>Intelligence Network/Crystal Ball</i> | 136 |
| <i>Escape and Evasion</i> | 136 |
| Finding the Tropic of Cancer | 137 |
| A Visit to Kush | 138 |
| The Mountain Gods | 140 |
| Dream Time | 142 |

PART C. KHUFU'S HORIZON145

| | |
|---|-----|
| Prodigal's Party | 146 |
| Khufu's Concerns | 148 |
| System Designer at Work | 150 |
| Inspiration | 154 |
| Developing Concepts | 156 |
| The Height Budget | 158 |
| <i>Refining the Design</i> | 158 |
| <i>Hemiunu's Sums</i> | 159 |
| Early Design Review— <i>Akhet Khufu</i> | 162 |
| Rising Threats to Khufu's Spiritual Authority | 164 |
| <i>Developing Social Hierarchy</i> | 164 |
| <i>The Rising Cult of Re</i> | 164 |
| Construction Strategies | 166 |
| Court Intrigues | 170 |
| A Narrow Escape | 172 |
| Insubordination in Kush | 173 |
| <i>Hemiunu creates external threats</i> | 173 |

PART D. THE GREATEST CHALLENGE.....175

| | |
|--|-----|
| Resourcing the Project: <i>Akhet Khufu</i> | 176 |
| Cities of the Dead | 180 |
| Hemiunu's Medical Research | 181 |
| The Final Design Solution | 182 |
| <i>How Long Would it Take</i> | 183 |
| <i>Work Patterns</i> | 183 |
| The Moaning Rock | 186 |
| Organizing the Project | 188 |
| Déjà Vu in the Quarry | 191 |
| The Builders' Village | 193 |

| | |
|--|-----|
| Trials of Novel Features | 195 |
| <i>Sliding Plug Stones</i> | 195 |
| <i>Fitting Girdle Stones</i> | 196 |
| <i>Sealing With Portcullis Doors</i> | 197 |
| <i>Constructing the Grand Gallery</i> | 199 |
| <i>Setting Slopes – Hemiunu’s Setsquare</i> | 199 |
| <i>Single Vs. Double Gable</i> | 199 |
| <i>Prefabricating Conduits</i> | 201 |
| Trouble in Sinai..... | 202 |
| <i>Inundation Woes Increase</i> | 202 |
| <i>Hemiunu travels north</i> | 203 |
| <i>Hemiunu Visits Lower Egypt</i> | 203 |
| Progress Meeting— <i>Akhet Khufu</i> | 206 |
| Eclipse and Curse..... | 208 |
| The <i>Serdab</i> , the Niche and Horus-Khufu..... | 210 |
| The Strange Case of Queen Hetepheres I..... | 214 |
| Building the Grand Gallery | 217 |
| Murder in the Palace <i>Hareem</i> | 219 |
| Creating Khufu’s Egypt Map..... | 220 |
| <i>Raising the Mound of Creation</i> | 220 |
| Khufu’s Sarcophagus | 226 |
| Hemiunu Visits the Healers | 227 |
| Hemiunu’s Last Dream | 228 |
| The Diaries End Abruptly..... | 230 |
| <i>The Mound</i> | 230 |
| <i>Plans for Denderah</i> | 231 |
| <i>The Beginning of the End</i> | 231 |
| <i>Djedefre Goes to Abu Roash in Anger</i> | 232 |
| Postscript | 233 |

Part A.

Provenance

Introduction

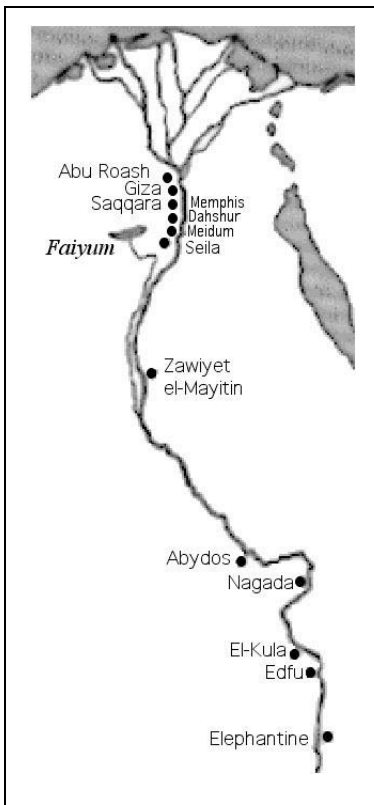


Djoser's Stepped Pyramid as it is today, showing dummy, barrel-vaulted shrine at left.

The pyramids of ancient Egypt are truly spectacular. Their size is awesome, and the accuracy with which some of them were built is legendary.

The first ever pyramid was built for Djoser (“the Special One,” 2668–2649 B.C.), second king of the third dynasty of ancient Egypt. His stepped pyramid at Saqqara forms part of an elaborate complex of buildings within a large enclosure. The complex of passages and chambers underneath the pyramid is even more extensive. The purpose of much of the structures can be determined from the carvings and inscriptions. Some of it, however, is difficult to understand and explanations are speculative.

Imhotep, perhaps the first genius in recorded history, is reputed to have built the stepped pyramid for his king. To Imhotep are also attributed the invention and introduction of ancient Egyptian mathematics. He was an astronomer and a renowned healer: he was deified in the New Kingdom of ancient Egypt, and the Greeks identified him with Asklepios, their god of medicine. There is an ongoing search for the tomb of Imhotep, which is probably at Saqqara, near the stepped pyramid he conceived and built for his king. Finding that tomb would be rare prize indeed.



There were, of course, many more pyramids to come, and many more builders. Imhotep was followed by a long line of pyramid architects, some of whose names have also survived through the millennia. One of these was Hemiunu, (“Hemi-you-knew”) sometimes called Hemon, who is best known as the architect of the Great Pyramid of Khufu (Greek: *Cheops*) at Giza. Hemiunu lived about a century after Imhotep. During that intervening period there had also been several kings, or pharaohs, as they would come to be known, and there had been many abortive attempts to build pyramids.

Djoser’s Stepped Pyramid set the style for following pyramids, but that style was no guarantee of success. The remains of incomplete stepped pyramids exist for Sekhemkhet at Saqqara, and Khaba at Zawiyet el Aryan, just south of Giza. Additionally, there are seven small stepped pyramids at Zawiyet el-Mayitin, Sinki near Abydos, Edfu, Nagada (at Ombos), Heirakonpolis (at el-Kuala), Seila (in the Faiyum) and on the island of Elephantine at Aswan.

The purpose of these small pyramids is uncertain, although conjecturally they may have been cenotaphs, or even markers to set out the authority of the king. With the possible exception of Seila, they are attributed to Huni the Smiter, the last king of the 3rd dynasty.

Seila is tentatively attributed to the first king of the 4th dynasty,

Snefru (Horus Nebma'at, 2613–2589 B.C.), father to Khufu (Horus Medjedu, 2589–2566 B.C.) However, Snefru is also believed to have built three other, much larger pyramids, including the world's first true pyramid (i.e. without steps). Snefru suddenly and dramatically changed the fortunes of the pyramid builders. His pyramids were large, complete and—for the most part—are still standing today. How did this remarkable change of fortunes occur and how was Snefru, who probably reined for some 24 years, able to build three large pyramids each of which may have taken some 15-20 years to raise?

Snefru's building rate was high and sustained. His three large pyramids, taken together, involve the raising of more stone and the undertaking of more work than the building of Khufu's Great Pyramid at Giza—the only remaining wonder of the ancient world.

Snefru's constructions seem to have stimulated architectural evolution. In addition to true pyramids, his reign saw the employment of increasingly larger stones for pyramid construction, while passages and chambers, rather than being dug out under the ground, were constructed within the masonry. While this may indicate growing confidence in the use of stone for building, it may also have spiritual significance, as the pervading theology was evolving too. While it is possible to enter Snefru's pyramids, and to explore the passages and chambers, we know neither their separate purposes, nor the associated rites and rituals with any certainty.

Egyptologists can, and do, make intelligent and informed speculations as to the purposes and meanings of pyramids, their complexes and their internal structures, and unfolding research often proves their speculations to be accurate. Every so often, however, there are surprises, even in a field to which so much effort has been devoted over so many years.

Amateurs also guess at the nature and purpose of the pyramids, particularly the Great Pyramid, which has caught the public imagination. Some of these guesses are charming and romantic, while others are silly and yet others are outrageous. An alternative history has emerged from the pens of some pundits that fundamentally disagrees with the research findings and the informed speculations of the Egyptologists.

Imagine the value, in such a confused situation, of coming across a first hand explanation and description of how and why the pyramids were built, together with what the pharaohs of the 4th dynasty were like, their rituals and behaviours, even the parties they threw, the food they ate and the women they loved. Such an explanation would be exciting, indeed. That is just what has emerged from the sands of Egypt in Hemiunu's diaries.

Pyramid building started in about 2650 B.C. with Djoser's Stepped Pyramids—built for him by Imhotep. After several abortive attempts by successive kings to emulate the stepped pyramid, Snefru—the first ruler of the 4th dynasty—successfully completed three pyramids, including the first true pyramid.

The pyramids of the 4th dynasty of ancient Egypt still hold many secrets. This encourages people to guess as to their purposes, and books on the subject have stoked public interest and imagination: nowhere more so than in the Great Pyramid of Giza.

Imagine the value, in this confused situation, of a first hand account of how the pyramids were built by the architect, who was also a vizier, a courtier and cousin to the king. These are Hemiunu's diaries.

Discovery of Hemiunu's Secret Diaries

In 1992, Hemiunu's diaries were discovered hidden in a secret recess in his tomb, on the Giza Plateau, west of the Great Pyramid to which he contributed so much as the Chief Architect.

The discovery was fortuitous. An Egyptian surveyor, Ahmed Raschid, working for a French film company, was trying to set up a theodolite. He poked the sharp point of the tripod into a crevice in the pathway near Hemiunu's comparatively large tomb in the western cemetery of Khufu's Great Pyramid. The tripod leg sank into the rocky surface, suggesting that there was a cavity of some kind underneath. As part of his equipment, Raschid had a simple ground radar device, which indicated that there was a small chamber and an even smaller passage leading to Hemiunu's burial chamber—which he knew about, as it was one of the subjects in the film that he was helping to make.

There were no clues from inside the burial chamber of any access or passageway. The tomb had been found originally in 1912, and very thoroughly searched in 1925. The wall, where, according to the radar, an entrance should have appeared, had been plastered in antiquity. While much of that plaster had come off or was loose, there was neither sign of opening, nor evidence of a plug stone, such as those used to close off and conceal burial chambers.

The ground radar, this time used against the wall, confirmed that there was a passage, although the echo was faint and nearly drowned in an echo "spike," from just behind the chamber wall. Upon investigation, and with the help of his brothers, Raschid found that a false wall had been built to conceal the real chamber wall with its passageway and plug stone. The false wall had been finished as though it was a typical cavern wall, carved out of the solid limestone bedrock, and without any indication of blocks of stone having been used in its construction. The gap between the two walls had been filled with fine sand, which had been rammed home and tamped into place so that, to all intents and purposes, the chamber wall, the false wall and the sand fill became a single entity. The deception had been masterly. Even if someone had bored into the false wall, they would have come across sand, which would have suggested to them that there was no further structure beyond.

Raschid and his brothers pulled down the false wall, and chipped out the plug stone. Raschid commented later on the strong, pungent smell as they broke through into the cavity, suggesting that the cavity had been hermetically sealed since the time of the 4th dynasty.

The brothers shone torches into the cavity and found a typical burial pit, like those in the Khufu's Queens' Pyramids. There was a shallow pit carved in the limestone bedrock, shaped as though to take a sarcophagus. Instead, the pit contained a large chest, of curious design—see reconstruction.

Hemiunu's secret diaries were found in 1992, in a secret chamber under Hemiunu's tomb in the Western Cemetery of Khufu's Great Pyramid.

The diaries, packed into an ornate chest, were surreptitiously removed, and the chamber re-concealed.

The chest and its contents found their way to Paris.

A major international programme was set in place to unravel the secrets of the diaries.



The lower part of the chest was made from five layers of thin, sweet-smelling wood, covered on the outside with a layer of clay-based plaster that had cracked as it dried. The top, or lid of the chest was made from a wood such as walnut, inlaid with copper bands forming a diagonal cross. The lid had been finished with some kind of resinous lacquer that imparted a rich sheen to the wood, and making it look almost alive as it reflected the flickering torchlight. The pungent smell in the chamber came from this lacquer.

Apart from the chest, the chamber was bare and singularly clean. The brothers searched it but found nothing other than the chest. On lifting the chest to test its weight, they found that it was quite light, suggesting to them that it did not contain any metal artefacts—they had been hoping for a chest full of gold and jewellery. Underneath the chest, in a shallow depression, they found a small statuette of Hemiunu wrapped in oiled linen—see later.

The brothers Raschid removed the chest without opening it, and carefully rebuilt the false wall to conceal their illicit activity. They sold it, still sealed, to a trader in the Khan el Khalilli market, who called in some expert associates to assess what they had. They opened it carefully, realized that they had something of great significance—but, perhaps, not of great monetary value—and sold it to a dealer in Egyptian antiquities from Damascus. From there, the chest—still with its contents virtually untouched, but now opened up to the atmosphere—found its way to Paris, France.

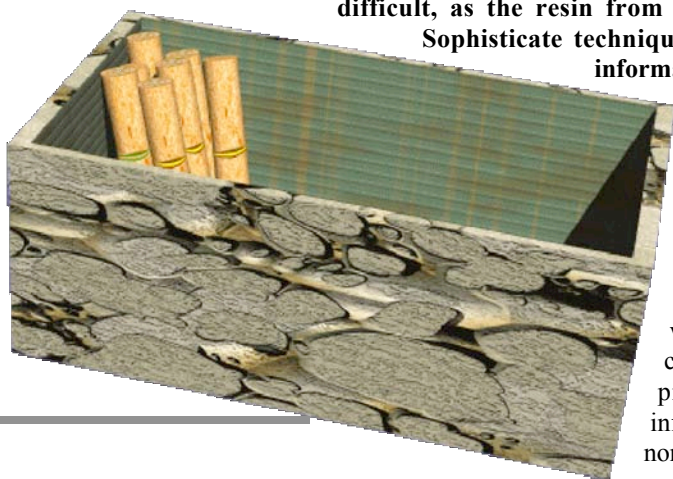
The chest was made from five layers of thin wood, covered with a clay-plaster.

The lid was made from a walnut-like wood inlaid with a “damascened” copper cross, and the whole covered with a translucent resinous lacquer.

The wood looked almost alive as it reflected the flickering torchlight

Recovering the Information in the Diaries

Recovering the information from the scrolls proved to be very difficult, as the resin from the lid had permeated the papyri. Sophisticate techniques proved essential to decipher the information.



The chest contained some 400 rolls of papyri, each tied with linen tape. The condition of the scrolls varied considerably. Some were evidently old when they were placed in the chest, while others looked relatively fresh from the outside. The choice of wood as the lining medium for the chest had been intended to provide protection against insect or mite infestation, and it had worked—there was none.

The chest is a work of art in its own right. It was beautifully lined with fragrant wood, which had prevented insect infestation.

The chest contained some 400 papyrus scrolls packed neatly into the chest, with each scroll poked downwards into the chest.

If the chest were placed on its side, it would have worked like a pigeonhole system, with the oldest papyri at bottom right, and others running in sequence from right to left and in rows from bottom to top.

However, even the fresh-looking papyri proved difficult to unravel. The vapour from the resinous lacquer on the inside of the lid had condensed as a transparent film on the outer layers of each scroll and had permeated from the open ends of each scroll: each turn was effectively stuck to the next turn at top and at bottom, and many of the scrolls were stuck to each other. The resin in the lacquer had then evaporated again into the chamber, so that over the millennia, the scrolls had become virtually solid. Solvents could not be used to soften and disperse the lacquer without damaging the writings and drawings, evidence of which was tantalizingly visible through the outer turns of some scrolls.

A reclusive U.S. philanthropist and Egyptology buff, Herman T Rockinhorpe III, funded the team of experts, led by Professor Gaston Maribeau of the Paris Université d’Egyptologie. They assembled in a large basement of the university, set aside for the purpose, and provided with great security. There were concerns about espionage—Egyptology finds are the subject of espionage and robbery. As it turned out, this was a wise precaution. Once news of the find and the assembly of the team leaked out, there were several attempted break-ins to both the building and to the team’s communications facilities.

The international team took some weeks to assemble in full, during which time Gaston Maribeau and his lieutenants in the school undertook a series of assessments, photographing, weighing, examining under infrared and ultraviolet light, x-raying, and finding out what materials had been used in making the chest and its lid. They even went so far as to use a mass spectrometer to analyze the vapour from the lacquer.

All attempts to unwrap the scrolls failed. Many different solvents were tried, but none was effective in preserving the written characters. Attempts were made to decipher using infrared sensors, and these had some very limited success in the outer layers. Several scrolls were passed through a CAT scanner, and this approach proved that it was possible to see individual characters as written in a row, even when written towards the centre of a scroll. However, it proved impossible to read more than a few characters coherently in this fashion, as the scrolls were not formed into even layers. Drawings and sketches could not be recovered in this way.

The international information extraction (I2E) team, as they became known, decided that the technique used in part on some of the Dead Sea Scrolls might be necessary. The idea was to make two longitudinal cuts 180° apart, so that a semi-circular “shell” of papyrus could be carefully teased off the scroll, using a mild solvent at the ends of the scroll only where needed. This method was quickly modified to make the cuts between the columns of symbols, which also ran longitudinally, i.e., from top to bottom of an open scroll, so that there was less interference with the writings.

Each of the (roughly) semicircular shells was numbered, and photographed using a special camera with a cylindrical lens that effectively straightened out each shell, presenting it as a flat surface. Photographs from successive shells were “stitched,” using techniques similar to those used to make panoramic photographs from a series of still digital photographs. The whole process was lengthy and tortuous, and the results were like the proverbial curate’s egg—“good in parts.”

The tops and bottoms of each and every column of text are likely to be missing, smudged, or on tattered papyrus remnants. The original papyrus had been used many times over in ancient times, with previous writings either partially erased or painted over.

Additionally, Hemiunu sometimes wrote in code, presumably to prevent others from reading his work. The code was not difficult to interpret—it was not unlike Cockney rhyming slang, with Hemiunu substituting words that were either written like the correct word, or words that sounded like the correct word.

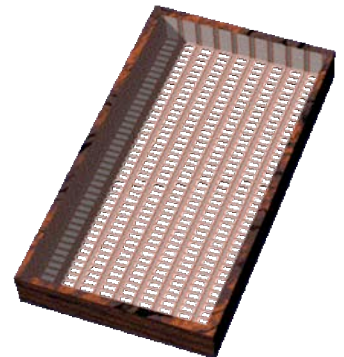
For example, “akhet” generally means “horizon” in English. There is another word, spelt differently with hieroglyphs, which also transliterates as “akhet,” that means “the season of the Inundation.” By using puns, homophones, and adjectives without the noun, or the determinative, Hemiunu made some of his writings appear as nonsense to the uninformed reader.

As the writings and drawings—there were many drawings—began to appear, it became clear to the experts that the style of writing was, unmistakably of the 4th Dynasty, and that the later scrolls had clearly been written by a highly educated and authoritative person. The strong suspicion had to be that these were the works of Hemiunu, or of someone very close to him.

The inside of the lid had a matrix, scribed on the wood. It consisted of 400 rectangles, 10 by 40.

Each rectangle had some glyphs inscribed in the top right corner. These turned out to be regnal years of, first, Snefru’s reign and second Khufu’s reign.

The lid was a roll (file?) index, showing which scroll in the chest corresponded to which regnal year—with several scrolls per year



The later rectangles also showed other characters. These were probably some kind of code indicating the contents of particular scrolls, but the code has proved intractable so far. It may be initial letters of events, plans or drawings of particular interest.

Interpreting the Diaries—Hemiunu’s Journal

Once the hieroglyphs and drawings had been extracted from the ancient scrolls, the job started of trying to understand what they contained.

Gaston Maribeau solicited support from around the world, calling upon the best brains in a wide variety of disciplines for help.

Among many others, he sought help in the fledgling field of reverse systems engineering, which turned out to be crucial.

Reverse systems engineering was able to synthesize much of the social, political and theological contexts, which gave meaning to the structures within the pyramids and temples that Hemiunu built.

In adult life, Hemiunu was an expert, and he used specialist terms and expressions. In interpreting the diaries, it has proved necessary to draw upon modern knowledge and idiom, first to appreciate what he was saying, and second to give expression to his advanced and sophisticated knowledge, not only of civil engineering, but also of management, logistics, metrics and, curiously, psychology.

In today’s terms, Hemiunu was a polymath; he was expert in subjects that today are considered separate disciplines, such as astronomy, theology and civil engineering. Hemiunu did not differentiate between them, which created some difficulties in unravelling the meaning of large areas of his work.

Gaston Maribeau recognized the problem, and called upon the aid of academic groups all around the world. Using secure channels on the Internet to coordinate their activities, the various groups worked in harmony to decipher, not just the words, but also their meaning in context. As work progressed, it became necessary to call in different specialists, until a new team existed; this came to be called the international exploitation team (IXT).

Amongst the experts involved were:

- Social systems analysts specializing in 3rd and 4th dynasty ancient Egypt
- Archaeoastronomers with expertise, not only in the ancient skies, but also in the legends formed by ancient peoples in relation to the stars
- Architects and civil engineering scientists, to interpret the many drawings, evidently of building methods, the dynamics of sliding stones and portcullis doors, and calculations associated with logistics, amounts of work, etc.
- Systems engineers. These proved essential to understand not just what Hemiunu had been building, but why he was building it, and what he believed its purpose would be.

Reverse systems engineering employs the so-called “organismic analogy;” it views a structure, such as a pyramid or a temple, as a living, functioning organism with the various internal parts mutually cooperating to achieve its overall purpose. The organism is seen as having evolved from previous, similar organisms, with which it will inevitably share many of its features. Although their form may have evolved, these features will have similar function. In this way it is possible to understand the nature and purpose of a structure in context.

What the Diaries Contain

Early entries were concerned with family matters, parties (of which there seemed to be an inordinate number), girls, hunting trips, and schooling. Later entries became more in the nature of a journal, with social functions, affairs, observations on royal activities, drawings of ideas for construction, notes of meetings, etc.

It appeared from the diaries that Hemiunu had been given a scribe's kit for his 10th birthday, and that he had been encouraged to write each evening about his experiences of the day. This practice became habitual, and so there were entries for virtually every day of his life.

- Records of events, situations, alliances, successes and defeats – the life and times of Hemiunu
- Hemiunu's apprenticeship in the family business
- King Snefru's court
- The administration of justice throughout the two lands
- Hemiunu's early mis-adventures, rites of passage, and love life
- Notes and diagrams of his designs and reviews of temples and pyramids
- Differences between priest-architects and the masons
- Developing stellar and solar theological issues
- Khufu's court intrigues, plots, threats and murders
- Major fallings-out between Hemiunu and Khufu...
- Hemiunu's rebellious "progress" through upper Egypt and the Land of Kush
- The design of *Akhet* Khufu
- The secrets of the Great Pyramid's construction—why there are no traces of ramps
- Why no 4th Kingdom king's mummies have been found
- Usurping the Throne of Egypt
- Why Djedefre built at Abu Roash

The diaries present a slice of the life of an exceptional man, born with a silver (electrum?) spoon in his mouth, living during the Golden Age of the 4th dynasty pyramid builders. Here is the holy grail of the archaeologist: a first hand account of a long lost culture, with its social and political practices, moral principles, justice systems, food logistics, work organization, etc.

As if that were not enough, the diaries also resolve many of the outstanding mysteries that have surrounded the 4th dynasty pyramids. Why was the Rhomboidal Pyramid bent? Did the builders use ramps to raise large stones? What was the purpose of the many, seemingly-unique features in the Great Pyramid? Why was the pyramid shape chosen? Why does each pyramid have a unique slope? And many, many more. Here are the definitive answers by the man who did it all.

The diaries reveal a slice of a highly privileged life from the Golden Age of the 4th dynasty pyramid builders.

Hemiunu lived for some 63 years—a good age for the times—dying just before the completion of the Great Pyramid.

As a vizier, and cousin to the king, Hemiunu was close to the heart of the political and social scenes. He hunted with the royal party. He accompanied the king's travelling court as it sailed up the Nile. He dispensed justice on behalf of his king. He even lusted after the king's daughter!

Exceptionally, he was an architect of Snefru's pyramids, and chief architect of the Great Pyramid, and privy to their secrets, mysteries, and methods of their construction.

Hemiunu of the History Books

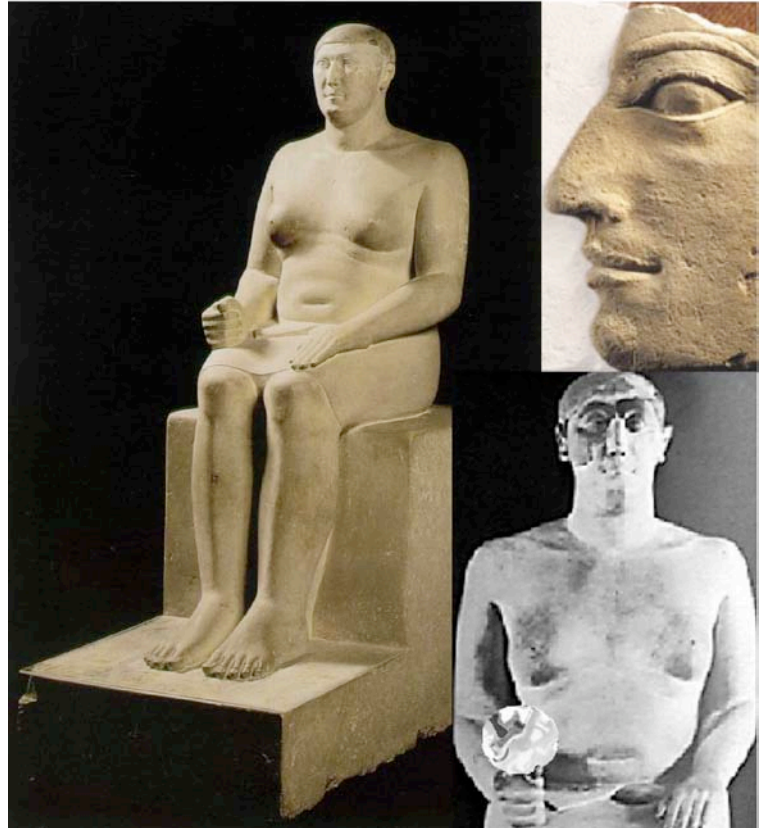
Hemiunu was a prominent figure during the reigns of Snefru and his son Khufu. Indeed, there are more extant representations of Hemiunu than of Khufu. Hemiunu's mortuary statue, shown in the collage, was created when he was nearly 62 years old; it presents an authoritative figure.

Hemiunu is shown seated, left. This life-sized statue is housed in the Pelizaeus-Museum, in Hildesheim, Germany, having been discovered in Hemiunu's massive tomb by a German Austrian expedition searching the Western Cemetery at Giza.

As was common in such statues of the period, Hemiunu is shown overweight, symbolic perhaps of wealth and position. (The diaries reveal that he was, indeed, overweight.)

The relief of Hemiunu is unusually realistic for the period. Note the curved nose, and the detail just under the eye, suggesting features characteristic of the man. The relief, owned by the Boston Museum of Fine Arts, was discovered in 1925

The curious figure, lower right, was found together with the diaries in a secret cache underneath the scroll chest in the tomb, in 1992. The figure is only some eight centimetres high, and is so similar to the full size statue that it may have started out as a test piece, intended to show what the full statue would look like. Note the crystal ball, mounted on a stick held in the right hand.



It was uncertain if his build was as heavy as that suggested by the statue; corpulence was a sign of wealth. It was also the practice to represent people as younger and fully fit. The reason for this was that the statues were to be inhabited by the soul of the dead person, who naturally did not wish to “return” in some degenerate state. It was not unusual for an old man to be represented in his tomb by a statue of a fit, virile young man. (In fact, we now know from the diaries that Hemiunu was chronically ill when the statue was commissioned and was suffering from arthritis in the neck and lumbar spine, severe toothache and heart disease, having already experienced a stroke. And, yes, he was overweight.)

That Hemiunu was depicted as a mature individual, and not in the first flower of manhood, is explained in the diary. Khufu commissioned

this statue for him, partly in recognition of his work in re-interring Queen Hetepheres I, Khufu's mother, on the Giza plateau, after her original tomb at Dahshur was vandalized. It was also partly in recognition of his work in designing and raising Khufu's Pyramid, although Hemiunu died before its completion.

Hemiunu's father and mother were Prince Neferma'at and Princess Atet. Neferma'at was son, vizier, and chief architect to King Snefru, but by a secondary wife. Hemiunu was, therefore, grandson to the king, but not in line for the throne. There were many grandsons, all princes of course, but few with royal aspirations.

The right hand of Hemiunu's large statue is clenched as though it was meant to be holding, perhaps, a staff of office; this would certainly have been normal practice. As the collage also shows, a recently discovered statuette contained a feature not evident in the full-sized statue.

The tiny crystal ball in the right hand of the statuette was explained in the diaries. Djadjaemankh, Chief Magician at the court of King Snefru, Khufu's father, apparently gave the crystal ball to Hemiunu on his fifteenth birthday, as part of a coming of age ritual ceremony held in Snefru's palace.

Through the ball, Hemiunu believed that he was able to communicate with people from his past and perhaps even his future. He believed—as Djadjaemankh had told him—that he was the protégé of Imhotep, architect of the first, stepped pyramid of King Djoser at Saqqara, and that they were able to communicate using the crystal ball. Hemiunu was able, he believed, to request and give advice, and to receive warnings of threats and pitfalls.

This may not be quite as strange as it appears. In ancient Egypt, it was the practice for a son to follow the same profession as his father. He would be brought up immersed in the practices, and would learn through an unofficial apprenticeship, working with his father from a very early age. So, there would be a long line of ancestors, all of whom would have pursued the same profession.

Claiming Imhotep as an ancestor would be to acquire impressive credentials for any architect—and it might even have been true, it is impossible to be sure. Moreover, belief in magic was universal; the idea that Hemiunu and Imhotep could communicate would have been entirely believable, and would have caused Hemiunu to be venerated and viewed with awe. It would also have meant that the crystal ball from the main statue would have been highly valued. Significantly, it has not been found.

Hemiunu of the history books is an austere, omnipotent, humourless character, seemingly dedicated to serving his king and to building the greatest pyramid. The diaries show this to be only the public face of Hemiunu, who had a lively sense of the ridiculous and a great love of family.



Unattributed statue in the Cairo Museum. Probably used as a “standard” mortuary statue, symbolic of the youthful, vigorous state in which an aged corpse would like to return in the afterlife.

The Secret Diaries of Hemiunu

Part B. Life, Love and Learning

Hemiunu's Education and Schooling

Early entries in his diaries show that Hemiunu received the very best of education—*sebayet*. As a boy, he was educated first by his parents, who taught him the basics of religious beliefs, right and wrong, social graces, proper behaviour to peers, superiors and, particularly, subordinates or the less well off; second by his tutor, who came to Hemiunu's father's palace on alternate days to teach him and his siblings astronomy, mathematics, measurement and geography; and third by the teachers in the king's palace, where Hemiunu attended on alternate days to be taught with all the many children of the king's harem.



Hemiunu's early life
was filled with
schooling, both at
home and at the royal
palace.

School was very strict,
and there was no
mixing of the sexes, at
least not in the palace
school.

Hemiunu was, none-
theless, or perhaps
consequently, in-
trigued by girls, and
not a little shy of them.

Being taught in the palace was no easy matter, as the ancient mural from the Louvre Museum suggests. At left, well-behaved students are shown working at their writing tablets with reed pens. At right an assistant has one truant by the neck and is beating another with a stick as he forces them to school. At centre, the teacher is dressed in a white linen costume and wields his staff of office—a rod with a model hand on top. He is admonishing a student who has turned around to watch the truants being brought into school. All the students are wearing school uniform—a white linen loincloth and skullcap. (The relief may be in the nature of a caricature, but it gives some idea of the more didactic practices in schools.)

Hemiunu was never caned—according to his diary, at least. He thought of himself as overworked by strict, somewhat terrifying teachers, who would sometimes keep him after the others to finish off some work. One of his drawing teachers used small chips of limestone to catch the attention of inattentive students. Hemiunu admired the teacher's aim, observing that he could hit a student's ear or nose at ten paces. Another teacher, presumably finding the teacher's hand staff inadequate, had fashioned a large bat, like a triple size table tennis bat, with which he used to inculcate lessons into the rear end of less tractable boys. Paradoxically, he was the boys' favourite teacher, being strict, but having a good sense of humour.

Boys and girls were taught separately at the king's palace. Girls were taught different subjects, including the rituals and practices associated with being a priestess, sensual dancing, making jewellery, wild

flowers and—for the older girls only—some subjects which were kept secret from both the boys and the younger girls. Hemiunu was intrigued.

When he was eleven, Hemiunu started to take a serious interest in girls—from a safe distance. The sexes mixed briefly at the palace during breaks for food, although even then they were on different sides of the garden where they ate, which had a small rectangular pool in its centre. Hemiunu recorded his particular fascination with one girl, called simply Neferet, whose reflection in the pool water Hemiunu used to watch. He thought she was so beautiful that she was somehow above mere mortals. He never worked up enough courage to speak to her, which would have been frowned upon by the girls' teachers in any case, but he did start to write some lines of poetry to her.

“Neferet is like the rising sun
As sweet as any blossom
I look at her, my legs grow weak
I start to lose all power...”

Hardly a promising start to a poet's career, and these lines were never finished, at least not in the diary; perhaps the full poem was written as a note and passed to Neferet, or to her friend, Khnumet, to be passed on.... We may never know.

The boys in Hemiunu's group were developing physically and were as lewd as boys of that age can be today. One favourite competition during boring lessons was to compare genitalia, the winner being not he with the largest, but he who could show himself while as close as possible to the teacher—without getting caught, of course. Hemiunu did not join in this activity, not because of any sense of right or wrong, but apparently because he was concerned in case his genitalia were not up to the standard of some of the other boys.

Hemiunu was evidently a strong boy, and he enjoyed sport, of which there was plenty, from running and jumping, to archery and fighting with the various weapons in use at the time. His father, like other fathers, made him wooden weapons with which to play-fight, but there were also competitions, where prizes were awarded to winners. Hemiunu excelled in archery and regularly won prizes for hitting moving targets.

Occasionally Hemiunu was sent up river to stay with relatives, his aunt and uncle, who owned a large estate in the country. Hemiunu mixed with the children from the local village, learned to speak their dialect, and enjoyed a measure of freedom that was denied to him at home. He also learned about farming and in particular about animal husbandry. His uncle was attempting to domesticate oryx, and Hemiunu used to watch and help rope the animals, which were particularly dangerous with their long horns. They were being bred for ritual sacrifice in the temples, and his

Ancient Egypt was a cattle culture in many ways, from the earliest days. Wealth was measured in land and cattle, and those who could afford it sacrificed cattle to the gods.

The mural below shows cattle being herded by boys and being presented as part of an overall logistics supply train. Note the shaven-headed priests.

Such large scale supplies could be associated with a feast, an offering, or could simply be painted on a wall to ensure that the deceased would always have ample supplies in the after life, even supposing that the priests who were supposed to maintain supplies for eternity failed to do so.

British Museum





uncle used to say repeatedly that the oryx were aggressive because they did not want to be sacrificed. Hemiunu was clearly puzzled; how could the oryx possibly *know* their fate?

Although he enjoyed the country life, especially the freedom, Hemiunu was serious-minded, and even at the age of eleven, his journal was full of diagrams of buildings, columns, colonnades, temple facades and the like.

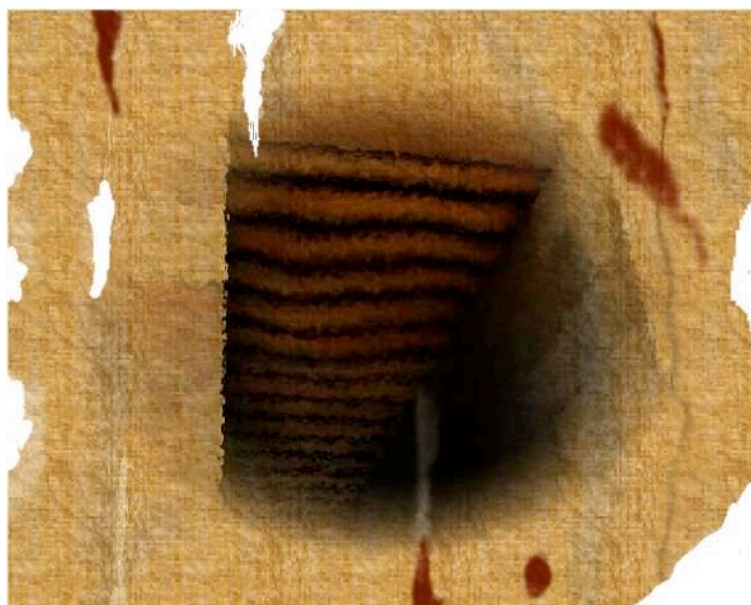
The sketch at left is typical of his work. For reasons outlined below, it does not appear to represent any

particular building. Instead, the young Hemiunu was either exploring ideas or copying out roughly what someone else had done. The simple sketch holds surprises: the columns are unlike columns of the 4th dynasty, and look much more like New Kingdom temple columns, right down to the spikes at their bottoms, which would represent waves. Similarly, the wings of Isis (or the vulture goddess?) on the architrave are not seen on 4th dynasty structures.

However, Hemiunu was sketching using perspective, and shading to indicate the curved surface of the columns. The perspective of the

naos is clearly incorrect, but it is still perspective drawing. In front of the naos are two vessels containing fluid for lustrations and what appear to be smoking embers in an offering tray. The whole, although amateurish, is entirely unexpected for the period.

Some of his sketches were of a much higher quality, and appeared to be studies from real life. The fine, detailed orthomorphic chalk and charcoal drawing shown at left is recognizable as the entrance to King



Djoser's enclosure at Saqqara, where Hemiunu undertook much of his studies. Hemiunu was presumably interested in the inner roof that, although made from stone, is carved to represent wooden logs. Representing wood in stone was not uncommon at that time.

Curriculum

Hemiunu recorded his timetable in his diary, which showed the titles of the various lessons he received. This does not go so far as to tell us what each lesson was about, but it is possible to piece together some of the topics covered at different stages under different subject headings. This is largely because the education was intensely practical. Although there were open air "classrooms," much of the teaching was "on site," i.e. out in the country, on the Nile, at a temple, or at an outdoor laboratory.

Hemiunu also recorded the names of some of the teachers and of the other boys. Prince Rahotep, one of King Snefru's sons, attended the school, although he was older than Hemiunu and they were in different groups. On one occasion, Hemiunu records that Crown Prince Khufu, the King's heir, actually taught his class, although Hemiunu was evidently too excited to record any of the subject matter.

Modelling

Using Models to Estimate Amounts of Work

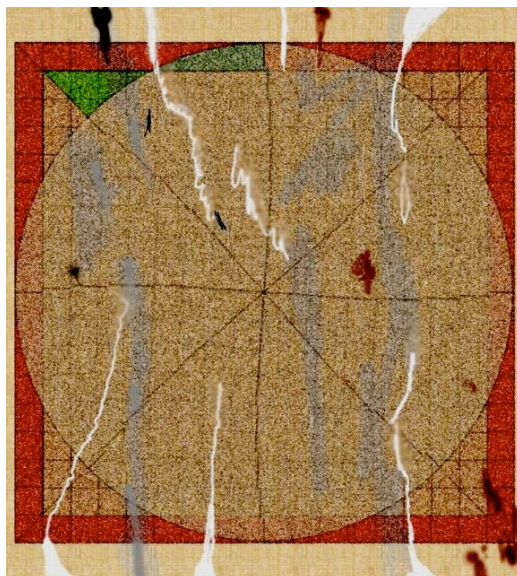
Students did a considerable amount of modelling work at all stages of their education. A typical exercise might be to find the volume of a solid wooden cone, given only a box of sand and a stone beaker.

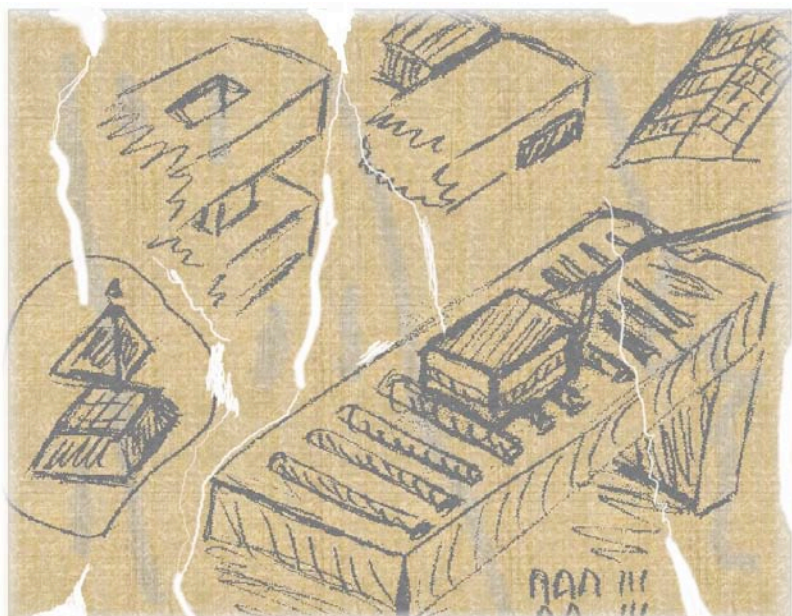
In another experiment, they had to calculate the area of a circle, using an area set out with small square stones, like tessera.

The inevitably damaged record in the journal is shown at right, with Hemiunu's faint drawing lines still visible through the grime; the original drawing had been a work of art.

The idea was to count up the number of tessera making up the circle, and then to count up the number of tessera forming the inner square. The same arrangement of a circle over a square-within-a-square was repeated in the open-air laboratory, but with the inner square being of different sizes in each case.

The students were expected to find by counting the tessera that an inner square of $\frac{8}{9}$ ths of the outer square, had about the same number of tessera as the circle. Although Hemiunu did the experiments, he clearly did not understand what he was doing, nor the lessons he was





supposed to be learning. He seemed quite happy that there was a simple way to calculate the area of a circle. He was blissfully unaware that Imhotep, who had devised this experiment originally, had been close to the heart of modern calculus.

Modelling to test feasibility of building and operation

Hemiunu also learned about ramps and sliding. Another open-air laboratory was dedicated to sliding blocks of different material up ramps.

The amount of effort needed to raise a block was measured by the number of boys needed to make a block move with the ramp set at a particular slope. There were several ramps, so the boys were divided into teams to compete against each other, with rewards being given to the winners in the form of sweet dates.

Young Hemiunu's sketches show a ramp with inset wooden slats, and a rope for pulling a block up the slope. The numbers at the bottom read 56, presumably the slope in *seked* (q.v.). A truncated pyramid is shown at left, together with the removed top part and a tiny pyramidion. Above there are two kinds of joint used both in stone and wood: a mortise and tenon joint, and a lap joint. The sketch at top right is not understood.

In another regular lesson, Hemiunu recorded competitive relay races to move blocks of granite back and forth over a course. The boys had to tip the block on to one corner and "walk" it from corner to corner, keeping the block balanced at all times. Hemiunu became expert at this, learning to continually rotate a tilted block along the edges of just one end, so that it staggered down the course with the minimum of corrective action on his part.

Theology

Hemiunu learned his theology mostly from informal and formal lessons with his father. Much of this learning had been accomplished by the time that Hemiunu started keeping his diary. There were certain topics that came up which caused him to make observations in his diary, especially as he got a little older. One subject that fascinated him was substitution by representation.

Substitution by representation

The youthful Hemiunu accepted the notion that the spirits of the living and the dead had no difficulty in passing through stone, and that false doors made of stone were a helpful guide to the spirits of the dead. He was puzzled as to why the spirits could pass through a stone wall, yet did not fall through a stone floor. Why was that different? And, if a spirit wanted to move up through a ceiling or down through a floor, could it do so? However, his big stumbling block was substitution by representation.

This principle, clearly accepted at the time, meant that a statue of a deceased person put into a tomb would be able to come alive, would become that person alive again—always provided the mortal remains were intact. Hemiunu understood that well enough. However, Hemiunu had problems with the mortal remains being physically in one sarcophagus, yet spiritually at the same time being in several other sarcophagi, perhaps very far distant. In these remote sites, the spiritual remains could also inhabit and vitalize tomb statues. Hemiunu wondered if two statues might be vitalized at the same time by the one *ka*, which he found difficult to accept.

His diary contains notes of lessons in which his ideas of the Netherworld were expanded. A burial at a certain depth—or deeper—enabled the spirit of the deceased to move freely from place to place, taking no time. The “translation” was triggered simply by desire, which was immediately satisfied. There were dangers to moving in this underground Netherworld, where the evil god Seth was known to wander, but these could be neutralized with spells, incantations and amulets—which Hemiunu would learn when the time was right.

The diary sketch appears to show three different ages of tomb: a stepped pyramid at left, a mastaba tomb within an enclosure wall at centre, and a pyramid at right, although this drawing was made before the first proper pyramid was built. Be that as it may, there is a vertical shaft under each structure leading to a sarcophagus. In each case the sarcophagus is shown under a separately identified stratum of rock. The three sarcophagi are then connected to a fourth sarcophagus, seemingly within a cloud, yet still underground.

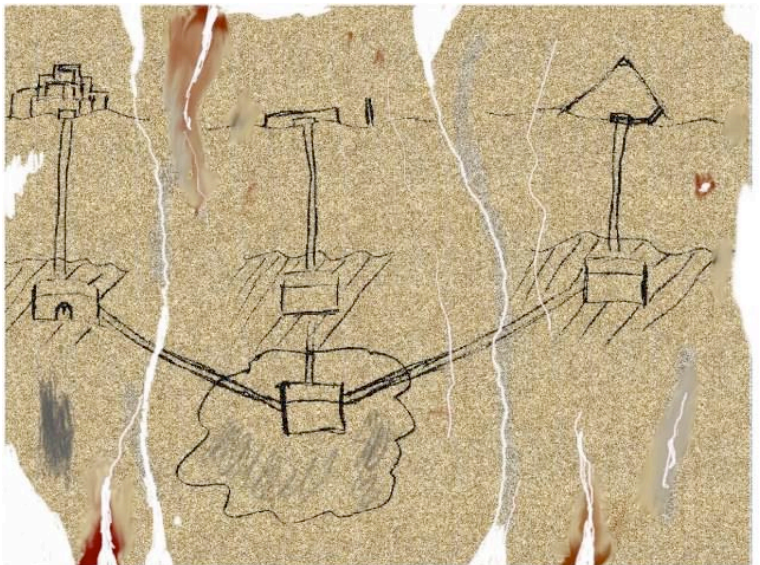
One possible interpretation of this sketch is that the

Substitution by representation was used extensively.

Murals and statues in temples, tombs and pyramids were not for decoration, but to come alive in the afterlife.

Many decorations show servants carrying food and drinks of all varieties. These were to ensure a continuing supply for eternity.

Statues of the king were also to be invigorated by his *ka* in the afterlife, within the dark, airless pyramid.



sarcophagi of various kings, although buried at some time and distance apart, can manifest themselves, presumably to commune, within one sarcophagus in the underground Netherworld.

Ma'at

Ma'at was celestial
balance and
harmony made
manifest on Earth
through mediation
between the King
and the gods.

The principles of
ma'at were taught in
Hemiunu's school,
and it is possible to
see in these
teachings the basis
of a caring society,
in which the better
off gave without
expectation of
reward – at least in
this life...

The method of
teaching was largely
through fable and
parable, perhaps
presaging both
Greek and Hebrew
teachings, including
those in the Bible.

Hemiunu was fascinated with *ma'at*, the concept of harmony, balance and justice. His note taking was assiduous on this topic. It was the duty of the king to spread, even impose, *ma'at* throughout the land.

The practical effect of this was the propagation of a kind of *noblesse oblige*, where not only the kings but the rich and powerful too had a responsibility to look after the poor, the weak, the widow and the orphan. This appealed to the idealistic, youthful Hemiunu, who saw himself as a protector of the poor and needy. This spirit and duty instilled though *ma'at* stayed with Hemiunu throughout his life, encouraging him to help others less fortunate than himself.

Lessons associated with *ma'at* often consisted of parables, where the teacher told them a story in which the principles of *ma'at* were displayed and upheld.

Hemiunu recorded the story of the rich merchant who was out walking with his servants by the harbour when one of the servants brought a cripple boy to him, explaining that the boy was hungry. The merchant said that he had no food to give to useless boys, and that the boy should pray to Isis for his foot to be mended.

Many years later, thieves attacked the merchant when on a trip to Upper Egypt. His servants put up a feeble fight, and soon they were all bound, while the thieves ransacked the sacks of goods. One of the thieves recognized the merchant—it was the crippled boy, now grown up, and leading the band of thieves. He told the merchant that he had taken the merchant's advice, overcome his disability, and had developed a successful career as a robber. He then asked if the merchant was proud of the once-crippled man's achievements.

Hemiunu had been set an assignment: to copy out the parable and to identify which of the central tenets of *ma'at* this parable illustrated. His responses were: "treat others as you would hope to be treated; always care for the less fortunate; and, as you sow, so shall you reap."

In another instance, Hemiunu's assignment was to act in the role of a judge in a court. The accused was a middle aged woman charged with stealing bread to feed her young children, all of whom had been deserted by their father. Hemiunu debated with himself in the diary: she had clearly stolen, which was wrong; her husband had deserted her and the children, which was also wrong. Hemiunu, at only thirteen, judged that the baker should not have accused the woman; instead, being a wealthy man, he should have given her any food that she and her children needed. Hemiunu gave as his judgement that the baker should support the woman and her children, and that the police should find the deserting father and order him to repay the baker by working in the bakery.

Cult of Osiris

Hemiunu was clearly familiar with the stories and legends of Osiris from his childhood. Osiris had once been a real king of Egypt at some time very long ago in the past. He had fought with his brother, Seth, who had cut his body into sixteen parts. (Hemiunu had a sixteen-piece puzzle of Osiris as a doll, in wood, which came apart, and had to be reassembled. He entertained his young brothers and sisters by putting the parts back in the wrong places!)

Isis, *Iset*, sister to both Osiris and Seth, found the pieces with the aid of Sobek (*Sbk*), the crocodile god, as many of them were in the river. Anubis (*Inpw*), the god of funerary rites, helped her to bind the parts back into a single body—which was why Anubis wore winding tapes around his neck. Isis could not find Osiris’ penis, so she made a substitute out of sycamore wood (or was it Nile clay?), breathed into Osiris’ mouth and he came alive again. They made love, but Osiris could not live for long in the world, so he went to the Netherworld as its king.

Isis gave birth to Horus, while Seth was hunting for them both in the marshes of the Nile delta where Isis had hidden. Horus grew up, fought with Seth to avenge his father, Seth lost a testicle and Horus lost his eye – although it was later repaired.

There were so many variations of the story that Hemiunu had lost count. His younger siblings used to ask him to tell bedtime stories about Osiris, Isis and the young Horus, and he used to scare them at night with stories of Seth coming out of the desert and creeping around their palace.

The cult of Osiris centred on the king. He was the god Horus incarnate during his life as king, but transmogrified into Osiris upon death, and travelled to the Netherworld to be its king. Thus the king was a god on earth, was Horus, god of the air. As a god, he was able to intercede with the other gods, both in the netherworlds, *det* or *duat*, and in the Two Lands, *tawi*. One of his aims in such intercessions was to ensure that the Inundation was neither too little nor too great, since either could spell disaster for the crops on which life in Egypt depended. Another aim was to act as a conduit for *ma’at* to be “acquired” and spread across the land as a universal calming and ordering influence.

The legend of Osiris and Isis was played out in the heavens for all to see, if they but had the eyes to look. Osiris was played by *Sah*, which Hemiunu wrote thus: ***, presumably meaning the three stars known to us as Orion’s Belt. *Spdt*, the goddess Sopdet in the form of Sirius, the Dog Star, played Isis, *Weret-Hekau*, “Great of Magic”. When Sirius arose at the same moment as the Sun, in its form of *Khepri*, then the Inundation would surely follow. And what was the Inundation? No more nor less than the breaking of Isis’ waters as she gave birth to the infant Horus, so signifying renewal and the start of a new year.



Throughout his life, Hemiunu was an obsessive “sketcher.” In the set of sketches above, he shows a bust, probably of Prince Rahotep, one of Snefru’s sons (with light hair?), who was both a teacher in the palace school and a dashing young man about town—note the moustache, his “signature.”

Bottom left is a head mask of Khepri, the scarab-headed god, evidently copied from a mural, while at right is a magnificent impasto of *Sbk*, Sobek the crocodile god. This appears to be a full head mask, as worn by priests during temple ceremonies. Note the elaborate *atef* headdress, with the two feathers, the solar disk, and the two royal cobras at either side, each with its own solar disk.

The Secret Diaries of Hemiunu

Hemiunu was clearly at ease with these stories and legends of his childhood. He was entirely at ease, too, with the different stories, often contradictory, about Osiris, Isis, Horus and Seth. They no more bothered him than a child to day would be bothered by variations in the story of Red Riding Hood. He was less sanguine about stories of Re, the Sun God.

Cult of Re

According to the emerging Heliopolitan creed, the sun took (at least) three forms. In the morning the sun god arose as Khepri, was Re at midday, and was Atum as he descended into the West in the evening. The sun god had other forms. He was also Re in the *senut*-house, Re on the Roof, and Re in the Sanctuary of Upper Egypt. He was Horakhte, Horus in the Horizon, carried across the sky on wings of a falcon. Or, he travelled across the sky with his retinue in an invisible boat, then travelled under the earth on another boat, before re-emerging from the eastern horizon, beyond which the gods lived.

He was also the king before he was incarnate, and the king when he died. Hemiunu found it all rather confusing, and difficult to reconcile with the Osirian Legends, where the king was the ultimate ruler, not Re, or Ra-Horakhte, or whatever. The diaries make it clear that as a young teenager, Hemiunu found the priests of Heliopolis somewhat threatening, and he always carried a full set of protective amulets whenever he met with them. He also resented the view that the god-king, Hemiunu's god-king, was subservient to Re, to be recruited daily to help row his fiery boat across the sky.



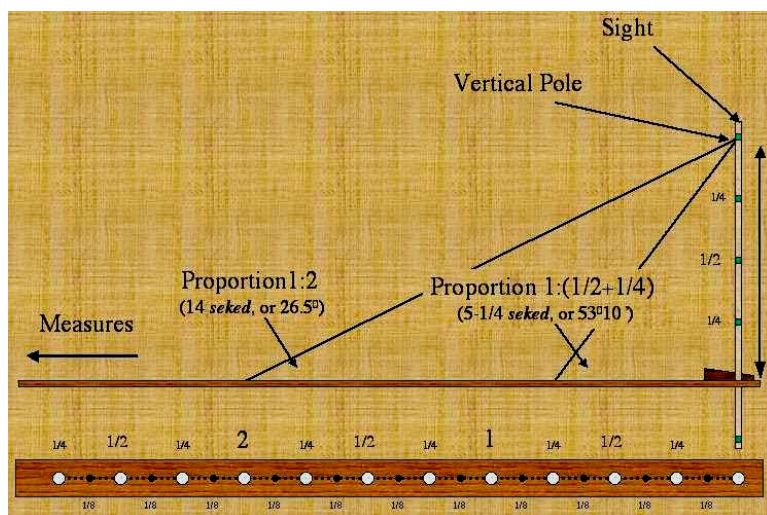
Hemiunu's chalk and charcoal picture of Ra Horakhte—"Horus in the Horizon" The hawk-headed figure was believed to carry the sun on his wings across the sky—at least in some versions of the sun-god theology. Note the cobra uraeus, indicator of sovereignty.

Astronomy

Another of Hemiunu's lessons was about astronomy—at least that is what we would call it; no such clear distinction existed for Hemiunu. To him it was all part of the wonders of the natural world in which he existed with all the other spirits.

He recorded an exciting field trip, which took place when he was thirteen, where his group of students went by boat to the plateau at Giza. There were, of course, no pyramids there. Instead, the edge of the plateau where Khufu's Great Pyramid would eventually stand was an observatory. There was a mound of limestone, an outcrop, which had been levelled-off, and on which there were several "observing platforms." One of these had a structure that was being used to try to measure the slope at which stars were at various times throughout the night. It consisted of a table on which sat a pegboard, with a vertical pole at one end, on top of which was a copper rod with a fork at the top. A cord was connected from the rod downwards to the pegboard, so that the end could be plugged into any hole. The figure shows what it might have looked like from Hemiunu's description.

Hemiunu was fascinated by these devices. He asked how the star slope device worked and it was explained that light from a star shone and reflected off the sides of the copper sight, so that it was possible to see when the star was right in the centre of the fork. The teacher explained that the observer had to line himself up along the taut cord with the star and the sight. The slope was then measured using the adjustable pole and the pegboard, as illustrated in the figure. It was, however, very difficult to operate the apparatus at night...



Slope-measuring apparatus, based on sketches in the diaries.

He also wanted to know what the measurements were used for, and was told it was to do with forecasting the future, and to be warned of impending threats and disasters.

Dawn Rising

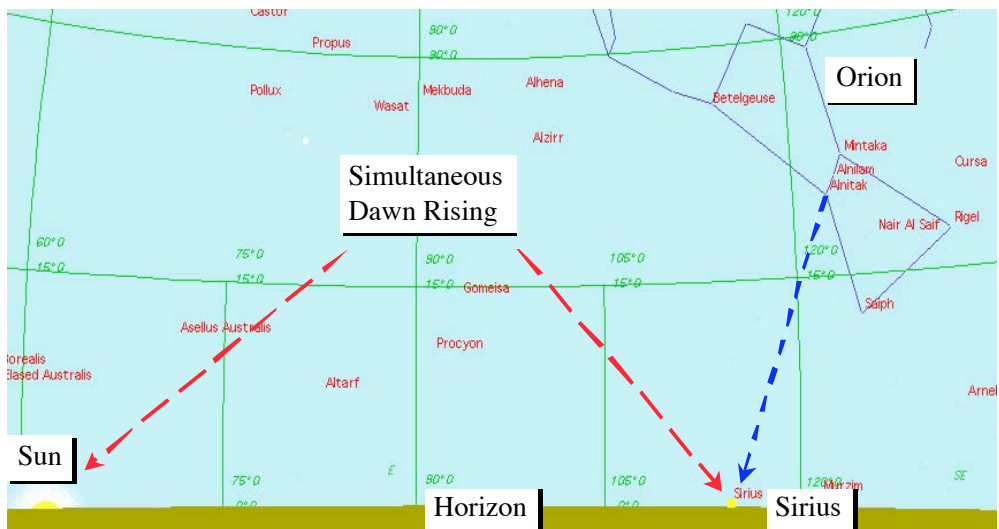
The reason for the field trip was not concerned with measuring stars so much as with observing the heliacal rising of *Sopdet* (Egyptian) / Sothis (Greek) / Sirius (modern). The ancient Egyptians had observed that the dawn rising of Sirius occurred just before the annual Inundation, so they had connected the two events. Hemiunu's field trip was to observe the event, which occurred—by our modern calendar—at about 4:40am on or about 5th/6th July each year, at that time. To make the observation, it was essential to find a good location such that the horizon was flat towards both the point at which the sun would rise and that for Sirius. The observation post at Giza was just such a location.

The night before the observation, the group of boys were supposed to go to bed early in the tents provided for them, but instead they sat around the camp fire, telling stories and listening to the many strange sounds coming from the desert just nearby. They were not used to being this close to the realm of Seth, and they were more than a little frightened.

Next morning they were awake before being called. Hemiunu had not been to sleep at all, as far as he could recall. Bleary eyed, they stood on the edge of the plateau and looked out.

What they saw is shown graphically in the sky map. To the southeast (right), they could see *Sah*, Orion, and they knew that the three stars pointed to *Spdt*, Sirius, although it had yet to rise – or come to life, as

The Secret Diaries of Hemiunu



Hemiunu called it. Hemiunu looked to the east (directly ahead), hoping to glimpse the home of the gods, but he could see nothing.

To the northeast, (left) the sun, still below the horizon, was beginning to light the sky, but there were lots of stars still visible. Gradually the glow from the sun got brighter until a brilliant point of light from the sun appeared just as Sirius came to life. It was a thrill that Hemiunu would never forget for his whole life. The whole group watched in awe, until one of the teachers started to sing the song of praise to Khepri, the morning sun, and they all joined in.

The students then watched the stars gradually fade. Their teachers had explained that the stars disappeared in the direction of the Netherworld as the sun got brighter.

Inundation

The group of students with their teachers then climbed aboard the King's barge, put at their disposal for this occasion, and set sail up stream towards Upper Egypt, passing their home harbour at White Wall as they went. The river was low, but the narrow stream at its centre was deep enough. On either bank the ground was scorched, and there were the remains of harvests in the form of roots and branches, left over bonfires, and general detritus. Hemiunu was appalled at how untidy it was – so different from the area around the palace that he was used to, and to his uncle's farm.

Driven by a stiff northerly breeze, the barge reached a nome known as *sab*, the Jackal, where there was a Nileometer for measuring the depth of the Nile. The students were shown how it worked and they each took readings. They then sailed further upstream for about half a day, before the captain turned the vessel around and headed downstream, stopping again at the Nileometer. He asked the boys to take readings again, and Hemiunu was surprised to find that the water had risen by

at least two palms. The Inundation, it appeared, had started—not with a roar as Hemiunu expected, but more with a quiet whimper.

The captain lost no time in heading back toward White Wall, aided by fast waters, where he docked and had the boat carefully tied up on long ropes. The water was rising visibly now, and the class moved up to higher ground. Within hours the Nile was a raging torrent, with black swirling mud, branches and whole trees being carried downstream at breakneck speeds that made Hemiunu's mind whirl.

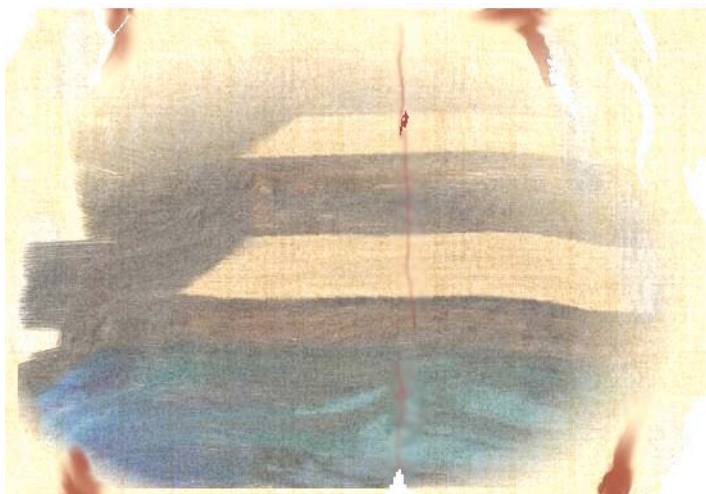
Hemiunu asked the captain how he knew when to turn round, so as to avoid the flood. The captain explained that the water level in the Nile went *down* sharply just before the Inundation started, and the captain had been watching the water level against the riverbanks for that to happen. He did not know why it happened, but it was probably a sign from Khnum, the God of the Nile who controlled the amount of silt in the Inundation, to warn them of impending danger.

The whole trip had been an assessment process, in which the teachers had watched how the boys had made use of their learning, had applied their knowledge in unfamiliar surroundings, and had coped with the unexpected and frightening. Hemiunu recorded with obvious pride that he had done well and was praised by his teachers.

That was the end of Hemiunu's formal teaching at school, although he still had much to learn about his profession, which was, like his father, and his father before him, to be chief architect to the king.

Hemiunu also had much to learn about the administration of justice as it was called then (and, coincidentally, now, by some police forces.) He continued to attend occasional classes on *ma'at*, the law, punishment, imprisonment, etc.

Some of the punishments of the time, such as cutting off the nose of some offenders, and cutting off the penis of others, did not seem untoward to Hemiunu, but he was concerned about ensuring that the person concerned was being justly tried, and had been truly found guilty. He considered it important to go to very considerable lengths to find out the truth, and was a vigorous defender of those who he considered to have upheld the principles of *ma'at*. In time he would become a vizier and would travel the land dispensing the king's justice.



Hemiunu's painting of the Jackal Nileometer was recovered by the I2E in comparatively good condition.

The painting shows a view looking south, with the river—which runs south to north—entering at bottom left. Each step is one cubit in height, so the height of the water can be read easily, at a glance. There was probably a scale on the inside wall, but it is not shown. The walls, and the steps rising against the direction of river flow, are arranged so that the turbulence in the river does not affect the level in the Nileometer;

The painting appears to use some kind of *impasto*. This is not the first time that Hemiunu used such a technique, and his representation of water was already masterly at the age of fourteen. Note the sunlight shining through the hole in the wall at bottom left, and the swirl in the water, which is transparent so that the lowest step can be seen through it..

Royal Fowling Trips

When Hemiunu was fifteen, he “came of age.” He did not record any ceremony associated with this event. Suddenly, however, he was invited to, and able to take part in, all the major adult activities with which the privileged many around the royal court filled their time.

Hemiunu’s father, Prince Neferma’at, was close to his father King Snefru—as close, presumably, as it was possible to be with a living god. Neferma’at had been born when Snefru was only a boy of fifteen himself. In his younger days, Snefru had not always been the crown prince, and in those earlier days he had been much freer to associate with young men of his age group. Prince Neferma’at told Hemiunu stories of Snefru’s youthful misbehaviour, which Hemiunu noted in his diary with obvious disbelief.



Ancient Egyptian “rowing eight.”

Note the cox, and the staggered rowers, with stroke and bow in the same order as today’s crews. The only difference is the presence of a lookout. The model, made in wood, is of a papyrus boat.

The two posts astern of the cox are presumably part of the structure for maintaining the integrity of the papyrus boat, i.e., to maintain hull shape and to keep the bow up out the water, even with a man standing on it.

Louvre Musée, Paris

Although those heady days with no responsibilities were gone, King Snefru always invited his son, Prince Neferma’at, to any social occasions; and now his grandson, Prince Hemiunu, was invited too. One of the first occasions was a fowling expedition to the Nile Delta, to Buto. Hemiunu had been duck hunting before around White Wall, but game was relatively scarce what game there was scared easily. This expedition to the marshes was different.

The fowling party boarded the royal boats at lunchtime, to catch the ebb tides in the delta. The boats kept their sails furled and used their oars to get out into midstream. Some of the young bucks took turns in rowing, much to the embarrassment of the royal servants, whose job it was. Among the older members of the party, Hemiunu saw Prince Khufu and Prince Rahotep on one of the other boats; they were deep in heated conversation and did not appear to be enjoying themselves.

Hemiunu described the fleet: it consisted of three boats for the hunting party, carrying in all some forty people plus crews; accompanied by half a dozen much lighter, faster vessels, each rowed by six armed men in uniforms, evidently soldiers. There were two supply tenders bringing up the rear, and these were towing at least a dozen light skiffs each. Hemiunu knew that these were for going in and out of the shallow reed beds to get close to the nesting birds.

The stream carried them quickly towards Buto, but night fell before they had reached the halfway point. They pulled into a harbour, had a meal and a drinking party on deck and then went to sleep on top of the boat’s superstructures. Hemiunu was told to cover himself with fish netting which the sailors had brought, to prevent being bitten by mosquitoes. He did not understand how this might work, but he was not bitten that night, and he slept soundly—no doubt aided by the very strong beer he had been drinking during the evening.

They reached Buto by lunchtime on the second day, were met by a worried looking man called Metjen, who ran around the senior members of the group obsequiously.

Hemiunu did not like him. The fowling party and broke up into small groups, each equipped with skiffs, poles for punting, throwing sticks, nets and clapper boards.

Hemiunu found himself with a group of others, sons of noblemen, many of whom he knew from school, or knew by sight. They were all older than him, but they encouraged him to join in. Hemiunu wondered if they knew who his father was, and if that is why they were being so nice to him.

The marshes and the reed beds were teeming with wildfowl, and Hemiunu thoroughly enjoyed himself, falling in at least five times as he got used to using the skiff, and trying to retrieve stunned birds from the water. Hemiunu also recorded his amazement at the seabirds used by the Buto fishermen, which they had trained to catch fish for them.

When the fowling was over for the day, they went to a riverside camp that had been set up while they were fowling. They had a magnificent meal, with fresh fish and duck, of course, washed down with light beer. Everyone then got down to some serious wine drinking. Hemiunu was not used to such strong drink. His father had taught him that it was very bad manners to become drunk in company, so he went into the marshes on his own near the camp and was very sick. He stayed there for some time until his head cleared, and he passed the time looking up at the stars and wondering which one King Snefru would eventually go to, as his final home among the Imperishables.

That night they slept in tents that had been brought along for the purpose. Next morning Hemiunu awoke with an aching head, spots before his eyes, and a chill down his spine, but he kept his counsel and ate some dry bread for breakfast. After breakfast, Hemiunu and the other young men returned to White Wall in two of the boats, while the older men went off to do some more hunting—although they would not say what they were hunting, nor when they would return. This time a stiff breeze aided the return journey, which took one and a half days. Hemiunu was well satisfied with this, his first outing as a man.



This well-known illustration is not from the Hemiunu's secret diaries, but is part of a magnificent New Kingdom fresco showing a fowling trip.

From Hemiunu's description of his trip, little had changed in the intervening 1,200 years—at least, as far as the hunting practices were concerned.

The wigs, however, would have surprised Hemiunu, as would the woman's dress, her bouquet of lotus blossoms and the wax cone on her head.

British Museum

Meidum–Hemiunu’s Baptismal Pyramid

The Inheritance...

Hemiunu’s fifteenth birthday had not passed by more than three weeks when his father announced that Hemiunu would accompany him on the next day to Meidum, where Prince Neferma’at was working on a project for his father, the king. Neferema’at would say no more.

Next morning, before sunrise, they set off in a boat which had a deck, on top of which was a hut. Prince Neferma’at and Hemiunu were to use this hut, like a room in a floating hotel, as their residence while working on the mysterious project. The boat was crewed by servants from his father’s palace, and the rear of the boat was stacked with provisions. The servants were all armed with sticks, knives and clubs, although Hemiunu had no idea why. Hemiunu was very excited—the writing in his diary wobbled with eagerness.



Recent photograph of the Nile bank—little has changed since Hemiunu’s time.

Even with a stiff breeze from behind them to fill their sail, it took several hours to reach Meidum. Hemiunu observed that the riverbanks were green and lush, with date palms, tall grasses, and the occasional farm building with cattle. He waved and the people waved back, which pleased him. He could see cattle inside farm walls, with smoke rising from cooking fires, and donkeys being herded along the banks.

Hemiunu knew when they were nearing Meidum—he could see the top of an

enormous structure, like a tower, and he had guessed that his father was taking him to join him at work. Hemiunu was pleased and proud. His father now respected him enough to take him along to work, where he would be seen by the men who worked for his father, the king’s chief architect.

The Inherited Design Concept

Hemiunu’s father explained that the pyramid had been built by Hemiunu’s grandfather, chief architect to *Nysuteh*, King Huni, father to King Snefru. The pyramid had been built originally with only seven tiers, but King Huni (Hemiunu referred to him as Huni, the Smiter) had been dissatisfied because it did not look as big as Djoser’s

Stepped Pyramid, even with its original seven steps—deliberately, one more than Djoser's Pyramid.

Grandfather had built up the outsides so that he could make it taller without changing the slope, and had added another layer at the top, making eight in all.

Hemiunu was clearly impressed by the enormous

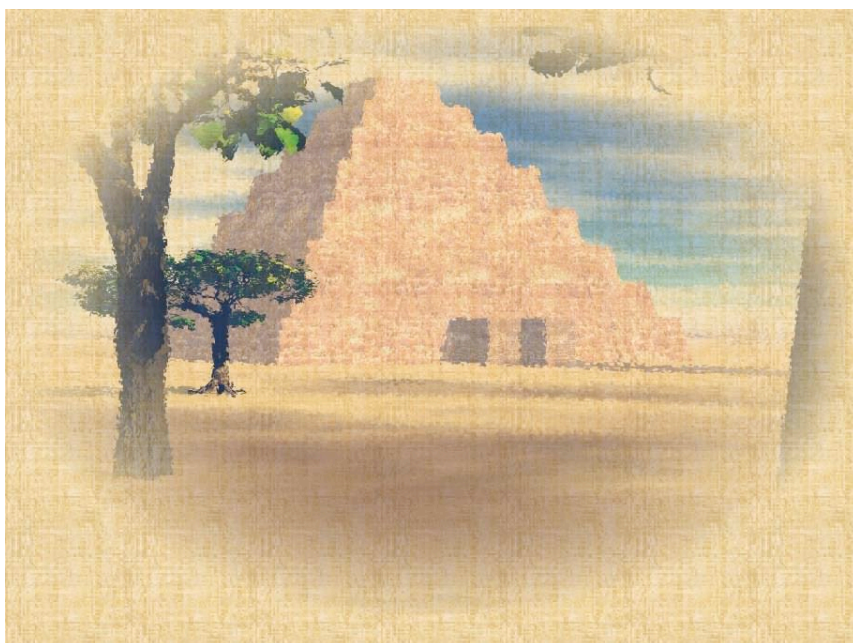
size of the structure and by its clean, almost pristine lines. Prince Neferma'at told Hemiunu to explore all around the pyramid, but to keep out of the tombs that were being prepared nearby for members of King Snefru's immediate family, including Prince Rahotep (Prince Neferma'at's half brother) and his wife Princess Nofret—whom Hemiunu clearly fancied, judging by his description of her “milk white skin!”

Hemiunu walked all around the pyramid, looked at the mortuary temple, examined the stele and the offering table there, walked down the causeway to the riverside and explored the valley temple and the river docking area. Returning to the pyramid he clambered up the tiers on the north face to reach the entrance. He went down the passage, sloping away at 14 *seked*—he knew all the slopes in all the pyramids, mastabas and tombs from his school studies, and that 14 *seked* was sacred to Osiris in his role of god of agriculture and the land.

Reaching the bottom, he straightened up as he entered a horizontal section of passage with a high ceiling. He negotiated some wooden boards set over a pit filled with spikes in the floor, skirted around some stones that looked like passageway plug stones, and found himself facing a ladder. Climbing up, he entered the burial chamber.

There was absolute silence, except for the guttering of the torch he was holding to light his way. Hemiunu was scared. He looked around and saw a large sarcophagus; it was made of red granite and was without markings, but the lid was sealed tight. Was King Huni in there?

Controlling his fear—after all, his grandfather had built this pyramid—Hemiunu looked around. He noted particularly the



Hemiunu made several sketches of the pyramid at Meidum. This (restored) sketch, made under the shade of some trees, shows the pyramid as he first saw it, with eight steps. The mortuary temple is visible, as is part of the causeway leading down to the river. The view is from the south east, so Hemiunu must have started work very early in the morning, judging by the angle of the sun.

The tree nearest the pyramid is recognizable as a sycamore, sacred to the goddess Hathor.



corbelled roof, with each layer of stone overlapping the one below until the sides were so close together that they could be bridged by a single narrow stone. He saw that the sides of the roof had been kept apart with timbers during the building, and wondered why that had been necessary. Corbelling, he noted, was something that he must learn about. He wondered just how much weight of stone the corbelled ceiling was holding.

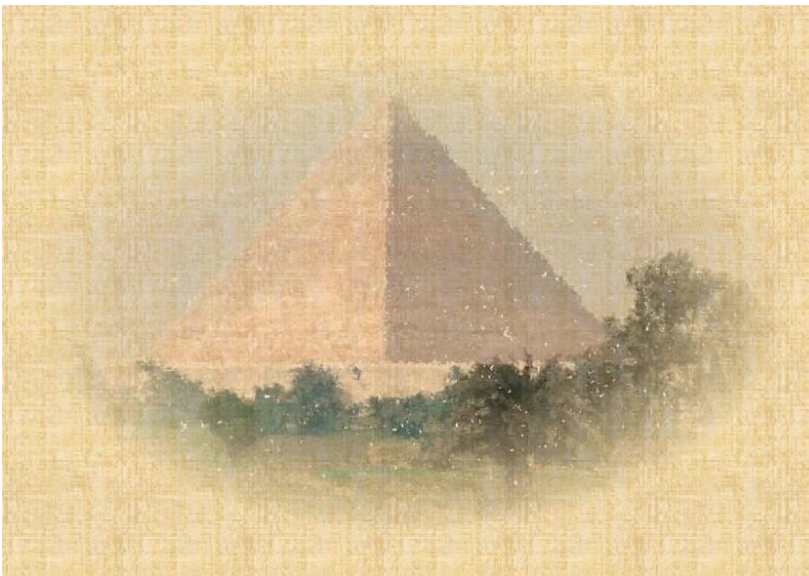
He was disappointed with both the small size of the burial chamber and with its finish, which he thought was rough. He decided that the chamber was clearly not finished. Perhaps that was part of the work that his father was undertaking.

Snefru's Intent

Hemiunu rejoined his father, and listened as he briefed his foremen on the plans for the building, as laid down by King Snefru. The king felt a debt to his father, and had decided that Huni should live for eternity in a "proper" pyramid. By this, the king meant that the steps on the sides of the pyramid should be filled in, to create smooth slopes, that there should be a pyramidion on top, and that the whole should be encased in white Tura limestone to create the largest, most impressive pyramid ever built. So, this was the plan.

Neferma'at set his foremen to work planning how the work was to be accomplished. There were some major problems, not least with foundations that would be needed to hold up the limestone cladding. It would have to be quite thick to provide a flat slope over all the steps, and Neferma'at was evidently concerned as to how the whole structure could be built solidly.

Meanwhile, Hemiunu set to work to sketch out what he thought the renovated pyramid would look like. He pictured it on the edge of the desert, but close to the lush vegetation that he had seen on his trip to Meidum.



Working to scale as best he could, he set the slope of the future pyramid at five *seked*; that was what Snefru had proposed, apparently, since estimates had shown that the slope of Djoser's Stepped Pyramid would be five *seked* if it were filled

in—when seen from within its enclosure.

Try as he would, Hemiunu could not make a cladding of five *seked* fit comfortably over his sketch of the eight-stepped pyramid of Huni. Trial and error showed that a maximum slope of five and a half *seked* was necessary, so that is what he drew and coloured in. Even then, a tremendous amount of packing would be needed to fill in the steps...

Hemiunu could also visualize the cladding sliding off those sloping shoulders of each step. Should not the steps have vertical faces rather than sloping faces, he asked prophetically in his diary?

Later that afternoon, Hemiunu and his father returned to the boat to wash and have a meal. Prince Neferma'at could see that his son was pensive. Hemiunu asked why it was permitted to enter the burial chamber, which had previously been sealed, and which, even now, contained King Huni's mortal remains, so that the king's spirits could appear at any time.

Neferma'at told him that all might not be quite as it appeared. First, Hemiunu had to realize that as an architect to the king ('me an architect?') Hemiunu would be privy to all kinds of knowledge and secrets that ordinary people did not know. Neferma'at reminded Hemiunu that a king, as a god, could store his mortal remains in any of a number of sarcophagi, and that he could effectively occupy any or all of the sarcophagi at one and the same time. The only prerequisites were that his mortal remains were preserved, and that the various sarcophagi were all buried sufficiently deeply to be in the Underground Netherworld. Under the pyramid was deep enough, but there were other places that were deep enough, too.

Hemiunu thought about that. He knew that the royal family had burial sites at Saqqara and at Abydos, the Holy City. So, perhaps the sarcophagus in Meidum Pyramid did not contain King Huni's remains. On the other hand, he had seen his father post guards over the open entrance to the pyramid, and he now knew why they carried weapons. Would his father post guards over an empty sarcophagus? Yes, he probably would. Then again, perhaps even his father was not sure where Huni's remains were interred. Or, perhaps the real power lay in the sarcophagus itself..

Before he finally went to bed, Hemiunu showed his father his sketch of Huni's Pyramid, and the slope he had found it necessary to use. For answer, his father smiled and showed his own drawings, with the slope also at $5\frac{1}{2}$ *seked*, but commented that he had chosen the slope for an entirely different reason. His father also changed the title from Huni's Pyramid to Snefru's Pyramid. Hemiunu fell asleep that night with his mind in turmoil. This was just the beginning...

As we know today, the pyramid at Meidum was filled in, and lasted for many centuries before the outer layers collapsed.

The photograph is taken looking toward the north east corner. The bank of rubble at the bottom is a mixture of core material, packing and casing stones, which has been robbed out in antiquity.

The curious shape arises because of the construction, first as a seven-tier pyramid and then as an eight-tier pyramid. The additional layers were not keyed sufficiently to the inner core; if they had been, the whole may have been reduced to a pile of rubble.



The Party at the Palace of Snefru

In his diaries, Hemiunu recounts his experiences at a banquet, held by King Snefru to celebrate the pronouncement of Khufu as Crown Prince. More was going on, it seems, than just feasting...

The banquet was held at the King's palace at *Ineb-hedj*, White Wall, in a walled enclosure set aside for such entertainments. Hemiunu attended with his father and mother, Prince Neferma'at and Princess Atet. Being accustomed to such lavish festivities, Hemiunu does not remark on the food or the entertainment in general, but he was clearly surprised by the behaviour of some of the guests.

King Snefru held lavish parties at White Wall, in an area set aside for the purpose.

Hemiunu attended a party to celebrate Khufu's pronouncement as Crown Prince.

There was feasting, music, and entertainment by jugglers, tumblers and dwarfs, including the famous dwarf Seneb.

Queen Hetepheres, the king's Great Wife, attended, as did her granddaughter, also called Hetepheres, an outrageous girl who—although he did not know it—was to figure largely in Hemiunu's future

The banquet started just after sundown. The enclosure was about 100 cubits by 50 cubits (170 x 85 ft), Hemiunu estimated, and was surrounded by a high white wall made from mud bricks, plastered and limed. Against the wall were set braziers at five cubit intervals, with fiercely burning cloths soaked in pitch, to light up the festivities. There were also two pits, one at either end of the enclosure, with large bonfires which were kept burning by a small army of servants.

The guests were invited to sit on cushions, which were set around the enclosure, parallel to the walls, but about five paces in from them. In the centre of the room was a performing area: when Hemiunu entered with his parents, there were several musicians playing familiar music on several drums, two harps and a large tube like a whistle, which made a pleasing sound like an owl hooting.

The noise from people talking rose steadily until, as more and more guests arrived, it became unbearable. Not to be outdone, the musicians played louder, too. Hemiunu was not used to such noise, and he thought it displayed bad manners and a lack of respect for the king, who was expected at any moment. Just then, King Snefru did indeed arrive, accompanied by his queens, led by Queen Hetepheres, the King's Great Wife, and mother to Prince Khufu, who was to be pronounced Crown Prince this very evening.

The noise stopped instantly. The king and his retinue walked to a row of cushions set aside for them by the central performing area. Queen Hetepheres and her guests took up positions at cushions on the opposite side of the area. There was a pause, and they all sat down together.

Without a word, an army of servants brought in bowls of food of every variety imaginable. Hemiunu watched how the others around him tackled the food, and did likewise. Using one hand to prop himself up, and the other to take a piece of bread and dip it in the bowl, he managed to feed himself without showing his inexperience.

After the food came the entertainment. This was Hemiunu's first encounter with Seneb the Dwarf, who was to become a firm favourite with the future King Khufu and his son, Djedefre. At the time of the

banquet, however, Seneb was the new court jester, and was entertaining King Snefru by playing tricks on some of the guests. One such prank saw Seneb coming up behind a beautiful young priestess, Senetites, and performing simulated sex, without the girl's knowledge. Every time the girl turned around to see what was causing the laughter, Seneb stopped and looked innocent. (Later, Seneb was "given" Senetites as his wife – see statue at right, Cairo Museum.)

Seneb was careful, Hemiunu noted, not to play tricks on the new Crown Prince Khufu, a corpulent, middle-aged man full of self-importance, clearly impatient to become king in place of his father—the benign Snefru. At this time, Hemiunu also appeared to be wary of his cousin Khufu, who he preferred to avoid after having seen him on the fowling expedition.

Hemiunu was clearly taken with one of Khufu's daughter, a very young princess called Hetepheres, after her grandmother, Queen Hetepheres I, Snefru's wife. The young princess was very beautiful, and already aware of her effect on men. She moved around the enclosure from group to group, flirting outrageously with every male – and many of the females, too. She then took an instrument from a musician and proceeded to strip off what few clothes she was wearing while accompanying herself. Hemiunu was both horrified and fascinated by the young Hetepheres. This was to be a lasting contradiction for Prince Hemiunu, as later diary entries show.

Meanwhile, Queen Hetepheres held court, being carried around the enclosure by four large men on a chair specially constructed for the purpose. She conspicuously ignored the behaviour of her young namesake, whether through disgust or because it was of no significance, Hemiunu was at a loss to know. (Queen Hetepheres' sedan chair has survived – see photograph at right, Cairo Museum.)

Hemiunu was keeping very quiet, observing but not being observed—he thought—when a servant pressed something into his hand. It was a note, inviting him to go across the enclosure to meet a woman he knew only by name and reputation. He looked around for her and saw her grinning at him from across the room. Hemiunu was horrified—she must have been twenty-five if she was a day, he observed, she had bad teeth, an awful wig, too much makeup, and no husband to keep her in check. He did not know what to do, so he simply did nothing, hoping the situation would go away.

Luckily he saw two of his friends from the duck hunt, so he made his way across to them, looking for safety in numbers. The young men spent the rest of the evening eying girls that they either knew, or would like to know, all of whom were firmly under the control of their parents. Hemiunu saw Neferet and Khnumet from his school, and several other girls that he definitely fancied—from a safe distance.



Seneb, his wife, Senetites, and their two children. Seneb was a favourite at the courts of Khufu and Djedefre, with titles and lands.

The design of the group shows sensitivity and respect. The whole has been arranged to form a square, with the children filling the space that would normally have been occupied by the man's legs. The light-coloured wife lovingly supports the darker husband; she has a serene smile. The children, a darker boy and a lighter girl in keeping with the canon, have their fingers in their mouths. Note that the husband's head is just above his wife's.



From Hemiunu's "University" Notes

From the age of 15, Hemiunu attended what we would call today a university, in that the establishment researched into and taught about everything there was to know. It truly was universal, as far as Hemiunu could tell. Like today's universities, however, it was a time and a place for growing up as much as for learning.

The university consisted of a number of open air "laboratories" or areas for research into different aspects of the world around them. It appeared to Hemiunu that priests from Heliopolis ran all the laboratories.

- There were observatories, like the one Hemiunu had visited at Giza, but looking into many different aspects of the heavens; counting stars, tracking and recording star risings, disappearances, coincidences and anomalies, star groupings and their significance; and the sun, moon and planets.
- There were trial fields for developing improved strains of plants, and for trying different arrangements of drainage. There were husbandry estates trying out different ways of domesticating and breeding cattle, deer, antelopes, goats and even pigs.
- There were pottery schools for making experimental pottery, for smelting and alloying, for making moulds for casting, and for carving and cutting different kinds of stone.
- And, of course, there were open-air civil engineering laboratories, of which the chief was Djoser's Stepped Pyramid complex a Saqqara.

Djoser's Stepped Pyramid with simulated cladding, to suggest the high levels of brightness and heat that would have been experienced in the enclosure from reflected sunlight by day.

Less obviously, perhaps, the area would also have been lit at night, particularly by the full Moon—but without any additional heat, of course.

Understanding Djoser's Complex at Saqqara

Hemiunu had been visiting the Stepped Pyramid of *Netjerykhet*, Djoser, since he was a small boy, both with his father and with his

school. Now, however, he was expected to do more than gawp and draw pictures; he had to understand both why and how. His first teacher, Nebhartef, was a stern, serious, grey man; he had grey hair, grey skin and his robe was grey, too. He took Hemiunu on a tour around the complex.

The overall rectangular complex was oriented approximately north/south. Nebhartef explained the purpose of the various



structures as they went around.

Two pavilions to the east of the stepped pyramid, one of the north and the other of the south, represented lower and upper Egypt respectively, and enable the *ka* of the living king Djoser to be anywhere he chose in either of the two lands of which he was the ultimate lord, *neb-tawi*. There was a direct spiritual link, or conduit, that only the king could travel through, Hemiunu noted.

Next, according to Hemiunu's record, they visited the *heb-sed* court. He recognized the barrel-vaulted shrines as representations in stone of the reed structures used by farmers to store straw and cattle feedstuffs in the Nile delta. Here the shrines were solid stone, with no internal rooms, again accessible only to the *ka* of the king.

Nebhartef explained the rituals pursued by the king during the *heb-sed* festival, and in the main arena to the south of the pyramid, to demonstrate his prowess in running, jumping, throwing and fighting. Nebhartef explained in hushed tones that, as the king got older, the ritual tests reduced to running around the course, and perhaps even to walking or being carried if the king should become infirm. It was important to ensure the fertility of the land...

Nebhartef also pointed out that the smooth white sides of Djoser's stepped pyramid reflected both sunlight and moonlight into the enclosure, as had been Imhotep's intention. On particular nights, moonlight reflected off the pyramid so illuminated the enclosure that ceremonies to celebrate both the living god Horus and the Moon were held. On most days, it was insufferably hot near the south face of the pyramid at noon. The *heb-sed* festival was sometimes held under the full moon in consequence.

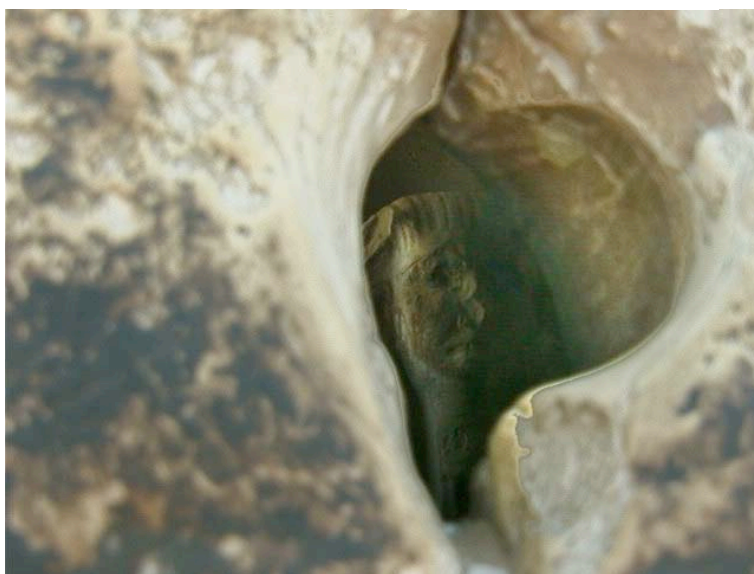
Backtracking, they went to see Djoser's *serdab*, where the fine statue of Djoser could be seen through the two holes, apparently looking out towards the northern skies. Hemiunu had seen this before, but was still awed at the sight of the great king himself. Nebhartef explained that the apertures served to allow the king's *ka* to see out, but also to receive offerings and to smell incense.

The courtyard in front of the kiosk was a flat area with a black line running from the kiosk, due north to the far wall. There were green stripes on each side of the black line, and then golden yellow stripes outside those. Hemiunu was

King Djoser as he may be seen today through one of the two holes in his *serdab* at Saqqara. The holes might have been intended for the king to see out, for incense to be presented to him, or offerings, or all three.

The original statue is in the Cairo Museum. Regrettably, it had the eyes cut out in antiquity, but the statue is still impressive.

The statue in the *serdab* is a copy.



The Secret Diaries of Hemiuunu

puzzled. Nebhartef explained that the coloured areas represented an idealized map of Egypt. The kiosk stood over the first cataract of the Nile. The black line was the Nile on its journey north, and the black silt it deposited on its banks. The green was the vegetation that grew on either side of the Nile, on the black land. And the gold was the desert. By looking out across this representation, King Djoser was in effect looking out over his two land of Egypt and his people, towards the Imperishable circumpolar stars where he had his everlasting home.

Hemiuunu asked why the kiosk was tipped back slightly so that King Djoser appeared to be looking upwards. Nebhartef explained that the king was looking out over his beloved Egypt, from the far south, at the first cataract, where the Nile water sprang into the world. His view covered the whole of the two lands, and on to the Imperishable circumpolar stars; by day he watched over his people and the Inundation, which he caused to happen each year; by night he projected his *ka* to the stars, to reside with his ancestral royal predecessors.

Carving at the foot of King Djoser's statue.

At right are sets of sacred symbols: the *djed* for eternity and the *tet*, representing the blood of Isis. In the centre are Djoser's titles.

At left, second row from bottom, reading right to left, are a palm leaf (I), an owl (M) and an offering table (*hotep*, meaning 'pleased') Together they spell Imhotep, architect of the first pyramid.

These symbols may look unimpressive and insignificant, but it is exceptional for the name of a commoner to appear on the statue of a king.

Cairo Museum

Imhotep

The complex was a working establishment, Hemiuunu soon found out, with the Cult of *Netjerykhet* being assiduously pursued by an army of priests, who held services around the complex on a rotating plan during the daylight hours. Priests also attended Imhotep's fabled tomb, outside the enclosure to the east, which Hemiuunu hoped to visit; rumour had it that Imhotep's was the most exquisite tomb ever constructed.

Imhotep had many titles, which Hemiuunu had to learn off by heart:

- Chancellor and Great Seer.
- Son of Ptah.



- Vizier.
- Confidante of Ra, Ib-Ra-Him (hence Abraham, or Ibrahim?)
- Treasurer of the King of Lower Egypt.
- First after the King of Upper Egypt.
- Administrator of the Great Palace.
- Hereditary Lord.
- High Priest of Heliopolis
- Imhotep the builder, sculptor, the maker of stone vases

The Party Scene

Hemiunu returned home every afternoon, and in the evening he visited a reception enclosure with young men of his own age, often those he met during his studies, or friends from hunting trips.

The major topics of interest appear to have been drink and girls (no change there, then.) The young men had become enamoured of a date wine fortified with a concoction made from fermented honey. Hemiunu had thought it impossible to ferment honey, but there it was—and powerful stuff, too! Drinking binges became standard practice every night of each ten-day week except for the one day he

Reconstruction from Hemiunu's description of the reception hall where he and his male peers spent many happy hours drinking into the night, discussing the world at large, and putting it right—as young men have done for thousands of years.



The Secret Diaries of Hemiunu

spent with his family. It was a “work hard, play hard” regime, which he clearly found fulfilling—for a while.

The drinking sessions were held in a walled enclosure especially designed for functions in the dark. Like most of his friends, Hemiunu was nervous of the dark, and the reception area had been designed for maximum lighting (see reconstruction.)

Around the walls were braziers made of translucent stone. As the pitch-soaked linen burnt in the braziers, it radiated through the stone containers and the light reflected off the walls, which were plastered and painted white, and off the floor of polished blue marble. In the centre of the room was a dais for performers (singers, musicians, dancers, contortionists, jugglers, etc.) and comfortable mats were set out parallel to the walls. Two further flames leapt up from the marble to light up the central area, although Hemiunu could not see how they were supplied with fuel. The whole created a warm and secure environment, with the moonlight (if there was any) adding more light, the stars shimmering in the heat rising from the braziers, and the evocative smell of the burning pitch, which had been laced with incense.

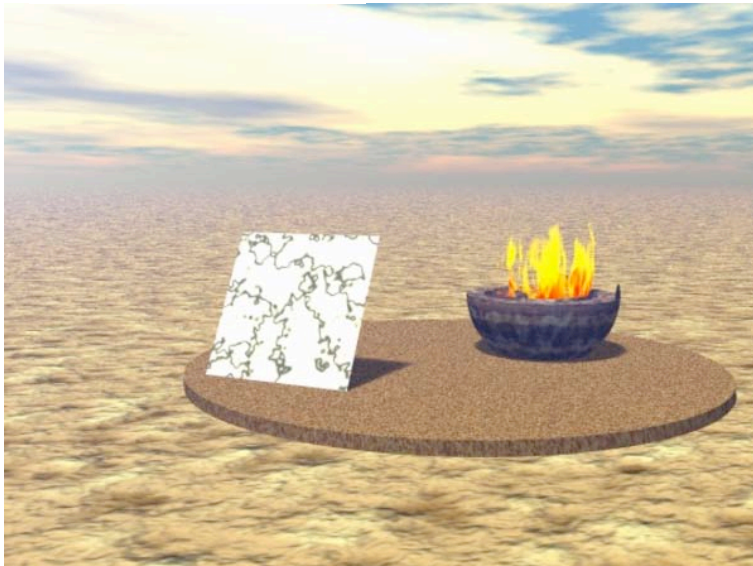
The young men enjoyed the entertainment, and Hemiunu was particularly smitten by a lithe young dancer who, he believed, was dancing and smiling just for him. Unfortunately, his colleagues thought she was smiling and dancing just for them. None of them had the nerve to talk to the girl.

Hemiunu recorded some discord with his mother on the subject of dancing girls. Mother, he observed, was definitely old fashioned. Father, similarly had retrograde views on drinking, although he was rather more encouraging in the direction of dancing girls, winking and grinning at Hemiunu in a way that made him uncomfortable.

Astronomy research described by Hemiunu. A horizontal area was cleared on the Giza plateau. A white, Tura-limestone slab was set up to face due south and tilted back to represent the slope of the south face of a pyramid.

The objective was to see when, date and time, sunlight and moonlight would be reflected off the polished surface towards the Stepped Pyramid, where observers signalled back the results.

Experiments were controlled using substances to change the colour of the fire(s) according to a prearranged code.



Astronomy

Hemiunu was particularly interested in learning more about the stars, the sun, the moon and the five planets that we call Mercury, Venus, Mars, Jupiter and Saturn.

On one visit to the research facility at Giza, where he had been before, he saw an experiment in progress that puzzled him, particularly when he found out that his father had ordered the research program.

Working on a horizontal, stone dais carved out of the rock, the researchers had erected a

framework on which stood a thin slab of white, highly-polished Tura limestone. The slab and its framework were set up to point due south. The framework allowed the researchers to tilt the slab to various slopes, which were determined by scales inscribed on the framework.

The head priest explained what they were doing. It would soon be the longest day of the year. The research was intended to find out at what slope the slab should be on that day to reflect sunlight directly towards Saqqara and the stepped pyramid. They used the fire as part of a signalling system devised, the priest said, by none other than Imhotep himself. Each signaller had several different powders, each of which made the flames turn a different colour. Each colour was an instruction: start, stop, tilt upward, tilt downwards, and so on. The same flame colours meant different things according to the experiment in hand. In this instance, four colours one after the other, when requested, gave the slope of the Tura limestone slab. At the remote site, by the Stepped Pyramid, there were two priests who were viewing the scene, giving the instructions, and recording results. Hemiunu was impressed with the sheer simplicity of it all.

Putting two and two together, Hemiunu realized that the research was intended to determine the slope of a pyramid at Giza that would reflect sunlight like a brilliant beacon directly at Saqqara on the day of the summer solstice. This could not occur at midday, he calculated, since Saqqara was east of south when viewed from Giza; some minutes after noon, he reckoned. Was that why his father had been mysterious about the 5-1/2-*seked* slope for the pyramid at Meidum?

The priest in charge told him that the ideal result occurred using a 5:6 ratio slope, which was not quite as steep as 5-1/2-*seked* (11:14). So, that could not be the reason...

Finding north—practical methods

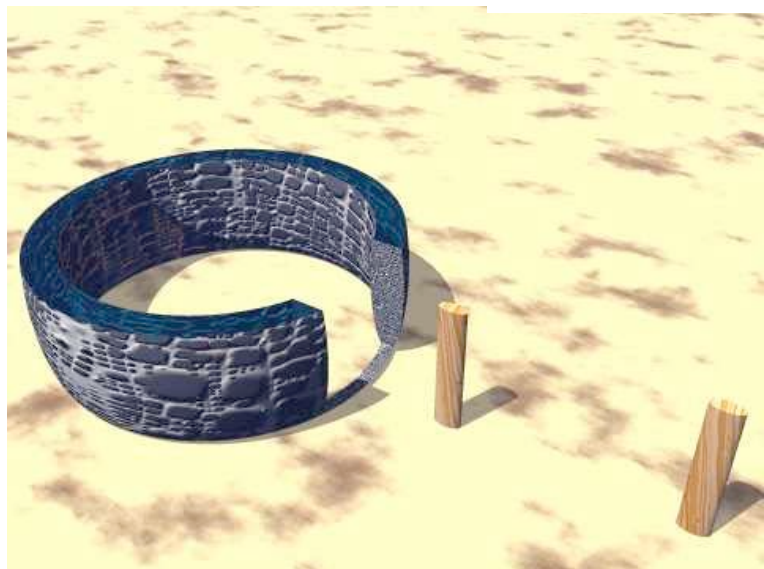
Hemiunu knew how to find south, from his schooldays. It was when the sun was at its highest point in the sky. Put a stick vertically in flat ground, and mark where the end of its shadow fell throughout the day. South lay in the direction of the sun when the shadow was shortest.

The method worked, but it was not very accurate. Some of the priests were

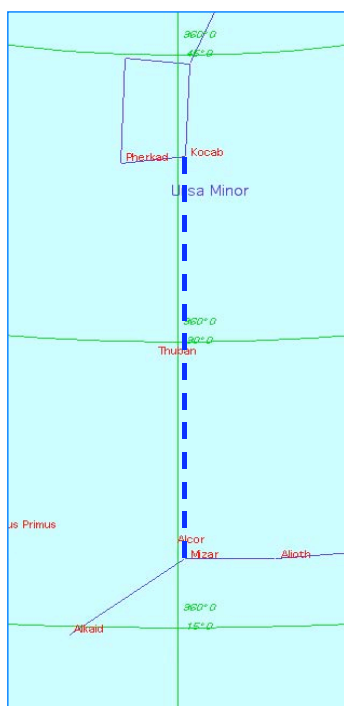
North-finding apparatus consisted of a circular wall with water in a channel on the top to level it. An observer sat inside the wall, facing the opening towards the north. As night fell, stars arose on the observer's right, rotated across the heavens, and descended on his left. A partner marked the direction of rise on top of the wall, and later the direction of fall. Dividing the two gave north.

The observer lined himself up with two posts to ensure he took readings from the same spot each time.

The method was approximate, but improved by observing a number of stars and averaging the results.



The Secret Diaries of Hemiunu



In 2550BC, a vertical line dropped from Kocab to Mizar through Thuban, the then pole star, pointed consistently just to the east of north.

As the stars rotated about Thuban each night, this provided a fairly accurate north reference for a few minutes just once each night, without the need for complicated apparatus and protracted measurements.



exploring alternative methods, including the one shown in the reconstruction. They explained to Hemiunu that they were having difficulty getting repeatable results, and he suggested that they should attach a head harness to the wall, so that the observer's head would always be in precisely the same position when observing. To his surprise, they listened attentively and set about making a suitable device.

Other priests were observing the arrangement of the stars looking north. They knew that the circumpolar stars rotated around a stationary point in the sky, and that the star Thuban, the then pole star, was near that point. The priests had arranged an apparatus similar to that used for finding north; two plumb bobs had been arranged such that an observer in the circular enclosure who lined his eye up with the two plumb lines would be looking due north.

The research was to look for patterns that would tell them where due north was without having to set up lengthy trials. So far they had discovered that when Mizar, a star in the Bull of Heaven (Great Bear), was vertically under Kocab, the vertical line joining the two stars was just to the east of north—as they currently measured it. The trouble was, they were uncertain about their measurement for north in the first place...

On another night, a group of differently robed priests were taking measurements on the plateau at Saqqara. Hemiunu knew that they were not priests of Heliopolis, but priests from the Temple of Osiris, near White Wall. They had concocted a complicated arrangement in wood, with sighting lines and pegboards. He had seen this device before on his school field trip.

The priests had set the device up with a small metal fork as the sight. The fork had been polished right into the split. The priests explained that it was possible to adjust the sighting pole and the fork so that the light from a particular star was “trapped.” The polished metal sides made it easy to be sure at night that the star was right in the centre of the fork, because that the reflections from both tines were the same.

The Priests of Osiris had set their apparatus to a fixed slope of seven-*seked* (45°) and had used the north south lines marked on their dais to line the apparatus up facing due south. So, the azimuth was fixed and the elevation was fixed, too.

Each night they watched to see if any bright star entered into the view of the sighting fork. Seven, as everyone knew, was the sacred number of Osiris. If a star should appear at seven-*seked*, then it would clearly be the star of Osiris. Sopdet (Sothis, Sirius) was already established as the star of Isis, heralding the Inundation each year; it was reasonable to expect that the star of Osiris would be close at hand.

Hemiunu was unimpressed with this approach; in his diary he observed that the Priests of Osiris had determined the answer before solving the problem. Suppose two, three, or even four stars passed

through the forks during any year. Would that mean they were all Osiris' stars? Hemiunu's felt that their research was invalid. 'Besides, their apparatus was poorly designed for measuring elevations and slopes reliably...'

Hemiunu's "First Time"

Part of the Osirian legend, as everyone knew, concerned the "First Time," *paut-tauti*. This was when a god first appeared on earth and commemorated the emergence of the god from the Primeval Mound of creation, before the god created other forms of life. Hemiunu's colleagues and friends seemed less concerned with the First Time of the gods, and more concerned with Hemiunu's first time. It was becoming an embarrassment to him that he was the last one of his group—or so they all said—to lose his virginity. He did not believe several of them, but that made little difference. Judging from his diary entries, Hemiunu was painfully shy.

He was down by the Nile one day, watching the fishing boats come in. By the harbour there was a small gang of workers splashing about in the shallow water and digging up wet clay, presumably for some building project. The workers were covered from head to toe in mud and clay, but they seemed to be having a great time, singing, laughing, splashing and pushing each other over as they worked.

One of the dirtiest saw Hemiunu looking and asked him what he was staring at. To his amazement, the voice was that of a girl, or rather a young woman. He managed to apologize, saying that he was enjoying their antics. A few minutes later, the young woman, Neferhetepes, came out of the water having cleaned herself by swimming into the Nile and back again.

Far from being a worker, she was a young priestess from the nearby Temple of Hathor. She had gone to the same school as Hemiunu, and knew him by sight, although he could not remember her. At first, Hemiunu had thought she looked like a boy. On closer, covert inspection, he decided she was not at all like a boy; on the contrary, he found himself blushing just looking at her. Luckily she did not seem to notice. Instead she shattered his growing illusions by shouting some jovial obscenities after her co-workers, who were carrying the clay off to the temple.

It turned out that she was in charge of a small decorating project in the temple, and had been supervising the clay dig as part of her priestly duties. Hemiunu hastily revised his ideas of priestesses, and before he realized what he was doing, he invited her to a party to be held the following evening at the reception enclosure where he and his friends met. He was mortified when she declined, saying that the reception enclosure was not a place where priestesses were allowed to go—an observation that surprised Hemiunu.

Instead, she invited him to meet in the temple early in the morning, in two days. He had never been to the Temple of Hathor, but agreed to

The Secret Diaries of Hemiunu

go, and they parted. In his diary that night, Hemiunu was clearly excited.

Estimating

Hemiunu had studies every morning; the following morning was no different. It was applied mathematics, of a sort. He and several colleagues had to work out the number of workers needed to raise a tomb in the shape of a truncated pyramid, and how long it would take. All students had access to standard figures showing for particular tombs how long it actually had taken, and how many men had been involved. It was their task, then, to compare the tomb in their question with the known, standard tomb, calculate the differences, and hence estimate the amount of work and the number of workers appropriate to the problem.

Hemiunu found this task easy, which was good, since his mind appears to have been on other things. The tomb of their task was the same height as the standard tomb, but had a larger base. He worked out the difference in volume, and scaled up the number of workers accordingly. In theory, scaling up the workers in this way would result in the truncated pyramid taking the same time to build as the standard model. Hemiunu knew that scaling up gave an underestimate, however, while scaling down gave an overestimate. He added an additional 150 workers “for luck” and handed the result to his tutor, Nebhartef, who asked him who Neferhetepes was. Hemiunu blushed; he had been doodling her name absent-mindedly.

That evening, Hemiunu faced an unexpected inquisition from his parents. His mother asked him what he had been up to down by the harbour, and his father looked concerned too, which was unusual. He told them what had happened and that he had been invited to the Temple of Hathor.

His parents were clearly relieved. Hemiunu should have realized that, with a name like Neferhetepes, his young priestess was no ordinary person. She was the daughter of one of the most powerful men in the country, a man with ruthless ambition, and with links—it was said—to Seth himself. Hemiunu’s parents clearly did not want to fall foul of Prince Ankhmare, with whom Hemiunu’s father worked at Dahshur.

The Temple of Hathor

Next morning, being the tenth day, Hemiunu was free from his studies and research. Bright and early, he walked to the Temple of Hathor, enjoying the ethereal light as the sun came over the eastern horizon. The ground was covered in mist from the river, and it swirled round his ankles as he walked.

In his diary, he described his first impressions of the temple. It consisted of four main sections: an open entrance, an outer covered reception, and an inner hallway leading to another room at the back. Three marble steps led to a marble platform beyond which was the

open entrance. Two tall columns, made from a kind of wood that Hemiunu had never seen before, flanked the platform. On top of each column was a cube of sandstone with the head of Hathor carved on each of the four faces. She had a curiously familiar mixture of features; part woman, part cow. Behind each pillar was an alabaster bowl with flames leaping from it. Incense-laden smoke from the flames filled the air, collected under the ceilings and tumbled lazily down the steps. Beyond the fires was a raised ceremonial pool, which Hemiunu knew was associated with ritual cleansing. The whole temple had a numinous air, made more pronounced by the swirling mist.

There seemed to be no one about as Hemiunu approached the steps. When he was in the centre of the steps he could see right down the corridor into the inner chamber, but could not make out what was in there. Just then several priestesses emerged through the corridor, apparently expecting him; Princess Neferhetepes, as he now knew her to be, was not among them.

The chief priestess, a woman of about 25, Hemiunu thought, came forward and led him up the steps, past the open flames, and into the first chamber. Two other priestesses, younger and both very pretty, came forward and tried to remove his clothing. Hemiunu backed away, but the chief priestess clapped her hands, and two more priestesses came forward with a large cloth, which they held up and averted their eyes, hinting to him by signs that he should undress behind the screen. To his own surprise, Hemiunu did as he was told,



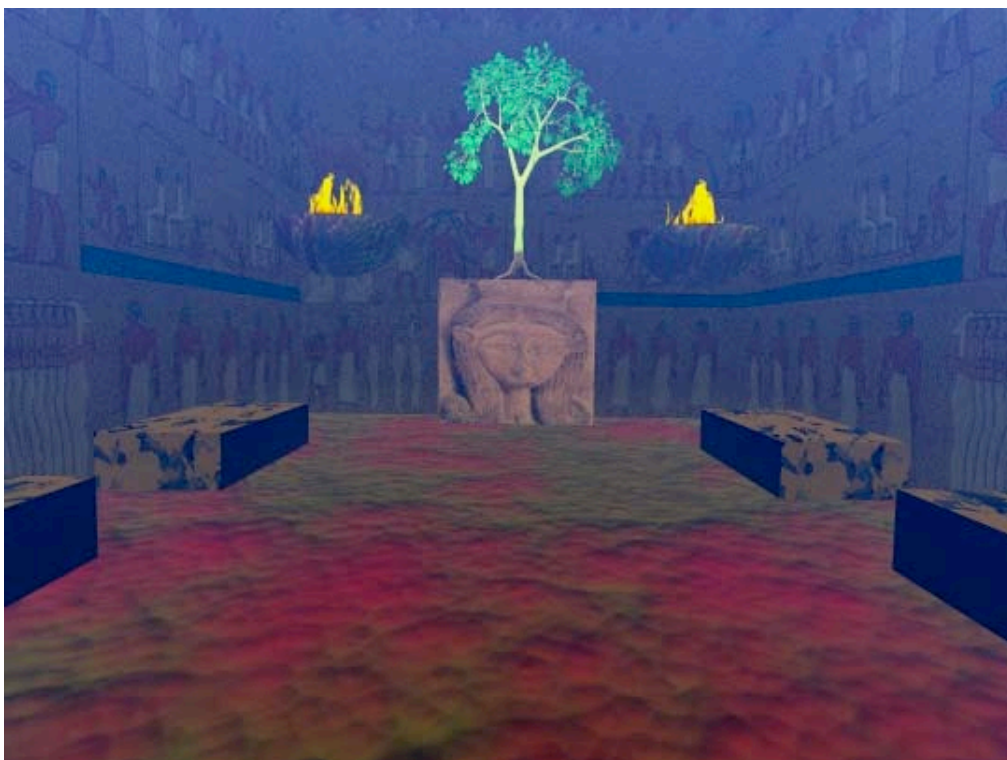
The Secret Diaries of Hemiunu

and the priestesses then gently nudged him towards the pool. He realized that he was required to enter the water, which he found to be warm, scented and very deep—it went over his head, and he came up spluttering. It was very pleasant, however, and he relaxed when the priestesses turned away and left him to float lazily in the soothing water.

Throughout this time not a word had been spoken, and none of the priestesses actually looked directly at him, which he thought was odd. He looked up at the sound of several *shesheset* (sistrums) tinkling—these particular instruments were new to Hemiunu. The priestesses were now dancing lightly and gracefully around the pool, shaking their sistrums rhythmically in time to their steps. Hemiunu began to feel concerns returning: was he being prepared for some sort of ritual slaughter?

The chief priestess motioned to two girls who came forward with the protective sheet again. This time he was urged by nods towards the inner corridor. Upon reaching it the girls stopped, and motioned him to continue—without the sheet. Naked and most definitely embarrassed, Hemiunu tiptoed cautiously down the corridor. Inside it was almost dark, except for two small burners at the far end, which lit up a small sycamore tree standing on another sandstone block, again with Hathor's distinctive face carved on it.

The inner chamber was heavy with a strong, musky odour that Hemiunu could not place; it was overpowering. In the dim light he



could see that the walls were painted with figures, but he could not make out what they were doing. Several divans were set against the walls on each side. As he stepped forwards, his bare feet trod on wine-red herbs strewn thickly all over the floor, which crinkled and gave off more of the strange, heady odour.

Hemiunu was no longer concerned; on the contrary, he was aroused—most powerfully aroused. And then he saw Neferhetepes. She had been standing just to one side of the entrance and had been watching him come in from behind. She came towards him, put her arms around his neck and pressed her naked body into his...

Corbelling

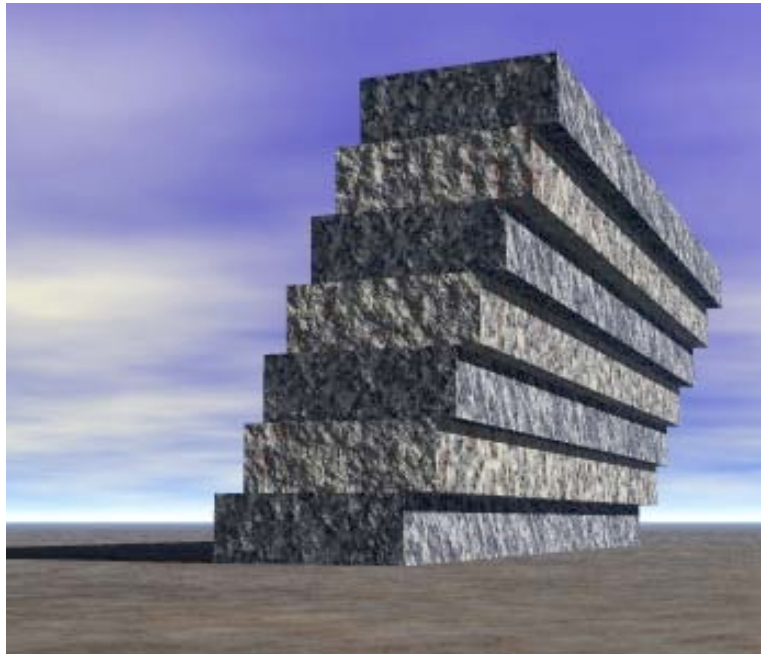
Hemiunu's formal education was coming to an end. While he still had much to learn, there would be plenty of opportunity to gain experience when working as an architect, on the job. There were still basic techniques and ideas to be mastered yet, however.

One area of concern for Hemiunu had been the roofing of chambers set under large, heavy pyramids. It seemed to him that the ideal method of building in stone involved setting carefully dressed stones on other, similarly flat stones, with all the courses running precisely horizontally. Only in this way, he reasoned, would there be no tendency for stones to split, shift sideways, etc. However, the downside of that was that the whole pressure of a pyramid's superstructure would then be felt bearing directly down on any chamber set within the masonry.

He had taken part in experiments with horizontal lintel beams, which fractured in the middle when loaded with stone weights. Horizontal beams, even when made of Aswan granite, would not bear any great weight.

Corbelling had been the answer at Meidum, as he had seen for himself. He did not really understand the limits of corbelling so he asked the chief mason, with whom he had become friendly, to let him have a set of rectangular blocks, all the same, so that he could experiment.

In his diary, Hemiunu recorded the results of his experiments. He found that for four blocks, he could just overlap each by just one quarter of its width.



The Secret Diaries of Hemiunu

For five blocks, he could just overlap each by only one fifth of its width. And for eight blocks, see figure, he could overlap each by just one eighth of their width. Here was a simple rule, he wrote. Then he realized that for a very large number of stones, the overlap would end up being zero.



Hemiunu's drawing showing the limits of corbelling.

His apparatus consisted of several stone blocks, each the same width, and a "gallows" bracket from which hung a plumb line.

His drawing shows the absolute limit: when the left hand end of the top block goes to the right of the base block, the pile will tumble.

This drawing, no longer a freehand sketch, represents a major enhancement in the quality of his work. It is likely that this drawing had to be presented to his principal tutor, Nebhartef, for approval.

So, he carried on experimenting. Eventually, he found that no matter how carefully he worked, he could not extend the corbel sideways more than the width of the stones. Here was the rule: the maximum corbelling overhang equalled the width of the blocks used to form the corbels.

He noted that the edges of the stones he had been experimenting with had started to crumble, and were no longer sharply square. He recorded in his diary that the theoretical limit for corbelling was largely irrelevant, as the major problem was to avoid the superstructure load from a tremendously heavy pyramid from crumbling the edges of the corbel stones shielding the chamber underneath.

How Deep was the Underground Netherworld

One further puzzle remained unresolved in his mind. He knew that King Djoser had been buried at a depth of over 56 cubits, which seemed to him to be an odd measurement. Nebhartef explained that the depth at which a sarcophagus might reasonably be expected to enter the Underground Netherworld (there were many different netherworlds, apparently) depended on more than the burial depth. It depended essentially on how much "stuff" lay between the sarcophagus and the open air. So, the depth of King Djoser's burial pit took into account the height of the multi-layered pyramid above it as well.

Priests from Heliopolis did the calculations, Nebhartef explained, and they did not afford as much value to the pyramid masonry as they did to the natural limestone strata of the necropolis plateau. Layers of granite, on the other hand, counted for more than natural limestone strata, because of granite's great density and durability. Hemiunu suspected that Nebhartef was unimpressed with the calculations of the Heliopolitan priests, but he had to be satisfied with the answer he received.

Security Systems – physical and spiritual

It was time for Hemiunu's final tests. These usually took the form of executing a real task with the aid of real workers, priests, masons, etc., without supervision. There was no time limit, but the task was not expected to take longer than six months.

Hemiunu's task was unusual. He had already shown his teachers that he could undertake any practical building task, and they knew that the priests, masons and workers were only too happy to support him. So instead they gave him a design task.

Hemiunu's task was to design a totally secure pyramid. Hemiunu knew that there was, ultimately, no such thing, and his diary notes are full of worried, largely illegible scribbles. It seems that, instead of trying to find an answer in the form of a design, he was first trying to establish a set of principles.

Eventually, after several weeks of indecision, he elaborated a set of principles that a sound, secure design must satisfy, in order to protect the burial chamber from entry and robbery. These came under three headings: avoidance of detection; self defence; and damage tolerance.

Avoidance of Detection

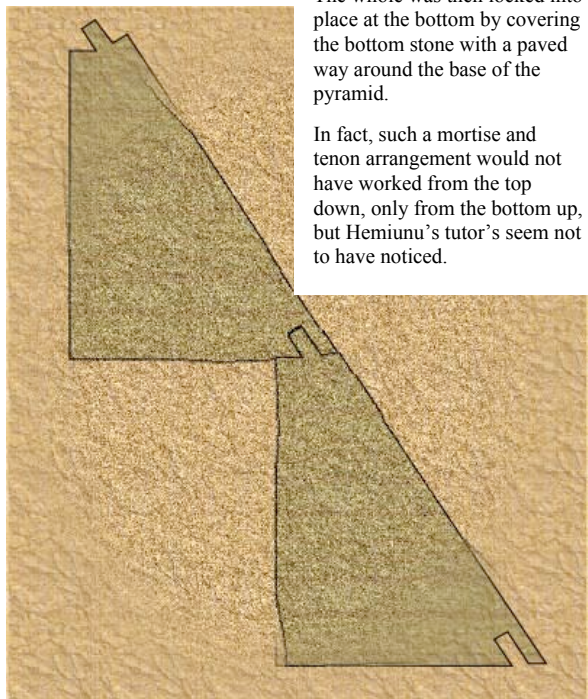
- The entrance to the pyramid should be concealed, so that potential robbers could not find the entrance(s). This meant that entrances should not be at points of symmetry on the pyramid, i.e. should not be at ground level, should not be in the centre of any side, should differ from one pyramid to another, and should be located so as to avoid detection by guesswork or 'mathematics'
- The whole pyramid should be covered in a seamless sheath, so that there was no visible opening of any kind. The white casing stones should lock into each other starting at the top and working down to the ground, with the ground level covered over by a paved area designed to cover the bottoms of the lowest casing stones
- Inside, and assuming that entry had been gained, the routes that were obvious to a robber should lead to rooms as they would expect, but not to the real burial chamber. The dummy rooms should be protected as though real, to convince robbers that they really had reached the burial chamber
- The real burial chamber should have its passage so concealed that there was no evidence of its existence, and it should be in a place within the structure that would be unexpected.

The drawing below is a draft from Hemiunu's graduation examination.

It shows how he believed that casing stones should be constructed. The idea was to fit casing stones starting at the top of the completed pyramid, and working downwards.

Each successive row keyed into the row above, and also sat on the relevant step (not shown). The whole was then locked into place at the bottom by covering the bottom stone with a paved way around the base of the pyramid.

In fact, such a mortise and tenon arrangement would not have worked from the top down, only from the bottom up, but Hemiunu's tutor's seem not to have noticed.



Self-defence

Hemunu's final examination was to design the perfectly-secure pyramid.

Knowing this to be impossible, he established a set of security principles, and showed how they might be put into practice.

But, like many great men to follow, when faced with an insoluble task, he changed the rules.

He proposed that the sarcophagus in the pyramid should be a *representation* of the real sarcophagus, perfect in every detail, and capable of being occupied by the *ka* of the dead king.

Meanwhile, the sarcophagus containing the mortal remains of the king should be buried in a secret place, so deep as to be in the Underground Netherworld, so that the king's *ka* could co-exist both there and in the sarcophagus representation.

- The outer shell of the pyramid was the first level of self defence; it should present no opportunity for robbers to insert tools, or to force their way in, and instead should be so bright as to blind the would be intruder, or roast him in the reflected heat of Ra.
- Inside the passageways should be protected by Osiris—essentially, slopes should be at multiples of 7—*seked*, i.e. 14—*seked*, 28—*seked*, even 56—*seked*, since the number seven was sacred to Osiris.
- Passageways to real and dummy chambers should be filled with stone as part of the sealing process. This would not only confuse and deter robbers, but it would also help stabilize the structure long-term.
- Stone doors (e.g. portcullis doors) should protect entrances to sacred passageways and sacred chambers, and should be fitted in threes, as that number was also sacred to Osiris. (Hemunu also proposed that the real chambers should remain undefended, since the defences might attract attention to them. He deleted that part of his draft.)
- As a last line of defence, sarcophagi should have stone lids that were too heavy to lift off, and the lids should be firmly sealed in place.

Damage Tolerance

- The pyramid should be able to withstand assault by pirates(?), by nature and by the forces of Seth.
- Creating a massive pyramid from large stones that were set in precise horizontal courses, yet had columns that leaned inwards, would provide the durability required.

Hemunu finished his report, of which there is a rough draft only in the diary, with an interesting observation, his *piece de resistance*: “It is not possible to totally secure an interment inside a pyramid for eternity. However, it is not necessary, either. If the burial chamber is arranged in, or under, the pyramid so that the sarcophagus lies within the Underground Netherworld, then – using the principle of substitution by representation – that sarcophagus may substitute for another sarcophagus elsewhere, which truly does contain the mortal remains of the king.

“It is my conclusion, therefore, that the safest pyramid is one that contains a *representation* of the king's true sarcophagus, while the sarcophagus containing the king's mortal remains should be interred in a secret place, deep underground, known only to a trusted few. Thus the king's *ka* can exist inside the pyramid without any risk, for eternity, while his body rests elsewhere.”

Hemiunu had done, for perhaps the first time in history, what many great men would do after him. Faced with an impossible task, he had simply changed the rules. It was a risk—he had not solved the problem precisely as set.

Hemiunu passed with flying colours, and graduated as a fully-fledged, if still inexperienced, royal architect.

Graduation

Prince Neferma'at was intensely proud, and decided to throw a lavish part to celebrate Hemiunu's success. Everyone who was anyone was to be invited, and in particular (or so it seemed to Hemiunu) anyone who was a colleague of, or rival to, his father. Crown Prince Khufu had agreed to come, with his daughter the outrageous Princess Hetepheres. Prince Ankhmere was also coming, although Hemiunu did not know, and was too embarrassed to ask, whether the Princess Neferhetepes, his "little priestess from the Temple" as his mother teasingly called her, would be coming.

As the day drew near, Prince Neferma'at's palace – Hemiunu's home, although he spent little time there these days – was a ferment of activity, with servants preparing and carrying food, collecting flowers from the riverbanks, sewing cushions, cutting and sewing new dresses and tunics, making new sandals, polishing the marble floors, collecting pitch for torches from the Black Pool, and tending to the stock which had been brought in from his father's extensive country estates, ready to be slaughtered.

He saw glimpses of the entertainment – some very lithe girls, he noted before his mother shooed him away – and the sounds of music pervaded the palace as musicians practised. They insisted on playing the oldest dirges, although Hemiunu preferred the newer music, made with the new copper instruments that were becoming popular at King Snefru's palace.

The fateful day came, and Hemiunu prepared himself by getting up early and going for a long walk up on to the plateau and out into the desert. After a while, as the sun started to come up, he turned left and then left again, coming back towards the Nile.

Unexpectedly, he came across an inlet, and there was a skiff sitting there, as though waiting for him. He climbed on and poled himself out into the middle of the inlet, stopped, got out his sketch pad and sketched a picture of the scene, which he later painted.

As he sat there enjoying the view and the cool breeze lifting off the surface of the water, he heard a whisper behind him. He turned round quickly, startled, but there was no one there. This happened three times, until Hemiunu called out aloud, asking who was whispering his name. There was no reply.



Hemiunu's fine painting on the day of his graduation shows an inlet from the Nile, with evidence of working in the low cliffs and on one of the hilltops.

Now thoroughly scared, Hemiunu poled ashore and went back towards the banks of the Nile and thence home to his fathers' palace, looking behind him all the while to see if he was being followed. Once there, he said nothing to anyone.

Hemiunu's Ceremonial Toolset

That evening, the celebration party started off rather like any other party. Hemiunu was to be presented, so he stayed in the background while the

visitors arrived. Crown Prince Khufu and his precocious daughter, Princess Hetepheres, turned up early, and Hemiunu thought the princess looked magnificent. Her dark, penetrating eyes darted in his direction, making him start until he realized that she could not see him—or could she?

Prince Ankhmare came with the Crown Prince, as though to emphasize his importance. Hemiunu was unimpressed; Khufu was Hemiunu's uncle, after all, and Hemiunu could call himself 'Prince' if he wished. Most of the time, he didn't wish, but tonight, he decided, was going to be different.

The party had assembled and was in full swing when his father asked for silence. The major-domo banged his staff on the marble floor, and the enclosure fell silent. Prince Neferma'at then launched himself into a speech extolling the virtues of his son, not forgetting the other graduates, too, of course.

After the big build-up, Hemiunu was called for, and he went forward, feeling very awkward at being the centre of attention. His father grasped his hand and presented him to Crown Prince Khufu. The prince smiled, presented Hemiunu with a ceremonial staff of office, and then announced to the audience that Prince Hemiunu was to be his chief architect and was to take charge of the preparation for his, Khufu's Pyramid. He also announced Hemiunu's appointment as vizier to the court of King Snefru. Hemiunu had been expecting neither of these statements, but more was to follow.

Djadjaemankh

At that moment there was a drum roll, and Djadjaemankh, the court wizard entered the room, surrounded by clouds of purple smoke

pouring out from under his black cloak. Hemiunu was impressed; now, that was how to make an entrance!

Djadjaemankh strode across the marble floor, bowed to Crown Prince Khufu and turned to Hemiunu. He looked intently at Hemiunu, and then asked if he had seen anything strange, or heard anything unusual recently. Hemiunu started, and Djadjaemankh noticed the reaction. Hemiunu was obliged to tell everyone about the whispering voice.

Djadjaemankh was delighted, and told the assembled throng that Hemiunu was thrice blessed by the gods, who had been calling to him to become the most famous of all royal architects, save only the great Imhotep himself.

Djadjaemankh then pulled out a large crystal sphere from under his cloak, and handed it to the Crown Prince, who handed it in turn to Hemiunu. Djadjaemankh told Hemiunu, and the audience who were riveted by this amazing spectacle, that the crystal ball was a window into the Netherworld. Through this window, Hemiunu would be able to converse with other great builders through time and space. He would commune with Imhotep himself, with the famous builders of Mesopotamia, even with the legendary builders from the First Time.

Graduation Night

Hemiunu was staggered; so much so that he was virtually speechless. Luckily the music started, and it became clear that the formalities were over. Princess Hetepheres smiled dangerously at him, clearly interested in adding him to her scalp collection. Before she could speak, Hemiunu felt an arm through his. He turned round to see the most beautiful girl he had ever seen looking up at him. She had the blackest hair, the whitest skin and the reddest lips, and she looked somehow familiar. “Remember me?” said Princess Neferhetepes reaching up to touch his nose with her finger. Hemiunu guessed that this gesture was territorial, as much to warn off Hetepheres as to tease Hemiunu, but he did not mind. In fact, he loved it.

Neferhetepes introduced him to her father and mother. Father seemed very pleasant, not at all like he had been expecting. The party started to warm up, and soon the noise of people talking reached a crescendo, so that Hemiunu and Neferhetepes found it easy to slip away unnoticed.

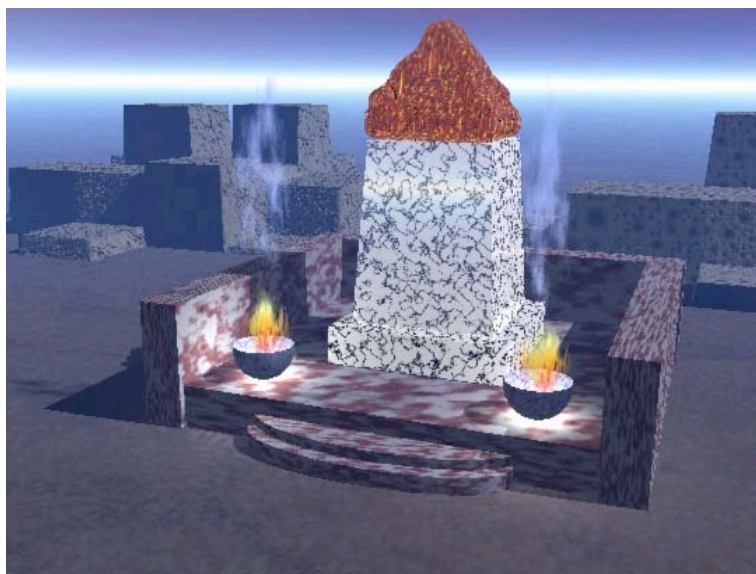
One outside, they walked together out under the stars, holding hands, sometimes silent, sometimes talking. The sun was glowing beyond the eastern horizon by the time they returned to the palace. By keeping the young princess out like that, Hemiunu had declared his preference; he was, it seemed, betrothed—according to his mother and father. Curiously, he found that he liked the idea, just so long as it was with his Neferhetepes.

Upon graduation, the court magician presented Hemiunu with a mysterious crystal ball, saying that it would enable Hemiunu to communicate through space and time with other architects. Hemiunu, he said, was destined to become the most famous architect after the fabled Imhotep himself.

To round up the celebrations, Prince Hemiunu found himself betrothed to Princess Neferhetepes, a situation he found most pleasing if a little unexpected.

The Priest-Architects and the Masons

The Keepers of Knowledge



Reconstruction of the *ben-ben* chapel at Heliopolis as described in Hemiunu's diary.

He recorded that the stone glowed gently at night, and gave an illusion of transparency (chatoyancy). He marvelled at the material, which glistened and seemed at times to be alive, especially in the moonlight.

Legend had it that the men who dug the stone out of the desert all died within six months, with terrible blisters over their chest, abdomen and legs.

The stone may have been a meteorite that was moulded into an approximate shape of a pyramid during entry into the earth's atmosphere. It may also have been radioactive, if the legends are to be relied upon...

This most sacred emblem seems to have disappeared at some time during the 4th dynasty.

priest architects of Heliopolis. Hemiunu had visited Heliopolis many times as a boy, to see the sacred sites, to hear the priests retell the myths of creation, to admire the thousands upon thousands of scrolls in the archive, and above all to marvel at the *benben* stone.

Hemiunu never tired of hearing the story of the *benben* stone. It had come down from heaven one night long ago in a storm of fire and great shower of sparks, to land on the plateau at Giza as a sign from Ra himself. It was made mainly of (rusty?) iron, the bones of the gods, but contained stones and veins of gold, the flesh of the gods, and it was in the shape of a pyramid, although all the edges and corners had been rounded off in the heat of the fire of the gods.

The *benben* stone had landed, so the priests of Heliopolis said, at the time of the first king, Menes, as a sign for the people of the two lands to unite. As long as the *benben* stone was safe, then the unity of the two lands was safe. The stone was sacred and so was its spirit, which was in the form of the sacred *benu* bird, a sacred heron-like bird born of fire, like the fabled phoenix, and appearing every 1,000 years.

Heliopolis was home to the library of research work undertaken by the priests since well before the time of their most illustrious Imhotep. The knowledge contained in the library and presented through the priests was regarded as infallible canon, and not open to challenge.

The groups of experts surrounding the king formed into rival factions. Chief among these factions were the priests of Heliopolis, the masons, and the king's overseers.

Hemiunu was a royal architect, destined to be Khufu's Overseer of all the Construction Works of the King. He was to follow in his father's footsteps: Neferma'at held the same post for his king—and father—Snefru.

There were several "schools" of architects; chief among these were the

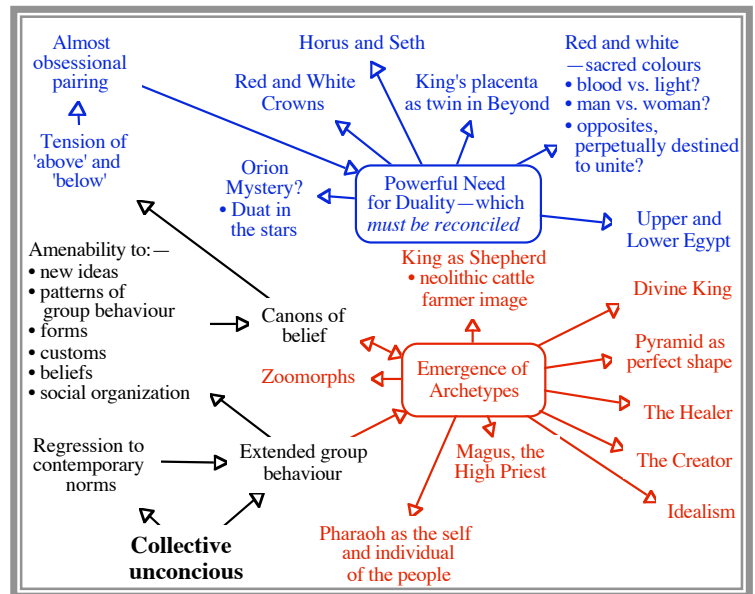
The Factions and their Allegiances

Heliopolis, On of the Bible, had always been the focus of the worship of Ra, the sun god. The great Imhotep himself had been a devotee. The worship of Ra had been the dominant theology for many centuries, but it had also evolved during that time, with fresh ideas emerging as to how the sun moved across the heavens and under the world, the relationship between the god Ra and other gods, and in particular the relationship between Ra and the king when he died and went to the afterlife.

At the time of Hemiunu, the theology was changing quite rapidly. At first, the king's spirit was viewed by some as fusing with that of Ra, so that they became one. Gradually, a view emerged that the sun was carried across the sky by a solar barque, and—like any boat—it needed a crew. Perhaps the king's spirit was the captain of the barque, with other, lesser gods making up the crew.

All of this was of little direct interest to the masons, who were led by a group of experienced architects and builders whose interests lay more in the direction of creating magnificent temples, tombs and pyramids. They also had a store of knowledge that was a curious mixture of the practical and the sacred. All building practice, it seemed had a powerful sacred influence and, if not executed in the proper manner, structures would not be blessed by the gods, would not endure, or be secure, be entered by the appropriate gods, and so on. So, the architects, too, had their infallible canon, and it did not entirely coincide with that of the priests of Heliopolis. The priests may have had the powerful *benben* stone as their icon, but the masons had a strong allegiance to the primeval Mound of Creation, from which all living things, and all buildings constructed from stone, emerged.

To keep the pot boiling, as it were, there were the followers of Osiris, believers and advocates of the Osirian legends, of Isis his sister-wife and Horus, their son. Like the other royal architects of the time, Hemiunu was firmly located in this camp. Osiris was the *ka* of the pyramid. It was through the legends that the king gained his legitimacy as a god-ruler, and his exclusive path to an eternal afterlife. It was also the theology that ensured the eternal future of Egypt, with the king as Osiris commanding and negotiating with the other gods of the heavens to assure the annual Inundation.



A Jungian view of the group psyche of the ancient Egyptians.

Like Freud, Jung was fascinated by what we might call the psychology of the ancient Egyptian culture.

As society emerged and evolved, the people as a whole seemed to behave, and certainly exhibited belief-based behaviours, that provide windows into their conscious and unconscious minds.

They exhibited a strong sense of duality, that almost everything occurred in pairs, that the pairs were in opposition, and that the differences must be reconciled. We still exhibit duality today: left versus right in politics, for or against in conflict, and so on.

Archetypes were also much on display, as the figure shows. Among these were canons of belief, concepts, rituals and rules that, once expressed, are set in mental concrete. Ancient Egyptian canon is particularly evident in their statuary, art and civil engineering.

Evidence of Dissatisfaction

View from Abusir looking south. At left is Djoser's Stepped Pyramid, precisely on the horizon. At right are Snefru's two large pyramids at Dahshur, both also precisely on the horizon.

Of the Dahshur pair, the so-called Bent Pyramid is on the left, while the right-hand pyramid is the Northern, or Red Pyramid.

Other pyramids in the photograph are 5th and 6th Dynasty.

Hemiunu first joined the Great Meeting of the Building of King's Works at Dahshur, straight after his graduation. Considerable progress had already been made on two of King Snefru's three pyramids to be built there

Hemiunu effectively joined the staff of his father, the chief architect and overseer of the king's works. His first task was to "come up to speed" with what had happened so far, so that he could understand what was going on in the seeming chaos that was the plain at Dahshur.

The Overseer, Prince Neferma'at had a team of scribes who recorded everything that was happening and that had happened. There was, in effect, a work log, which recorded activities, shortages, accidents, mistakes, progress, logistics and meetings. Hemiunu found the "minutes" of the design meetings most helpful.

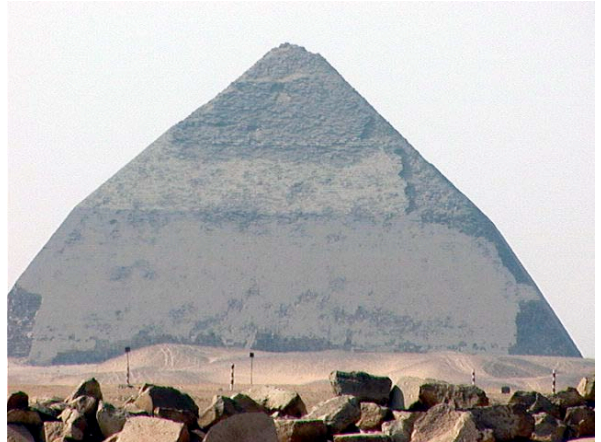


From the beginning, the Dahshur site had been planned to contain two pyramids. King Snefru wished the two pyramids to be conceived, designed and constructed as a pair, since one was to be the *ka* of Osiris, while the other was to be King Snefru's *ka* pyramid. Both pyramids were to be placed so that they appeared side-by-side on the horizon when viewed either from Djoser's Stepped Pyramid, or from the River Nile. This had meant that they were aligned with respect to each other on a north-north west, south-south east line, and had to be about 3,750 cubits (over 1 mile, or nearly 2km) apart.

The king was bombarded with advice from each of the three factions telling him what his pyramids should represent and how they should be constructed so that he would have the best possible prospects of having his body preserved and being transported to the stars, as was

his royal expectation upon death. In the end, he elected for compromise.

The so-called Bent Pyramid was designed to be so from the start, with the lower part representing the primeval Mound of Creation, while the upper part represented the sacred *benben* stone. The chambers set in the masonry were covered by the requisite depth of limestone (some 56 cubits) in the Mound of Creation to ensure that the king's sarcophagus would be in the Underground Netherworld, and there were to be entrances/exits to and from the west as well as to and from the north.



The slope of the lower part of the bent Pyramid was set at precisely five *seked* ($54^{\circ}28'$), to satisfy the royal architects who insisted on the magic of the sacred measurement, and the lower structure was built with the stonework sloping toward the centre, in keeping with tradition.

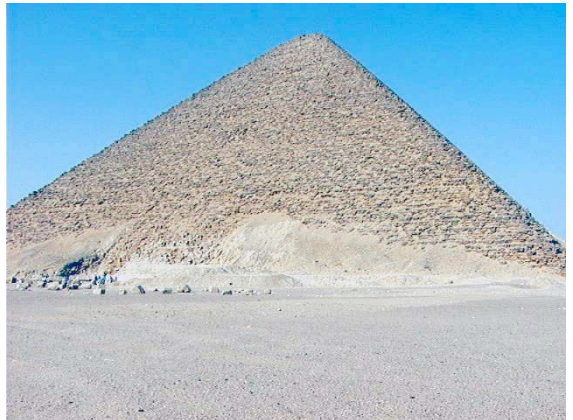
The slope of the upper part of the Bent Pyramid was set, not to seven *seked* (45°) as the architect priest of Heliopolis wished, but using the ratio of proportions 18:17 ($43^{\circ}22'$). This slope was chosen to be as close as possible to seven *seked* without offending the Osirians, who insisted that seven *seked* was a slope so sacred that it should not be visible to normal mortals.

Having created a compromise in the Bent Pyramid, Snefru decided that each part of the pyramid should have its own *ka* pyramid. The *ka*-pyramid for the upper part of the Bent Pyramid was to be the Northern, or Red Pyramid, which was therefore to have the same slope of 18:17, and the same height as the Bent Pyramid overall.

The *ka*-pyramid for the lower part, the Mound of Creation was to be a small pyramid just to the south of the Bent Pyramid. It was to have a base length of 100 cubits and a height of 63 cubits (nine sets of seven cubits), giving it a slope of some 5-1/2-*seked*. It was also to have an elaborate interior, with a Grand Gallery leading to a burial chamber raised high in the masonry. Hemiunu thought he now knew why the Meidum pyramid was to be clad with casing sloping at 5-1/2-*seked*. Although he may have been closer, he was wrong for the second time.

Hemiunu was to learn of many other differences between the two pyramids, but his immediate thirst for knowledge was quenched. Little did he know what lay ahead of him...

Bent Pyramid “The Southern Shining Pyramid” as it appears today, looking west. Much of its lower limestone cladding is still intact, owing to the method of construction with inward sloping layers. The upper half used horizontal layers of stone.



The Northern, or Red, Pyramid “The Shining Pyramid” as it looks today, stripped of its shining Tura limestone cladding. Horizontal layers appear to have been used throughout.

Bigger stones were also coming into vogue, but gaps were filled with rubble and tafla, a local clay.

Hemiunu's Dreams

In a reconstruction of Hemiunu's dream, he is seen as his *ba*, soaring over Dahshur.

Although the building of the pyramids was only in its tenth year, in his dreams, both pyramids were completed.

The reconstruction looks from the northeast, and shows the Northern Pyramid in the foreground with the Bent Pyramid in the distance. Note the Temenos walls, the mortuary temple and the entrance building.

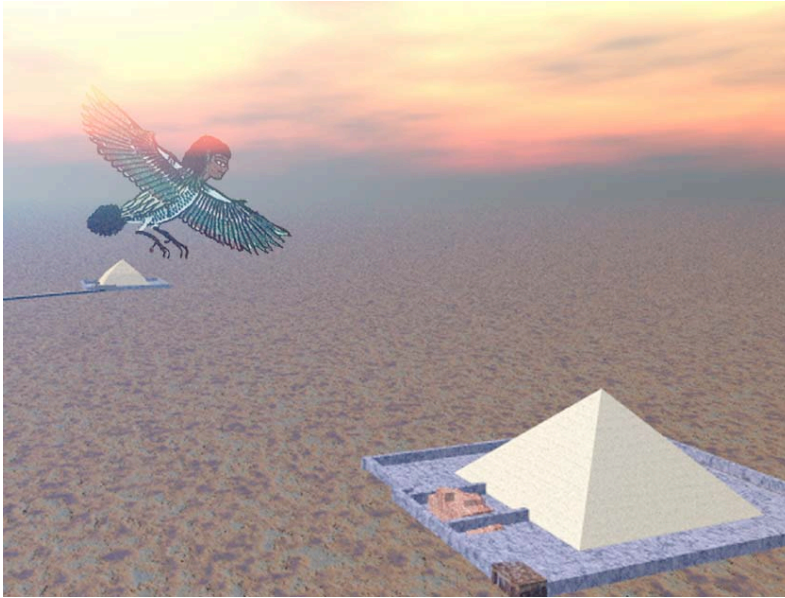
Ancient Egyptians dreamed. Psychologists cannot be sure, but it is possible that they dreamed more than we do today. The Bible tells how Joseph interpreted the dreams of pharaoh, and that Joseph was well rewarded. Hemiunu, it seemed, was a prolific dreamer, too, and he recorded some of the more interesting of his dreams.

Hemiunu had a recurring dream. He would be alone at night in a room. By holding himself rigid, with his arms out sideways, his back arched and his head tipped backwards, he was able to float, takeoff and fly effortlessly. With practice, he would fly out of the room, and would soar high in the night sky, looking down on the river Nile, the neat rows of vegetables, the palm trees, and the houses.

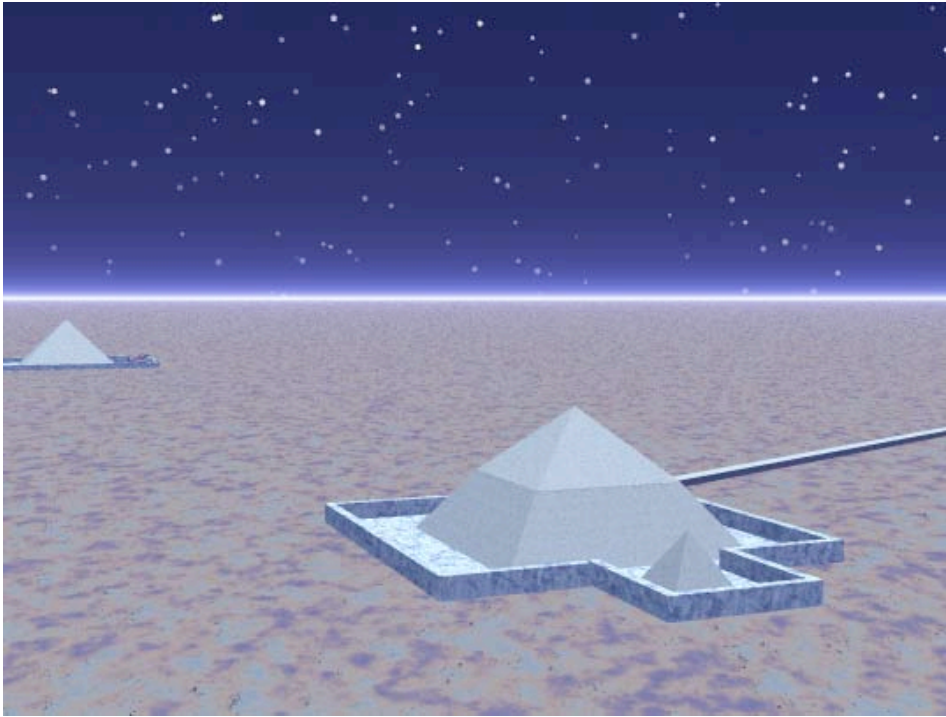
After some time, he would find that he was sinking, and he had to push off from high points to maintain his flight – a rooftop here, a tree branch there...Then he would notice a pack of dogs, or jackals—he could not be sure which—had started to follow behind him, intent on jumping up to seize his legs when next he was forced to land. He

would escape several times, only to wake in a sweat just as the pack was about to seize him...

Hemiunu worked out that he was in tune with his *ba*, the part of the human spirit that could fly free of the dead body, but which could also escape briefly during sleep. Clearly, his *ba* was soaring over Egypt, and he was able to see the pyramids, especially those at Dahshur.

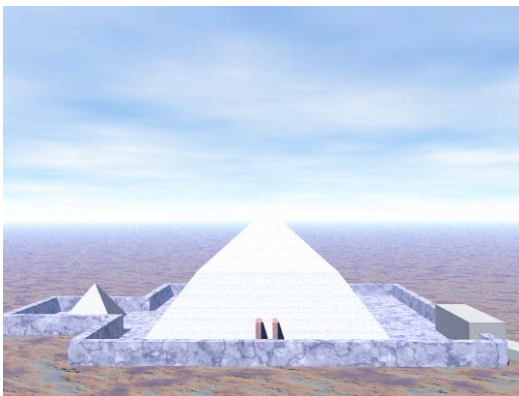


In one dream, he flew out over the plateau at Dahshur and saw the pyramids there completed, although they were less than half built at the time. His *ba* arrived on site as a new day dawned. He soared above the two main pyramids, and he saw them take on the colours of the night sky, and of the hibiscus dawn. In another dream, Hemiunu again found himself over the plain at Dahshur, but this time he saw a gigantic, ghostly *ka* figure emerging from the Northern (Red) Pyramid. This concerned him so much that he told his father about his dreams; to his surprise, his father became very excited.



Within two days, Hemiunu received a message by runner telling him to attend the king's palace on the following morning. This was unprecedented. Although King Snefru was Hemiunu's grandfather, there had been little or no contact between them. Hemiunu had never visited the King's chambers in the palace, and Hemiunu had seen the king only at a distance during festivals and when passing on the river.

The Dahshur plain by moonlight from the southwest, showing the Bent, or Southern, Pyramid in the foreground, with its *ka* pyramid, Temenos wall, pavement and causeway.



Two more reconstructions from Hemiunu's dreams. The left-hand figure shows the finished Southern, or Bent, pyramid by day, with the Temenos wall enclosing the pyramid and the small *ka* pyramid on its south face. Facing, at centre is a mortuary temple, while at right is an entrance block, leading to a causeway down to a small valley temple.

One dream, reconstructed at right, caused a stir. Hemiunu records seeing a gigantic, ghostly *ka* figure emanating from the Northern, or Red Pyramid. The pyramidion at the top glowed like the sun, and the pyramid was infused with the light.

An Audience with the King

Next morning Hemiunu was up before dawn, and was unable to eat any breakfast. His stomach felt like “a hive of bees.” He washed and dressed with particular care. Putting on his best linen cloth, and his gold armbands, he strode out manfully into the early morning light to make his way to the palace.



Snefru's Palace Court, seen from the Nile. The palace was built on a spur of land pushing out into the Nile. The court consisted of four rows of wooden pillars, plastered and painted. Rows one and two, and three and four, were covered to form porticos, leaving the centre open to the sun.

Within the porticos there were pools and plants—an area much favoured by the ladies of the king's harem.

Hemiunu had made this journey many times before as a schoolboy attending the palace school. He was no longer a schoolboy, however. Gone was the boy's side lock of hair. Gone too were the days without role or responsibility. He was to face the king, for what reason he knew not.

He arrived at the palace far too early, and wasted some time walking up and down outside trying to calm his nerves. Another figure came trudging along the path; it was Memi, the chief priest of Heliopolis, who Hemiunu knew well from his frequent visits to see the *benben* stone and to research among the many scrolls there.

Memi did not speak, but looked intently into Hemiunu's face before beckoning him to follow. They went through a large portico and into a dark corridor. There were armed guards standing by the entrance to the corridor, but they recognized Memi, and said nothing.

Life, Love and Learning

Memi ushered Hemiunu into a small chamber and signalled him to sit and wait; Memi then left the chamber. Hemiunu described the chamber as being square, very high, and without window openings. The walls were painted with scenes of boat trips on Lake Faiyum, and of scenes of fowling. A tapestry hung loosely in one corner, but Hemiunu could not understand the patterns on it.

After what seemed like an eternity, Memi returned and ushered Hemiunu into another, bare chamber. Four priests sat cross-legged and motioned for him to sit in front of them on a cushion placed there for the purpose. Hemiunu knew none of them, but they wore contrasting costumes, indicating that they were of different sects.

The four priests wasted no time on pleasantries; they immediately launched into a tirade of questions: how often did he dream; in how many of his dreams did he fly; what were his other dreams about; how did he interpret his dreams; had he told the whole story, or was there more; and had he dreamed last night. Hemiunu answered all the questions instantly and openly; he had nothing to hide.

The avenue of columns approaching King Snefru's throne. The avenue was paved with black and white marble, which reflected the glare of the sun into the eyes of those approaching the king.



King Snefru's Throne. The throne was set on a dais of red granite, and the whole was set inside a bower formed from twigs and branches, with moss wound around them and plants grown on the moss. This screen allowed the cooling breeze through, but concealed the view. Hemiunu was aware, nonetheless, of some mud-brick buildings beyond the bower.

The throne itself was made of a dark wood base, with a lightwood high back, above which was a curious white, fluffy canopy. This last dappled the sunlight falling on the throne. The king sat on a red cushion, and was so high that even when seated, he looked down on his subjects from some height.

The Secret Diaries of Hemiunu

A view of the palace court from one of the porticos.

The pillars were all carved in a style invented by Hemiunu's father, Prince Neferma'at, using coloured plaster inserted into carved grooves as an alternative to bas-relief.

Several pillars showed the same offering table scene. King Snefru had invited Prince Neferma'at to employ a series of different artists to try different methods of carving the pillars, to see which method turned out the best.

So, the pillars were a form of open air art competition, with various methods of carving being tried in plaster-on-wood, before trying them in stone.

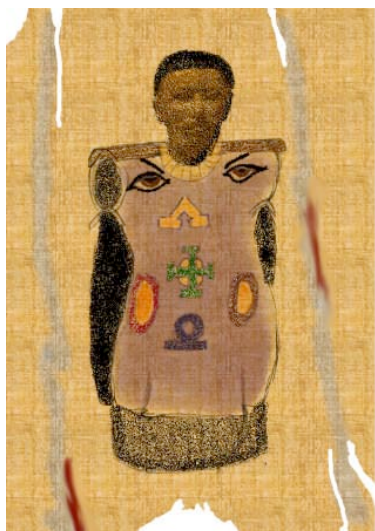
As it turned out, Prince Neferma'at's method worked in plaster, but not in stone. The inserts tended to shrink, and fall out of their stone grooves as they dried, and the method was discontinued.

Notice in the simulation how the sunlight on the white marble of the avenue lights up the avenue columns, making them appear to glow.

There was a pause while the priests deliberated amongst themselves in low tones. Then one of them left and returned with Memi. Hemiunu guessed that he had just been tested, had passed and was about to go on to the next stage.



He followed Memi as instructed, and found himself walking down an avenue of highly decorated pillars. The pillars were made of wood that had been plastered and then both carved and painted. Hemiunu recognized his father's newly invented style of inserting coloured plaster into grooves, as an enhancement of carving in relief.



Hemiunu's sketch of his Seer's cloak, with its strange devices. The superimposed head could be a self portrait.

On either side, just beyond the pillars, there were cushions, and pools of water, tables with bowls of exotic fruits, censers, and lotus flowers in abundance. Beautiful young women, dressed in the sheerest of linen, or less, were sat round, talking quietly to each other, laughing and playing.

Hemiunu was so busy trying not to be seen looking at the young women that he scarcely noticed the king sat on a raised dais at the end of the avenue. Hastily gathering himself, Hemiunu bent down and prostrated himself as his father had taught him. Suddenly he was trembling, in the presence of the god-king.

The king told him to rise and come forward, which he did hesitantly. The king seemed to be quite human after all, Hemiunu thought. To Hemiunu's surprise, the king was corpulent. (Hemiunu had changed his diary entry several times before writing "fat", as though he was trying to come to terms with the idea that his god-king could be fat.) The king was not dressed in the regalia that Hemiunu was used to seeing from a distance. Instead, he was bare headed, with a loincloth and sandals. In spite of this, there could be no doubt that he was the king: he emanated power; Hemiunu recorded that the air crackled in his presence.

Suddenly the king was asking questions, and Hemiunu started as though coming out of a daydream. The king wanted to know about the *ka* figure Hemiunu had seen in his last dream. Did Hemiunu recognize it? No, Sire. Did it have a straight or a curved beard? Curved. Were the two arms raised over the head? Yes. Did it move? No. Was there any sound? No. For how long did it appear? For the duration of the dream—several minutes. What was the light inside the pyramidion? Hemiunu did not know. Was the pyramid transparent to the light like water? Yes. Ah! And the pyramid was fully completed? Good!

The king was pleased. He clapped his hands and the court magician, Djadjaemankh appeared, with Memi, who had withdrawn temporarily. They had obviously been waiting within earshot, and came hurrying forward in step.

The magician was carrying a staff, and the chief priest of Heliopolis was carrying a long cloak. The king, it seemed, was appointing Hemiunu as Great Seer—a title held previously by Imhotep, Hemiunu knew. Memi stepped forward and put the cloak around Hemiunu's shoulders; it was heavy and covered in embroidery, unlike anything Hemiunu had seen before. The magician then handed Hemiunu the staff, which was a pole of some 3-1/2 cubits length, with a crystal ball mounted somehow on the top.

The king spoke: "Hemiunu, you are blessed among all men with special sight. Henceforth you are the royal seer, charged with advising the king of things to come. You are also appointed vizier to the royal court, with all the privileges and responsibilities that accompany that rank and position." Hemiunu was beckoned forward towards the throne, and Snefru came down the steps to place his hand on Hemiunu's head, as a sign of affirmation and blessing.

It was the end of the audience. Hemiunu left in a daze. In the space of one day he had gone from a trainee architect to a royal seer and a vizier—he knew that wealth and power went with both titles. Wealth had never been an issue; he would inherit his father's extensive estates, lands and palaces. However, it would be good to be independent. And, of course, this was "one in the eye" (direct translation) for his compatriots, many of whom were vying with him for advancement. Who would have thought that it would all have come from a dream...?

Hard on the heels of such unworthy thoughts came a strong sense of fear. He knew nothing about seeing into the future. What if he had no more dreams? He knew even less about being a vizier. He was only 18 years old. How could he travel the land, sitting in judgement, not only on petty criminals, but also on mayors, nobles and even nomarchs?

His fear urged him home to talk with his father and mother, both to tell them the great news and to ask them what he should do. Surely there must be some way out. He might be unable to do as the king decreed, but he dare not refuse either....



Hemiunu's Staff of Office as the Royal Great Seer.

The staff was made of stout hardwood, tipped with a metal spike, and topped with a crystal ball caged in electrum. On top of the crystal ball was a curiously-coloured quartz sphere, and finally a matching electrum spike.

Hemiunu recognized the duality implicit in the conception of the staff: twin spikes, two spheres, all mounted on the one rod.

Ancient Magic

Kinds of Magic

Hemiunu had been immersed in magic, *heka*, even before he was born. From his diary, it is evident that he did not consider magic to be anything unusual. There was magic all around; the idea of paranormal did not exist. Nonetheless there was much to learn about the magical ways in which the Egypt and its gods worked. And then, there was always the possibility of applying magic oneself, to achieve some end....

Hemiunu had moved from worry to elation. He now had some rank, albeit junior, among the magicians of the land. A seer was one with magical powers; the king had affirmed him as a Seer, the Royal Seer, therefore he had magical powers to see. Perhaps he had others, too...

Magic in the Land

There was magic in the land. Every tree, every rock and every living creature could, and probably did, harbour its own *ka*, its life essence. There was special magic in *Hep-Ur* ("sweet water"), Great Hapi, or the Nile, with its life-giving waters, and in the annual Nile inundation, caused by Isis' tears as she cried over Osiris. Why else would the Inundation come just when the land was parched and dry, to provide water in the middle of the hottest time of the year. *Akhet* was the season of the Inundation, starting approximately in the month of Thoth (August?) of each year.

This combination of water, the silt it carried, and the heat from the sun was the foundation of Egypt's natural wealth of food and livestock. In other countries, Hemiunu had heard, their rivers, which ran from north to south, also ran dry in the hot summer. The Nile ran from south to north, against the prevailing winds, so that ships could sail up river against the flow, or row down river with the flow. Magic.

Of course, that magic could not be taken for granted. The many gods of the Nile—Hapi, Khnum, Isis, Sobek, and many more—must be thanked for their largesse, and must be entreated and given offerings to ensure continued prosperity. Once in a while the Inundation was either insufficient or excessive, both prejudicing that year's crops; the exercise of magic, often by the king himself, would be necessary to prevent further problems. Even the great King Djoser had been obliged to make a special pilgrimage to the Temple of Khnum in the south; the Inundation had failed because Khnum had been neglected, and his temple had fallen into decay. Restoring the temple and its worship solved the problem.¹

¹ Hemiunu and his contemporaries would have been horrified by the very idea of the Aswan High Dam, which blocks any silt. This would have been seen as a sacrilege and affront to Khnum, whose role it was to control the flow of silt.

The gods of Egypt were not remote gods, like those of later Greece and Rome; they did not live on high mountains. Instead, they were all around, in the river, in the rocks, in the sycamore and the tamarind, in the crocodile, the hippopotamus, the bull and the lion. They were not vengeful gods, either, unlike those later classical gods. By and large, they took little active interest in human affairs, although in legend there had been times when one or two gods had scourged the land.

The Osirian legends saw gods interacting with each other, often in the way of family squabbles. Seth, the god associated with chaos and the desert, was brother to both Isis and Osiris, parents of Horus. There were many stories of their fights, of murder and reincarnation, of virgin birth and bloody mayhem. Many of the tales were cautionary, designed to show how people should behave, and how good and the rule of Ma'at always won in the end. The tales, for children of all ages, were full of magic, with the gods performing incredible deeds. Magic pervaded every aspect of everyday life.

Magic in the Heavens

There was also magic in the heavens. Much of this magic had occurred for many centuries in the night sky for all to see, if only they could understand. Latterly, magic was being seen more and more in the sky by day.

As recently as the time of King Djoser, some 50 years earlier, the pyramid complex had been oriented north south, with Djoser's cult temple looking out northwards to the Imperishables—the circumpolar stars that never disappeared from view throughout the year. Hemiunu had already observed how Imhotep used the white limestone casing on the Stepped Pyramid to reflect the noonday sun from the south into the main enclosure.

By the time of King Snefru, the pyramid complex appears to have been oriented east west, with valley temples by the Nile in the east leading up causeways to the mortuary temples set against the eastern wall of the square-based pyramid. Superficially, at least, the emphasis in some of the magic was changing from stellar magic by night, to solar magic by day.

Hemiunu saw things differently. From his perspective, the pyramid complex was oriented to the four cardinal points, and the four corners of the pyramid pointed to the four corners of Egypt, where the heavens were held up by the four sons of Horus: Imseti, Hapi, Duamatef and Qebehsenuef.

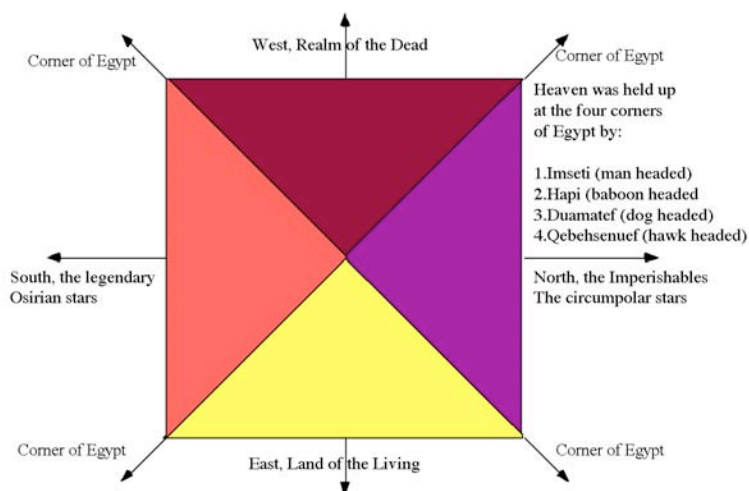


A composite amulet from the New Kingdom. The Was sceptre of power, with its jackal head, is mounted on the sacred Djed Pillar for eternity, which in turn is mounted on the Ankh, for life.

Heh, the personification of Eternity, sits on top of the Djed Pillar.

British Museum

The Secret Diaries of Hemiunu



In approaching the pyramid from the east, one was approaching from the land of the living. Beyond the pyramid and the far horizon to the west, *Amenti*, was the realm of the dead. Hemiunu saw the pyramid as a junction, or crossing point, between being alive in this world, and being resurrected in the afterlife. Going from this life to the afterlife was very directly analogous, he observed, to crossing the Nile from the east to the west bank. That much was east-west orientation.

Hemiunu knew from his earliest lessons that the cardinal points were attributed to Osirian characters, and to genies.

To the South was Isis, wife and sister to Osiris. Imseti was also to the South where he protected the liver of the dead king in the canopic chest.

To the North was Nephthys, sister to Isis, and also Hapi, the baboon-headed protector of the lungs in the canopic chest.

To the East was Neith, an ancient goddess, and Duamatef the jackal-headed protector of the stomach.

To the West was Selket, the scorpion goddess, with Qebehsenuef, the falcon-headed protector of the intestines.

However, he also saw the Imperishable stars to the north, and the Osirian stars to the south. So, in that respect, the pyramid, like the flow of the Nile, was oriented south north.

Hemiunu saw the Osirian legends being played out in the night sky each year. Myths from as long ago as the First Time told of the Goddess Sopdet (the Dog Star, Sirius) bearing a child in the form of a tiny star that appeared, just visible on a dark, moonless night, nearby. That tiny star was no longer visible in Hemiunu's time, but the star of the Goddess Sopdet had become identified with the Mother Goddess Isis, bearing her son Horus. Which meant that there must be another star nearby that could be identified with Osiris, and yet another for his brother Seth.

Hemiunu was aware that the Priests of Heliopolis had identified candidate stars for both of the brothers. This meant that the Osirian legend had been played out annually ever since the First Time, raising the question—was what happened each year in Egypt a direct consequence of the annual movements of the equivalent stars in the heavens? If so, was it possible to influence this annual stellar ritual dance? Was it possible for the dead king, transmogrified into Horus or Osiris, to rise into the heavens as an all-powerful god among gods, and to command the Inundation? If so, then the future of Egypt and its people would be assured for all eternity.

If Hemiunu had no doubt about the *possibility*, then he had considerable confusion over the manner of its execution. The dead king's *ka* had to ascend into the heavens. How? On wings, perhaps, like Hemiunu's *ba*? Or, better still, on the wings of a royal falcon—the hawk could fly higher than any other bird. Maybe on a cloud of smoke, or on a thundercloud; Hemiunu was puzzled, but not concerned. Just because he did not know about this particular magic, did not mean that it did not exist. This was magic for the king to know. Besides, the priests of Heliopolis, where such information was

stored in sacred scrolls, had written it all down. (These spells and incantations would become known as the Pyramid Texts.)

Magic in Structure and Form

Part of the magic associated with royal interments concerned the architecture of the pyramid complex. More than that, each pyramid complex was located in a sacred place. These places, chosen with great care by priests and architects, would eventually constitute a single, extended necropolis.

Hemiunu appeared to know of this concept. He recorded that the two main pyramids at Dahshur were located to be precisely on the horizon when seen from the Stepped Pyramid at Saqqara, and vice versa. (The next pyramid, Khufu's Great Pyramid at Giza, would also be on the horizon when viewed from the Stepped Pyramid, but to the north.)

The elements of the complex, with its valley temple, mortuary temple, *ka* pyramid, Temenos wall and paved enclosure, ceremonial boats, etc., were all located with great care, according to canon, ritual and research specific to each king. The materials used—limestone, marble, alabaster, granite, cedar, etc.—were all chosen for their magical properties as much for their structural appropriateness.

And then there was the magical power of the pyramid itself. The focus of power was the sarcophagus, but it was magnified and concentrated by the shape and the enormous mass of the pyramid, representing as it did (at least, in Hemiunu's mind) the magical, primeval Mound of Creation. Its unique slope, the slopes of the passages leading to the internal chambers, the special shapes and dimensions of those chambers, all enabled and enhanced the pyramid's power. The whole pyramid, with its special external and internal shapes in stone was a talisman. (Not entirely unlike today's churches, which are formed in the shape of a cross and which point to the east.)

Moreover, the power of the dead king had to be renewed daily once the body of the king had been interred. This was effected by the priests of the cult of the king, who would make daily offerings of food, pronounce ritual spells and incantations, and conduct lustrations.

The rituals extracted the spiritual essence from the food so that it might sustain the dead king's spirit. Subsequently, the secular element of the food was available to be consumed by the priests of the cult, their families, the poor, widows and orphans, etc. In this way, the king was sustained in the afterlife and his name was remembered.

Applied Magic—Spells and Rituals

There were three elements to applied magic at the time of Hemiunu—the spell, the ritual, and the magician. Spells were traditional, and so had to be learned by the magician; they could be personalized by the use of particular names of places or people. There were many scrolls that could be looked up when the wording of a spell

The Secret Diaries of Hemiunu

had been forgotten, or when a spell to deal with an unusual situation was needed.

Rituals came in many varieties, and were also traditional. Lustration, purification by sacrifice or by washing, was a common ritual used to prepare someone or something for some sacred act or ceremony. The use of elaborate censers, was also commonplace, with the incense being made to drift over the subject to be purified. Life, it was believed, could be breathed back into the dead in the Opening of the Mouth Ceremony, using a special tool with magical properties, the *ur-heka*, which was struck against the lips of the mummy.

This detailed drawing from Hemiunu's diaries appears to be an extract from what is called today the Pyramid Texts, carved in relief. Snefru's rectangular *serekh* is plain to see; it is rectangular, rather than the rounded shape used later, known as a *shenu*, or cartouche..

No known instances of the Pyramid Texts have been found earlier than the fifth dynasty.

Egyptologists suspect, however, that some of the writings are from an earlier period. If this extract from Hemiunu's diary is what it purports to be, then it would be a significant



Hemiunu was particularly interested in the spells and rituals associated with royal interment, as these constrained and directed the designs of temples and pyramids. He spent several weeks researching into the spells we call today the Pyramid Texts, to see how they might affect the internal construction of the pyramids at Dahshur, and Crown Prince Khufu's pyramid, for which he hoped and expected to be the chief architect—although nothing had been said officially yet.

Spells came in several forms. There were spells for resurrecting the king, ascension spells for raising him up to the stars, and there were also pronouncements. Hemiunu found some texts, those concerned with the Netherworld, of particular interest and noted them down in his diary. (The following uses the Faulkner translation of the Pyramid Texts, with paragraph numbers.)

Sarcophagus text: "The King is my son of desire. I have given to him the Netherworld that he may preside over it as Horus who presides over the Netherworld §5

Hemiunu found this perplexing, as he understood that the king would transmogrify into Snefru-Osiris, not Snefru-Horus. Perhaps, he reflected in his notes, this is an outdated text? Or perhaps Snefru-Horus becomes Snefru-Osiris?

The king as a star fades at dawn with the other stars:
"Orion is swallowed up by the Netherworld. Pure and

living in the horizon. Sothis (Sirius) is swallowed up by the Netherworld. Pure and living in the horizon..." §151

Hemiunu found this more interesting. He had observed the stars fading as the sun rose at dawn. This text indicated that they did not disappear, instead they went into the Netherworld. That could not be the same as the underground Netherworld. This Netherworld was in the dawn sky, where the star *Sahu* (Orion) was. So, *Sahu* was a pointer to the Netherworld.

The king becomes the supreme deity. "Lift up your faces, you gods who are in the Netherworld, for the King has come that you may see him, he having become the great god" §272

Hemiunu understood this to mean that the stars were to appear so that the King may see and be seen. When the king rose to the Netherworld, he became the supreme god, ruler of the other gods. This meant that he became Snefru-Osiris, as Hemiunu had anticipated.

The king is identified with the sun: "The king takes possession of the sky...the king rests in life in the West, and the dwellers in the Netherworld attend him. The king shines anew in the East..." §306

Hemiunu understood this text as identifying King Snefru with the sun—but his diaries make no mention of the Sun God, Ra, at this point.

A resurrection text: "Betake yourself to the waterway, fare upstream to the Thinite nome, travel about Abydos in this spirit form of yours which the gods commanded to belong to you; may a stairway to the Netherworld be set up for you to the place where *Sahu* is, may the Bull of the sky take your hand..." §1716-§1717

Hemiunu found this text the most interesting of all, as it told him directly about features and facilities that would be necessary as part of the pyramid complex.

The dead king would need a boat to go on the Nile to Abydos. The pyramid would need some form of stairway, or at least access to a stairway to reach the Netherworld and the star *Sahu*. Hemiunu knew that the Bull of the Sky referred to the planet Saturn. So, here was another practical difficulty. If *Sahu* pointed to the Netherworld in the dawn sky, did this text mean that Saturn had also to be visible in the dawn sky at the same time—an unlikely combination, as Hemiunu knew from his studies at university? There were hundreds of other texts and spells, but Hemiunu found many of them rather repetitive. There were others, the significance of which he did not understand, and he found the priests of Heliopolis of little help. Some spells were already so old that their meaning had become obscured. It would, for that very reason, be very foolish to leave them out.

The Magic of Numbers

Of all the numbers, seven was the most sacred, perhaps because of the seven sacred wanderers: Sun, Moon, Mercury, Venus, Mars, Jupiter and Saturn.

The number seven was embedded in the ancient Egyptian unit of slope, the *seked*.

One *seked* was the distance in cubits that you had to walk forward for a vertical drop of seven cubits.

This gave the slope of seven-*seked* (45° in angular terms) particular significance.

Indeed, every time a slope was mentioned, it referred to a vertical proportion of seven, which then did not have to be uttered.

So, the use of the *seked* as a measure of slope obviated the need to say the sacred, magical number out loud...

The 4th dynasty pyramid builders were fascinated with numbers. Numbers were not regarded as abstract ideas; numbers were used to count material objects. However, some numbers were regarded as having magical powers. Today, some people regard, say, seven as their “lucky number.” To Hemiunu and his colleagues, the number seven was more than “just lucky.”

The Sacred Seven

To this day, many people regard seven as a lucky number, but without knowing why. The Babylonians had a seven-day week in the dawn of history. However, the ancient Egyptians used a 10-day week, which militates against the idea of Babylonian origins.

Hemiunu mentioned the seven sacred wanderers in several places in his diaries, by which he meant the seven heavenly bodies: sun, moon, Mercury, Venus, Mars, Jupiter and Saturn.

Be that as it may, the number seven was embedded in the ancient Egyptians unit of slope, the *seked*. One *seked* was defined as the distance in cubits that one had to walk in a horizontal direction for a vertical drop of seven cubits. So, walking seven cubits forward with a drop of seven cubits equated to a slope of seven *seked*, or 45 degrees in modern terms. This was why the angle 45 degrees is so hard to find in ancient Egyptian architecture: the slope invoked the use of the sacred number seven, not once, but three times!

The use of the *seked* was, according to Hemiunu, the equivalent of a prayer. To refer to a slope as, say, five *seked*, indicated that the slope ratio of horizontal to vertical was five to seven: saying “five *seked*” implied the sacred number seven, without actually saying it.

Measuring and Setting Slopes – the *Seked*

Use of the *seked* as a unit of slope created some interesting issues, to which the ancient Egyptians mathematicians apparently had no answers. From the definition of the *seked* given above, it follows that a horizontal plane has an infinite slope; one would walk forever and never achieve a drop of seven cubits. On the other hand, a vertical drop had a slope of zero *seked*, equally puzzling to ancient Egyptian mathematicians, as they had no concept of a number ‘zero.’

Hemiunu was quite happy, it appears, just to ignore the limits, if only because the *seked* worked rather well when setting the slopes of passages and pyramids. Most ancient Egyptians pyramids were in the range, using modern measures, of 43 to 54 degrees, or 7-1/2 to 5 *seked*; notice that the *seked* measure increases as the slope, measured in degrees, reduces, and vice versa.

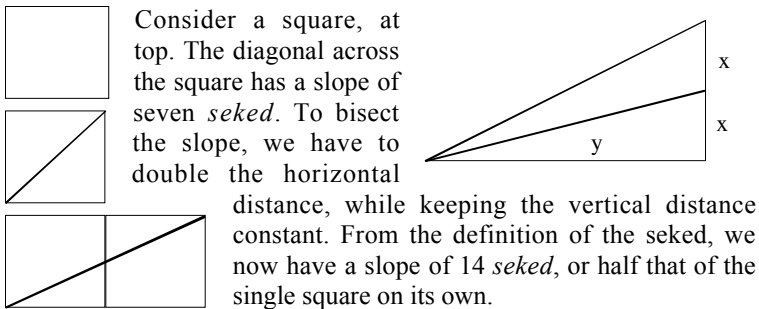
Slope Bisection

Another aspect of using the *seked*, and one that will turn out to be particularly relevant, is in halving, or bisecting, slopes. This is simple when using degrees; half of 45 degrees is 22.5 degrees.

However, as Hemiunu showed in his diaries, when the ancient Egyptians undertook the same exercise, they would get a different answer. Bisecting seven *seked* (equivalent to 45 degrees) gives 14 *seked* (equivalent to 26.5 degrees).

(N.B. The equivalent slope is given in degrees, but the ancient Egyptians had no concept of slope angle, however measured—only horizontal to vertical proportions. This was, seemingly, also true of medieval cathedral builders.)

This apparent anomaly comes about as follows:



Alternatively, looking at the triangle on the right. If a slope is measured as $y/2x$, as shown, then bisecting the slope gives just y/x .

Hemiunu set great store in halving the *seven-seked* slope. That slope was too sacred to be used, but the risk could be mitigated by bisecting, and bisecting again. So, many passages within pyramids slope at 14 *seked*, while some causeway slopes appear to have been set at 56 *seked*, or three successive bisections of seven *seked*².

Unfortunately, a very great number of people have spent many accumulated lifetimes measuring the pyramids in units other than the *seked*. As a result, they have failed to see the very obvious relationships that are present and highly visible in the designs when using cubits and *seked* measures.

Cubit Relationships

Hemiunu also believe that there was magical potential in the use of numbers within the structure of pyramids. In particular, he felt that there was magical power in using the right ratios between the length, width and height of chambers. He also felt that there was power in making numbers add up. Today, psychologists would recognize that

In the absence of angular measurement of slopes, which had yet to be conceived, the ancient architects were faced with an issue when it came to halving or doubling a slope.

For Hemiunu, at least, this was no problem. To halve a slope, he either doubled the base length, or halved the vertical length.

This method, rather obvious when measuring in *seked*, gives different results to those obtained when measuring in degrees. E.g., half of seven-*seked* (45°) is 14-*seked* (26.5°).

Some modern analysts have missed the relationships between different slopes in pyramids by measuring in degrees instead of *seked*.

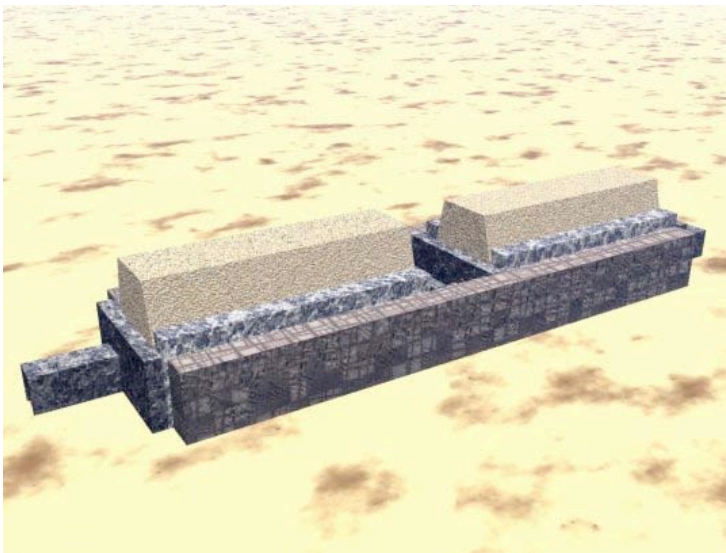
² 56 was a sacred number in other connections. Burial pits were set at 56 cubits depth, because $56 = 7 \times 2 \times 2 \times 2$, i.e., Osiris' 7 doubled three times. This depth was supposed to ensure that the mortal remains were in contact with the underground netherworld

The Secret Diaries of Hemiunu

he was reducing uncertainty, or mental entropy; we all experience the same sensation when we manage to fit the last piece in the jigsaw puzzle, or the last word in the crossword puzzle.

Some of the instances that appear in Hemiunu's diaries include the following:

- The height of the Bent Pyramid, as we have seen, was 200 cubits. The base length of the associated *ka* pyramid was set at 100 cubits, exactly half. Hemiunu considered doubling and halving to be satisfyingly correct proportions.
- In the Red Pyramid, which has two identical antechambers set in the masonry, each with a corbelled roof, the dimensions of each chamber are 7 cubits wide, by 16 cubits long by 23.5 cubits high. The intention had been, according to Hemiunu, to make the height equal the sum of the width and the length, but the corbelling process had not worked out precisely, much to Hemiunu's disappointment. (See below.)
- Also in the Red Pyramid, the upper, burial, chamber had a width of 8 cubits, chosen to be precisely half of the 16-cubit length of the two antechambers. This was to "compensate" for the upper chamber being at right angles to the lower chambers, i.e., with its long axis running east west.
- Successive integers were also used extensively, so the proportions of an opening or aperture might be $(X+1) : X$. The Red Pyramid, for instance, has a slope set in the proportions of $18 : 17$, but it was also common to find chambers with a ground plan of $2 : 1$ – this was particularly apposite, since it combined successive integers with doubling/ halving



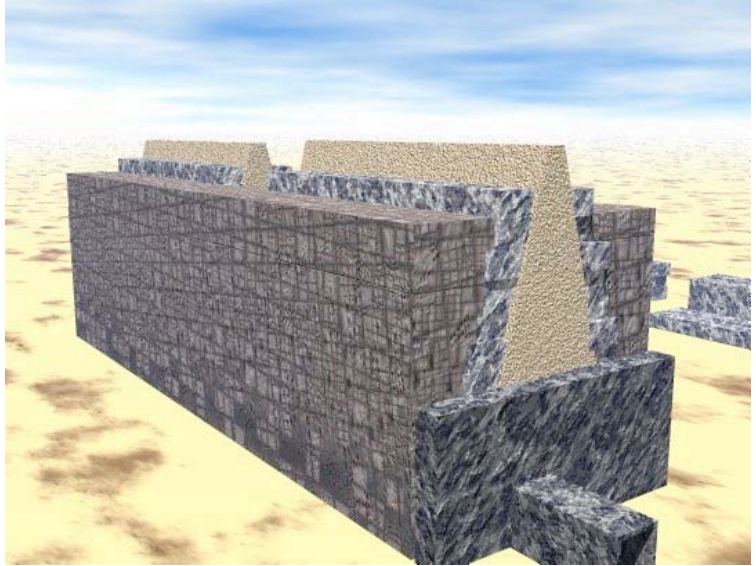
Not in Hemiunu's diaries is the evolved solution to the pyramid slope, which eventually settled as 3:4, ($53^{\circ}7'48''$). This slope was particularly convenient: it used successive integers, but was also $5\frac{1}{4}$ *seked*, so satisfying all parties.

Hemiunu found that designing chambers, passages and slopes to have certain "magical" relationships and properties was no guarantee that they would be built precisely to specification.

While it was straightforward to specify and control the length and breadth of a chamber, the process of corbelling was less

easy to manage in practice.

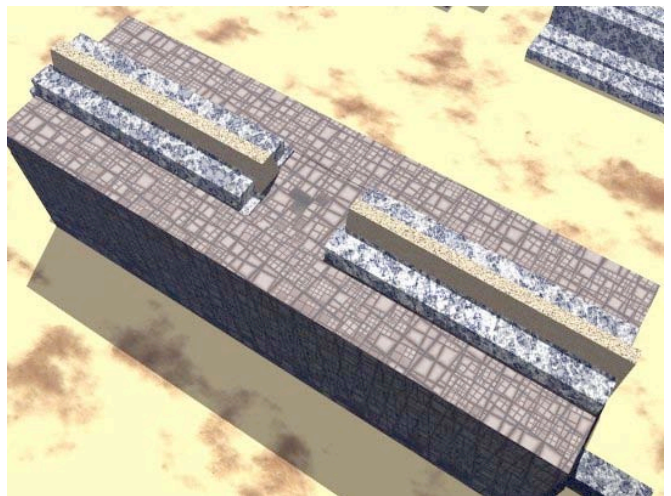
The simulations are based on Hemiunu's description of the construction of the two antechambers contained within the masonry of the Red, or Northern Pyramid. The first of the pair is reached by a passage from the northern face, which descends at a slope of 14-*seked*, before levelling out and entering on the eastern end of the north face of the chamber, at ground level. The chamber has a base wall, also built at ground level, on which are set 11 courses of corbels, rising to a point.



The figures show how the construction of the two chambers was achieved. Once the inner wall of the chamber was built, and before any corbels were laid, the hollow centre was filled with a sand and clay mix, which was piled up, tamped down and formed into a ridge. The sand was designed to prevent corbels from falling into the chamber as the walls rose.

Outside of the rising corbels, a construction wall was built on either side. Successive corbels were dragged to the base of this wall, raised up the side of the wall by rocking and cribbing, and the corbel was then slid into place, fitting into a groove in the sand cut in preparation. Each construction wall was then extended inwards to close the corbel gap, so that the construction walls thickened towards the top.

The whole structure rose in synchronism, with the outer wall always at the level of the next corbel, and the central sand and clay ridge rising too, until the whole structure topped out. The sand-clay mix was then progressively removed, acting as a descending platform for the inside of the corbels to be dressed, plastered and painted as necessary.



To make the whole process work, the rising corbels on each side had to be parallel at each course, and this proved to be difficult, with errors in corbel thickness compounding the difficulty. The overall result was that the height was often not precisely as required.

The Marriage

Hemiunu seems to have almost fallen into marriage. Both he and the Princess Neferhetepes tacitly assumed that they were a pair, and they spent much of their time together when she was not on temple duty and he was not engaged in his administrative duties as a vizier, or his architect work at Dahshur.

However much Hemiunu and his “intended” may have wished it, tacit arrangements were of little interest to either his, or her, parents. It was too good an opportunity for a party.

The diaries make it clear that Hemiunu had little idea what he was in for. In the event, the wedding party—for that is what, in effect, it became—lasted for three days, and was the social event of the year. Hemiunu’s mother saw to that.

Marriage at that time could take several forms. For the king, it could be more in the nature of a legal and political alliance. For young people in love, it was more by way of regularizing the behaviour they were already exhibiting—Hemiunu and Neferhetepes had been living and sleeping together, mostly at Hemiunu’s father’s palace, but also at the home of Neferhetepes’ parents, Prince Ankhmare and Princess Itet.

This was not considered untoward; there seems to have been a high degree of sexual freedom at this particular time, at least before marriage. Once marriage had been entered into, however, fidelity was expected of both parties, man and woman. Nor was it acceptable in Hemiunu’s circle to have more than one wife. This would be inconsistent with *ma’at*. Hordjedef, one of Khufu’s sons, was waxing lyrical on the subject at the royal court, and in the courts of justice, and people were persuaded that there was a moral way to behave before and during marriage that was consistent with principles of *ma’at*.

Both Hemiunu and Neferhetepes were happy with these arrangements, and Hemiunu in particular was looking forward to the occasion. He invited all his old cronies from his less responsible days (his mother’s expression). His parents invited relatives, of course, but also people of influence at court—this was too good an opportunity to be missed. King Snefru had encouraged the two sets of parents to hold the festivities at his summer palace, set on the shores of Lake Moeris in the Fayum area. The lake was some 35 miles south of White Wall, near Meidum, and it was one of the king’s favourite places. He was particularly fond of being rowed on the lake by his younger concubines.

The king was especially fond of a small island set in the lake, which was just off the shore. He had turned the island into a nature reserve, and had had a temple constructed to the Goddess Hathor. The lake had no crocodiles or hippopotamus in it, so swimming was quite safe. The

Hemiunu and Neferhetepes married with great ceremony, really to satisfy their respective parents.

King Snefru permitted the two families to use his estate at Lake Moeris in the Fayum, south of White Wall. Just offshore was a lush, secluded island, which the king had turned into a nature reserve.

The marriage was, in effect, a 3-day party.

There was no ceremony as such, no legal signing. It was necessary only to publicly affirm their mutual commitment by being together at the party, and by spending the following week alone together on the “honeymoon island.”

Theirs was to be a monogamous bond for life.

Life, Love and Learning

island was home to all kinds of birds and small mammals, and was planted with fruit trees and nut trees. Couples, at the king's discretion, used the island for trysts, or what we would call honeymoons. The king also had an estate on the edge of the lake, near the island, and it was there that the marriage festivities were to be held.



Both families moved temporarily from their respective palaces to the king's estate, to set up the party: there was a lot to do, if this was to be the social event of the year. Food and drink of all kinds were shipped in. Entertainments were recruited, auditioned and quartered. There were to be dancers, jugglers, acrobats, contortionists, strong men, a tattooed lady whose whole body was covered with pictures, and even a woman who would take on any man at wrestling.

There were to be numerous animal acts, including the feeding of a recently captured male lion; fights between two bulls; hare coursing; donkey racing; monkeys; geese; and many more. There were also to be games, in which young men and girls would compete in racing, throwing and jumping events. According to Hemiunu, King Snefru particularly liked watching the girls' events; he offered special prizes to those who won, and sometimes to those that did not.

Finally the great day came for the celebration. Hemiunu and Neferhetepes played host, as a mark of their new status, while guests arrived from all over Egypt—some had come from as far as Aswan.

A reconstruction of the island in Lake Moeris where Hemiunu and Neferhetepes spent the first weeks of their married life together.

The island was a nature reserve set up by King Snefru, and set aside for special events and occasions. The king put the island at Hemiunu's disposal for his marriage.

Note the Temple to Hathor on the island, with its everlasting flame.

The Secret Diaries of Hemiunu

Hemiunu wondered in his diary whether they had really come to see the happy couple, or had used the opportunity to gain unscheduled audiences with the king. Either way, he did not really care. The party got underway with music and entertainment, accompanied by considerable amounts of drinking, especially of the honey-fortified beer that Hemiunu appeared to like so much.



Hemiunu's painting of his "honeymoon" on King Snefru's island. He showed himself and Neferhetepes on a skiff, spearfishing at dusk. Apparently, he was using the reflection of the fire in the water from the Temple of Hathor to locate the fish, which may have risen towards the light.

Note Hemiunu's conventional representation of Neferhetepes as smaller than himself. This appears to have been appropriate only once they were married.

Hemiunu, however, did not drink any alcohol—he wanted to keep a clear head so that he could play host; besides, he was getting to a stage where getting blind drunk no longer appealed to him as a pastime.

The entertainment was splendid. There were different activities going on in different areas, and guests could walk around and watch, or even join in if the activity allowed it. It all became very noisy and excited as the day wore on.

Hemiunu's father decided to make an impromptu speech late in the afternoon. He was slightly the worse for wear, but nonetheless acquitted himself admirably. He praised his new daughter for her beauty and intelligence, and thanked her family for bringing up such a lovely girl. He thanked the king for his generous hospitality, although the king seemed to be half asleep during the speech. Finally, Prince Neferma'at praised his own son, of whom he was inordinately proud.

That was the signal for several men to make speeches, which began to bore the rest of the party members. Soon there was a cry for Hemionu to say something. Unlike some of the others, he had prepared a short speech, which he delivered; he did not record what he said.

As the sun started to sink in the west, Hemionu took Neferhetepes to the edge of the lake, where a skiff was waiting. She got on carefully, and he then stepped on to the stern and poled the skiff expertly away from the lake's edge and towards the island. The scene was intentionally symbolic of two young people setting out alone and together on life's journey. Hemionu felt that, at this point, they had become married.

The island was not far from the shore, and Hemionu could see the flames from the fire that was kept burning night and day in the temple. He had visited the island previously to set up the facilities there, but had said nothing to Neferhetepes. He poled the skiff into the little harbour and on to the beach. They stepped ashore and climbed up the overgrown path to the camp where there were several mud brick buildings. One of these was a two-storey building, used for sleeping out under the stars and above the mosquitoes, which always stayed near the ground.

Hemionu did not record any more in his diary of that particular day. The couple spent over a week on the island; they trapped, hunted and went spearfishing together on the skiff. Not that they needed to, because the priests, who came twice per day to maintain the temple fire, also replenished the food stores. During the week they really got to know each other, and Hemionu became totally convinced that Neferhetepes was the only woman for him, that she was the finest woman alive, and that he was a very lucky man to have her as his partner.

To his surprise, he found that she was an adept trapper, and could skin and cook a hare with ease. She also surprised him with her fish cooking ability. She could fillet a fish in seconds, and she had some interesting ways of cooking. He particularly liked the way she cooked a whole fish by covering it completely in clay from the shore, and then baking the clay in the embers of a dying fire.

For his part, he enjoyed himself climbing trees to pick the sweetest fruits, something he had not done since he was a boy. He made one drink from the pods of the tamarind mixed with sweet dates and beer, and another from the crushed stems of some thick-stemmed grasses.

For both of the young people, this seems to have been a time to look back on with nostalgia. All too soon, Hemionu was to be plunged into a busy world of administration, architecture and construction, while Neferhetepes would find herself with children to raise, and a palace and estates to run. They had bonded for life, however, and neither of them would ever betray their mutual trust.

Hemionu and Neferhetepes signified their marriage by setting out alone, together on a skiff from the shores of Lake Moeris to the king's island retreat, with all the wedding guests watching.

There they spent the week alone together, trapping, hunting and fishing, and sleeping out under the stars.

Each found out more and more about the other, and both liked what they found.

As a result, they formed an unshakeable pair bond that would last their whole life through.

A Royal Progress...

Hemiunu and Neferhetepes had no sooner returned from their week on the king's island, before Hemiunu received a summons to appear before the king. Hemiunu was to accompany him on his next "progress" up the Nile to Thebes and beyond.

Moreover, Hemiunu was to attend courts of justice as the king held them in the various cities. The king presented him with several scrolls containing complaints and charges levelled by individuals that had found their way to the king, and on which Hemiunu would pass judgement. Hemiunu was evidently being prepared and groomed for his role as a vizier, dispensing justice on behalf of the king. The king commanded that Neferhetepes should attend, too, to accompany Queen Hetepheres, the king's great wife.

King Snefru had several objectives for his biennial progress. It was important that all the population, throughout the length and breadth of the land of Egypt, should see him. This gave them confidence that their god king was alive, well, and in control; it also helped to keep the various nomarchs, regional rulers of the nomes (administrative areas) in their respective places.

Snefru wished to visit the sacred sites at Abydos, to commune with his ancestors, and to check on the progress of some construction there about which little was known.

The king also wished to check personally on building works which he had sponsored at important sites on the Nile, such works usually consisted of a the building of a new temple, or the enhancement of an existing one. On this visit, he intended to visit the temple of Khnum at Aswan, to make obeisance at the shrine, and so to ensure the Inundation.

Lastly, the king wished to see for himself how things were at the southern limits of Egypt, at and beyond the first cataract of the Nile at Abu (Elephantine).

In all these locations, and several more besides, the king would hold court, to administer justice in the name of *ma'at*. It was in this arena that Hemiunu was to cut his teeth as a vizier. The king, it seemed, only dealt with the cases he regarded as important; the rest were to be addressed by Hemiunu and another new vizier, Ankhaf, who was a distant cousin of Hemiunu's and, inevitably, related to the king. Ankhaf was slightly older than Hemiunu, would become his lifelong friend and colleague, and would join with him in building Khufu's Great Pyramid. For the time being, however, they were both nervous, new viziers being put to the test.

Hemiunu spent several days doing his homework, going over the scrolls he had been given, and then discussing the various cases with his father, who was very experienced in such matters. This evidently

calmed his nerves; he found that the judgements he had determined appropriate agreed with those his father would have delivered.

The fateful day arrived, and Hemiunu and his new wife went down to the docks at White Wall, to board one of the sizeable fleet of ships that together made up the king's flotilla. The scene was chaotic, with men running backwards and forwards carrying bundles of goods, rowing boats going to and fro, orders being shouted, sailors being cursed, and women looking aghast.

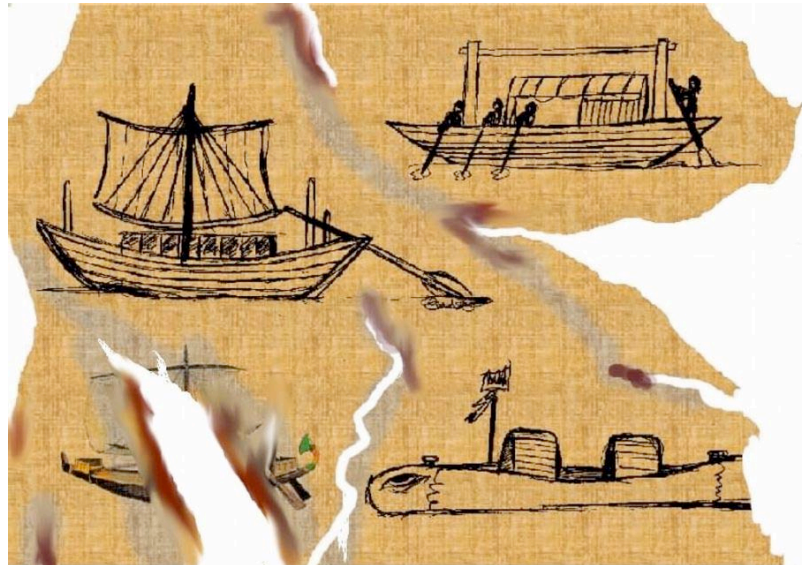
Hemiunu could see the king's ship looking resplendent with its large sail, painted rowing blades, and ornate deck housing, in which the king and his immediate circle would rest, sheltered from the sun by day, and sleeping by night, using nets for protection against the interminable mosquitoes. There were dozens of other ships, too, for food and beer, cooking, tents and furniture for setting up ashore, soldiers, courtiers, the king's favourite dogs, hawks for hunting further up river, and – of course – viziers. Altogether, Hemiunu counted over 30 sailing ships and twice as many rowing boats; many crewed by armed men in uniform.

Hemiunu had one relatively small sailing ship set aside for him and Neferhetepes. The ship had a captain and crew of six, who would see to every need of the new vizier and his wife, who was less than enchanted about spending the next four months as the only woman on a craft full of sailors.

Hemiunu sketched some of the ships of the king's flotilla as it made its way up the Nile on the king's progress. Three of the sketches were reed and ink, the fourth was reed ink and chalk.

The rather tattered sketches showed standard ships for the time, except for the one at bottom right, which looks to be ancient even for the time; moreover there is neither sail, nor oar, and it carries a totem

One suggestion is that this vessel was towed, and that it was a floating shrine to the god Horus.

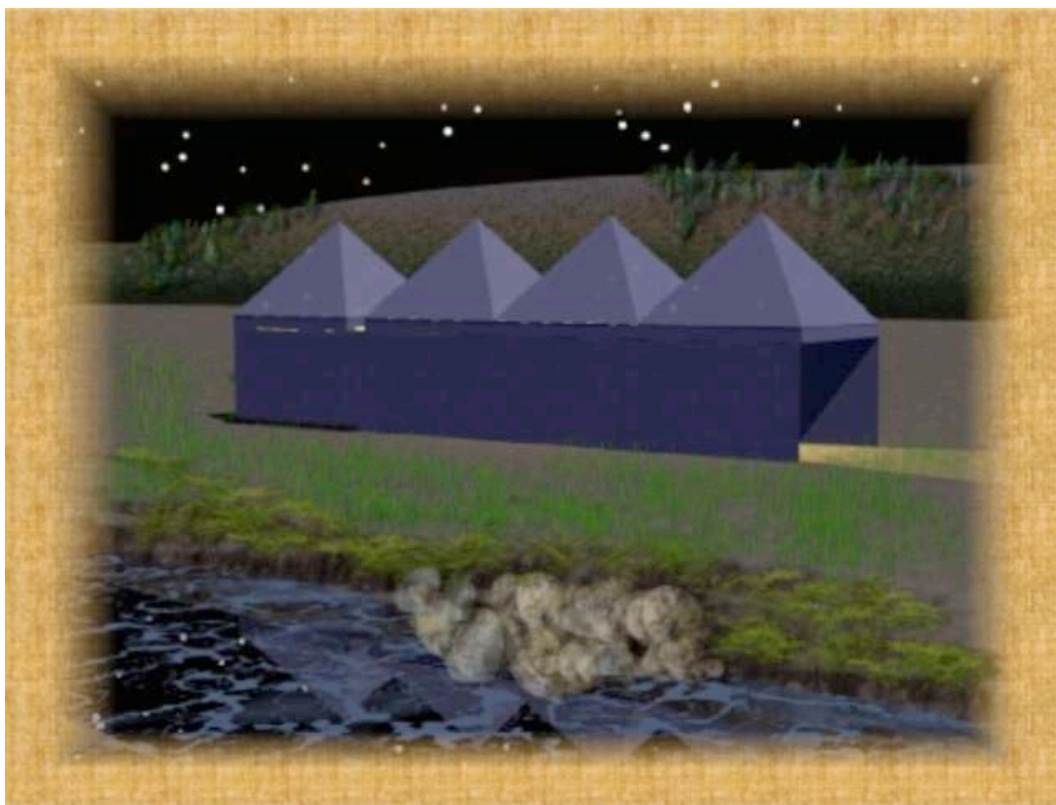


Somehow, they set sail and the flotilla headed into the centre of the channel. Sails filled with the promised wind from the north, rowers pulled on their blades, and the ships gradually sorted themselves into an orderly system, with three light rowing boats at the front, carrying armed men to lead the way. Then came the king's ship, with the other sailing ships following, surrounded by a loose ring of rowing boats. The king was seated on his ship, in full view, wearing his full regalia, including the double crown of Upper and Lower Egypt. It was an imposing sight, and Hemiunu was clearly impressed.

Moving Justice....

Hemiunu's first trip up river with the King was one of the most memorable events of his life; he often referred back to it as a time of great excitement, and one where he learnt more than at any other time.

The flotilla made haste rather slowly upstream, as the north winds were only a whisper. Hemiunu had time to get used to the rhythm aboard ship, and to take stock of the life teeming along the banks of the Nile. Neferhetepes travelled with him on his boat, and they passed the time happily, enjoying each other's company. It was not to last...



After what seemed like two weeks (twenty days), the flotilla unexpectedly veered off to the west bank and various ships formed into clusters around the principal vessels, variously dropping anchor and driving staves into sandbanks. They had arrived at *Abt*, Abydos, the Holy City in the eighth, Thinite *sepat*, (nome, or administrative area), and the first point of call. Although it was evening, the crews of three ships leapt into action, and before Hemiunu had realized what they were doing, they had erected a sizeable structure on the sandstone shore.

Hemiunu knew that it was the court where the king would sit in judgement on the following day, and for several days thereafter. Although the structure looked a hazy blue in the late evening light, it was actually made up of four white, tent-like sections, each with a pyramid-shaped top, a valance and walls made of sheer linen. The pyramid tops were made of pith; they were translucent, but strong. Hemiunu sketched and painted the structure by moonlight. He was clearly impressed.

That evening there was a celebration ashore, hosted by *heri-tep a'a* – the “great overlord,” or nomarch: he was a large man, fat, sweating, and overbearing; yet, unctuous at the same time. He was attended at all times by two armed bodyguards, soldiers of immense size. King Snefru was also attended by a platoon of soldiers, although they kept a discreet distance.

Two parties got going, clearly prearranged; one for the royal passengers, and another for the crew. Hemiunu and Neferhetepes were rowed ashore and Neferhetepes was immediately whisked away to attend Queen Hetepheres, who apparently wanted to ask Neferhetepes all about the week spent on the island in Lake Moeris. Hemiunu could hear giggling and outright guffaws coming from the circle of ladies surrounding the queen, and he could see Neferhetepes looking embarrassed.

Embarrassed too, he joined some colleagues that he knew from his work at Dahshur, and got “well oiled” drinking date and honey wine, to which he had become particularly partial. He spent the evening chatting and socializing, but he was secretly rather bored, and after a while he wandered out into the desert and looked at the stars.

A cough interrupted his reverie. To his further embarrassment, it was King Snefru, with his attending soldiers standing back in the gloom. The king told Hemiunu to relax; he, too, had come out to look at the stars; he, too, was just a little bored. The king, it seemed was really quite human after all.

They discussed the forthcoming trip, and the king asked Hemiunu what he thought about various matters. Hemiunu answered as carefully as his wine befuddled state would allow.

The king asked him about the lands to the south of Aswan, rich in gold, and defended by fierce and proud warriors. Hemiunu felt that they had a right to be proud, and independent, but that a treaty between the two nations might offer Egypt gold as well as hardened fighting troops to deal with the insurgents in the Nile delta—a recurring problem. Hemiunu even went so far as to suggest that if a suitable princess might be found amongst the tribes to the south, that she might make a valuable addition to the king’s harem, and would consolidate and guarantee any agreements that the tribesmen might make.

The King administered justice in each and every nome as part of his stately progress towards the southern border separating Egypt from the Land of Kush (Nubia).

The procedure was the same at each nome:

- The relevant nomarch would greet the king and there would be a lavish welcoming party.
- The king would then visit local building projects—usually temples, dams or irrigation.
- He would also confer with his many local estate managers.
- Then he would preside at the court, where cases would be brought before him for judgement.
- Sometimes there would be a hunt, or a visit to an outlying quarry or mine, and occasionally there would be a display of wild animals.

Finally, the royal party would pack up and move on to the next nome....

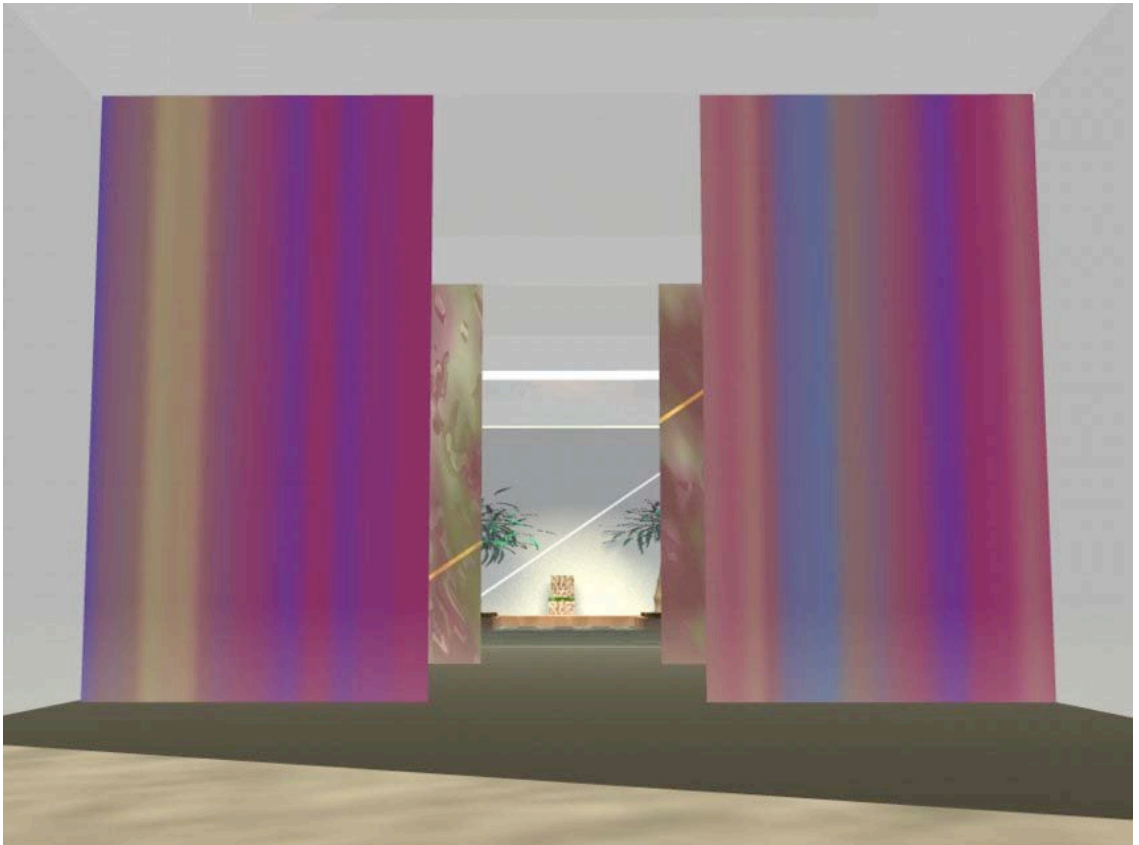
The Secret Diaries of Hemiunu

The king listened, smiled, but said nothing. After a while, he went back to the party and Hemiunu went to find Neferhetepes, wondering if he had said far too much—his stomach lurched at the thought.

Next day, bright and early, Hemiunu arose and found that hot food was already waiting for him on deck. He could see ashore, where a crowd of local people had already gathered around the entrance to the tented court, which was guarded by the king's soldiers—lots of them. He could see several men carrying staffs of office, and he guessed that they were village elders, or headmen. One stout chap looked like he could be the local mayor, judging by his obvious self-importance.

Hemiunu hurried ashore and made his way to the court. Picking his way through the crowd, which seemed to part for him anyway, he entered the outer precinct of the court—the first pyramid. In the distance, he could make out the king's throne, but in between there were groups of people in animated conversation. They fell silent as he approached, and he suddenly became aware that they were frightened of him.

He was tall and powerfully built; with his Seer's cloak and his staff with the crystal ball, Hemiunu realized that he must have presented an



awe-inspiring figure.

Hemiunu saw several court officials, each surrounded by a group of supplicants, seeking the king's justice. One senior official was also organizing the other officials, creating a list of cases and putting them in order.

King Snefru entered the far chamber from the back, took his place standing imposingly in his full regalia in front of the throne, which was set on a raised dais. He had just come from the Temple of *An-Her*, the Abydos nome deity. The court usher banged his staff of office on the stone-clad flooring, the whole area became instantly silent, and the usher beckoned to the senior official, who led a man forward—or rather, dragged him forward. Overcome by the situation, and his fear of his god king, the man started to behave like a slaving idiot. The senior official beckoned to another official, the one who had entered the man in the lists. He came forward and prostrated himself in front of the king. The king asked him to rise, and explain what was going on.

The official quietly explained about an inheritance problem, in which the man's elder brother had cheated him out of a share in their father's land. The king asked for the elder brother, who was not present. The king pondered for a moment, before declaring that the elder brother's absence indicated his guilt. He ordered that the supplicant be given his share of their father's land, and that, in view of the elder brother's

The court "room" was pristine, yet simple. There was a marble throne, on which the king would sit in judgement, with a green cushion. The throne was set on a wooden dais, flanked by two mature date palms that appeared to be growing out of the tiled floor.

(Hemiunu had seen this trick many times before, but it never failed to impress—the palms were in large wooden tubs let into the ground, and the tiles were cut to fit around their trunks.)

In front of the dais were two low benches covered with dyed animal skins, on which could sit opposite sides in a dispute, court officials, or the king's viziers as appropriate.



The Secret Diaries of Hemiunu

absence, the younger brother would choose which half of the land he preferred.

Hemiunu watched as the suppliant, still only half aware of what was going on, was lead outside, and Hemiunu saw an official talking with a headman, who was presumably going to implement the king's ruling. So this was the king's justice. Fair, effective, immediate, and in keeping with *ma'at*. Hemiunu was impressed, particularly that the suppliant received justice even although he was unable to present his case.

Hemiunu observed the last pyramid-topped tent, where the king sat in judgement. It had been erected and fitted out in short order, but was nonetheless impressive. The floor was raised, and covered with highly polished black and grey tiles. The black parts looked like holes, or pools of deep water, and evidently made supplicants nervous about walking on them. At either side there were low benches, each covered with coloured rugs, on which might sit witnesses or officials, depending on the nature of the judgement.

At the back was a raised dais, on which one of Snefru's state chairs was set. It was made of red marble, and had a green cushion on it; Hemiunu thought he recognized the cushion as like the one he had seen on the throne in the King's palace court. To finish off the décor, two large date palms stood, one on each side of the dais. Hemiunu observed that, once the court was in session, a replica of the king's



double crown was placed on his chair whenever he was not in the court. Hemionu also noticed that the court officials paid reverence to the replica crown, as to the king, whenever they entered or left the chamber.

Hemionu later found out that there were several adjustable metal mirrors set in the pyramid roof, which reflected sunlight either on to the throne, or on to a supplicant, as the king felt appropriate.

Crowds of men beleaguered the king whenever he stepped out from the court. It turned out that these were his estate managers, and that he had some 35 *hut*, estates, and over 122 farms, or ranches, up and down the Nile. Snefru founded *niut*, villages, throughout the Nile valley, and his wealth and benevolence were legendary. However, it all meant work. Under the load, Snefru beckoned to Hemionu, who hurried across to be told that he, Hemionu, was to sit in judgement that afternoon on the king's behalf.

Before he really knew what had happened, Hemionu found himself sitting on the king's chair with a supplicant kneeling before him. The man was complaining that his neighbour had kidnapped his wife, and was making her keep house and work in his fields. The supplicant had tried to get his wife back, but had receiving a severe beating for his trouble—and his wife had been beaten, too.

Hemionu called for the neighbour, who appeared reluctantly before him, escorted by two soldiers. He was a surly ox of a man. Hemionu asked him if the accusation was true. The man did not respond. The supplicant's wife was called, but was too frightened to speak. The local official confirmed that the situation was as had been described.

Hemionu pondered, and then pronounced: "You are a strong man, who has used his strength to dominate, steal and kidnap. Your strength should be put to better use. You will serve in the king's army in *Ta-Khent*, (Abu, Elephantine, on the southern border of Egypt) for five years, starting immediately. During that time, your neighbour will have your land to farm, or not farm, as he pleases." Hemionu called for the captain of the guard, and instructed that the man be inducted that instant, in front of the court, and that the captain take him in custody and send him to Elephantine without delay—and with no opportunity to bully or take revenge.

Hemionu pondered about his decision in his diary. His objective was to restore balance. By removing the aggressor from the scene, he was giving an opportunity for the supplicant and his wife to reunite. By giving the supplicant the right to farm the aggressor's land, he was recompensing the supplicant for the temporary loss of his wife. And he was laying the way open for the supplicant to let the aggressor's land go to ruin if he so wished, so that the aggressor would have nothing to return to. The aggressor had disturbed the even flow of *ma'at*. Hemionu had laid the way for the restoration of *ma'at*; it would not return immediately, but with time...

Hemionu found himself unexpectedly sitting in the king's place, dispensing justice in the king's name.

Although taken by surprise at the turn of events, he nonetheless gave a good account of himself, remembering that his judgement should always be designed to restore any disturbances in the balance and harmonious flow of *ma'at*.

Hemionu always agonized after the event, however, in case he had made a mistake, been too lenient or too harsh, or had, perhaps, been deceived by a witness.

The king, however, had every confidence in Hemionu, and was to use his skills frequently in the administration of Justice.

Thebes, City of a Thousand Lights....

Several days later, the king's progress recommenced and the flotilla wound its way slowly up river. Stops were frequent, with each nomarch greeting the king, setting up court, administration of justice, and re-embarking beginning to blur in Hemionu's mind.

Hemionu was eager to visit *Waset*, Thebes, the focus of Upper Egypt. He had heard much about the city since he was a child.

Initially, however, he was disappointed by its appearance—it was build out of Nile mud bricks, and looked drab and lifeless in the noonday sun.

The scene brightened up when the population came streaming out of the city carrying coloured banners, streamers and totems.

Hemionu found the people to be rather more open and fun-loving than those of his native north. He also found that they had a different class of villain....

Eventually they reached the place that Hemionu wanted to visit more than any other—*Waset*, that would become Thebes to the Greeks, Homer's City of a Hundred Gates. *Waset* was also goddess of the Theban Nome, and *Waset* was the largest city in Egypt after White Wall. It should prove exciting.

Hemionu did not know quite what to expect. His first impressions of Thebes, seen from the boat, were less than inspiring. It seemed to be a drab, lifeless clump of mud brick, *mastaba*-like blocks, without doors or windows. There was an outer wall, also of mud brick, plastered with clay like many of the buildings.

As the flotilla drew up at the quayside, people poured out through the city gates, cheering and waving banners and streamers. King Snefru, it seemed was expected, and was very popular. The king sat impassive on his sedan chair, waiting to be carried ashore in state.

Hemionu stayed on board, watching the festivities with fascination. These people were quite different from those he was used to at home; they were more open, energetic, excitable and—fun. (There were several crossings-out before Hemionu chose the word “fun.” It evidently did not come readily to the mind of the serious young architect-turned-vizier.)

Dusk turned into night very quickly, and Hemionu made his way quietly ashore with his papyrus sketchpad. Climbing up on to the outer wall, he sketched several views of the city, to be painted later. He was enchanted by the play of the moonlight on the mud buildings. The clay plaster had shrunk in the searing noonday heat, and the building occupants had pushed holes through the gaps on the north side of some buildings, presumably to let the cooling north winds in. At night, this resulted in a thousand tiny, points of light flickering like crystals...it was magical.

The king attended some grand function that evening, to which Hemionu and Neferhetepes were not invited. They spent a happy evening relaxing on the boat, enjoying the sound of the water slapping on the hull, and the sight of the moon dancing on the water.

Next morning, court was set up inside the courtyard of a magistrates building. Thebes produced a different class of villain, it seemed to Hemionu. Grave robbing and temple desecration seemed to be rife, as were infidelity, adultery and divorce. Hemionu listened attentively to the various cases, eager to learn from the king's judgements.



After two days of solid work, the king announced that there would be a hunt. Hemiunu brightened up at the prospect, until he learnt that the intention was to hunt hippopotamus. He had a healthy respect for the hippopotamus which, as he knew only too well, killed many more Egyptians than crocodiles each year. A hippopotamus had even killed a king during a hunt...

Next day, various members of the royal party gathered in the market square together with a host of the great and the good of Thebes. They were divided into groups, and each group was given a pair of guides, and their choice of weapons. Hemiunu was very handy with a bow and arrows. He had his own bow that was so powerful that few others could draw it. And, he had it with him.

He need not have bothered. His party failed to see any hippopotamus that day. The king's party, on the other hand, tackled a large male and killed it, but not before the huge beast had killed two of the party. To Hemiunu's surprise, no one seemed unduly concerned—it was an honourable death....

Hemiunu wrote much more about his first trip. There were to be many others, later, but none provided quite the level of the sheer excitement and delight he felt on this, his first royal progress.

Abu and the Temple of Khnum

Abu (Elephantine)
was the
southernmost
boundary of Egypt.
Further south lay the
Land of Kush, with
its fierce warriors,
but also with its
fabulously wealthy
gold mines.

Through Kush came
trade with the fabled
Land of Punt, for
ivory, frankincense
and exotic animals...

As King Snefru's
royal progress
moved gradually
further south, naval
and military river
traffic began to
increase, too, until it
became evident that
"something was
afoot."

The last stage of the king's progress took him to the southern edge of Egyptian territory at Abu (Elephantine) in the most southerly nome, *Ta-Khent*. On the way, the party stopped and went ashore to meet the people and see the sights; the terrain was changing, and was no longer the familiar wide floodplain. During the Inundation, the water rushed through this part of Egypt with such fury that it tended to drag trees up by their roots, and the famous black silt had less opportunity to settle.



Hemiunu was fascinated with village life. Villages were perched on higher ground to protect them from the Inundation. High ground was in such short supply that houses were built on the rubble of previous houses, giving villages an unusual, higgledy-piggledy appearance that Hemiunu found surprisingly attractive.

Hemiunu noticed a significant increase in river traffic, most of it going south, and much of it military. He learnt that King Snefru was not just making a royal progress through Egypt, but also contemplating a foray or two into the Kingdom of Kush (Nubia), which was a source not only of gold, but also of amethyst and copper.

When the flotilla arrived in Abu, it had swelled with the addition of a dozen or more ships filled with military personnel. Abu itself was a garrison town, with many more military about than townsfolk. Everywhere there were soldiers and sailors (it was hard to tell the difference) exercising, rowing, and practising their fighting skills. There were other, furtive-looking men, darting in and out of doorways, that Hemiunu took to be spies, although for which side he could not be certain.

Elephantine today is not so very different from Hemiunu's time. The photograph below shows the view from Kitchener Island towards the temple ("Top of the Winds") on top of the ridge. Below are several



rock-cut tombs, two with causeways visible running down to the west bank of the Nile, forming the necropolis of the princes of Aswan³.

One of King Snefru's first duties was to visit the Temple of Khnum, *Khnemu*. Hemiunu had heard of the temple since he was a child. It was the fabled temple that King Djoser had visited many years ago. Disappointingly low Inundations were concerning King Djoser when his chief architect Imhotep suggested that the problem might be caused by a failure to maintain temples to the gods. One god, in particular, was Khnum, the creator god, whose temple at Abu had fallen into disrepair. Djoser restored the temple, and the Inundations were restored too.

King Snefru visited the temple alone, and spent two days inside without emerging. When he came out, Hemiunu took the opportunity, together with Neferhetepes, to visit the temple, and to see for himself the fabled "jars of Hapi," two large, earthenware jars from which it was said the waters of the Inundation flowed. (Hapi, the god of the Nile, and was often depicted as a man with breasts, holding two water jars.)

The West bank of the Nile would become the burial place of the princes of Aswan, the and Governors of Kush (Nubia.)

In Snefru's time, however, Kush was not conquered, and was the confederate chiefdom of Wawat and Satju

Snefru would have to mount an expedition into the Land of Kush, to "establish better relations..."

³ These are Sixth Dynasty tombs of the Governors of Kush: Mekhu, Sabni, Khufhr-Hor and Heqaib, leaders of the time. Heqaib was, in life, Pepynakht, Governor of Elephantine in the reign of Pepi II of the Sixth Dynasty. Pharaoh Pepi, who reigned longer (94 years) than any other king in recorded history, was so impressed with Pepynakht that he was considered to be the ideal, loyal servant. After Pepynakht died, he was deified and called Heqa-ib (literally "ruler-heart", translated loosely as "king's close friend", or "king's confidante"). Heqaib was worshipped at his shrine until the end of the Middle Kingdom.

The Secret Diaries of Hemiunu

Inside the Temple of
Khnum, patron of the First
Cataract.

Hemiunu felt the touch of
special magic...

From his diaries, Hemiunu evidently did not actually believe in the story of the earthenware water jars. The temple was uninspiring, too, having been cut out of the Aswan granite, which was hard, but dull to look at. When he and Neferhetepes entered the tomb, they could see very little at first for the gloom. The temple was filled with water, and they had to wade into it to get to the nexus of the temple.



The Temple of
Khnum at
Elephantine had
become important
in the time of King
Djoser. He had
restored the
temple, in order to
restore a failing
Inundation.
Subsequent kings
also worshipped
there.

As their eyes adjusted to the flickering light from the crackling braziers, the only source of light, Hemiunu suddenly realized that they were looking at two enormous earthenware pots, from each of which was pouring a jet of faintly-glowing pink water. The two strong jets flowed smoothly into the pool with hardly a splash, and without any sound. All around, the water was faintly luminescent, and Hemiunu could see very big, black catfish swimming idly in the shallows—he estimated their length at some two cubits (just over a metre.) As he and Neferhetepes waded through the water, it sparkled and glowed around their feet.

Try as he would, Hemiunu could not see how the jars were filled: where was the water coming from, and why was it glowing like that? Hemiunu could think of only one explanation – he was truly in the presence of the gods, Hapi and Khnum.

Hemiunu and Neferhetepes stayed in the temple for several hours, enraptured and awed by the sight.

A few days later, Hemiunu and Neferhetepes went on a sightseeing trip up river towards the first cataract: this was the point where ships had trouble passing because of the rocks in the water; it was also the southern limit of Egypt.



In the distance they could see a range of hills, with a scar showing where the mighty Nile cascaded during the annual flood. Nearer, he could see the deep chasm cut by the furious waters; the sides were covered in green vegetation now, but that would be stripped by the heat of the sun and the force of the Inundation. In the middle distance, Hemiunu could see the haze from a waterfall. This was altogether a different Nile from the one to which he was used.

That sightseeing trip was the prelude to Hemiunu's and Neferhetepes' return home. On King Snefru's instructions, Hemiunu held courts and dispensed justice in each of the nomes to the north of Abydos—as the return flotilla approached White Walls. The nomes had names that Hemiunu had known since his boyhood: *Minu*, Cobra, *Shoy*, Mountain Viper, Tree Viper, Hare, Oryx, Jackal, *Anty*, Sceptre, etc. Hemiunu now understood why Abydos, which was well up river, had been the first port of call on their outward journey. Snefru had obviously been eager to reach Abu/Elephantine/Aswan as quickly as possible, but without arousing suspicion amongst the spies of Kush. Hemiunu observed that there was rather more to being king of Egypt than courts, pyramids and parties....



New Kingdom depiction of Hapi. Note the breasts, the two jars overflowing with water, and the lotus flowers growing from his head.

The Story of Dahshur

Hemiunu spent much of his twenties and thirties at Dahshur, learning his trade as an architect and overseer, and also learning how to create the magic in stone that was essential if the pyramids were to project their kings to the heavens.

It was one thing to work out what the magic proportions of a chamber should be, or how three chambers should be located in relation to each other: it was quite another to construct the chambers precisely in line with the design.

There were so many things to go wrong, or confound the intentions of the designer. Some stones were uncertain as materials, and were likely to crack after having been set in place and covered with other stones; corbels were a particular problem in this respect, as were stone beams supported only at each end. Every cracked stone had to be replaced; otherwise the magic spell of which it was a part would not work.

Pyramid Problems

One reason for this obsession with quality and accuracy was the unfortunate history of the pyramids that had built since Djoser's Stepped Pyramid. None had been completed until the stepped pyramid at Meidum, and Hemiunu felt that, too, was incomplete.

King Sekhemkhet (Hemiunu called him Djoser), who succeeded King Djoser, had started out with ambitious plans to build a complex like Djoser's, only bigger still. It had not really risen above its enclosure wall before being abandoned. Hemiunu had explored the underground workings beneath the pyramid as part of his education process. It would have been impressive.

Hemiunu had been surprised, he recalled in his diary, to find a magnificent, sealed sarcophagus in Sekhemkhet's underground complex. It was unlike any other he had seen, being carved from a single block of alabaster.

Hemiunu also explored the so-called layer pyramid of Zawiyet el Aryan, which he took as another object lesson in how not to build pyramids. It had been intended for King Khaba, and used a plan not dissimilar to that of King Sekhemkhet.

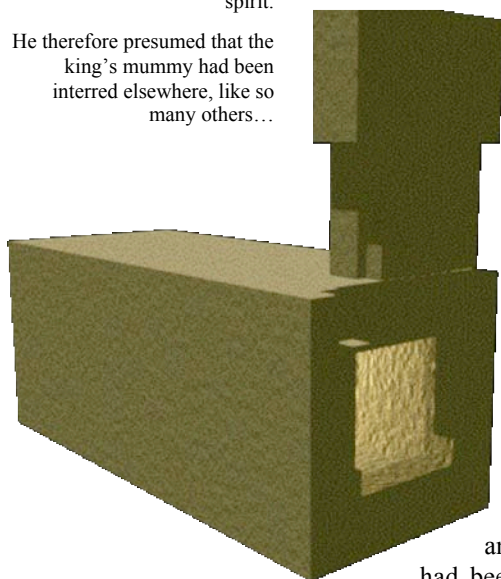
The pyramid was on the edge of the plateau to the north of Saqqara, but with full view of Djoser's Stepped Pyramid in one direction, and of the site at Giza where Hemiunu had first seen astronomers undertaking their research. A plan was forming in Hemiunu's mind

Simulation of Sekhemkhet's sarcophagus, made out of a single piece of alabaster, as described in Hemiunu's Diaries.

When Hemiunu saw the sarcophagus, it lay in the unfinished burial chamber of Sekhemkhet's so-called Buried Pyramid at Saqqara.

The sarcophagus was already sealed, but Hemiunu could not see how the king's mummy could have been interred there, without guards or any mortuary rituals to preserve the king's spirit.

He therefore presumed that the king's mummy had been interred elsewhere, like so many others...





about the site at Giza, which was revered as the most likely spot to be the original primeval mound of creation...

The layered pyramid was built, Hemiunu observed, using small stones employed more like bolts of wood laid on each other to form inward sloping piles. Like Djoser's Pyramid, it was intended to have a central burial shaft, but in this instance no sarcophagus was found. The pyramid had risen further than that of Sekhemkhet, but not by much. It was altogether a rather poor effort, Hemiunu concluded.

One aspect of King Khaba's Pyramid did appeal to Hemiunu, however. Unlike Djoser and Sekhemkhet, Khaba had chosen to build his pyramid, not out in the desert, but close to the edge of the Nile. His pyramid was closer to the river than the Meidum and the Dashshur pyramids, and Hemiunu saw this as a distinct advantage when bringing in stone from Aswan and the other quarries. Not only could stone be shipped in, but workers could also be brought in, even on a daily basis, from much farther: this compared with desert sites, where sizeable villages had to be created to house workers and their families.

Pyramid Research Station

With this unfortunate recent history, the success of Huni in raising his stepped pyramid at Meidum was all the more remarkable. Hemiunu was interested in the basis for this success, following on the heels of consistent failure. Evidently, the time available to the relevant king was a significant factor: like Sekhemkhet, Khaba had reigned for only six years, while King Huni managed some 24 years. Hemiunu felt that

Rising entrance to the centre of Khaba's so-called Layered Pyramid of Zawiyet al Aryan.

The construction used rather poor, small stones laid in inward sloping columns against a central core. The degree of slope can be seen in the photograph.

Unlike previous pyramids, Khaba's Pyramid was constructed on the edge of the plateau just above the passage of the Nile, making the transport of granite from Aswan and white limestone from the Tura Mountains much easier.



Photograph of Djoser's Stepped Pyramid showing the small cross-section stones, cut like bolts of wood and stacked in inward sloping columns.

The similarity with Khaba's Pyramid construction (above) indicates that Khaba's Pyramid, like that of Sekhemkhet, was constructed along very similar lines to the original model provided by Imhotep for King Djoser.

What worked for the great Imhotep, Hemiunu concluded, may not work for lesser men....

there was more to it than simply time. His studies showed that the three kings went about their building projects rather differently. King Huni, for instance, had a much simpler design, with no underground complex to create. He also started out with a modest plan for his initial stepped pyramid, although he expanded upon the original concept with time.

Research Subjects

Hemiunu, with the full approval and support of his father, Prince Neferma'at, set out to research pyramid building ideas and methods, and his principal research ground was at Dahshur. Although the outline designs of the two pyramids were already established, the building methods were not. Nor were the means of recruiting, accommodating, training and organizing the building workers.

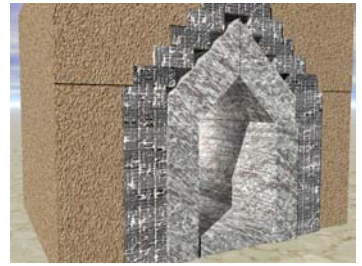
Hemiunu realized that there would be a need for a continuing supply of skilled and experienced builders; he also appreciated his own ignorance. He therefore spent several months of his early years on site in each of centres of effort: the quarries; the training "schools;" the transporters; the logisticians, who organized and supplied food, beer, etc; the toolmakers, and so on. Not only did he learn a vast amount about the many aspects of pyramid building, but he also made many good contacts and friends, and – importantly – he gained the respect of all the workers as one who knew their job as well as his own.

Once he had established his knowledge base, Hemiunu became aware of how much he did not know, and this guided his research. Some issues seemed simple, others less so:

- How might it be possible to control the dimensions of a chamber within the masonry with the great accuracy needed to ensure its magical capabilities?
- While corbelling was a valuable means of creating chambers within masonry, were there other ways that might be even more effective?
- Conventionally, corbelling consisted of horizontal layers of stone. Was it possible to corbel on a slope of, say, 14 *seked*? If so, would it be possible to create grand, vaulted passages rising and descending at the magical 14 *seked*?
- How could a pyramid be built on, or over a hill, or on poor foundations? Was there a way to create good foundations for something as massive as a pyramid?
- Was there an optimum size for the stones used in building a pyramid? Smaller stones were easy to handle, but very great numbers were needed. Very large stones were difficult to handle, but much fewer were needed, and the larger stones created a more stable structure
- Was it possible to predict how long it would take to build a pyramid, and how many workers would be needed, simply by examining its design?
- Hemiunu had noticed that many pyramid-like structures seemed to reach one third of their intended height before being abandoned. Was there some barrier at one third of final height that had to be overcome? Was it a magical barrier, or something else?
- Was there a perfect pyramid, one where every part was accurate, correct, magically in tune, and where the whole was flawless in every aspect?

Creating Chambers

Hemiunu was familiar with corbelled chambers – he had studied the theory and experimented with the practice. He was also aware of their limitations, particularly when it came to accuracy of roof slope or roof height. His diaries show half sketches, where he was playing with ideas. He realized that it was possible to have almost any number of corbels, one above the other, and yet create the same internal shape. With many corbels, each would be relatively thin and would overlap by only a small amount. The ultimate would be to have a multitude of wafer thin corbels, each overlapping by a hair's breadth. Eventually he realized that he could achieve exactly the same effect by replacing many corbels with a pitched slab.



Hemiunu was interested in how a pitched-roof chamber could fit into a pyramid's masonry.

In these two reconstructions from drawings in his diaries of actual experiments at Dahshur, Hemiunu illustrated some of his ideas.

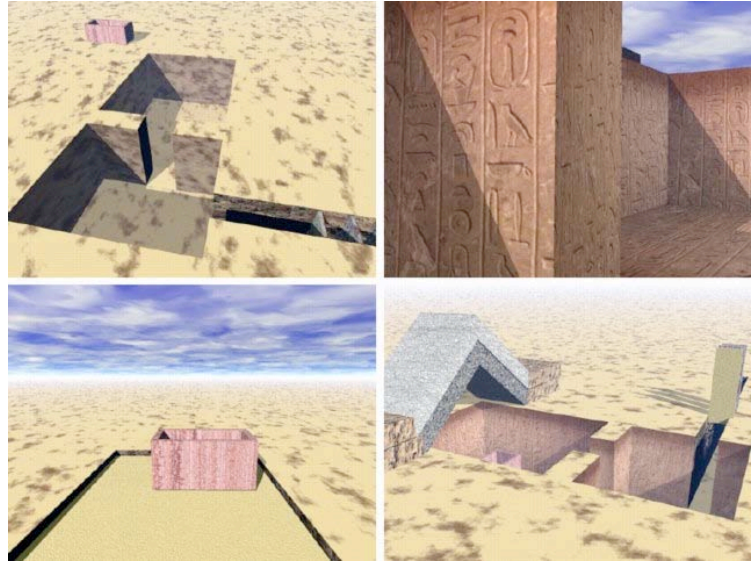
He had realized that putting great weight on the apex of a pitched roof would flatten it like a pancake, forcing the lateral stones at the base of the pitch sideways and outwards.

In the example above, he avoided this side thrust ingeniously by surrounding the pitched roof with a corbelled ceiling. Invisible from within the chamber, the corbels took the weight of the masonry above. However, it looked from the inside as though the pitched roof was taking the weight. In this manner, he could control the vertical dimensions of a chamber precisely.



The second example is a variation on the first. As the pitched roof was supporting only its own weight, Hemiunu demonstrated that he could create a vaulted roof, simply by carving the vault out of the two slabs forming the roof of the chamber.

This experiment did not persuade his architect colleagues at the time. However, just such a vaulted roof was included in the underground complex of the later Menkaure's Pyramid, the smallest of the three on the Giza Plateau.



Hemiunu experimented
with all aspects of
construction in stone.

He believed that
experiments were the
way to understand, and
that it was unfair to try
something out for the
first time on a real
building, only to find it
did not work.

In this, his approach
presaged that of modern
science and systems
engineering.

He also explored the
mathematics of building,
looking for relationships
and ratios that were
invariant, i.e., that
applied in buildings of
different sizes and types.

He went on to experiment with creating a pitched roof chamber in the desert at Dahshur. He dug two linked chambers into the desert rock—see figure, top left—with a passage leading into one of them. Within the passage were grooves for three portcullis doors, which would eventually be lowered to seal the passage. For the moment, however, all was open to the air or, rather, wind, as Hemiunu had no concept of air in the sense of a gas that we all breathe.

Next he filled the burial chamber with sand and dragged a sarcophagus over the top — bottom left. The sand was then removed into the connected chamber, and out through the passage. At this point, any plastering, painting or artwork could be executed in full daylight, top right.

The chamber was filled with sand again, only this time it was raised to a ridge above desert level. Limestone slabs were then dragged up on to the ridge and held in place with sandstone blocks — bottom right. The limestone slabs were dressed to create a point at the apex where they met. A second layer of slabs was dragged into place and locked into position, while the sand was removed for a second time from the chamber beneath.

Finally, several layers of stone were set in place to represent the foundations and base of the pyramid. The chamber and its cap were covered over, the portcullis doors were surrounded with masonry, and the whole was completed as an experiment.

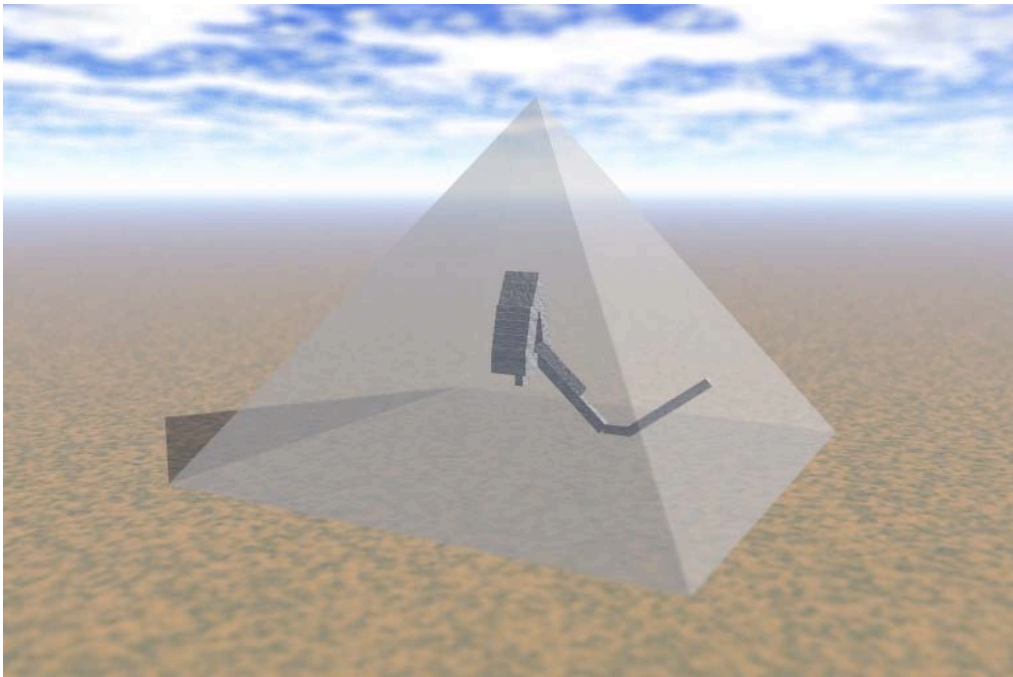
Entering the passageway, and going into the chambers gave the impression to Hemiunu, and to others, that the whole set up had been built in masonry. It was stable, the dimensions of the chamber were exact, and it was relatively simple compared with corbelling. His fellow architects were interested and impressed, but not convinced. Their mindset was on corbelled chambers higher up in the masonry...

The Bent *ka* Pyramid

One of Hemiunu's first solo assignments was the small *ka* pyramid that sits to the south of the bent Pyramid at Dahshur. He decided to use the opportunity to try something spectacular and difficult: he wanted to corbel on an incline.

Corbelling had always been undertaken on the horizontal up to that time. Hemiunu's idea was to create a passage, inclined at 14 *seked*, and approaching the sarcophagus chamber that was to be placed in the *ka* pyramid.

Hemiunu's plan was simple, but effective. He built twin 14-*seked* ramps and, alongside, two substantial construction walls running north-south and only a few cubits from each other – just about the outside width of the passage. These construction walls would form part of the eventual structure, i.e., they would be hidden within the completed pyramid.



The two walls provided platforms for the builders and to raise the corbels, which were then lowered from each wall on to the ramp below—see figure below. The corbels started at the bottom of the ramp, with others being added as the construction walls rose on either side.

Eventually, the corbels from each side nearly met in the centre above the ramp. Horizontal stone beams were used to bridge the small remaining gap. The burial chamber itself was a conventional corbelled affair set into the masonry at the top of the gallery that Hemiunu had constructed. As the rest of the pyramid masonry was added, layer-by-

The Secret Diaries of Hemiunu

layer, the construction walls, the gallery and the burial chamber gradually disappeared from view.

Corbelling on an incline. The top left graphic shows the twin ramps that formed the basis of the slope of 14-*seked*.

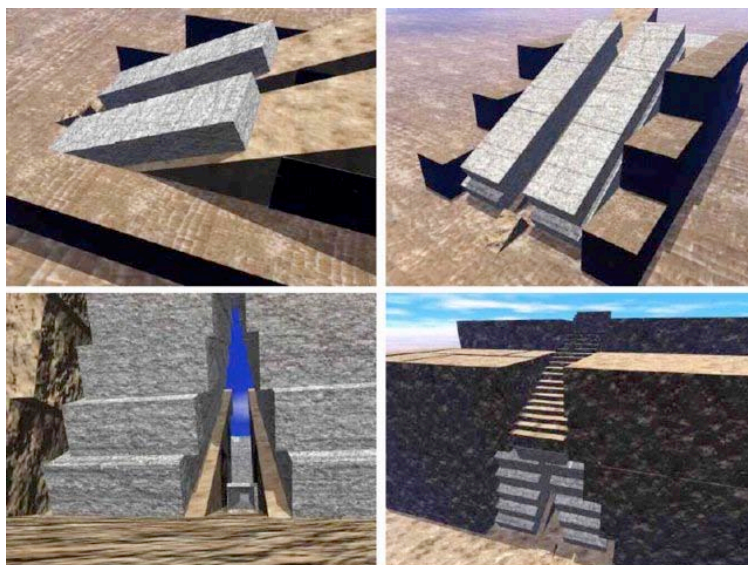
The first two corbels have been placed on the ramps.

Beside the ramps are the beginnings of the twin construction walls, on to which successive corbels would be cribbed.

Top right shows an end view, with several layers of corbel in place, and the construction walls correspondingly higher.

Bottom left shows a view between the two ramps, and the vestige of a passageway in the distance, purpose unknown

Finally, bottom right, the inclined corbelled gallery is complete. And overshadowed by the construction walls, which go on to form part of the bulk of the pyramid.



The finished structure was entered conventionally up on the north face, leading from which was a passage inclined downwards at some 14-*seked*. When the passage reached about ground level, there was a short horizontal section, before it started to rise, still as a simple, rectangular cross-section passage. Suddenly and unexpectedly, it opened out into the gallery that Hemiunu had conceived, with its high roof giving an impression of vastness and openness, even in this tiniest of pyramids.

The effect was impressive. Architects came from other sites to marvel. It was not obvious from looking at the finished product just how it had been achieved. Even Crown Prince Khufu took time out from his busy schedule to visit. To many, it looked like magic, and Hemiunu's reputation soared accordingly.

Hemiunu was formulating a plan. Looking ahead, he was well aware that he was the leading, perhaps only, candidate to be the overseer and chief architect for Khufu's Pyramid. Hemiunu had had a broad design in mind for some time, and building the *ka* pyramid at Dahshur gave him the chance to try out his ideas.

Hemiunu's *ka* pyramid has many features that anticipated those in the Great Pyramid. There is a passage descending from the north face, which then turns upwards and eventually becomes the corbelled gallery, like the much larger one in the Great Pyramid. While the gallery was a test piece for corbelling on an incline, it also had a practical purpose; it was used to store the stone blocks which would be lowered into place to seal the southern part of the entrance passage. Stones for the northern part were loaded into, and guided down, the inclined passage from outside as part of sealing off the pyramid.

The burial chamber in both cases is at the top of the gallery, although in the case of the *ka* pyramid it was too small to house a sarcophagus. Instead, Hemiunu revealed, it was intended to house a statue of King Snefru, which could be revitalized by his *ka* in the afterlife.

Unlike the Great Pyramid, however, the burial chamber has a corbelled roof, with the corbels rising rather high for the size of the chamber. Hemiunu was taking no chances....

Foundations and Stability

Pyramid foundations were a problem. Hemiunu had already seen that the foundations of the outer cladding that his father, Prince Neferma'at was proposing to add to the Meidum Pyramid were an issue, due to the crumbling nature of the rock surface there.

Similar problems arose at Dahshur, particularly for the Bent Pyramid, and it had proved necessary to do some shoring up. Hemiunu felt that there ought to be a better way, and as was becoming his trademark, he undertook a series of experiments. The one with which he was most pleased, according to his diary at least, was the process of levelling. Hemiunu believed that it was essential to have a perfectly level foundation and first layer, or else the whole structure would turn out to be a series of corrections and over corrections as the layers of stone crushed down and settled.

His eventual method of foundation levelling is shown in the figure. First, a rectangular channel was dug, to the dimensions of the pyramid or other structure. Then, the channel was filled with water, and on a still day, the level of the water was marked all the way around on the inside and outside of the channel wall.

One way to mark the wall was to squirt dye into the water, which stained the stonework; Hemiunu used a dye made from crushed beetles. Hemiunu also insisted on a still day because he had observed that a breeze could pile up the water, so that the downwind water level could be as much as two fingers above the upwind level.

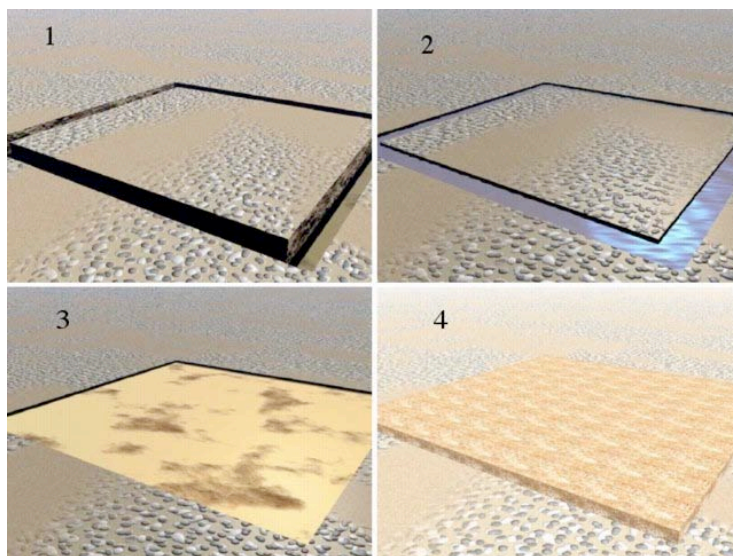
The centre of the rectangle was then carefully dug out to the level of the watermark, using posts and string to mark the level across the open area. Finally, the first layer of stone was fitted, stone by stone, to the exposed surface, to create a perfectly flat level; in principle. Hemiunu recorded that it took practice and expertise; only his best

Levelling the foundation area was achieved using water. A channel was dug out, and water introduced containing a dye.

The area inside the rectangular channel was then chiselled away to the level of the dye mark around the edge.

For larger areas, a grid of channels was used, instead of just one rectangle. Otherwise, the method was identical.

As a result of Hemiunu's experiments, this became the standard levelling method for the duration of the Old Kingdom.



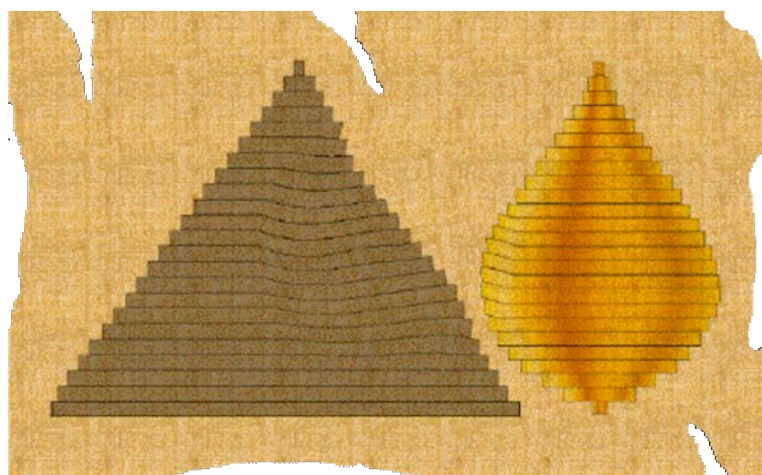
The Secret Diaries of Hemiunu

builders could achieve sound results, but when they did, the work was impressive.

Hemiunu's Calculator

Hemiunu's diary was full of calculations at this time, many of which are unintelligible; they were more like hasty scribbles than rational thoughts. Some research by the Exploitation Team revealed that Hemiunu was trying to create a standard calculator, using which he could make estimates for any pyramid with respect to how long it would take to build, how many men would be needed, how much stone, etc.

The picture below, taken from the diary, puzzled researchers for weeks; finally, one of the researchers realized that the width of the gold bars on the right corresponded to the amount of work needed to raise the tier of stone on the left. Hemiunu had cracked the problem of the one-third completed pyramid.



Is this the world's first bar chart?
Hemiunu undertook a vast amount of calculation in his efforts to understand pyramid design and construction.

In this example from his diaries, Hemiunu has drawn a tiered pyramid on the left, while on the right the length of the corresponding bars indicates the amount of work needed to raise the appropriate tier.

So, the first tier does not have to be lifted, and there is very little work.

The second tier has slightly less stone, but all of this has to be lifted by one tier. And so on, to the top.

Hemiunu showed that, regardless of pyramid size or number of tiers, the greatest amount of work arose in raising the tier that was at one third of the overall height of the pyramid – an observation of which few are aware even today.

In the process, Hemiunu had unwittingly used basic forms of both integral and differential calculus.

Ignoring the quarrying and transporting effort, and considering only the work involved in raising the pyramid proper, Hemiunu had worked out the amount of work on a tier-by-tier basis. The lowest tier was the largest, i.e., had the most stone, but none of it had to be raised. The second tier had slightly less stone, but all of it had to be raised up by just one tier above the foundation. At the very top, there was only the pyramidion to raise, i.e., very little stone, but it had to be raised through the maximum number of tiers.

Hemiunu had found a universal rule. The maximum amount of work in raising a tier– for any pyramid – occurred at one third of full height; this was where the product of the numbers of stone in the tier, multiplied by the tier height, reached a maximum.

So, the golden pear shape on the right of the figure may well be the world's first bar chart, with the length of each bar corresponding to the work needed to raise the corresponding tier.

Hemiunu had repeated this calculation for at least ten notional pyramids, each with a different size and number of tiers. He found the volume of each tier by calculating the volume of the pyramid above it, without the tier, and the volume of the pyramid above, including the tier; subtracting one from the other gave the volume of the tier. It is the same method as is used today. Hemiunu had, in the process, cracked the basis of simple calculus. He found that he got virtually the same result regardless of the number of tiers.

Hemiunu was clearly fascinated with this result. It opened up great possibilities for him. If he knew the proposed size of a pyramid, he could work out quite accurately how long it would take to build, provide he knew how many workers were to be available. Conversely, if the objective was to make a pyramid rise steadily instead of slow down as it approached one third of full height, then Hemiunu could predict how many additional men should be put to work each year to ensure steady upwards progress.

Stone size

Hemiunu also experimented with the size of stones, particularly of the limestone blocks used for building the body of the pyramid. He found that smaller blocks were less likely to be perfectly regular, and that laying a course of smaller blocks created an uneven surface for the next course. This in turn led to blocks cracking and crumbling at the corners, and to a tendency for blocks to shift sideways under the load from above them. It was this sideways thrust that led to instabilities, and layers of stone settling noisily and unexpectedly.

The solution was to quarry larger blocks, as large as practicable, and to dress them so that, at least, the upper and lower surfaces were smooth and parallel, and the height of each block in the course was identical. Each block then sat steady and unmoveable in its place, with no settling, no sideways thrust, and no instability. One problem that remained was the inordinate amount of time it took to dress each of these large stones, to make it perfectly flat and regular on all sides.

The Search for Perfection

Hemiunu was a seeker after perfection, and his research was to lay the groundwork for the pyramids at Giza. Not that all would be well; there would always be difficulties in such enormous ventures, but at least the essential groundwork had been done, and Hemiunu could now visualize the "perfect pyramid." His diaries use this term repeatedly, without defining what the perfect pyramid looked like. It seems likely, however, that the Great Pyramid of Khufu embodied his ideas of the perfect pyramid....

The Corvée—Legend and Practice

Much has been made of the so-called corvée⁴. Egyptologists, have presumed, without any hard evidence, that the only way in which labour could be brought together in sufficient numbers to construct a pyramid was by recruiting labour from the various nomes up and down the Nile.

Egyptologists have assumed that an annual corvée took place, to provide a seasonal workforce for pyramid building.

Hemiunu's diaries show that farm workers, far from being available for a corvée during the Inundation, were exceedingly busy at that time.

Hemiunu also doubted whether farm workers would necessarily make good pyramid builders.

He believed that pyramid builders were highly skilled and experienced people, and that it was the greatest honour to work on the king's pyramid.

This is not an unreasonable supposition; during the Inundation, for example, it might be supposed that there would be a large numbers of young farmers with little to do until the waters started to recede, and they could get at their land. It has even been suggested that building pyramids was a form of national service, designed to prevent the discontent among the many, idle farm workers.

The evidence from Hemiunu's diaries did not quite see things in that light. First, the idea that farm workers would be idle during the Inundation did not fit. It was essential to trap the water once it had flooded the land; only by trapping the water would its life-giving silt slowly settle out on to the land. This meant that irrigation channels, water traps, barriers, baffles, etc., had to be in full working order, despite having just been overrun by a sometimes-raging torrent. Farm workers were, in fact, very busy at this time repairing dykes, barriers and traps, digging out choked ditches and channelling the silt-laden water on to areas of ground that had not previously been cultivated.

There was a period, for some time before the Inundation, however, when there was a slack period for farm workers. Crops had long since been harvested, and the heat of the sun had baked the surface of the land into a dry, dusty cake. Animals still had to be looked after, but arable farming was in suspension. And it did seem to be true that the relentless heat of the sun caused tempers to fray from time to time...

Just because some farm workers might be available did not make them suitable for the work of building pyramids. Hemiunu believed that the work of building the king's pyramid was an honour that should be granted only to the most able and devoted of the king's subjects. Moreover, farm worker were not necessarily suited to working with stone, to quarrying, hauling, rope-making, tool making, and the host of other tasks necessarily associated with the pyramid engineering business. Some might have potential, once they had been trained, he conjectured. But how to find those who might be suitable, how to recruit them to the tasks of pyramid building, how to train and enthuse them to take on this most demanding of roles...?

⁴ Corvée: a period of labour sometimes required by the state in lieu of taxes, or, a day of unpaid labour required of serf for a manorial lord

Hemiunu Leads the Games

Hemiunu had an idea. He would institute an annual, national event, to be held up and down the country in the various nomes, towns and estates. These “games,” as he called them, encouraged the young people to compete with each other for prizes, to see who was best at running, throwing javelins, shooting arrows, lifting weights, etc.

Hemiunu’s idea had instant appeal. He travelled up and down the Nile, coupling one of his periodic progresses as the king’s vizier with a publicity campaign for the proposed games. With King Snefru’s backing, he could hardly fail....

The games were designed to entertain the people, of course, but they also identified the most capable young people, of both sexes. Hemiunu established a series of competitions, including running over various distances, jumping over obstacles, wrestling, rowing, sailing, throwing, archery—his personal favourite—and weight lifting. There were other events to encourage participation, including hay baling, pig catching and donkey racing. Prizes were provided by the nomarchs, as part of their duty to the king, and consisted of food, fine linen clothing, animals, etc. Some prizes were given to individuals, but often the prizes were allocated to the village of the winners, to encourage wider participation.

Lastly, the winners in various categories were eligible, but only if they so wished, to be considered either for entry into the school for pyramid builders, or for the army. If they applied, and were successful, they were assured of a full career and, additionally, their family would receive an annual award of food and clothing from the king for each year of honourable service.

The annual games were a great success. By making entry to the pyramid builder’s school a high status prize, Hemiunu had ensured a ready supply of the best young men to be trained. It became a badge of honour for each successful applicant’s family that their young man was “a pyramid builder.” Successful young women could also apply to become managers and organizers of provisions and care for the pyramid builders.

So, there was no compulsion, and no corvée in the sense of a tax on the nomes. Instead there was a ready supply of able young men keen to be of service to their king and country. Hemiunu’s games were remarkably successful, and his ideas were carried though into the way the pyramids were built, using competing teams working for prizes against each other. Hemiunu had discovered the secret of establishing and maintaining high morale.

Only one aspect of the games disappointed Hemiunu; he never won an archery prize, in spite of competing in every “games” that he could....

Hemiunu instituted annual games up and down the Nile. The games were competitive, and were designed both to entertain the people, and to highlight the most capable young men and women.

Winners were eligible to be considered for entry into pyramid builder’s school, or the army – but only if they so wished.

By making the work of pyramid building high status, Hemiunu managed to recruit the best young people who were both able and keen to serve king and country.

His approach to raising and maintaining morale was carried through into the actual building of pyramids, undertaken as it was by teams competing for prizes.

Pyramid Progress

For Hemiunu, time seemed to fly by when he was working at Dahshur. Although the original intention had been to raise both the Bent (southern) and the Red (northern) pyramids in parallel, things had not worked out quite according to plan.

The two large pyramids at Dahshur were progressing well. Neither found entire favour, however, with the Bent Pyramid being criticized by its lack of “purity,” due both to its shape and to building problems, while the Red, or Northern, Pyramid was deemed by some as “too squat.”

Even King Snefru seemed to be undecided as to his final resting place. Was it to be here, at Dahshur? Sarcophagi had been installed in both pyramids. Or, perhaps, at Meidum? Or elsewhere?

In practice, the Southern Shining Pyramid, had been built more rapidly, largely for political reasons—or so Hemiunu believed. Senior officials and socialites at King Snefru’s Court were eager to reserve their places in the afterlife, which necessitated them being interred in their own mastabas as near to the king’s interment as possible.

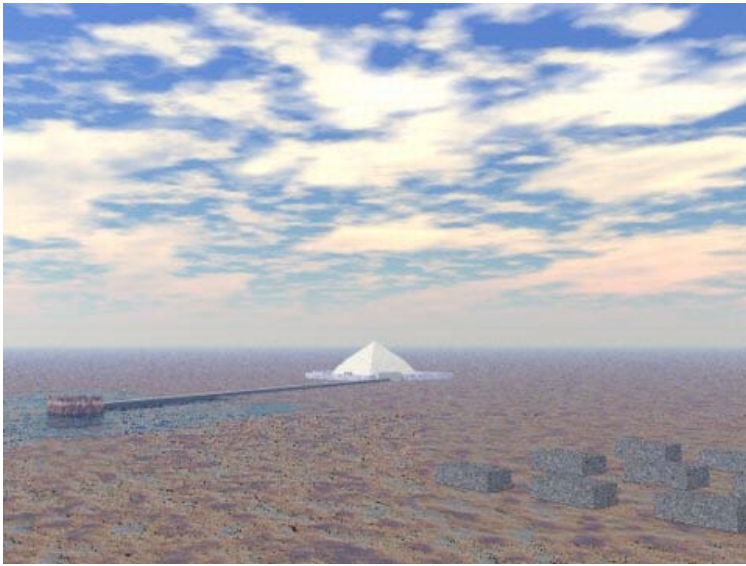
It had been determined by the priests of Heliopolis that the most propitious site for the mastabas of the well connected was midway between the Bent and the Red Pyramids, and to the north east of the Bent Pyramid. Snefru, of course, had not committed his mortal remains in advance to either of the pyramids, which left his courtiers feeling uncertain – hence the pressure to complete the Bent Pyramid, and remove the uncertainty.

The Bent Pyramid had, indeed progressed well, and was ahead of its “twin.” This was partly due to the additional attention it had received; during the raising of the lower tiers, major problems had arisen with the foundations crumbling. The ground on which the pyramid was built was composed of sand, clay and gravel, and the base had required extensive “stabilizing,” as Hemiunu called it. All was well, once this stabilization had been effected.

There were critics, however, who talked in muted tones about the unfortunate appearance of the Bent Pyramid. To some, apparently, it just “did not look right,” with its two different slopes. Others suggested that the Bent Pyramid was “flawed,” and that it was unlikely to satisfy the king. The emphasis, in some minds at least, started to move towards the Northern Pyramid as perhaps now more likely to be the king’s final resting place. As a result, mastabas of the officials and courtiers started to spread northwards. So the developing mastaba “city of the dead” spread, but in an orderly fashion, with the mastabas in neat rows and columns, representing their individual “palaces of the afterlife” arranged in avenues and streets.

The Red Pyramid rose steadily in its turn. It was the first true pyramid, and the various pundits were impressed with its perfect regularity of form. It was precise, it was pure, and it was indeed perfect. Or was it? King Snefru was well pleased, by all accounts, but Queen Hetepheres had been heard to mutter that it was “too flat,” its sides were “too shallow,” and it looked altogether rather “dumpy.” (This is the nearest term that the translators could up with.)

King Snefru was advancing in years. He had been on the throne of Egypt for some time, and he had yet to make up his mind...



The picture at left shows the completed Bent Pyramid within its Temenos wall, connected via a covered causeway to its valley temple at left. Out in the desert today, the valley temple was then at the head of a natural inlet. This had been enhanced by Snefru's engineers to bring Nile water, shown in flood in the graphic, up to the temple during the Inundation.

Granite from Aswan and limestone from the Tura Mountains were both brought to the landing stage and hauled up the causeway during the construction phases, before the causeway was paved, walled, roofed and decorated internally.

At right can be seen some of the mastabas of Snefru's royal circle of elite nobles.

Initially, the king favoured the Bent Pyramid, and it certainly was an object of pristine, white beauty. However, as time went by he came to doubt its magical potency, because its shape was not "pure," but rather a design compromise.

The Northern, or Red Pyramid was, he considered, a safer bet for the afterlife. It was, after all, a perfect, pure shape, and its internal construction had come much closer to specification than the internals of the Bent Pyramid. It stood to reason, therefore, that its magical potency as a means of safeguarding and transporting the king's soul in the hereafter would be superior to that of the Bent Pyramid. Besides, there was Hemiunu's dream to consider....

The graphic below illustrates the interior of the covered causeway. Only narrow slots, set into the tops of the walls at intervals, lit the passage. Between these pools of light the interior was dark, almost concealing the many figures of animals, deities and nobles carved in relief and painted on the walls. A brazier at the pyramid end guided the faithful even at night.



Return to Meidum

Before the Northern, or Red, Pyramid was even half completed, King Snefru sent word that he wanted the pyramid at Meidum to the south to be turned from a stepped pyramid into a pure pyramid, with a slope of precisely 5-1/2 *seked*. (51°50'35")

Hemiunu was, of course, aware of the plan, which had been formulated when he first started working with his father, Prince Neferma'at. The prince, as King Snefru's Overseer, was responsible for the work. The king was away at the time, defending the border with Libya to the west, but he apparently made it clear to Neferma'at that the Meidum Pyramid, if completed in time, might serve as the king's final resting place. He also instructed that the Meidum Pyramid was to be ceremonially, and significantly, renamed "Snefru Endures." (Hemiunu did not record its previous title.)

Neferma'at was surprised at this and confided as much to his son Hemiunu. The interior of the pyramid at Meidum was quite rough by the standards that had been achieved at Dahshur, both in the main pyramids by Neferma'at and in the *ka* pyramid by Hemiunu. Moreover, there was a sarcophagus for King Huni already in the Meidum Pyramid, put there before the pyramid had been built over the top. Pre-positioning was necessary since the entrance passage through the masonry was too narrow to allow a bulky sarcophagus to pass. It would be necessary, Neferma'at suggested, to prefabricate a second sarcophagus in parts, and reassemble it in the pyramid's burial chamber.

Hemiunu wondered if the king's suggestion of interment at Meidum was a ruse, and was scolded by his father, Prince Neferma'at for even thinking it. The prince explained that the king's family had long association with the area around Meidum. Many of the king's relatives were interred there; even Queen Hetepheres was due to be interred there. As Hemiunu knew, Prince Neferma'at had spent many years creating a final resting place for his wife and himself at Meidum.

(The diaries show that Hemiunu, like the dutiful son he undoubtedly was, listened to his father, but was privately unconvinced.)

Snefru's Design Concept

Hemiunu asked his father again, after an interval of over 15 years, why the king wanted a slope of 5-1/2 *seked*; it was question that had remained unspoken – and unanswered – between them for ages. The prince finally explained.

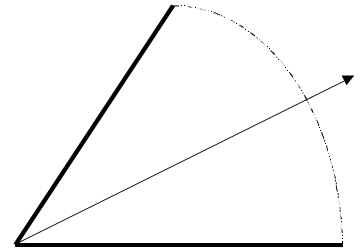
A major concern of the king was that his pyramid should be able to project him to the heavens so that he could both enjoy his afterlife in his palace among the northern stars, and negotiate the annual Inundation with the Osirian stars to the south. An equal concern for the king was that his spirit, his *ka*, should be able to find its way back

from the heavens to his resting place, so that his mortal remains, his *ba* and his *ka* could re-associate—essential for the soul to endure.

The priests of Heliopolis had calculated that on day of his birth, the light from the Sun at its highest point, midday, would be reflected horizontally off the polished face of the pyramid towards the south, upper Egypt and the Holy City of Abydos, provided the pyramid slope was precisely $5\frac{1}{2}$ *seked*. This corresponds to a birth date at the end of the month of Thoth, during the season of *akhet*, the Inundation (29-31st August.) Hemiunu felt it just as likely that the king's spirit, looking from Abydos, would be directed towards the southern heavens and the Sun by reflection of the smooth side of the pyramid.

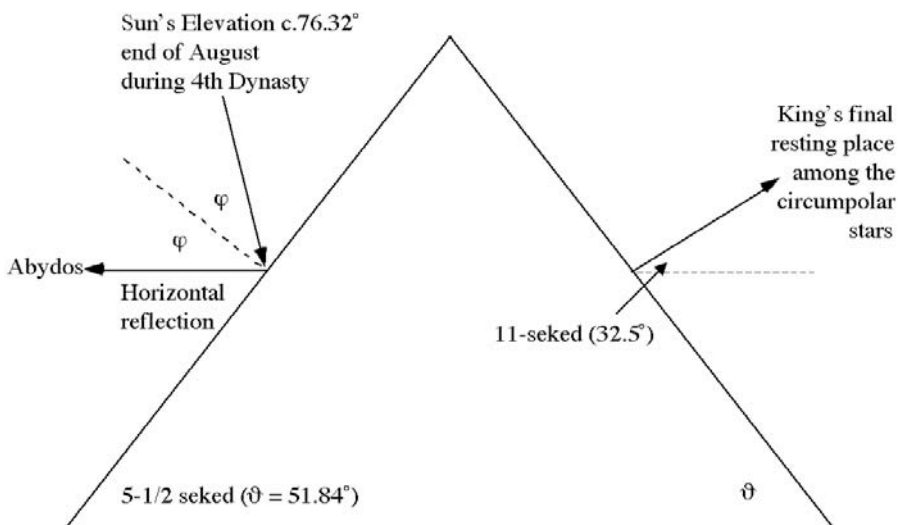
The priests had also calculated that bisecting the slope of $5\frac{1}{2}$ *seked* gave a slope of 11 *seked* (32.5 degrees) and that this slope pointed directly at King Snefru's particular star amongst the Imperishables—the circumpolar northern stars. They likened it to a bow and arrow, with the arrow notched in the lower left corner of the pyramid—see graphics. The pyramid-as-a-bow would then fire the arrow at the bisected slope towards the northern stars. So, different birthdays for different kings indicated different pyramid slopes and different star-palaces in the northern heavens.

Evidently, the choice of $5\frac{1}{2}$ *seked* was propitious on two counts: it reflected the life-giving rays of the sun towards the Holy City on the day of the king's birth; and it pointed to his final resting place among the stars. Hemiunu was satisfied with this notion; it fitted with his ideas of appropriate magic, and with the unique relationship that he felt that a king should have with his pyramid. It was also compatible with his mounting suspicions that the king's were not actually interred in their pyramids, but most probably at a secret site in Abydos...



The bow concept. The priests of Heliopolis proposed that the pyramid acted like an enormous, powerful bow, able to project the king's *ka* to his palace among the circumpolar stars.

The slope at which the "arrow" was launched bisected the pyramid slope, so the choice of pyramid slope effectively "aimed" the king's *ka* towards his particular star-palace.



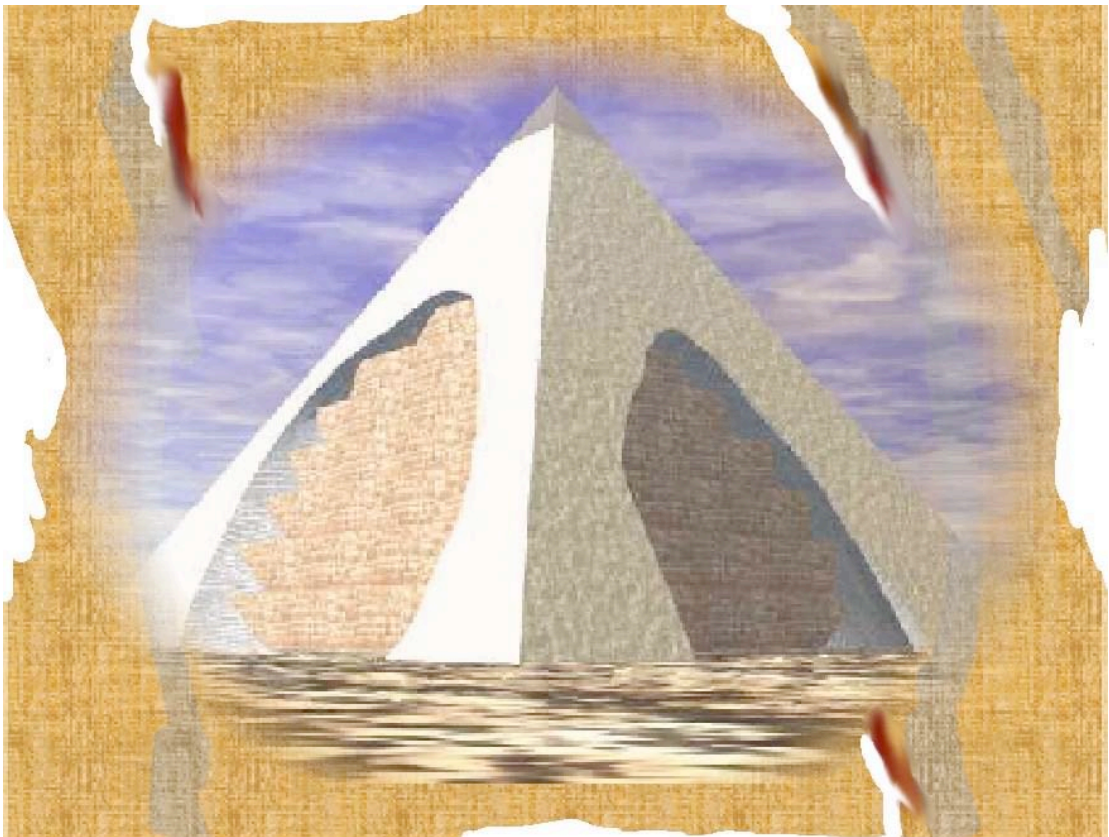
Achieving the Shape

Prince Neferma'at started work at Meidum immediately he received instructions from the king. Hemiunu assisted him, taking some of the workers off the Bent Pyramid, which was nearly finished, and some off the Red Pyramid, which was not. Hemiunu also started a recruiting drive for more builders, by increasing both the size of the annual games, and the prizes for winners. This would take nearly a year to have any effect, but it could not be helped.

Hemiunu also increased activity in the Tura Mountain quarries, as both the Red Pyramid and now the Meidum Pyramid, too, would require the special white Tura Limestone to form their casing stones. Neferema'at reopened the limestone quarries at Meidum; turning the stepped pyramid into a perfect pyramid shape was going to require a large amount of limestone to act as packing.

Hemiunu did not record the method of work at Meidum, but he did paint the scene at a stage during the conversion process. The painting, which shows the work only partially completed, is revealing.

First, it is evident from the painting that there were more than the eight steps that Hemiunu showed in his first painting. It seems likely that, as part of the process of creating a "pure" pyramid, some



additional steps had been created, probably to simplify the problem of packing the very large steps that were there to begin with. Originally, there had been seven steps, then eight, now it seemed there were at least a dozen. This meant that the amount of Tura limestone needed for the casing would not be excessive, as each step was smaller.

Contrary to current wisdom, the builders had not started from the top and worked down, nor had they started from the bottom and worked up. Instead, they evidently started at the corners, building up the quoins from the bottom to the top until all four corners were complete, and the capstone was in place.

Hemiunu's painting suggests the reason for this; the builders used the pyramid steps as platforms while raising the corners. Then the builders worked across from each corner to meet in the middle, filling in each tier from the top to the bottom. Again, they were able to use the existing steps as platforms. Hemiunu suggested elsewhere that the outer casing stones were locked together, so that bottom edge of an upper stone overlapped the upper edge of a lower stone. This prevented rainwater and wind from penetrating under the casing stones, as well as adding to security.

Finally, when they reached the bottom, thick paving stones were placed around the base of the pyramid, overlapping the bottom casing stones and locking them all in place.

Snefru is Satisfied

On his return from the wars, King Snefru visited both Dahshur and Meidum. He was particularly impressed with the achievements at Meidum, which had transformed his father's original stepped pyramid into a splendid, pure pyramid. It was completed at about the same time as the Red Pyramid, but in Hemiunu's view, it was much more imposing.

The reconstruction shows the Meidum pyramid, as it would have looked from the desert at about midday in the month of *Pakhons* (April) in the season of *shemu*, harvest. The Meidum pyramid was the first pure pyramid ever built, according to Hemiunu, who was inordinately proud of his father's achievements.



Snefru Dies

King Snefru had reigned for some 24 years. Under his rule, Egypt had prospered, the population had grown, and life had been good. Everywhere *ma'at* ruled, or, if it was temporarily disrupted, then *ma'at* was quickly restored by the king or by his viziers. The king was regarded as benevolent, one who cared for, and looked after his people. He had personally conducted military campaigns against the Nubians in the south and against the Libyans in the west. And he had conducted a vigorous building campaign, not only of pyramids, but also of temples and shrines up and down the Nile.

However, he was getting older. Without warning, he died. He had been resting in his palace, and he simply did not wake up. Hemiunu was clearly shocked. The king had reined for as long as he could remember, and he had become used to the idea that Snefru would always be there.

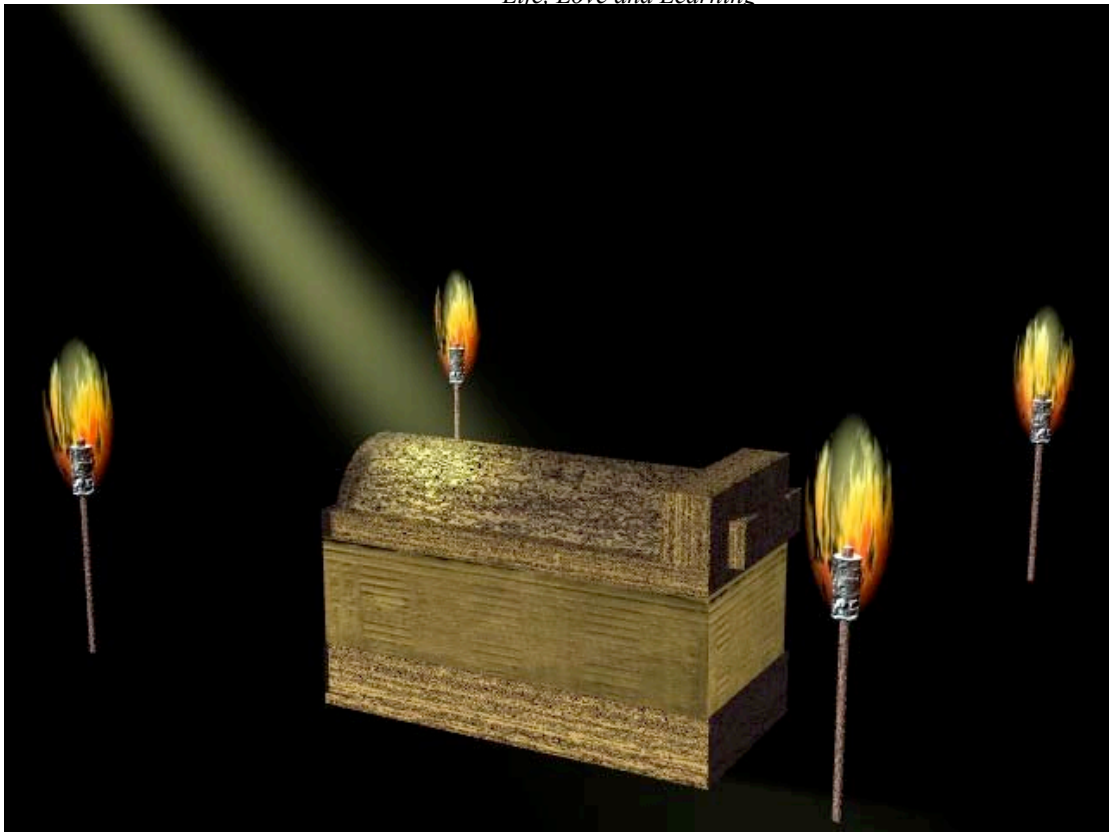
There should have been a well-oiled state machine that leapt into action to deal with this predictable situation. There was not. For a while, at least, there was chaos. Then Crown Prince Khufu stepped into the breach, as was his right, summoned the courtiers, officials and viziers, and held a meeting at which he made it clear who was now the ruler, and how things were going to proceed. Officials were sent out the various nomes, to let everyone know what was going on, and to invite nomarchs and others to the various ceremonies surrounding the King's interment, which would take place some seven weeks (i.e., 70 days) after his death—Hemiunu referred to it a “the King going to his *ka*.”

Preparations had to be made for the king's entombment. It emerged that the king was to be interred in the Northern, or Red, Pyramid. Crown Prince Khufu would lead the entombment ceremonies, and immediately after he would be proclaimed the god-king Horus, in the approved and traditional fashion.

Hemiunu was not closely concerned with the entombment; his father, Prince Neferma'at, was the king's principal vizier, as well as having been his closest adviser. Nevertheless, Hemiunu observed and recorded activity both at the Bent Pyramid and at the Meidum Pyramid.

Hemiunu made it his business to observe what was going on. The sarcophagus in the Bent Pyramid had been carefully sealed. A brand new wooden coffin had appeared in the Meidum pyramid, freshly painted and sufficiently heavy to be carrying a body. Whatever was in the sarcophagus and the coffin, Hemiunu knew that it was not the mortal remains of Snefru.

The day of the entombment was a sad time. From his diary, Hemiunu was clearly upset. Priests at a temple near Heliopolis had mummified the king, and his remains were brought by royal barge in an elaborate,



painted wooden coffin to the valley temple of the Bent Pyramid at Dahshur. Three small boats, each rowed by six marines in uniform towed the barge. The noise of their blades in the water was the only sound; even the birds had fallen silent.

After a brief ceremony in the Valley temple, the cortege entered the covered causeway leading to the Bent Pyramid, and proceeded in silence to the pyramid. Priests within the Temenos wall surrounding the pyramid conducted further lustrations. The cortege then set out to the Northern, or Red, Pyramid where the same procedure was conducted.

Crown Prince Khufu then led a small party carrying the coffin into the Pyramid, through the northern entrance. This party remained inside for many hours, until it was dusk. Finally, they emerged and the formal entombment was over. Hemiunu could not help noticing that a plain, sealed coffin was quietly removed from the pyramid. As he watched surreptitiously, his father and two of his uncles, took the coffin down to a waiting boat, and rowed off quietly into the night....

After Snefru's entombment in the Red Pyramid, there was a period where the elite nobles and courtiers could visit the burial chamber.

Four torches lit the sarcophagus, and a narrow beam of sunlight, reflected into the chamber by polished metal mirrors, highlighted the heavy lid..

The sarcophagus was carved with the pattern of Djoser's palace facade on its ends and sides. The lid, which was enormously heavy, was carved from one large slab of limestone. It had a barrel shaped top, with one end formed into a rectangle, and two small protrusions on the outside. Hemiunu knew that this was part of the magic surrounding the sarcophagus, which allowed the King's *ka* to leave and re-enter at will

Snefru's Entombment

The King is Dead, Long Live the King

As the heir, Khufu managed and officiated at the entombment of his father. As Snefru was ceremonially transmogrified into Osiris-Snefru, ruler of the Netherworld, Khufu was simultaneously sanctified and became Horus-Khufu. As Horus was the son of Osiris, so Horus-Khufu was the son of Osiris-Snefru. This ritual progression was the legitimisation of Khufu as the god-king of Egypt. Conceptually, the line of succession had been unbroken since Osiris himself was a real, live king of Egypt.

Khufu was evidently upset at his father's sudden death. Hemiunu observed, however, that his distress was tempered by his pleasure at ascending to the god-kingship; he was middle aged, and had been waiting impatiently for his opportunity. Nonetheless, Khufu performed his ritual duties as the dutiful son he undoubtedly had been.

After the formal ceremonies had taken place in the temples and the burial chamber of the Northern Pyramid, Khufu "progressed" to the king's palace with his full retinue. There, Hemiunu knew, there would be feasting and celebrations throughout the night and the following day. Hemiunu, however, had a different sort of invitation.

The Family Interment

Hemiunu received a message from his father, Prince Neferma'at, indicating that he was needed urgently and immediately for some family business. Hemiunu guessed what that business was going to be. His father and his uncles, Kanefer and Uhemka, (Neferma'at's brothers) were getting a little too old for the nefarious activities he felt sure they had in mind.



Hemiunu took leave of Neferhetepes and hurried off to meet the co-conspirators. They had a boat waiting, and as Hemiunu jumped aboard they set sail up river. They sailed all night, and at dawn they pulled in over some overhanging tree branches, and had breakfast. Nobody mentioned the large wooden box on the deck, covered with a heavy cloth. At a glance, Hemiunu could see that it measured two cubits by three cubits by four cubits, the magic

measurements for a royal coffin.

Resting during the day and travelling only in complete darkness, they reached Abydos. Waiting for twilight, they beached the boat, and manhandled the coffin on to the jetty alongside. Four poles were poked into the recesses at the four corners, and each of the four men had a yoke with two ropes, like those used for carrying leather buckets of water. Each man looped his two ropes around the poles, so that the coffin was carried by the four men walking in line, two between the poles at the front, and two between the poles at the back.

They strode silently and in step, out into the desert as dusk fell. Hemiunu could see the hills in the distance. Nearby, the desert was featureless; they were not going in the direction of the burial grounds for earlier kings with which Hemiunu was familiar. His father and his two uncles clearly knew where they were going however, and Hemiunu made sure he memorised the route.

Eventually, well out into the desert, they came to a spot where there was a pile of spoil from underground workings. Without a word, the group set to work, checking out ladders going down the hole into the desert rock surface, testing and tying ropes on to the coffin, etc. The coffin was eased into the hole, and down about twenty cubits to a ledge. From there, it was eased down a further 20 cubits to a second ledge, and finally to the burial chamber at a depth of some sixty cubits. This, Hemiunu knew, was the depth appropriate to entering the underground Netherworld.

When they had finished, the group climbed back up to the surface, and filled in the hole, finally removing leftover spoil, and all traces that anyone had been there. There was no telltale mound, no hump or bump...nothing.

The small group returned to their respective homes, still having said nothing. There was, after all, nothing to say.

The burial chamber at Abydos. When the coffin was lowered into the large, underground chamber, Hemiunu found that the chamber had been pre-stocked with large numbers and varieties of exquisite stone jars, all tightly sealed and unmarked.

In addition there were several large trunks, one with a curious lid, and some basic furniture; tables, benches, etc.

The chamber was some 60 cubits underneath the desert rock surface – a necessary condition, Hemiunu knew, to ensure that the coffin was located within the underground Netherworld.

Hemiunu knew what – or rather who – was in the coffin, but neither his father nor his uncles spoke a word to confirm or deny his understanding. Hemiunu knew better than to ask....He had just been privy to the greatest secret of them all.



Part C. Regime Change!

Horus-Khufu

Khufu became king in effect the moment that he conducted the entombment ceremony for his father, King Snefru. However, Khufu did not wait for the formalities before taking a grip of Egypt.

Taking Control

Within days of his father's death, and with the entombment ceremony still several weeks away, Khufu sent out invitations to the many nomarchs and their families to attend the entombment and investiture ceremonies. That was to be expected: the nomarchs were all related to the dead king – that is how they achieved their status and position. At the same time, however, Khufu sent out his viziers to take stock of the land and all that was in it. This meant that much of the inspection would be carried out when the nomarchs were not in their nomes, but instead at their patron's funeral.

Hemiunu had been working with Khufu over several years to develop a design for Khufu's pyramid.

The most likely design was based on the *ka* pyramid at Dahshur.

There was also full agreement that the pyramid should be built on the sacred hill at Giza.

Hemiunu was devastated to find that the commission to build Khufu's pyramid had not gone to Hemiunu, as the natural choice, but to his cousin Prince Ankhaf.

As vizier, Hemiunu was suddenly involved in administering the work. Khufu wanted to know in precise detail all holdings of silver and lapis lazuli throughout the land. There was to be an immediate full census of the population, and of all oxen and small cattle. He wanted to know how many prisoners were still in detention, or working as slaves, from the Nubian and Libyan expeditions. There was also to be an inspection of the administration in each nome, which was responsible for recording such things as the height of the Inundation at various times during the Season of *Akhet*, the amount of land under cultivation, and by whom, and taxes—who had paid, how much, and how much was outstanding. Records were also to be inspected concerning the amount of food held in stores, predicted crop yields, and the like. The final, collated results were for Khufu only – they were not to be seen by anyone outside of the palace administration.

There was a considerable amount of work to do. Hemiunu was not sent to the nomes; instead, he was responsible, together with a team of scribes, for receiving and collating all the responses and reports. He used previous records as a start point, to show him what to expect. This turned out to be a useful baseline, as he was able to judge whether things had changed significantly since the prior census.

As the work progressed, mourners starting arriving from all over Egypt, and from bordering vassal states, too. Several of the nomarchs made a point of visiting Hemiunu, who had set up office in the King's Palace. He realized that these nomarchs were worried about what was happening at home while they were away. In fact, that seemed to be Khufu's real intention; to unbalance the nomarchs and to let them know that the soon-to-be new king was very much in charge.

Pyramid Design

Hemiunu had been working for Khufu, off and on, for many years. Khufu was very keen to “hit the ground running,” as far as his pyramid was concerned. He disapproved of his father’s approach of building three pyramids, as it dissipated effort. Instead, he wanted one pyramid, but it had to be the biggest and the best. Without any training in psychology, a subject which did not yet formally exist, Hemiunu questioned in his diary why Khufu felt a need to compensate: was it his shortness of stature, perhaps, or maybe his portly figure? Hemiunu evidently felt somewhat uneasy around Khufu, who was in many ways the opposite of his father. Snefru had been calm, tolerant, insightful slow to anger, and forgiving. Khufu was more volatile, declared that he was ‘uninterested in the detail,’ and held grudges.

Hemiunu had known from an early age that he was destined, as Neferma’at’s son, to oversee the building of Khufu’s pyramid. It was the way of things. Watching himself carefully so as not to offend Khufu, Hemiunu worked with him to outline the design of his pyramid. Khufu seemed remarkably uncertain of what he wanted, but the *ka* pyramid that Hemiunu had built at Dahshur had impressed him. It seemed to Hemiunu that Khufu wanted something like the *ka* pyramid, but scaled up to be very large.

Hemiunu had also discussed with the soon-to-be-king where the pyramid should be located. There was no uncertainty here. The mound on the plateau at Giza was the ideal spot. Not only was it reputed to be the real Mound of Creation, but it was also an ideal spot from a constructional point of view. There were excellent limestone quarries within 500 cubits, with much of the limestone forming in beautifully linear strata, making extraction straightforward. Also the site was close to the Nile, and the river rose well up the side of the plateau during the high Inundation, which should ease the transport of granite from Aswan, and white limestone from Tura.

Hemiunu was shattered one day during the middle of the census work to receive a message from his colleague, cousin and fellow vizier, Prince Ankhaf. It seemed that Ankhaf had been approached by Khufu and instructed to start work immediately on the new pyramid, using Hemiunu’s sketch designs and the *ka* pyramid as the basis for the work. Khufu had not mentioned Hemiunu, and when Ankhaf asked if he was to be working with Hemiunu, he was told to get on with the work in hand and not to ask questions.

Hemiunu replied, thanking Ankhaf for the information and congratulating him on receiving the commission. Hemiunu was, however, devastated – and angry. There could be no greater insult to his father than to have his son so publicly humiliated in this manner. And for what? Both Neferma’at and Hemiunu had behaved in exemplary fashion. Hemiunu was not just angry; he was gripped by a rage such as he had never experienced.

Death in the Family

Hemiunu Loses His Father

Prince Neferma'at had completed his many tasks in building pyramids for his King Snefru. More pyramid stone was laid during King Snefru's reign, most of it under the direction of Neferma'at, than at any other time in Egyptian history.

The famous statues of Prince Rahotep, son of King Snefru, and his wife Princess Nofret. Now in the Cairo Museum, these fine statues were found in Rahotep's mastaba at Meidum.

The two statues are quite remarkable. Note the confidence, even arrogance, in Rahotep's pose, together with his pencil moustache and gold neck chain. Nofret is equally self-assured, with her thick wig, elaborate necklace, and pronounced cleavage.

Hemiunu had watched his father, whom he had thought invincible and immortal, suddenly age and wither into an old man. Within a few weeks of King Khufu ascending to the throne of Egypt, Prince Neferma'at died in his sleep—his job was done, and he was worn out.

Hemiunu's diary stopped for several weeks, whether through grief, or because he was inundated with work in preparing for his father's interment, is not evident.

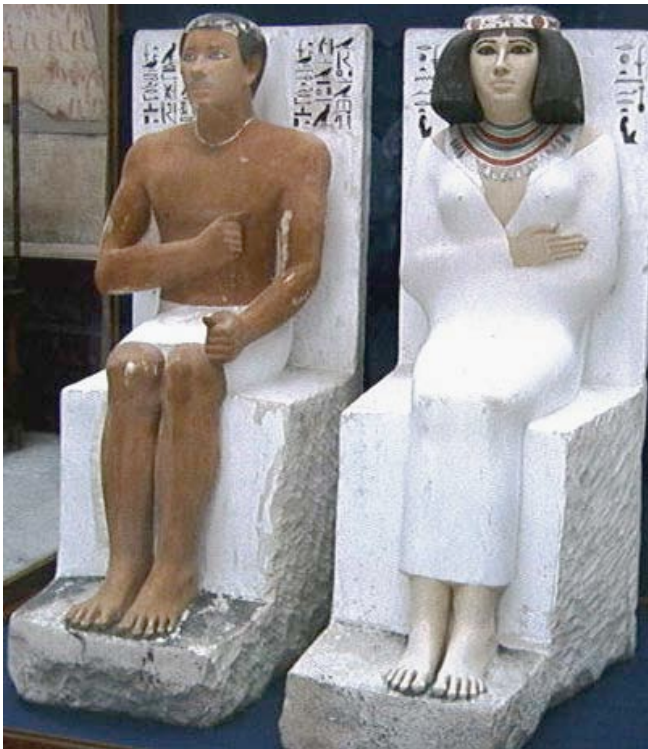
When he resumed making entries, it is clear from the context that he had taken charge of preparing the *mastaba* at Meidum to receive his father's mortal remains. There were "jobs-to-do" lists, and lists of names of those attending the ceremony of interment.

Hemiunu was also concerned about his mother, Itet, who was showing little sign of realizing that her husband was dead. She seemed to be in a trance, going about her daily rituals and duties without apparently

noticing what she was doing, or those around her. There was a place set aside in the large mastaba at Meidum for her, and Hemiunu wondered sadly if she would soon be taking her place there.

Hemiunu's two brothers, Serefka and Uhemka, looked after the business of preparing Neferma'at for the afterlife, the ritual process that took seven weeks - 70 days. His sisters, Ankhesenmeryre, Bunefer and Inet-Kaes, looked after their mother as best they could, and also decided upon the nature and content of the interment ceremonial.

The mastaba at Meidum was one of a pair. The other one was for Prince Rahotep, another of King Snefru's sons, and his wife Princess Nofret, whose statues may be seen in the Cairo Museum. Both mastabas were large and impressive, with walls crenelated in the style of a palace.



Regime Change!

Inside Prince Neferma'at's mastaba there two tombs and two chapels, one pair each for Neferma'at and Itet. The walls were beautifully decorated with paintings, and with details of Neferma'at's many titles and positions, including *djat*, vizier, and *za-niswt smsw*, eldest king's son. Neferma'at had been a most important man, head of the administration of Egypt, and second only to the king himself.

Hemiuu did not record the interment ceremony. Instead, he was taken aback by the sudden death of Queen Hetepheres I, King Snefru's great wife and mother to the recently ascended Khufu.

Queen Hetepheres had been a calming influence at King Snefru's court, and it had looked as though she might moderate any excesses of the new king, Khufu. She was a shrewd judge of both people and situation, and King Snefru had constantly sought her counsel in matters of state.

Queen Hetepheres was interred in a large mastaba between the Valley Temples at Dahshur that had been prepared for several years. She was placed in a fine sarcophagus, and surrounded by many of the material possessions she had enjoyed during her life, including that sedan chair in which Hemiuu had seen her carried all those years ago. Hemiuu attended the interment ceremony, which lasted over two days. There were ritual lustrations, women wailing, musical instruments playing dirges, and the air was thick with smoke from braziers and incense burners.

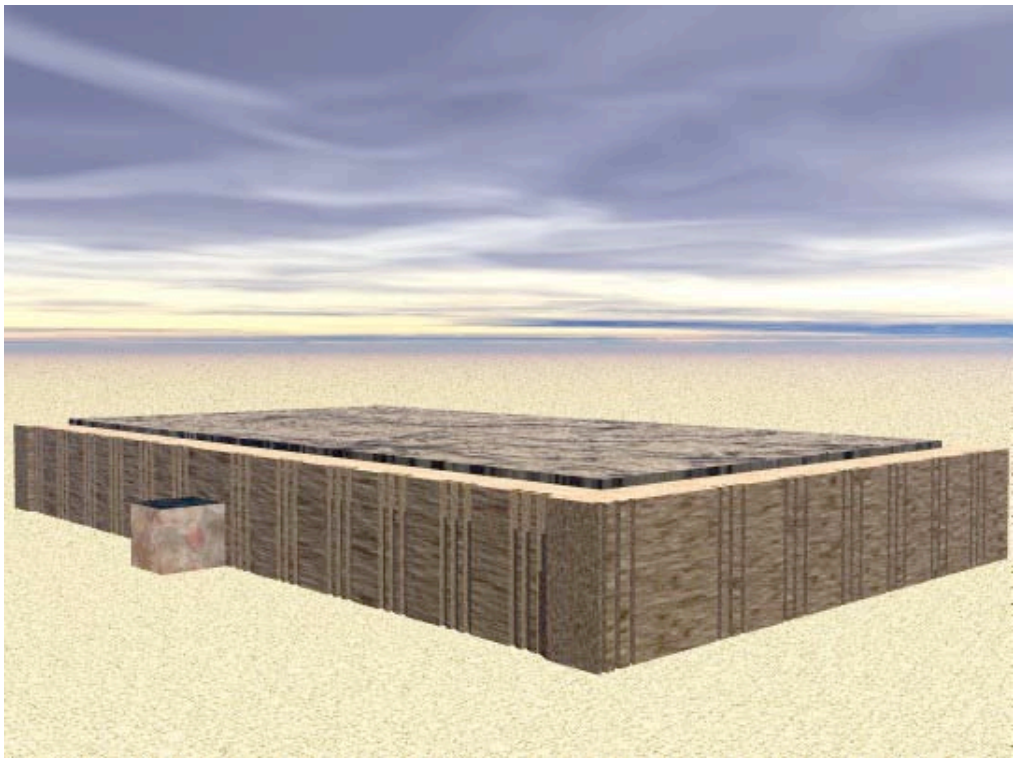
The mastaba of Prince Neferma'at and Princess Itet at Meidum.
(Reconstruction from Hemiuu's description)

The wall is carved in the style of the palace façade at Djoser's funerary complex at Saqqara – this pattern was a recurring theme of the time.

Inside were separate pairs of compartments for the prince and the princess. Each had a burial place and a "chapel," although Hemiuu described it more as a place for communing with ancestors rather than praying in any modern sense.

The walls were decorated using the style with which Neferma'at had experimented and which has come to be linked with his name. Instead of full relief, the idea was to carve channels and fill them with coloured resins, to create the picture. Unfortunately the resins tended to shrink and fall out of their channels, and the style fell into disuse.

In every other respect, however, Neferma'at's life had been a great success.



Strategic Withdrawal

Bearer of the King's Seal

King Khufu's Seal of Office? This peculiar illustration has been restored. In the background is a waterfall, possibly a scene from Upper Egypt. In the foreground is what appears to be Khufu's royal seal, although this is uncertain.

Rather than a cartouche, the design shows a *serekh*, displaying the palace façade. Like his father, Khufu seems to have favoured the *serekh*. Above the façade is Khufu's Horus name, Medjedu

The seal is sandstone, carved in intaglio, suggesting that it was used to create raised images in wax. It would have been worn around the neck on a cord or tape.

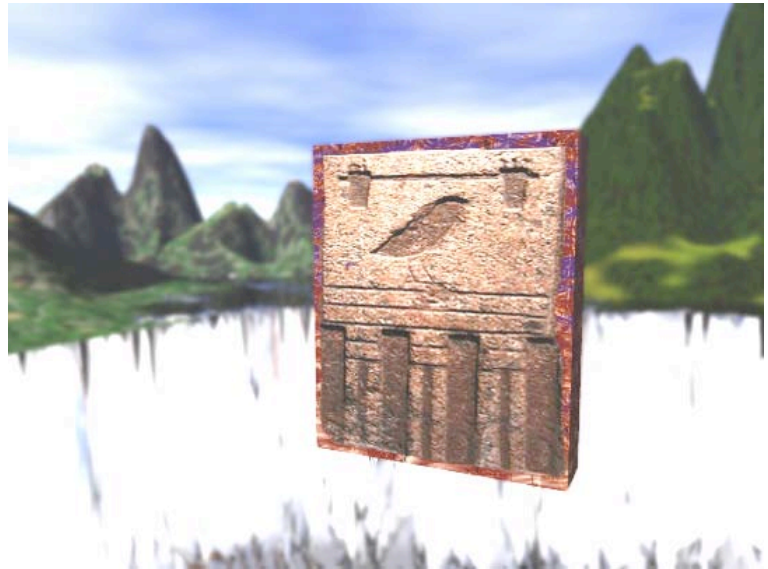
Why Hemiunu would paint his vizier's seal in this way is unclear.

Perhaps he was practising perspective. Perhaps he painted the seal – if that is what it is – over a previous painting with which he was less than satisfied.

We may never know.

N.B. The design is virtually identical to that carved on a large, damaged stone in the British Museum. The stone may have been used as a boundary marker, to delineate one of Khufu's estates.

Upon coming to the throne, Khufu had reissued the king's seals so that they bore his cartouche rather than his father's. This was normal practice. The bearer of the king's seal carried the king's authority and had, in effect, absolute power throughout the land under the king. Like other vizier's Hemiunu had been re-appointed to bear the new king's seal. He had used this authority to complete the census that Khufu had called for.



Hemiunu made an appointment and delivered the census to the king in person and in private, as directed. Khufu went through the work, asking questions, and querying the implications of some entries. He was clearly very interested and had some objectives in mind, although Hemiunu could not be sure what they might be.

At the end, he thanked Hemiunu for his excellent work, observed that there were quite a number of areas that required attention throughout the land of Egypt as revealed by the census, and dismissed Hemiunu. At no point during their meeting did either of them mention Khufu's pyramid, nor did the king suggest any reason for Hemiunu's public disgrace; it was, Hemiunu observed in his diary, as though nothing had happened. But it had, and Hemiunu was deeply wounded.

With his father dead and his future, once so clearly marked out for him, now uncertain, Hemiunu spent some weeks contemplating his prospects. Finally, he decided that he should do what Egypt expected of its viziers; he would administer the country on behalf of the king.

Planning with the other Viziers

Hemiunu revealed a number of anomalies by comparing the old with the new census, and proposed remedial activities to rectify matters – “to restore *ma’at*.” Hemiunu then canvassed each of the other viziers, proposing that he, Hemiunu, should undertake a major progress through the land as the king’s representative, rectifying anomalies as he went. At this time there were two principal viziers, one each for Upper and Lower Egypt, together with a number of “viziers-without-portfolio” who, like Hemiunu, tackled issues on behalf of the king as and when they arose. The principal viziers, being aware of Hemiunu’s delicate situation, were sympathetic to his proposals.

Hemiunu then formulated a full plan of activities that he intended to undertake on a journey up river that would take perhaps three years or more. He sent out messages, carried by scribes loyal to him, arranging with nomarchs, head priests, estate managers and project overseers for inspections, courts of justice, initiation of new ventures, etc. He sent a copy of his proposed itinerary to King Khufu, but made sure that it was hidden under a pile of other administrative material, so that the king would take weeks to find it, if at all.

Hemiunu was preparing for a strategic withdrawal from court and from the capital. By burying himself in valuable work for Egypt, he hoped to overcome his discomfiture and anger, while at the same time spreading and restoring *ma’at* as he felt the king would want. Only—he gave the king no opportunity to disagree or interfere.

Hemiunu had inherited one third of his father’s extensive estates, and King Snefru had granted him new estates, so he was now wealthy and powerful in his own right. Hemiunu used this power to move quietly and quickly. He progressively moved his household from White Wall up country to one of his father’s old estates near Denderah, which was staffed with people loyal to Neferma’at’s memory. Without letting anyone know, he also moved his family to this new location by night, but stayed on in White Wall to cover their departure; they were ostensibly going on a trip to educate his sons, Sneferukhaf and Kawab. Finally, without taking leave of anyone, he slipped away up river.

The other viziers, knowing of his plans, were not surprised. Khufu did not notice Hemiunu’s absence for several weeks: when he did notice, the two senior viziers feigned surprise at the king’s lack of awareness. Surely Hemiunu had advised the king in advance. A search revealed Hemiunu’s letter to the king; Khufu was mollified, but highly suspicious. Hemiunu had anticipated Khufu’s every wish, as an excellent vizier might be expected to do, but the speed of Hemiunu’s actions had startled the king. Khufu was no fool; he realized that Hemiunu had escaped his grasp, and he knew why. He also realized that he had just lost Egypt’s premier pyramid architect, and, as Hemiunu learned from Ankhaf, Khufu was not best pleased.

Hemiunu decided to absent himself by undertaking a long and arduous trip to the far reaches of Upper Egypt.

He moved his family up country surreptitiously, so as not to arouse King Khufu’s suspicions.

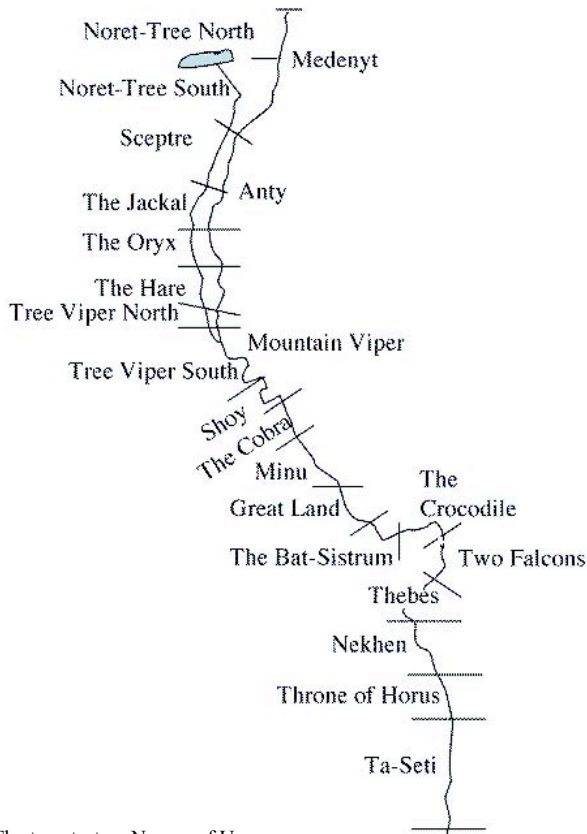
He planned a series of activities, inspections, judicial courts, and project initiations, all based on shortfalls revealed in the census that Khufu had called.

Agreeing his plan and itinerary with the other viziers, he set off on his self-imposed exile without the king knowing.

When Khufu finally discovered the disappearance, he realized that he had been outsmarted. He had disliked Neferma’at and had transferred his dislike to Hemiunu. Khufu had intended to take Hemiunu down a “peg or two,” but his plan had backfired. He had lost the country’s finest pyramid architect.

Hemiunu's Progress

Hemiunu's plan appeared, at first glance, to be a simple, methodical progress though Upper Egypt, visiting and inspecting each and every nome. The plan started with nome *Noret-Tree* North, and ended with nome *Ta-Seti* in the far south, at Elephantine.



The twenty-two Nomes of Upper Egypt as they would become, and using translations of their names where appropriate. North is up.

Ta-Seti, "the Land of the Bow," may have been so-called because of the fame of the Nubian archers.

To begin with, that is how things worked out. Hemiunu visited each nome in turn, was met by the nomarch, visited the temple of the local deity, held judicial court, inspected on-going projects, and so on. Where the census had indicated a need, he inaugurated irrigation projects, dams, dykes, ditches, the construction or enhancement of grain stores, and in one nome he even arranged for stud animals to be shipped between nomes to improve the size, health and quality of the oxen.

As he progressed further to the south, Hemiunu modified his plans, and inaugurated several new temples, a function normally reserved for the king. He wrote ahead to the respective nomarchs so that they were prepared, and he sent advisory scrolls to the king, aware that the delays in communications to and from the north meant that any inauguration would have taken place before the king could stop it.

Hemiunu also took the opportunity to visit his estates, many of which he had inherited from his father. The estate

managers, farmers and stockmen had known Hemiunu since he was a child, and had transferred their loyalty from Neferma'at to Hemiunu. As he progressed further and further south, Hemiunu set up a private intelligence network which reached all the way back into the royal court.

Promoting the Annual Games

Hemiunu was determined throughout his self-imposed exile to make as sure as he could that Khufu's pyramid was progressing as it should. To that end, he also promoted the annual games that had been held under the auspices of King Snefru. He pledged King Khufu's enthusiastic support for the games.

Hemiunu introduced several new categories into the annual games, including long distance races, swimming, ploughing, vaulting over bulls, and riding wild oxen. He awarded new prizes for these new categories and increased the level of prizes for the prior existing categories. This would cost King Khufu more, but on the other hand, it was also guaranteed to maintain and perhaps increase the flow of capable people into the military and, more importantly, into pyramid construction.

Working on Hemiunu's Design Project

Hemiunu found himself with periods of inactivity, particularly when sailing between nomes, and during court sessions; the latter tended to be long, drawn out affairs, with advocates arguing about the facts of cases.

He had plenty of time to think about his situation. To stop himself from becoming depressed, he gave himself a project. He would continue developing the design of Khufu's pyramid, but he would also develop an understanding of:

- what the pyramid really represented
- how the magic of the pyramid should operate
- what strategy might be employed in building a pyramid as large as that contemplated by Khufu. Hemiunu knew that simply scaling-up his miniature Dahshur *ka*-pyramid would not work

From his diary, it is evident that Hemiunu was less than certain that the various groups of priests really knew how the pyramid worked. Apart from any other considerations, they disagreed among themselves, with one faction proposing one notion, while another had completely different ideas.

The priests of Heliopolis were in the ascendancy, and had been since before the time of Imhotep, who was counted among their number. They viewed the pyramid in relation to the sun god, Ra; initially, they had identified the dead king with Ra, but more recently suggestions had arisen that the dead king would be first among those who daily rowed Ra's solar barque across the sky. Evidently, they were making it up as they went along – or so Hemiunu thought.

The priests of Osiris and Isis viewed the pyramid in relation to the legends Osirian legends. The legends had become identified with particular stars in the southern skies – the direction in which Hemiunu was travelling, and where he could see these stars by night for much of the year.

These two priestly schools were not incompatible in Hemiunu's view. For a start, it was possible, even inevitable, that the pyramid would operate both by day and by night, and so could serve both viewpoints and beliefs.

Hemiunu set out on a “royal progress” of his own, towards the far reaches of Upper Egypt.

As he went, he established an intelligence network so that he knew what was happening at Khufu's court.

The solitude of his self-imposed exile gave Hemiunu the opportunity to work on his ideas for the “perfect pyramid.”

To achieve perfection, he needed to understand what the pyramid really represented, how its magic should operate, and – most importantly – how to build such a potentially enormous structure.

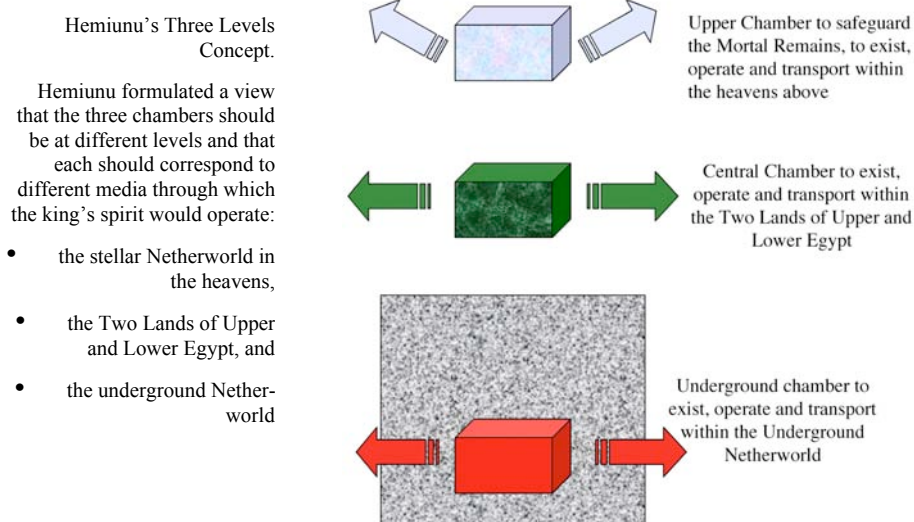
He knew that simply scaling-up would not work.

Hemiunu Develops his Pyramid Concept

Structural aspects of pyramid design had evolved rather ahead of theological aspects. For instance, the practice of having three principal chambers in a pyramid had been established without the reason for three chambers being fully developed.

The rationale that was developing as part of Hemiunu's design studies saw the sarcophagus chamber as high in the pyramid, in parallel with the practice of sleeping upstairs or on the roof of a house out of the reach of danger. High also meant closer to the sun god, Ra. From the roof of a house, one could see the stars, and Hemiunu felt that the sarcophagus chamber should similarly give the king's *ka* a view of the legendary Osirian stars as well as the northern circumpolar stars, where Khufu's final palace would be.

Hemiunu also saw a fundamental need for another chamber set into the ground, deep into the underground Netherworld - and into realm of Seth. The god of chaos was a powerful god, and not necessarily conducive to ancestral communion in an underground chamber, so the chamber had to be both designed and constructed to withstand Seth and his cohorts.



Between the high burial chamber and the deep underground chamber, the king's *ka* had access to everything spiritual that was in the heavens or in the Netherworld. This left a need for a third chamber, from which the king's *ka* could access anywhere on the surface of the earth, or more particularly the surface of Egypt. Hemiunu saw the three chambers respectively in relation to the heavens, the land of Egypt and the underground Netherworld.

Regime Change!

He remembered that Djoser's pyramid complex included pavilions of the north and south. These two structures had enabled Djoser's *ka* to roam at will over Lower and Upper Egypt respectively; Hemiunu viewed them as gateways, enabling the spirit to travel instantly from the pyramid to any spot in Egypt. Thinking about it, Hemiunu wondered in his diary if the spirit travelled to a real place in Upper or Lower Egypt, or to a spiritual equivalent of a real place. After all, if the spirit had no substance, then the location need have no substance either. Perhaps, Hemiunu ruminated, there was a complete spiritual Egypt, which can be roamed at will by a spiritual king....

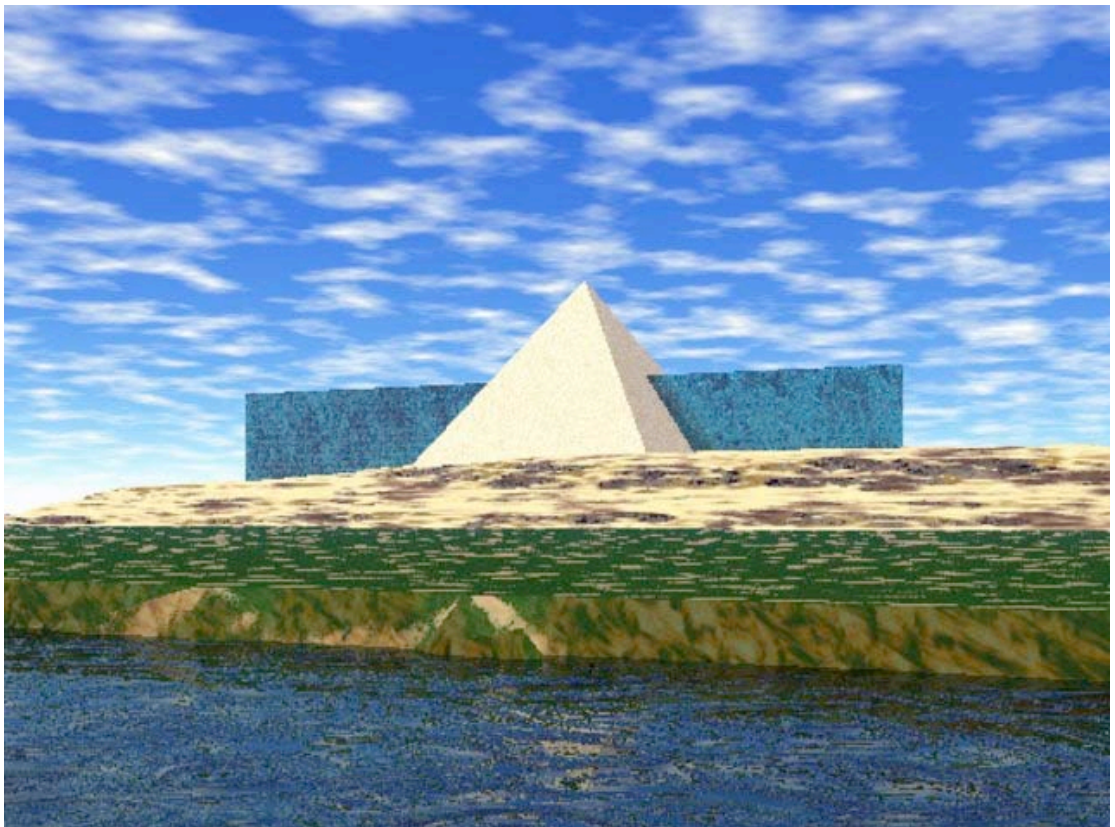
Whether or not that was true, it suggested to Hemiunu that, in addition to the three chambers he had already marked out in his mind, there was a need for two more, as pavilions of the north and south. These two would never be accessed by anyone living, even during the entombment ceremonies, but only by the king's *ka* as it travelled either the real Upper and Lower Egypt, or some spiritual version

Hemiunu was clearly trouble by these thoughts. What about travelling by night? How could the *ka* find its way around Upper and Lower Egypt by night? What if the king's *ka* wanted to travel on the real Nile, as apparently required by the Pyramid Texts, and not on some spiritual equivalent of the Nile? There were so many options and so many variables that Hemiunu was finding it difficult to incorporate all

Hemiunu imagined that crossing from east to west through the pyramid was like crossing from east to west across the Nile.

Perhaps a spiritual Nile flowed through the centre of the pyramid, dividing the lower part, the primeval Mound of Creation, into two halves, east and west.

Perhaps, too, as the Nile was a means of travelling north and south, so the spiritual Nile within the pyramid might be sailed by the king's *ka*. This would necessitate the provision of spiritual boats, so that the *ka* could sail on either the spiritual Nile, or the real Nile in his spirit form.



The Secret Diaries of Hemiunu

The night sky as it looked at midnight on the spring equinox in Hemiunu's time. Sirius is marked, together with the three stars in Orion's Belt. These are the legendary stars in the southern skies.

In the northern skies, Polaris, today's Pole Star, is shown, together with Thuban, the then pole star. Above Thuban can be seen the stars of the Great Bear, Ursa Major, which go to make up the Plough.

Centre Left is shown the Milky Way, which the Egyptians referred to as the Field of Rushes.

the possibilities and eventualities in one design.

It came to Hemiunu that the king's pyramid might be a complete spiritual Egypt. To make this idea work, Hemiunu had to consider that a spiritual River Nile ran from south to north through the spiritual land, and that both were represented somehow in the physical pyramid. The land presented no problem; after all the pyramid, or at least part of it, represented the primeval Mound of Creation

With this thought, other concepts started to gel in his musings. The spiritual Nile might be reflected in the heavens; in that case, the heavenly Nile flowed from the Osirian stars in the southern skies to the king's final resting place among the Imperishables, the northern circumpolar stars. The dead king would need a boat to sail upon this celestial Nile, but at least there was a way for the *ka* to go between the two stellar regions.



Did this mean that the spiritual Nile ran through the passages and the chambers in the pyramid? Would that put the king's *ka* at risk; perhaps a spiritual *ka* could drown in a spiritual Nile?

On the other hand, the idea that a spiritual Nile ran through the centre of the pyramid was compatible with crossing the Nile from the Land of the Living in the East to the Realm of the Dead in the West. This was the route followed by Ra, travelling in his solar barque, as he went from newborn in sunrise to death at sunset. It was also the route followed for royal entombment, with the royal funerary barge travelling from the east bank, across the river, to the west bank and the necropolis.

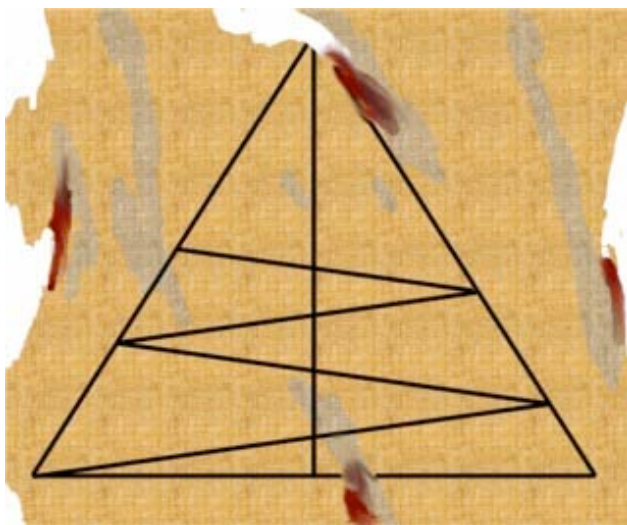
Gradually, Hemiunu formulated a concept of how the pyramid complex could "operate." To him, it is clear from his writings, the

pyramid was a live machine, powered by the king's *ka*, able to safeguard that *ka*, yet project it as, when and where the *ka* desired, and to similarly retrieve the *ka*, too.

Hemiunu was possibly the first person in history to thoroughly explore the concept of operations for a system – a practice that is common amongst today's top system designers. Today, they consider it essential to explore how some future system is going to operate *before* considering detailed design and construction. Some, however, prefer heuristics, or trial and error—much as other builders did in Hemiunu's day...*plus ça change, plus c'est la même chose*.

One other area that Hemiunu worked on was the building strategy. In his research into the moving of larger stones, he had found that the only practicable way to manage really heavy stones was to keep them at their point of balance. One or two people could manage a balancing stone; it could be rotated around its pivot point, it could be rocked gently from side to side, and so on. Once off its balance point, it became intractable.

He had also realized, as a direct result of building the *ka*-pyramid at Dahshur, that it was necessary to lower heavy stones into place. This meant that internal features, chambers, passages, anterooms, etc., had to be built from above. Hence, the double construction wall that he had helped develop at Dahshur would, he felt, be essential in building the perfect pyramid.



The drawing found in his diaries at this time appears to be an examination of the potential of ramps. The zigzag lines are at 56 seked (7.1°,) and the text suggests that Hemiunu was looking for ways to use ramps to raise the heavier stones that would be needed for corbels in the Gallery and the burial chamber. From the context of his notes, he was evidently concerned about the use of ramps with the heavier stones, and was looking at different ways of raising the stones

Inaugurating a Temple

Hemiunu inaugurated several temples on his progress up the Nile. None gave him greater pleasure than the temple to Ra in the Nome of Nekhen.

Hemiunu had sent details of the temple design and where it was to be located before he set out on his progress, which – as it would turn out – was to become more of a witch-hunt than a vizier's tour.



Reconstruction from Hemiunu's diary of the Temple of Ra, that he inaugurated at Nekhen.

Hemiunu's design saw the temple on an incline to the west. The roof was an open circle, which from the angle of a viewer looking upwards towards it could look like an eye.

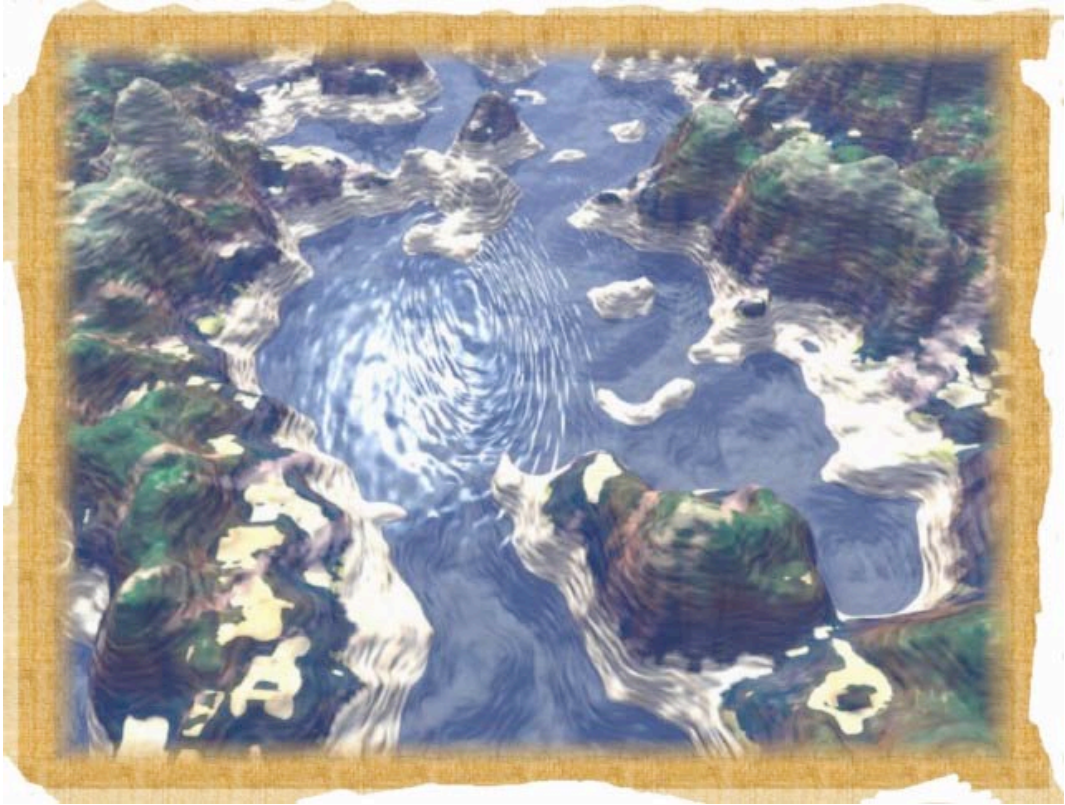
At sunset each day, depending on where one was standing, the sun passed behind the "eye," and for a brief period it looked like the eye of Ra.

He arrived at Nekhen at a most propitious time. The nomarch, a second cousin of his, had commissioned work on the temple immediately he received the advice, and his masons had just completed the temple, which was small and of curious design. The nomarch was interested in why Hemiunu had specified the design and the particular situation in which it was to be sited.

As the party walked out through the fields and beyond to the hills at the edge of the desert, the sun was just going down. Hemiunu led the group to a particular point near, but below the temple, which was raised on a hill. The group paused to watch just as the sun dipped so that it was visible through the open loop at the top of the temple.

"There you see it," Hemiunu wrote in his diary, "the eye of Ra." The people realized that the open temple ceiling looked like an eye, and that, for a moment, the sun looked like the pupil looking – or glaring – through the eyelid.

Charting the Cataracts



When he reached Abu, in the furthest nome, *Ta-Seti*, Hemiunu heard from the local nomarch and sailors that the cataracts in the River Nile above Abu were inhibiting river trade, and were limiting security as even military boats found it difficult to get past or over the cataracts.

Hemiunu had a wooden tower built overlooking the cataracts. He had heard that at some times of the year, the river water ran crystal clear. From his tower, he could see the rocks and channels under the water. He made several detailed drawings and paintings of these rocks and channels, which were then used by sailors to navigate the channels even when the water was filled with silt.

His main vantage point involved him in looking south, so that the sun's rays showed the details under the water. However, that also meant that at certain times of the day the sun's reflection on the water surface interrupted his work. Hence the rather fine painting shown here, which has been restored to show its splendid detail. The rushing water has picked out different rock strata, although the water was at a low level when the painting was made. Hemiunu recorded stratification detail, since all the rocks would be covered and invisible for months after the Inundation....

Hemiunu erected a wooden tower over the cataracts so that he could record the rocks and channels beneath the water. His intention was to provide navigation information for sailors trying to get past the cataracts.

He chose a time of low, calm river flow, when there was little or no silt in the stream, and his picture shows in fine detail the narrow channels carved in the riverbed.

His paintings and drawings would have been of great value to sailors and others, especially in the months after the Inundation, when the water was higher, but thick with silt.

The Granite Quarries of Abu

Learning the ropes



Slots cut in a granite block at the Aswan Quarries.

Wooden wedges would be hammered into the slots, the wood would then be wetted to make it swell, and the granite would split along the perforation.

Hemiunu was fascinated with the granite quarries near Abu. He had heard much about them and they supplied nearly all the granite that was used for building within the pyramids and temples further north.

He surprised the quarry master, Ankhwah, by asking if he could learn to work granite the hard way – by doing it alongside the other masons. Ankhwah was only too happy to oblige, so Hemiunu set to work with a diorite hammer, laboriously working out grooves and dressing surfaces. The workers had discovered centuries before that the way to cut granite was to split it, using the power of water. A series of slots were “rubbed out,” usually in a straight line, wooden wedges were driven into the slots, water was poured simultaneously over all the wedges to make them swell, and if all went according to plan the granite split along the perforated seam.

Hemiunu soon found that there was much more to it than that. The masons developed a feel for the stone. They could see where a seam would split neatly, or where a curve might be possible, and they knew

almost instinctively where cracks and fissures might develop, even within seemingly uniform rock.

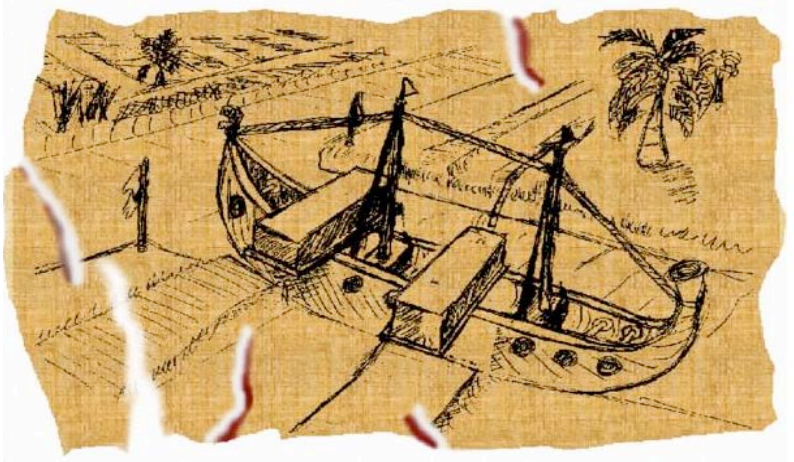


Hemiunu had expected that the holes in the granite bedrock would be punched out with tools of some sort. To his surprise, the process was quite different. The masons used very hard, green diorite stone “hammers,” not so much for hammering, but more for rubbing rhythmically on one spot. They used a mixture of animal fat and coarse sand as a grinding

Regime Change!

paste. The photograph shows a green diorite hammer, or rubbing stone, with typical red Aswan granite in the background.

Hemiunu also found that the quarries were a joyful and very noisy place. With many holes to rub to create a perforation, the quarrymasters had hit upon the idea of music and singing, so that the men worked in unison, all rubbing to the same rhythm, which was beaten out on drums, sistrums and anything else that was to hand.



Transporting Granite Monoliths by Boat

Hemiunu was also fascinated by the way in which the larger granite monoliths were handled, put into boats and sailed down river. The key





was to always move the blocks down a slope. The masons had constructed a granite surfaced ramp leading from the quarries down to a purpose-built canal. They had also acquired a stock of round polished granite “marbles,” by the simple expedient of putting small granite rocks in pools in the cataracts. As water, sand and silt poured into the pools, they acted as stone tumblers, creating smooth round granite pebbles. With several handfuls of these pebbles on the ramp, even the heaviest granite blocks slid so easily down the slope that the problem was more in stopping them – which was usually accomplished with ropes and manpower.

Loading granite monoliths on to boats had proved trickier, and there were still occasional failures, but the basic methods seemed to work. In one approach, the blocks were run down a slope and put athwart ships, as shown in Hemiunu’s drawing. Boats were built with very broad beams to accommodate stones, but clearly this approach had its limits. If a stone protruded beyond the rail of the boat, the boat became unstable.

In an alternative approach, the boat was set with the stern to the canal bank, but the bow moved away, and the bow was then weighed down with ballast. The deck of the boat was aligned with the slope of the ramp, and the stone simply slid into place, using marbles throughout

Regime Change!

to ease the movement. Finally, the load was straightened on the vessel, and the ballast removed.

This approach was rather slower and created its own problems, since some boats leaked so much with their bows under water, that they never rose again. Their remains blocked the harbour and it took some time and considerable effort to clear them out of the way.

While Hemiunu was there, the masons were experimenting with a new approach, which can still be seen on the Nile today. They strapped two boats side-by-side, and loaded long stones right across both centres. This was so successful, that they tried three boats strapped together, and then two boats with outriggers tipped with oxen stomachs blown up to act as floats. The masons, Hemiunu decided, were nothing if not inventive...

Looking Ahead...

While he was working at the quarries, Hemiunu took the opportunity to see how much granite had been ordered for Khufu's pyramid. Ankhaf had ordered several large beams, apparently to cover boat pits, but none for the Pyramid itself. Hemiunu put in a large order in Ankhaf's name, to avoid any delays.

Hemiunu also learnt from the quarry masters that dressing (smoothing) the large blocks often took much longer than cutting them out of the base rock. If he should ever need a major supply of granite blocks or beams at short notice, then the key to fast delivery would be to have as little dressing done in the quarries as possible. One side of each beam had to be dressed; otherwise it would not be possible to slide it down the ramp and on to the boat. Hemiunu remembered this advice, which was to prove invaluable at a later date.



Khufu's Second Anniversary Party

Khufu Dictates his Roles

Hemiunu made observations in his journal about a letter he had received from Ankhaf. It concerned King Khufu's second anniversary party, held at the palace in White Wall, to celebrate two years of reign. The proceedings started with the king pronouncing his principal roles, which were to:

- Interact and intercede with the gods on behalf of the people
- Spread and maintain *ma'at* throughout the land
- Ensure the annual Inundation on which life in Egypt depended
- Continue in these roles for eternity

Ankhaf must have expressed some surprise at this public declaration of the king's purpose, which was normally not spoken, and certainly not in such circumstances. Hemiunu observed in his notes that the king must have felt a need to remind the elite courtiers and nobles of his status as the god Horus. Hemiunu could only surmise that Khufu felt insecure in some way. And things were about to get worse.

Princess Hetepheres Entertains

As had become the custom at parties since King Snefru's time, Khufu's daughter, the Princess Hetepheres took it upon herself to entertain the crowd. She had satiated her desire to shock people with her sexual prowess. Her latest method of entertainment was to produce plays, in which a small number of actors played out some story, often one that she had created herself. She had even had a special area created for her plays, with seating around an elaborate, well-lit amphitheatre.

On this occasion, Ankhaf recounted, she had presented a political dialogue, in which two courtiers were presented, talking confidentially to each other. They appeared at first to be talking about the resounding success of the king's progress. This was not surprising, since the king had been planning such a progress up the Nile for some months, so the dialogue seemed at first to be taken from the future, some months ahead.

As the dialogue unfolded, the audience heard how the royal personage had made wise and just pronouncements, how he had founded important projects, how the people in each nome had displayed their great affection, even adoring love for the royal person.

Then discrepancies entered into the dialogue. The royal progress detoured via the cataracts above Abu/Elephantine, and the royal personage earned great respect at the granite quarries for his ability with the mason's hammer—something King Khufu would never have lowered himself to do.

At King Khufu's anniversary party, to honour the second year of his reign, the king surprised the party by reaffirming his roles as the god-king Horus. His outrageous daughter Princess Hetepheres then entertained the assemblage by presenting a play in the form of a supposed dialogue between two courtiers.

These two were heard to discuss a royal progress up the Nile. As the dialogue proceeded, it became clear that the progress referred to Hemiunu, and not to King Khufu.

The king was outraged and immediately sent out a party of marines to bring Hemiunu back to court.



The audience began to suspect that this dialogue referred, not to King Khufu in the future, but to Hemiunu in the recent past. The implications were clear and shocking, just as Princess Hetepheres had intended: Hemiunu had been usurping the king's role and authority, and moreover he was accepted and loved by the people of Upper Egypt. Hemiunu was vying for the crown of Egypt!

Princess Hetepheres had an amphitheatre built, entirely of wood and mud brick, so that she could stage entertainments at palace parties. The simulation shows what the setting may have looked like, working from Prince Ankhaf's description in a letter to Hemiunu.

Never mind that it was all completely untrue. The thought had been uttered. The king flew into a rage, actually stamping on the floor according to Ankhaf. The party was immediately disbanded, the two actors were imprisoned, Hetepheres was confined to the harem in disgrace, and the king sent for his generals, treating the matter as though civil war had broken out.

Prince Ankhaf's letter had been timely. Hemiunu had been unaware of the furnace that Hetepheres had been stoking. Come to that, Hetepheres may not have anticipated the explosion of fury that her "entertainment" had unleashed.

Hemiunu immediately started planning his next moves. This had not been on his agenda. Meanwhile, Ankhaf's letter contained other information about the state of progress with Khufu's pyramid – a matter dear to Hemiunu's heart.

Early Problems with Khufu's Pyramid

The Causeway and the Docks

Ankhaf had been active; he had initiated much of the work needed to create the pyramid complex, which was much more extensive than the pyramid itself. He had opened up and set to work the quarrying of good quality limestone. He started the construction of a ramp to the pyramid site.

One of the most important tasks was the construction of the causeway linking the Valley Temple, down by the River Nile, with the Mortuary Temple, which would abut the eastern face of the pyramid. The causeway had to be constructed early in the schedule, as it would be used to haul stone from the riverside. All of the granite coming from Aswan would have to be dragged up the side of the plateau; this necessitated a large causeway, with a gentle slope throughout. Unfortunately, the slope leading to the plateau was far from gentle in places, so the causeway was going to incur a major effort in building.

In addition to granite, however, it would also be used for hauling casing stones made of Tura limestone, and of course the constant flow of logistics – food, water, tools, cooking utensils, ropes, sledges, etc., which would see it active every day. Eventually, it would be paved and covered over to act as the numinous passageway to the other world. That would be many years from now, however.

Docks were necessary at the foot of the causeway to accommodate the constant trade of ships bringing in rocks, stones, and logistic supplies. Like the causeway, the docks were dual purpose; they would eventually become the basis for the Valley Temple. Altogether, Ankhaf reckoned that building the causeway was not too far short of the effort involved in building the pyramid.

Ankhaf plans a novel underground chamber

Prince Ankhaf had been trained alongside Hemiunu, and their experiences were similar, too. When Ankhaf found himself facing a dilemma, he would have turned to Hemiunu to discuss the issue, but Hemiunu was not there. Ankhaf had to work things out on his own.

His first problem concerned the site for the new pyramid: Khufu's pyramid. It was to be on the sacred hill that was revered as the primeval mound of creation. In Ankhaf's mind, this made it difficult to envisage sinking a large, open pit into the ground, as had been in Hemiunu's mind for several years. After all, that was the way in which Djoser had been buried. In fact, Hemiunu was pretty sure that all royal chambers deep underground had been dug out using the open pit method.

Ankhaf elected to retain the large underground chamber in Hemiunu's design, and to reach it using a sloping passage set at the standard 14

Regime Change!

seked (26.6°). The chamber would be deep, and the shaft would therefore be long, but the pyramid was large, so the opening to the shaft could still be set in the north face of the pyramid, and would descend through the pyramid before reaching the rocky surface and burrowing into the mound of creation.

No one had ever dug such a long, sloping shaft into the ground before, but Ankhaf saw no real problems: so, with the blessings of the Priests of Heliopolis, he set to work on the shaft. The priests were pleased that original pit notion had been set aside; they were unhappy about “mutilating” the mound.

In Hemiunu’s original design, based on the *ka*-pyramid at Dahshur, the passage from the north face had descended at 14-*seked*, had levelled off for a short distance, and had then risen again towards the gallery at 14-*seked*. At no point had it penetrated the rock surface. Ankhaf was concerned about this diversion from the plan, but saw no difficulty in marrying up the two plans; the down part of Hemiunu’s plan would simply carry on downwards towards the underground chamber.

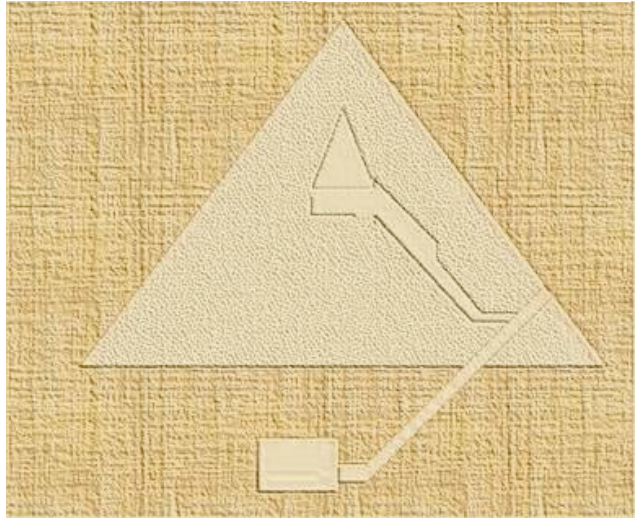
Setting out the foundations

Ankhaf had supervised the setting out of the great pyramid base. He had used Hemiunu’s approach to levelling the site, using a grid of water channels. Instead of levelling off the mound, he cut the shape of foundation stones into it so that the mound took on the appearance of a set of large stone blocks. Where he had cut off pieces, he was able to use some of them to create fresh stones to fit into the foundation layers. Altogether, Ankhaf had done a very creditable job, and Hemiunu told him so in his reply.

Hemiunu had serious concerns, however, which he kept to himself. Ankhaf’s design was not tenable if a third chamber was to be built up in the masonry. Ankhaf’s retention of the horizontal passage section was also a concern. It had helped in the small *ka*-pyramid, where its purpose had been to connect with the central burial chamber, but to minimize the passage length.

Overall, Hemiunu thought the design was unbalanced, with too much to the north of the centreline, too much high up in the *benben* stone, and nothing in the heart of the pyramid at all. The current design did not support any particular concept of operations; “how was this all supposed to work?” Hemiunu mused.

Ankhaf’s sketch of his early design. Note that the burial chamber is high up, and has a corbelled roof. The entrance passage from the north face goes down to the underground chamber. It also divides to copy Hemiunu’s original *ka*-pyramid design



Although he recognized the sketch as just a rough outline, Hemiunu was concerned.

The burial chamber was too high, and too central.

The overall layout was unbalanced, with an obvious need for a third chamber at the heart of the structure.

Splitting the down section of the entrance passageway created a weak point; the horizontal section may well fall into the down section beneath it.

Overall, Hemiunu felt that the design attempted to scale up from his original *ka*-pyramid, and that the result was less than ideal. As shown, the gallery and the burial chamber, with its corbelled roof, would be enormous....

The Pursuit

Khufu Sends the Marines

Within only three days of Princess Hetepheres' unfortunate play, King Khufu sent out a small band of marines with orders to bring the vizier Hemiunu back to court, by any means necessary.

Hemiunu had never been sure about the value of his crystal ball, but he often ascribed his knowledge of what was going on to the crystal, to hide the fact that his intelligence network had been at work.

On occasions, he thought he saw strange, swirling figures in the crystal, especially when he was out in the desert watching the sunset through the crystal.

Occasionally the crystal went cloudy, seemingly as a warning, and on several occasions the crystal gave off sparks when he was polishing it.

In the illustration, which was only partly restorable, Hemiunu is watching the sun set over the Nile. The crystal ball, with its inverted image, is filled with clouds, although the sky towards the sunset is quite clear.

The band consisted of ten marines, led by a coarse, hardened veteran called Bebi, a tax collector by profession, who did not like his soft, easy life at headquarters being disturbed for the non-military purpose of “encouraging” an absconding vizier to return home, dead or alive. He would soon show Hemiunu who was boss. Bebi and his platoon set off in two small fast boats, expecting the round trip to take little more than two or three months.

Intelligence Network/Crystal Ball

Hemiunu had set up a very good intelligence network. His wife, Neferhetepes, who was continually travelling up and down the Nile in Upper Egypt visiting and inspecting his estates and farms, was diligent in gathering and passing on information. She was in close contact with some of the wives at court, and she was still a Priestess of Hathor; this tight-knit sisterhood provided excellent intelligence through a secure person-to-person network.

Hemiunu also had his crystal ball, the one Djadjaemankh had given him so many years before. Hemiunu took his crystal ball with him wherever he went. He often looked into it, hoping to see something—he did not know what. Now, quite unexpectedly, the ball changed its appearance; it became milky rather than clear, and the milky clouds moved around in turbulence. Clearly, this was a warning, although Hemiunu was not sure as yet just what it meant. He would be foolish, however, if he did not respond to the warning.

Escape and Evasion

Announcing to his hosts in Abu that he was off to the oasis of el-Kharga in the western desert, and swearing them to secrecy, he actually set off southwards towards Buhen.



Finding the Tropic of Cancer

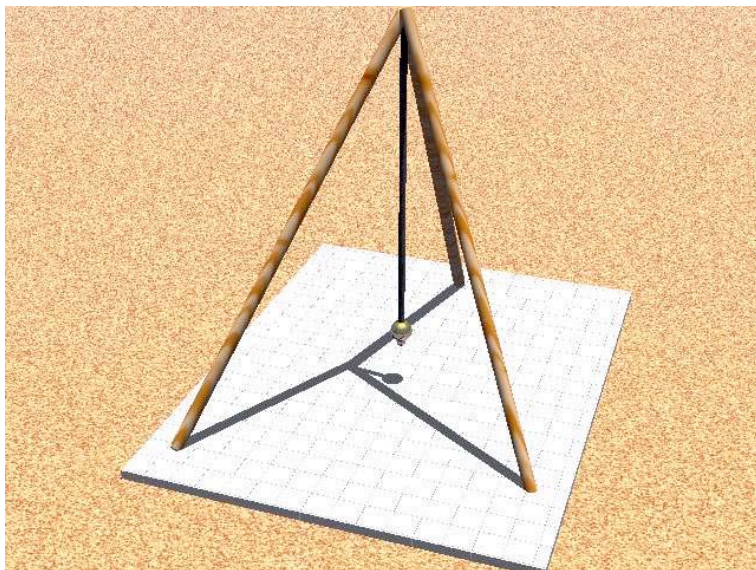
Hemiunu had been interested for many years in a solar phenomenon. He had been told that, just south of Abu, the sun cast no shadow at midday on the summer solstice.

The solstice was past. It was now the month of *mesore* (July?) in the season of *shemu*, (*dry time*, harvest). However, each day at midday, Hemiunu solemnly stopped the boat in which he was travelling with a servant and a guide, and set up his apparatus. This consisted of a tripod of canes, with a plumb bob suspended from the centre point. The whole apparatus was placed on a linen cloth stretched taut on a wooden stretcher. There were marks on the cloth for the tripod feet.

Each day, Hemiunu marked the tip of the shadow as best he could. He found that the shadow from the tripod obscured the shadow from the bob.

His frustration was eased when he realized that the shadow from a tip of a stick set in the ground drew out a straight line from west to east as the sun rose, transited and fell. So, he changed his apparatus to a much simpler one, in which he used the tripod and the bob to set up the stick vertically in the middle of his linen cloth each day.

Now he could stop at any time when the sun was shining clearly, mark the tip of the stick's shadow and move on. As he travelled further south, he reached a point where the path of the shadow passed directly through the base of the stick, and he was satisfied. The sun was directly overhead at midday at that point, something that had could never occur in Egypt. He was truly abroad.



Hemiunu was interested in confirming stories he had been told about the sun being directly overhead in Nubia.

He concocted a simple apparatus, shown in the figure, with three canes, a cord and a plumb bob made of electrum.

The apparatus was mounted on a white linen cloth, on which the sun cast the shadow of the plumb bob.

Each day at noon, Hemiunu measured the length of the plumb line shadow. Each day, as he travelled further south, the shadow shortened, until he reached a point where the sun was directly overhead and the shadow was just the size of the bob. He then refined the experiment still further – see text.

Finally, Hemiunu was satisfied – he really was abroad. Nowhere in Egypt was the sun ever truly directly overhead.

A Visit to Kush

Hemiunu pushed on southwards into Wawat, a Confederate Nubian Chieftom within Kush. He followed the River Nile, heading for Buhen, an Egyptian trading post, led by his Nubian warrior guide, Toshka.

Hemiunu was fascinated to be outside of Egypt. He recorded having strange feelings: how could the people of Wawat (he called it Yam) possible exist, let alone thrive and flourish, without the power, might and organization of Egypt. And what about the gods of Egypt? Were they still present in Kush? If not, what did that mean for Hemiunu?

Toshka explained that the people in this strange land had their own very powerful gods, but that these gods spent much of their time fighting and feuding with each other, leaving the people to fend for themselves. He, Toshka, would show Hemiunu the Kushite gods.

On the journey they came across a village in the bow of the river. The people lived in huts on stilts, and the huts were built inside a palisade. As Hemiunu approached, he was aware of a stench, the like of which he had never experienced: it was coming from the village. Even Toshka wrinkled his nose. Hemiunu soon found the cause. The hut dwellers threw their food scraps out through a hole in the floor of each



Regime Change!

hut; they also defecated through the same hole at night, and the faeces lay rotting underneath.

Toshka advised that the Inundation would put things right. The river would overflow its banks and flush the village clean, while the people remained safe in their houses-on-stilts. Hemiunu also learned that the Kushite men stood up to urinate, unlike Egyptians, and that the Kushite women squatted down to urinate, unlike Egyptian women: very strange.

As they were preparing to leave the village, a Nubian runner arrived with a message for Toshka. Bebi had been sighted only a day's distance to the north. He had not been fooled by Hemiunu's false trail, but was instead taking the desert route through the oasis of Dunqul to reach Buhen ahead of Hemiunu, and surprise him.

Taking Toshka's advice, Hemiunu decided to head out to the east, through the Wadi Allaqi, passing the gold mines about which he had heard so much. Meantime, he sent a message to the Wawat Confederate Chief, apologizing for not completing his visit, and explaining the circumstances. The chief was apparently entertained by the idea of an Egyptian vizier "on the run" from his own king, and despatched a team of soldiers to escort Hemiunu safely into the Nubian mountains to the east.



The gold mines of Kush were dug deep inside hills, following the rich veins. Some of the veins were thick with gold, so that pure nuggets could be picked out.

The mines were worked by night in the season of *shemu*, to take advantage of the cool night desert air. As a result, the mineshafts could be seen from a considerable distance, owing to the torches with which the shafts were illuminated.

Hemiunu and Toshka did not wait for their escort, but set out immediately eastward towards the Wadi Allaqi. Toshka recommended that they travel at night for two reasons: first, Bebi would travel by day as he did not know the territory; second, it was the hottest part of the year, and travel by day in the hot sun and the dry desert hills was tortuous.

Hemiunu arrived at the gold mines very early in the morning. As his picture (restored) shows, the mineshafts were visible at night from the burning torches within. The Kushites had decided as it was dark inside the mines during both day and night, they might as well work by night when it was cooler.

After a brief respite, Hemiunu set off once again, this time heading for the mountains further to the east, and nearer to the Red Sea.

The Mountain Gods

Hemiunu continued east, climbing ever higher into the mountains. Toshka explained that they were approaching the gods of Satju. They had received news that Bebi and his platoon were returning to White Wall using the desert route to the west, having given up pursuing Hemiunu as a lost cause.



Toshka suggested that they should take some time to visit the gods. After a day's rest, they set off to climb what Hemiunu took to be a mountain with several peaks.

As they neared the summit, Hemiunu detected a noxious smell that got worse as they climbed. They put damp cloths over their faces to reduce the unpleasant effect.

At the top, Hemiunu met a sight for which he was quite unprepared. He was standing on the rim of a caldera. Around the rim were several outcrops sticking up like broken teeth. Inside the caldera was filled with a vast ocean of mud, some dry, some bubbling and giving off dense fumes. Sticking out of the surface were three spouts, shooting flames upwards. Around the spouts were clumps of sulphur, and there were patches of sulphur on the mud where they had landed after having been shot into the air by the spouts.

Toshka said that his people prized the yellow stuff, using it to treat skin disorders, preserve food, and kill pests on vegetation. He

Regime Change!

gathered several lumps of the stuff in cloth bags brought for the purpose.

Two days later, Toshka took Hemiunu on a trip to another god. Hemiunu thought he was prepared now, having seen the caldera: he was not. They travelled for several hours, finally reaching a plain that was liberally pockmarked with small craters, but on which not a blade or twig grew. Out of this desolate plain projected a stubby, bare mountain with the top cut off. It did not look promising.

They crossed the plain and climbed the side of the volcano. Even before reaching the rim, Hemiunu was struck by the noise: there was a cacophony of squawks, trumpets, booms, screeches, etc., which got ever louder as they climbed.



At the top, Hemiunu was staggered to find that inside the caldera was a tropical hothouse. The very bottom of the depression was partly covered with water, which was giving off clouds of mist. The floor and sides of the caldera were covered in dense, lush vegetation, all dripping with the moisture from the mist. The noise was coming from a myriad of bird and animals; they were everywhere, squabbling over the bountiful supplies of fruit, nuts, leaves, etc.

As they climbed down the inside of the caldera, Hemiunu wondered if they had found the fabled paradise of the First Time. Soon they had to take some of their clothes off, as the atmosphere was so warm and humid. The lake turned out to be clean fresh water, with waterfalls running down the inner walls, evaporating and settling on the walls again. There were also several springs of crystal clear water.

Dream Time

Hemiunu was enchanted with this paradise on earth. While the others refreshed themselves, bathed and explored, Hemiunu sat down with his back to a tree to savour the experiences. Within a few minutes, he was in that Netherworld between waking and sleeping.

Hemiunu visited the mountains of Kush. One of the mountains was an extinct volcano

Inside its caldera was an isolated lush, tropical paradise, with all kinds of exotic vegetation, birds and animals.

Hemiunu fell asleep under a tree and fancied that he met Osiris – not the god, but a descendant of the so-called gods of the First Time, who had visited Egypt perhaps a thousand years before, setting up and establishing the basis of their current civilization.

But, was it a dream?

Hemiunu woke with a start. Some sixth sense had told him he was being watched. He sat up slowly, keeping his head down, but his eyes raised.

A tall, exceedingly thin figure stepped into the clearing and walked slowly toward Hemiunu. Hemiunu looked up, straight at the person. Was it a person? The figure was taller than Hemiunu, perhaps four cubits (about six foot ten inches). The whole body, including the head, was grey and hairless, and there were no signs as to whether the figure was male or female.

Hemiunu was about to speak when the figure said: “You must be Hemiunu.” Hemiunu was surprised, not only that the person – it surely was a person – spoke, but at the archaic accent and words used.

Hemiunu confirmed his identity, and asked how the figure knew him. “We know much of what is happening in Egypt. We know for instance why you are here, and we also know that Khnum Khufu is in great need of you.”

“Forgive me, but how do you know all this?”

“We are of the people you know as the gods of the First Time, *paut-tai*. Our ancestors travelled north many years ago and brought peace and prosperity to Egypt. We became the first kings, and we spread justice and harmony throughout the land. We were not gods, of course, just men and women like you.

“However, a great illness overtook our people. Instead of mixing with the peoples of Upper Egypt, we chose to preserve the purity of our line and we only had children among ourselves. After several hundred years, our children started to die, and those children that lived were often weak and unstable.

“We realized that we were being punished for our arrogance and we retreated back to this our homeland, where we have stayed ever since. There are fewer of us now, but our children do not die in this, our secret paradise.”

Hemiunu paused: “What is your name?”

“I am called Osiris – a name with which you are familiar. Your king Osiris was my ancestor, and we often call our children by this traditional title. My wife is called Hathor – another name you know well. But she is not my sister.

Regime Change!

“I also know what is happening at court. Khnum Khufu is unhappy with the progress being made on his pyramid and he desperately wants you to return, to take over the construction. He is sorry for the way he treated you – he has realized that he made a mistake and that he cannot do without you. He will not, however, admit that openly. He is not a generous-spirited man.”

Hemiunu listened intently to this, partly so that he could remember for his diary, but also because he was still having trouble with Osiris’ accent.

“I am sorry about my accent,” said Osiris, as though he could hear what Hemiunu was thinking. “I have not spoken Egyptian out loud for many years. Yes, I can read the thoughts of people, and I can see through their eyes – that is how I know what is happening so far away.”

Hemiunu started: he thought he heard Toshka and the others returning. When he looked back, Osiris had disappeared. Toshka came running through the clearing, excited by the beauty of the place.

Hemiunu did not mention what had occurred. He was not really sure what had occurred. Had it been a dream? Could it possibly have happened? He recorded it in his journal that evening as a dream.

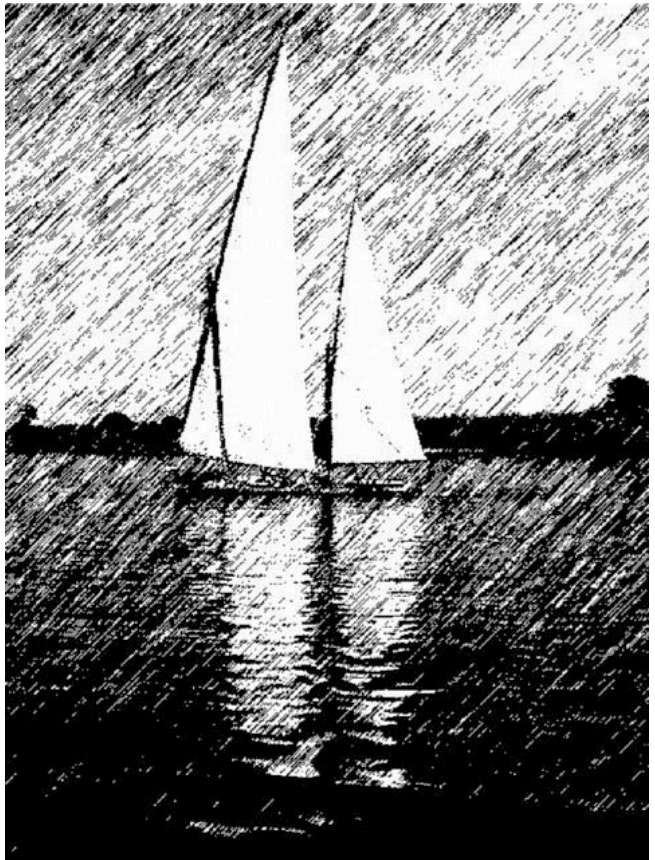
The party stayed in the lush tropical caldera overnight. Next morning, they slowly packed up and got ready to leave. As Hemiunu picked up his crystal, a small shard dropped to the ground. It was covered in tiny writing, in the oldest hieroglyphic symbols and expressions. It pointed out the best route to get home. It also told Hemiunu that he should gaze into his crystal after sunset, as the sky faded through red to grey.

It had been no dream. But it was something to think about on his return via the Red Sea to White Wall. Hemiunu’s mind was in turmoil...beliefs he had treasured for his lifetime had been false. Yet, there had been a kernel of truth in them. It had always been the belief that Osiris was once a real king on earth. So, it seemed, there had been a real Hathor, too. Perhaps the Osiris he had met in his dream was a god pretending to be some sort of person? Had there been a real Seth? Had the brothers feuded?

Hemiunu returned to Egypt via the Red Sea, and using a series of small boats that hopped from landing site to landing site along the west shore.

Near the northern end of the Red Sea, he joined a merchant who was carrying goods from Punt to King Khufu’s court.

Disguised as a physician and scribe, Hemiunu slipped into White Wall totally unrecognised.



Part C. Khufu's Horizon

Prodigal's Party

Hemiunu had slipped into White Wall unnoticed in his disguise. His appearance had changed radically in the three years that he had been away. He was much leaner, his skin was darker, and he had grown a beard and moustache, as it had been too difficult to keep his face hair-free. He had no trouble getting into his palace; he knew every nook and cranny. The palace was deserted, but was guarded and maintained; he was still a royal vizier, after all.

After several days of rest and recuperation, Hemiunu ventured out and wandered around the town and the docks, talking to people, finding out what had been happening, and sensing the mood of the townsfolk. They seemed happy enough, but some were unsettled by the “goings on” at the royal palace. The king did not command the love of his subjects in quite the same way as had his father, King Snefru.

Hemiunu learned that there was to be yet another party at the royal palace, and that Princess Hetepheres was to present one of her “entertainments.” The general public, it seemed, were unimpressed with the princess, who they regarded as a wanton slut in fancy clothes – as one old lady indelicately put it. Another described her as a disgrace to her grandmother’s name. On the other hand, the old men seemed to think that she was “interesting.” Nothing new there then, Hemiunu observed in his diary.

On the appointed day, Hemiunu donned his disguise as a physician and joined the party. The guards challenged him at the gates, but he showed them his vizier’s seal of office; one of them muttered ‘welcome back.’ He slipped into the entertainment room, and joined small groups of people who he did not know, saying little, stooping to conceal his height, and quietly watching what was going on.

The major-domo announced that the Princess Hetepheres was putting on an entertainment, and invited the guests to move towards the amphitheatre. Keeping with the others, Hemiunu shuffled on to a seat high up, at the back of the amphitheatre; it was still light, but the sun was going down and the whole scene was bathed in the red light of sunset. He was in shadow, however.

The princess announced that the entertainment was to be a play, written not by her, but by a bright young man that she was “encouraging.” The couple in front of Hemiunu exchanged knowing glances.

The play was about the conflicts between Osiris and Seth, his evil brother. It was a morality play, with good triumphing over evil. Hemiunu thought it was boring and predictable, but he realized that Hetepheres was not going to stage anything too controversial in the king’s presence. Not after her initial performance.

Hemiunu returned to
White Wall
unrecognised – his
appearance had changed
during his journeys, and
he was disguised as a
physician.

He joined a party at the
royal palace at which
Princess Hetepheres was
to give another of her
infamous “entertain-
ments.”

After the entertainment,
Hemiunu revealed
himself to the king, and
was welcomed back into
the king’s good graces.

The Princess Hetepheres
was less pleased,
however. Hemiunu had
rightly, and publicly,
blamed her for any
misunderstandings.

King Khufu had arrived late, and had slipped into his seat in front of the amphitheatre. He did not look happy. He may have to attend such parties, but he did not have to like them.

At the end of the play, the audience descended from the seating in the amphitheatre and formed into small groups, discussing the play and how well the actors had done. Hemiunu sidled into the group around Khufu, and nudged his way so that he was standing just beside the king.

Khufu made some observation about the play. Hemiunu said in a firm voice: "The king is very wise." Khufu started to agree with this interjection, but then realized that he did not know the speaker, and turned around. He glared at Hemiunu, who stood tall - a good cubit taller than Khufu.

Khufu looked up at Hemiunu. It slowly dawned on him that he was looking at his long absent vizier. "It is about time you returned," he said with a strangled voice.

"Deepest apologies, majesty, but you gave me very many tasks to perform, and I have only just completed them all. I am, however, sure that your majesty will be pleased. Everything has been completed exactly as you instructed."

Khufu was nonplussed. Here was his vizier acting very properly, as though nothing had happened. "It has come to my ears that you were acting beyond the authority of a vizier," Khufu said, trying to sound authoritative.

Hemiunu answered without hesitation, and with a tone of greater authority than the king had managed. "May I suggest that such thoughts could have emanated only from some silly, immature, addle-brained child? I feel sure that your majesty, in his great wisdom, would have dismissed such obvious falsehoods with the scorn they deserved. There could be no more loyal subject than I."

Princess Hetepheres had been standing listening to this exchange. She appeared to be about to say something, but the king raised his hand to silence her. "You are absolutely correct, Hemiunu, as ever. I am pleased to have you back among us. And I have some serious work for you to undertake. When you are rested."

"I need no rest, Sire. I am in your service at all times, my king."

The tension in the area eased. People started to chatter in their groups. Princess Hetepheres made as though to speak, first to the king, who dismissed her with a wave, and then to Hemiunu, who gazed blandly at her, until she turned on her heel and walked away. Hemiunu clearly enjoyed writing that part up in his diary. He had made an enemy of the princess, but that had been necessary to appease the king's anger.

"...such thoughts could have emanated only from some silly, immature, addle-brained child...your majesty, in his great wisdom, would have dismissed such obvious falsehoods with the scorn they deserved. There could be no more loyal subject than I."

Khufu's Concerns

The next day, Hemiunu made an appointment with the palace officials to see the king in the usual manner, as though the last three years had not happened. The king sent for Hemiunu immediately; he had a number of concerns about which, it seemed, only Hemiunu could advise him.

Khufu had a whole range of concerns about his expected afterlife.

He worried about the Netherworld, about travelling in the dark – of which he was afraid – about seeing his dead mother, about his health, about how long eternity would be, and many more.

Most of all, he worried about how he was going to operate in the afterlife to ensure the annual Inundation.

How was he expected to reach the stars?

How was he to persuade the Netherworld gods to accede to his wishes?

Most of all, he wanted to know how his *ka* would graduate into an *akh*, the shining light which was the final stage in becoming an Imperishable star.

While all kings of Egypt were interested in the afterlife, it was something of an obsession with Khufu. He was not content to leave things to the magic of the various priesthoods. He wanted to understand how it would be in the afterlife, where he would have to go, how he was going to get there, who he was going to meet, what they would have to talk about, and how he would get back again.

Khufu was not content with being told that, as a spirit, he would be able to travel anywhere. He wanted to know how. And would he have to travel by night? It was one thing moving around among the stars – would he need a boat for that? – but quite another sailing the Nile in the dark. King Khufu, the great warrior pharaoh was, it seemed, afraid of the dark.

Hemiunu listened gravely to the king, and made notes that are still evident in his diaries. The king also wanted to know precisely how, if he was entombed at Giza, he could commune with his ancestors who were at Abydos. Was such communion to be at night, or by day? Who visited whom? And so on. It was evident that the king had been thinking long and hard, and was concerned about the practicalities of life – or, rather, afterlife.

How was he supposed to find the various Netherworlds: the Underground Netherworld of his ancestors, the stellar Netherworld of the southern skies, and the stellar Netherworld of the northern skies? Were these Netherworlds connected? Would he be able to go from one to the other: if so, how? When he went to Abydos on the Nile, would he use a real boat, or a spirit boat? What real boat? What spirit boat?

Khufu wondered about his mother, Queen Hetepheres, for whom he had a great fondness. Would he meet her again, as though in life? Would they both be old when they met in the afterlife, or would she be young as he remembered her when he was a child? Would he be a fit, healthy young man in his prime, or an old, ailing invalid as his father had become?

For how long would his name and his spirit live once he passed on to the afterlife? Khufu knew that depended on the preservation of his mortal remains. How long would they last in the pyramid, yet to be built? How could they be made to last for ever? How could the pyramid be made totally secure for all time? How could he ensure that the priests would say prayers and make offerings at his mortuary temple for “millions of years”?

Khufu had other concerns, too. He knew from the plans that he had seen that the burial chamber in his new pyramid had been located very high up within the structure. This was all very well from the point of view of reaching the stars, but Khufu was equally concerned with being buried deep in the ground, as had Djoser, for example. Which should he be—high up, or deep down? And if he were up in the air, would not Ra, the sun god, be able to see his activities and require him to row the solar barque across the skies when he should be in the stellar Netherworld, negotiating the Inundation? It was all very confusing to Khufu.

Khufu knew where the southern Netherworld was—the star *Sahu*, (al Nitak, the left-hand star in Orion's Belt) pointed to it as the stars faded at dawn. He knew in general terms where the Imperishable stars in the northern hemisphere were, too; but he did not know in which precise direction he should go to reach the particular star where he was destined to have his palace in the afterlife.

There was a basic issue, too, which had never been resolved to Khufu's satisfaction. How was he expected to travel between his pyramid and the stellar Netherworlds anyway? Was he supposed to use some kind of ladder – where was it? Or, climb up a rope – where was it, and to what was it attached? In a cloud of smoke, perhaps? That implied some kind of fire, which he would presumably have to start—using what? Khufu had hit the vital, unanswered question, one that had puzzled the priests and Hemiunu since time began.

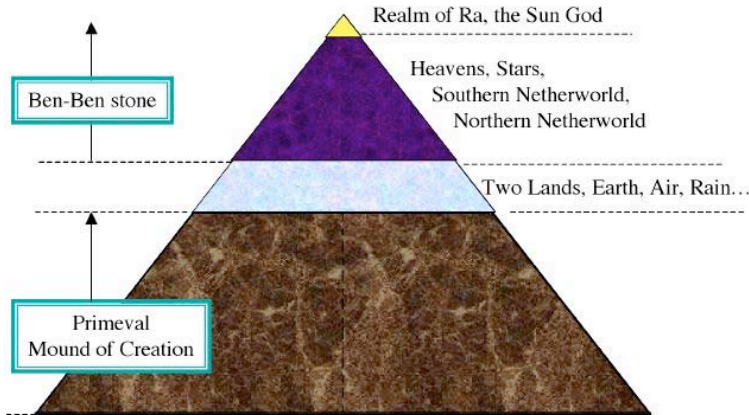
Khufu had not finished, however. Out poured ever more questions. And they were all fair and reasonable questions, even if the god-king Khufu Horus—of all people—should already know the answers, and even although Hemiunu was not the person to ask. Hemiunu was, after all, an architect and overseer. He was not a priest. Or, did Khufu believe that he was possessed of magic powers and the knowledge of the ancients? It would not do to disabuse Khufu of that belief.

Khufu wanted to know how he was supposed to ensure the Inundation. That would be his main objective each year, and it was vital to the well being of Egypt, but just how was it to be done? Would these other gods, whoever they might be, just do as he told them, or would there be disagreement, some struggle perhaps? Would he have to give them presents, to persuade them—if so, what kind of presents, and where would he get them from? Khufu, it seemed, was more worrier than warrior.

Last but not least, Khufu was concerned with the transmogrification of his *ka* into the *akh*, the final stage in the process of reaching the stars, when his spirit would become a shining light. Was there some process to be gone through? Would he be examined, by whom, and about what? Suppose he was unsuccessful—what happened to his *ka* then?

Hemiunu listened, took notes, promised to return with answers, and decided that he did not want to become king: ever.

System Designer at Work



Hemiunu's diary shows a fever of activity as a result of his meeting with Khufu. There are pages and pages of scribbles and sketches, mostly unintelligible.

The first recognizable pattern to emerge was a new view of the levels within the pyramid design. Hemiunu had moved on since the Bent Pyramid at Dahshur; it seems that he had concluded that the pyramid would only meet Khufu's needs if it had:

Hemiunu's revised layer concept for the pyramid.

Between the lower primeval mound of creation, and the upper *ben-ben* stone, he interposed a layer to represent the two lands, with the atmosphere, the air, the rain, the earth, the gods, etc.

This allowed him to conceive the *ben-ben* stone as containing the heavens, the stars, and six of the seven planets: Mercury, Venus, Mars, Jupiter, Saturn and the Moon. The heavens also contained the southern and northern Netherworlds, including the gods with whom Khufu would negotiate for a successful Inundation each year.

Tradition had it that the *ben-ben* stone had come down from the heavens. Hemiunu saw this new approach as simply confirming the legend.

Finally, at the pyramidion, Hemiunu set the supreme god Ra, shining down and giving life to all.

Hemiunu was apparently just setting out the theology: there were no dimensions on his figures to indicate the height of each level.

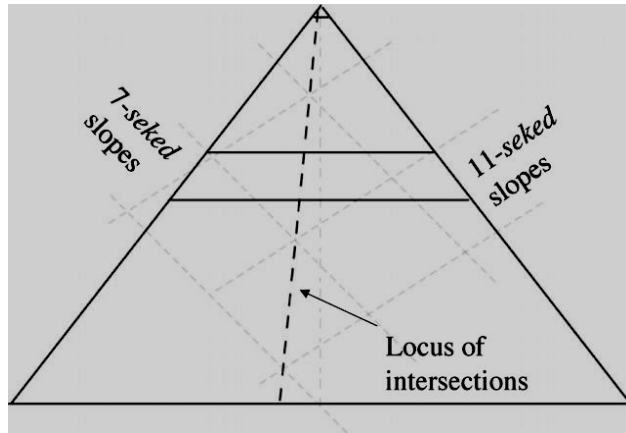
- A surface representing the top of the primeval mound of creation
- A layer above this, representing the everyday world in which all Egyptians lived, with its earth, rivers, towns, air, rain, desert, and so on—not forgetting the gods who lived throughout the land
- At the upper limit of this level there was a second surface and layer, representing the heavens, much of which were visible only at night. The heavens contained the stars, six of the seven planets, comets, etc., and the two stellar netherworlds, one to the south and the other to the north. Within these netherworlds there lived the gods with whom Khufu would have to negotiate for a successful Inundation each year
- At the pinnacle of the heavens was Ra, the sun god. In Hemiunu's scheme, he had separated Ra, the supreme god, from the other gods and planets, and placed him in the pyramidion where his light could illuminate Egypt, the heavens and the upper surface of the primeval mound

Hemiunu next tackled the thorny question of the king's interment chamber. The king wanted to be buried deep underground, in a pit like King Djoser of old, whose pit had burial chamber had been at the bottom of a pit over 56 cubits deep. The underground chamber that had been partially completed deep under the pyramid would have fitted the bill: it was deep enough, but the entrance passage was too small for a sarcophagus. Besides, if Khufu was to travel to the stars, his sarcophagus should—according to contemporary thinking—be high up, as had been the case with the Bent Pyramid.

There were only a few design constraints facing Hemiunu in the placement of the King's Chamber, but he had a difficult time solving the problem, as there were so many variables. He had decided that he

would include spirit conduits from the chamber to the southern and northern Netherworld's, so as to resolve Khufu's concerns about navigation.

He also knew the elevation slopes that these conduits must take: seven *seked* and 11 *seked*. The conduit to the south must slope up at seven *seked* towards the southern Netherworld, as seven was the number sacred to Osiris. The conduit to the northern Netherworld must slope up at half the slope of the pyramid itself, which was to be 5-1/2 *seked*, in honour of Hemiunu's father Neferma'at who had set the Meidum pyramid at 5-1/2 *seked*.

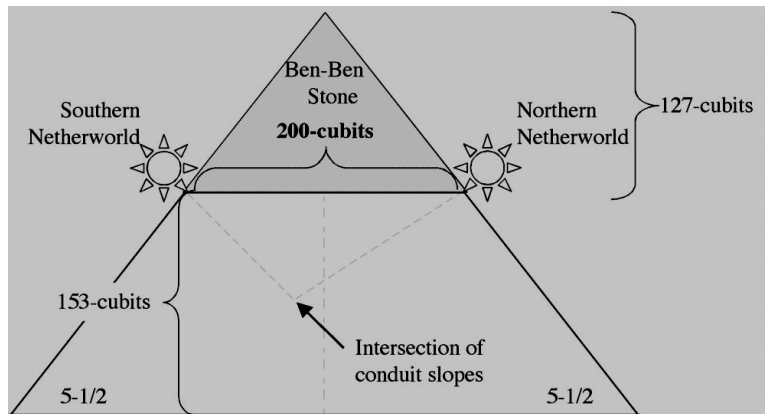


The diagram shows how Hemiunu tackled the problem. He drew three pairs of lines, each pair having one of each slope, making sure that the lines cut the outside edge of the pyramid at the same level. Where the line pairs crossed should be where the King's Chamber would be. As the diagram shows, he did not get a unique answer; instead, he found that the chamber should lie on the "locus of intersections," (not Hemiunu's words), shown by the heavy dotted line.

So, he could place the King's Chamber anywhere on the locus and the *ka*-conduits would emerge from the pyramid at the same horizontal level. But where should the chamber be on that locus? Clearly, it should be inside the primeval mound of creation rather than above it, but that still left a lot of choice in the vertical direction.

Hemiunu resolved the problem by fixing the size of the *benben* stone such that its base had a 200-cubit side – see diagram. He calculated that the *benben* stone would occupy the top 127 cubits of the pyramid's overall height of 280 cubits.

Hemiunu's concept was two-fold. The *ka*-conduits would emerge exactly at the corners of the *benben* stone, i.e., at the northern and southern reaches of the heavens as depicted on the base of the *benben* stone. So, the king's *ka* could choose either to project to the real heavens, visible in the night sky and at dawn and dusk, or



The Secret Diaries of Hemiunu

could operate within the spiritual map of the heavens within the *benben* stone. Hemiunu was using the principle of substitution by representation to create a universe within the pyramid, yet at the same time offering the king's *ka* the opportunity to travel to the real thing, as he might wish.

Hemiunu added in his notes that the king's *ka* would need several boats to complete his many journeys. Were he to visit the southern Netherworld, for instance, he might need a boat to travel across the skies on the celestial Nile to the northern Netherworld, i.e., the circumpolar stars. In keeping with contemporary sailing practice, he might need one boat by day, and another by night, fitted out with lights to guide the way.

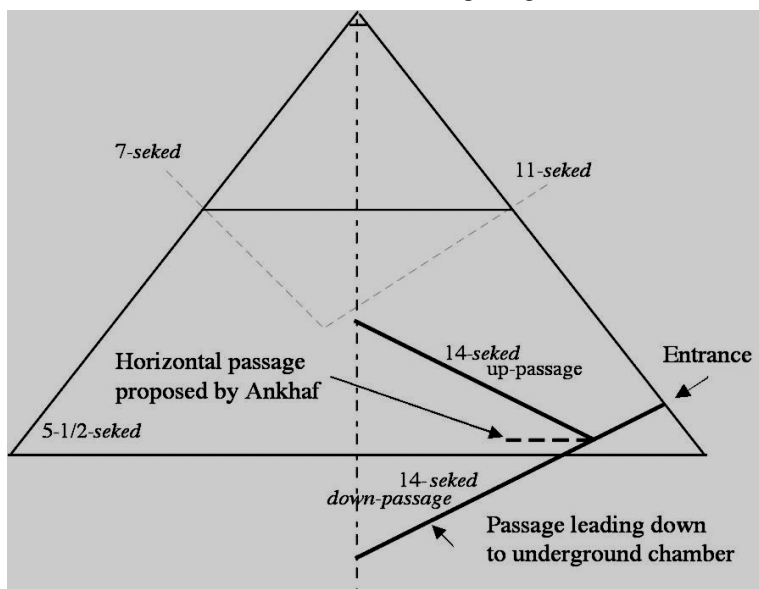
He would similarly need a boat to travel the same journey across the mystical map of the heavens on the base of the *benben* stone. Here, however, he would need only one boat as, with Ra in the pyramidion, the sun would shine continuously and there would be no night.

Hemiunu recorded his satisfaction with the design so far; he had been able to resolve the king's concerns about stellar navigation, and he had solved the problem of the king's fear of the dark. The king could navigate across the spiritual map within the *benben* stone and his *ka* would be simultaneously present both in the Netherworld of the map and in the Netherworld of the heavens. To be in one representation was, by the magic of substitution, to be in the other, too. This was, after all, how the magic worked.

In his design, Hemiunu had not yet located the sarcophagus chamber. He had established the paths of the *ka*-conduits, but these must enter the chamber horizontally, and at a sensible height above floor level, if they were to be useful passages for the spirit. He was also concerned about the passage from the entrance in the north face, which had to reach the King's Chamber, as it would come to be called.

Prince Ankhaf had been building the new pyramid to a design based on Hemiunu's *ka*-pyramid at Dahshur. Designs for very small pyramids did not scale up well, so there were problems.

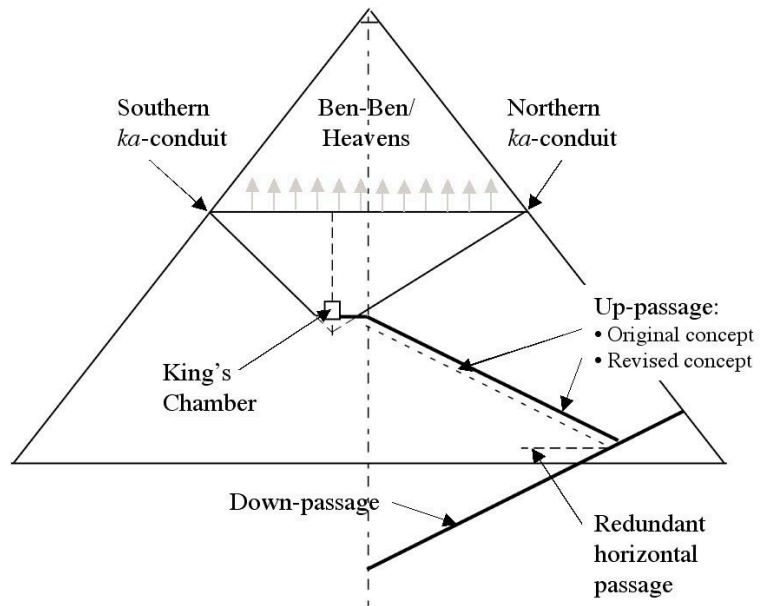
Ankhaf had dug out most of the down passage to the underground chamber. The slope of this passage was at 14 *seked* (26.6°), which was appropriate and conventional; it was exactly half of the 7 *seked* slope that was sacred to Osiris, and at which the



southern *ka*-conduit was set in Hemiunu's design concept.

Ankhaf had also started to construct a horizontal section, similar to that in the Dahshur *ka*-pyramid, and this was where Hemiunu saw problems. The up passage had to be at 14 *seked*, too; it was necessary to the magic that the slope of the passage approaching the burial was at 14 *seked*. If Hemiunu started at the southern end of Ankhaf's horizontal passage, then the up-passage would not rise high enough to reach the King's Chamber. The horizontal passage had to go.

Once Hemiunu had made that decision, he then had freedom in his design to move the up-passage up to the right or down to the left, so long as he maintained the slope. From his notes, it appears that he made several wooden models at this stage, and was trying out different configurations



The result of this next stage of design is shown at right. The King's Chamber is located on the vertical through the *ka*-conduit intersection point. It is also located on the horizontal from the intersection of the up-passage with the centre line of the pyramid, which drops down from the pyramidion. At the bottom end of the up-passage there would have to be a small amount of rework, as masonry had already been raised far enough to cover the new junction with the down-passage. Hemiunu was unconcerned by this, deeming it straightforward.

The two *ka*-conduits have been given horizontal sections, enabling them to enter the King's Chamber at head height above the floor.

Overall, Hemiunu observed in his notes, the design seemed to be going quite well. But he was aware that he had been putting off the real problem: how to give the king the pit burial he desired.

Hemiunu spent several weeks working at this problem, drawing sketch after sketch after sketch, and scribbling across each one. Eventually he remembered the advice he had received from Osiris; he took several days off and spent some time out in the desert, trying to think about anything else but his pyramid conundrum. Each evening, he would get his crystal ball out, and gaze through it towards the sunset, hoping for inspiration....

Inspiration

Hemiunu was wandering aimlessly in the desert when he chanced across a strange and unusual object he described as a temple. His description and sketches were detailed enough to permit a reconstruction—see graphic.

The “temple” consisted of a low mound with a number of rectangular stones standing on top. Most of the stones formed two concentric semi-circles. At the centre were two pairs of stones. One pair was round in cross section, while the pair facing the opening to the semicircles had rectangular cross sections.



The whole assemblage seemed to be very old indeed. The stone was deeply etched with what looked like water erosion: Hemiunu had seen similar effects at the cataracts south of Abu. There had been no significant rainfall in this part of the western desert for many years, however. True, there was the occasional flash flood, but nothing to account for that degree of erosion.

The ground seemed to have been etched, too. In this case, however, he could see signs of human activity. There were score marks made by

some kind of tool. Again, the marks seemed very old, but it was harder to be sure, as the scores looked like they had been smoothed by sand and wind.

He wondered, too, about the purpose of the stones. The four at the centre might represent people: two men and two women, he thought. Perhaps the other stones were witnesses, observing a ceremony. Or was that fanciful?

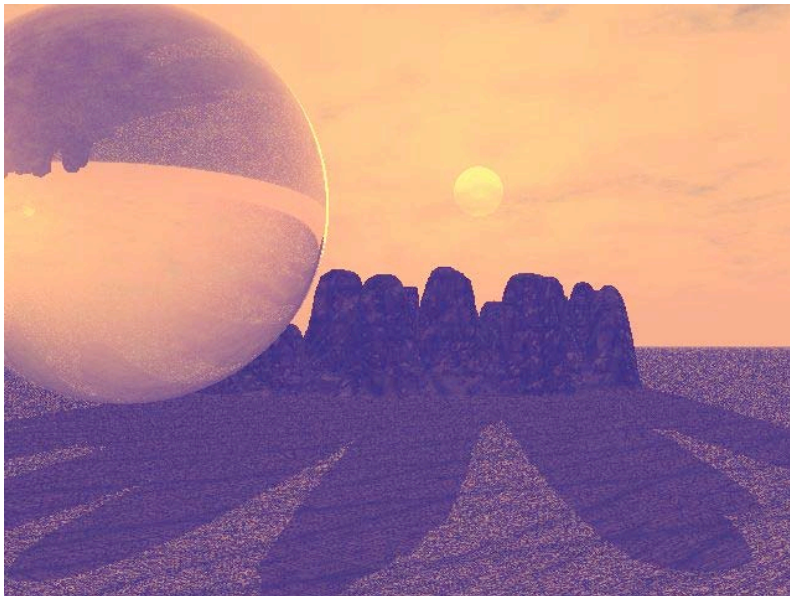
As the day stretched into evening, Hemiunu noticed that the semicircle opening faced toward the setting sun, and that the stones were casting lengthening shadows to the east. The shadows looked more like teeth.

Could the stones be used to tell the time of the year, perhaps? Hemiunu walked eastwards and then looked back towards the sun through the stones. Sure enough, it was possible to see the sun between the stones as it slid down towards the horizon. Hemiunu sketched the view, and thought some more.

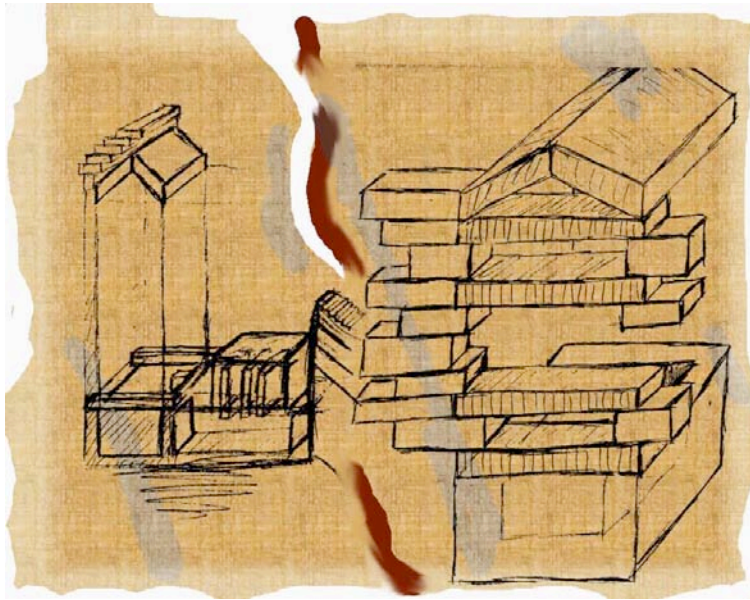
He had set up a makeshift camp earlier, being determined to stay out in the desert for a couple of nights. He fetched his crystal ball from his tent and set it up so that he was looking toward the sun through the stones. Perhaps this chance discovery would change his fortune.

As usual, he soon started to feel drowsy. He wondered why the world was upside down in the crystal ball. Why should everything be out of place? Perhaps that meant something: perhaps not.

Just then, halfway between waking and sleeping, he had an idea.



Developing Concepts



Hemiunu's idea was simple, but ingenious. He would create a pit burial for Khufu, like King Djoser's, but high up in the pyramid.

Instead of being dug down from the plateau surface like Djoser's, Khufu's pit would be "dug down" from the surface of the primeval Mound of Creation.

The idea had instant appeal; it felt right to Hemiunu. He began to sketch out his ideas, and some of those sketches have survived.

His first idea is shown at left of the graphic. The burial chamber is shown at the bottom left, with a column above it representing the burial shaft. At the top of this shaft he envisaged a single or double pitched, or gabled, roof, with a stack of corbels to divert and carry the down thrust from the pyramid above.

To the right of the burial chamber he drew in an entrance with three withdrawn portcullis stones, and the upper end of the Grand Gallery.

Over the top of the burial chamber he drew two stone beams, one at either end of the chamber. The inside width of the chamber was to be 10 cubits, making the span for each beam greater than 10 cubits. This was clearly a concern, judging by Hemiunu's notes.

He had never spanned such a large gap with a stone beam. He judged that the beams would need to be granite, and – importantly – that they should carry no load other than their own weight, otherwise they would bend and collapse. He decided that they would have to be taller than they were wide to give them sufficient strength to avoid bending and breaking. (This appears to be the same principle as that used in the design of the modern I-beam, which is designed to resist tension at the bottom and compression at the top.)

Hemiunu knew that King Djoser's burial chamber was sealed with nine stone beams, so he would seal Khufu's chamber from above with nine stone beams, too.

His first diagram worried Hemiunu. The tall "pit" that he had drawn was too tall to fit comfortably with other features in the overall pyramid design, but more importantly it would create a weakness within the structure. He could envisage the sides of the "pit"

collapsing inwards under side pressures. The second diagram shows how Hemiunu went about addressing those concerns.

Hemiunu could have filled the pit with rubble, as was the general practice for pits dug into the limestone plateau. Hemiunu elected, however, to span the gap with more granite beams. These beams would serve several purposes:

- First, and most important, they would prevent the sides of the pit from caving in; granite may be poor under bending, but it was excellent in compression
- Second, by including several layers of granite he could afford to reduce the height of the pit; granite was denser than limestone, so that a 1-cubit layer of granite might be worth 2-cubits of limestone. Instead of having to dig a pit in excess of 56 cubits like Djoser's, he could reduce the depth of the pit to fit in with his overall height budget for the pyramid
- Third, the five layers of granite that he proposed would satisfy King Khufu's concerns about being supervised by Ra; even Ra would not be able to see into the King's Chamber through five thick layers of granite

The second figure also shows Hemiunu's early ideas about keying in, or bonding, the pit to the rest of the structure using overlapping Flemish bonds—clearly not invented by the Flemish.

Finally, there are three simulations based partly on Hemiunu's drawings and notes, and partly on what can be seen from within the Great Pyramid today, showing how the so-called relieving chambers were integrated into the pyramid structure.



Reconstructions of the burial pit that Hemiunu conceived above the King's Chamber. The perspective view above shows the construction of the stack. Each course of granite beams was separated from the others by spacers. The tops of the beams were left rough to emulate granite strata – and to save time in unnecessary dressing.

The reconstructions below show how the burial pit and the chamber are keyed into the surrounding masonry. Note the corbels preventing the superstructure from bearing down on the gable peak, and the sarcophagus in the chamber. Hemiunu was considering a double gable roof at this stage.



The Height Budget

Hemiunu was developing a “height budget” for the great pyramid. He was evidently working from the top down, rather than from the base up. This may have been because the base incorporated the natural mound at the Giza site, so that the actual point at which the base started in the centre of the pyramid was uncertain.

Refining the Design

The diagram shows Hemiunu’s initial height budget. He started by sketching out the various features in the pyramid quite roughly, by eye.

Working from the top down, he gradually refined the design by calculating the various vertical drops until he had a complete set of vertical dimensions.

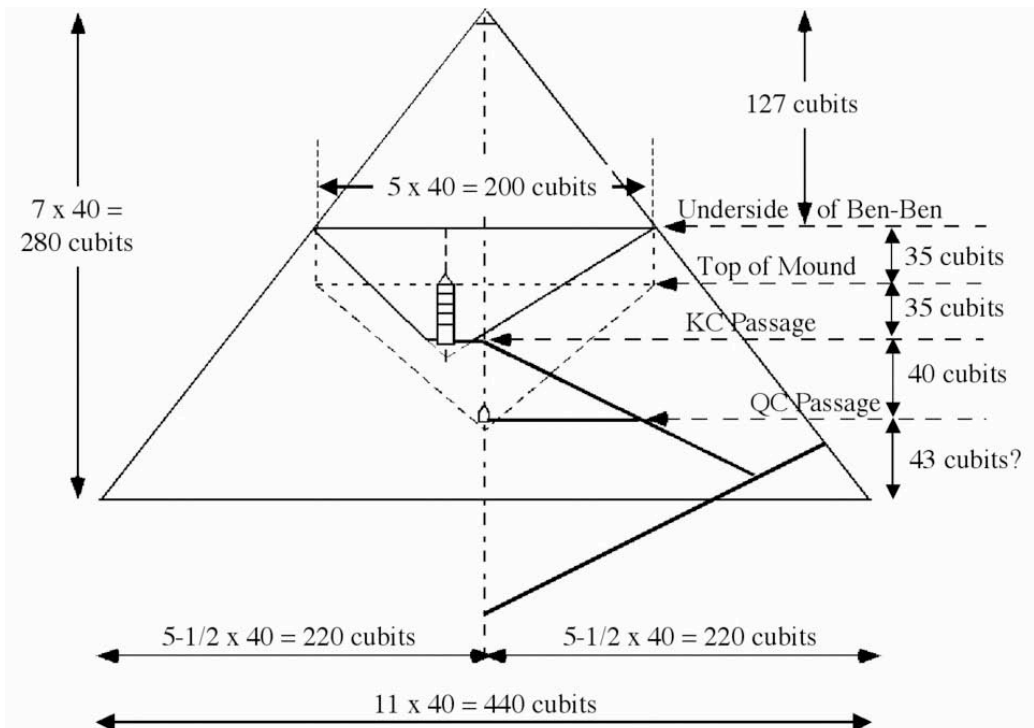
Contrary to some popular current ideas, the four *ka*-conduits were essential to the design from the start; where the pairs of conduits crossed formed “anchor” points in the design.

It is noticeable from the budget that Hemiunu worked in 40-cubit lengths where he could.

Hemiunu worked in 40-cubit units. The pyramid, with its proportions of $5\frac{1}{2}$ to 7, has a height of 280 cubits, i.e., 7×40 , while the base, that is half the side length, is $5\frac{1}{2} \times 40 = 220$ cubits. So, the pyramid proportions were $5\frac{1}{2}$ to 7 in lengths of 40-cubits, i.e., the slope was $5\frac{1}{2}$ *seked*.

Within the pyramid, the vertical distance between the horizontal passages into the King’s and the Queen’s Chamber (KC and QC) respectively is also precisely 40 cubits. Hemiunu set the horizontal base of the *benben* stone at $5 \times 40 = 200$ cubits: this inevitably led to the vertical drop from the peak being 127 cubits.

He was intent on establishing magical relationships between the various parts of the structure – only this would empower the structure for his king, Khufu. Hemiunu had decided upon the internal pit above the burial chamber, but was still uncertain as to its precise height. He next inserted a *serdab* into the design. If the burial chamber was for



Khufu to navigate to the stars, then the *serdab* was for Khufu to navigate through *tawi*, the Two Lands of Upper and Lower Egypt. Khufu was, and would always be, *neb tawi*, Lord of the Two Lands.

The *serdab* (Arabic for kiosk), or Queen's Chamber as it would come to be erroneously known, would also need *ka*-conduits, but this time they would guide the king's *ka* to the surface of the Mound of Creation, where there would be a representation of Egypt. Here, Hemiunu observed in his diary, were both a need and an opportunity for symmetry. The king would always want to treat Upper and Lower Egypt equally. So, the Queen's Chamber would have to be on the centre line, dropped down from the peak. Further, the *ka*-passages would have to be of equal slope. Duality was vitally important, too.

He decided that the two *ka*-passages from the Queen's Chamber would reach the surface of the Mound of Creation directly underneath the points where the two *ka*-passages from the King's Chamber emerged from the side of the pyramid, at the bottom of the *benben* stone (see diagram). So, the *serdab ka*-passages would also be 200 cubits apart as they emerged, conferring upon them magical status as being directly beneath the southern and northern Netherworlds.

After a number of trial models and calculations, Hemiunu settled on a depth for the burial pit that made the two Queen's Chamber *ka*-passages slope upwards at $8\frac{1}{2}$ *seked*.

- The surface of the Mound of Creation was then 35 cubits below the under-surface of the *benben* stone, and hence of the heavens
- The entrance passage to the King's Chamber, and hence the overall depth of the king's burial below the Mound surface was also 35 cubits – duality, again.
- The slope of the two Queen's Chamber *ka*-passages, at $8\frac{1}{2}$ *seked* each, neatly complemented the $5\frac{1}{2}$ slope of the pyramid and the fourteen-*seked* slope of the internal passages ($8\frac{1}{2} + 5\frac{1}{2} = 14$).

This arrangement presented just the duality and symmetry that Hemiunu was seeking. The elements of the design locked together. He had found the magical arrangement he sought.

Initially, Hemiunu approximated the internal design, using his visual judgement of proportion to set chambers and passages out roughly to get his ideas straight. He used wooden mock-ups, but did not rely upon them; instead, he went on to refine his design using calculations.

Hemiunu's Sums

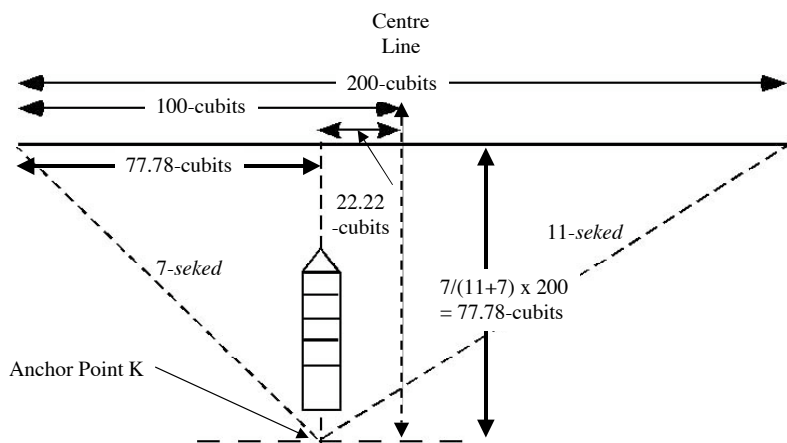
Hemiunu had a delightfully simple way of calculating dimensions inside the pyramid design, one which would appeal to people who do not appreciate conventional mathematics, trigonometry, etc.

The graphic shows drawings based on those in the diaries, with the numbers converted for legibility. Hemiunu appears to have been

The 70-cubit drop from the heavens (i.e., the underside of the *benben* stone) was more than fortuitous. '70' was a magic number. It was the number of days in 7 weeks, and the number of days required for the full process of mummification.

'70' was also the number of days that the star Sirius/Sopdet/Isis disappeared from the night sky each year.

So, separating the sarcophagus from the heavens by 70-cubits was apposite. Hemiunu was particularly satisfied that the 70-cubit drop divided into two 35-cubit parts: the heavens to the surface of the Mound; and the surface to the sarcophagus at the bottom of the burial pit.



Hemiunu worked his height budget using design “anchor points.”

Anchor Point K was the point of intersection of the 7-seked and 11-seked slopes of the *ka*-passages from the underside of the Ben-Ben stone.

Similarly, Anchor Point Q was the point of intersection of the two 8-1/2-seked *ka*-passages from the top surface of the Mound of Creation.

These anchor points, while essential to the design, and of great value during construction for setting out the *ka*-passages, had no function in the final construction and would eventually be concealed in the masonry.

measurement in *seked* was based on a vertical proportion of 7.

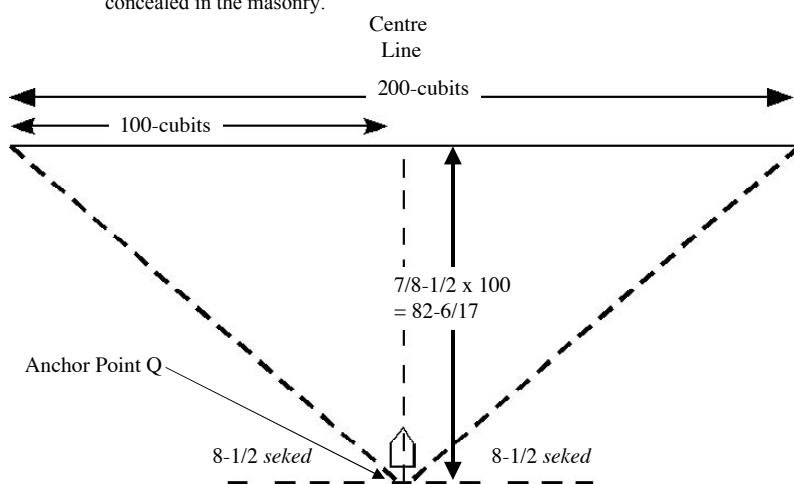
That meant that the 200-cubit surface was divided in the ratio of 7:11, so the section to the left (south) of the King’s chamber would be $200 \times 7 \div (7+11) = 77\text{-}7/9$ cubits. Simple subtraction from 100 cubits showed that the centre of the King’s Chamber would be $22\text{-}2/9$ cubits from the centre of the pyramid. Further, since 7-seked results in an isosceles triangle, he knew that the vertical drop to the point at which the two *ka*-conduit slopes intersected must also be $77\text{-}7/9$ cubits. (Reader’s who think that is a complicated calculation should try it using trigonometry and angles.)

These calculations did not precisely locate the King’s Chamber, but they did show the boundaries within which it must lie. He performed similar, even simpler calculations for the Queen’s Chamber, where the symmetry helped.

The two *ka*-conduits would cut the surface of the Mound of Creation

at 100 cubits to either side of the pyramid centre line. The simple *seked* proportional relationship meant that the vertical drop to the point of intersection of the two *ka*-conduit slopes was $100 \times 7 \div 8\text{-}1/2 = 82\text{-}6/17$ cubits.

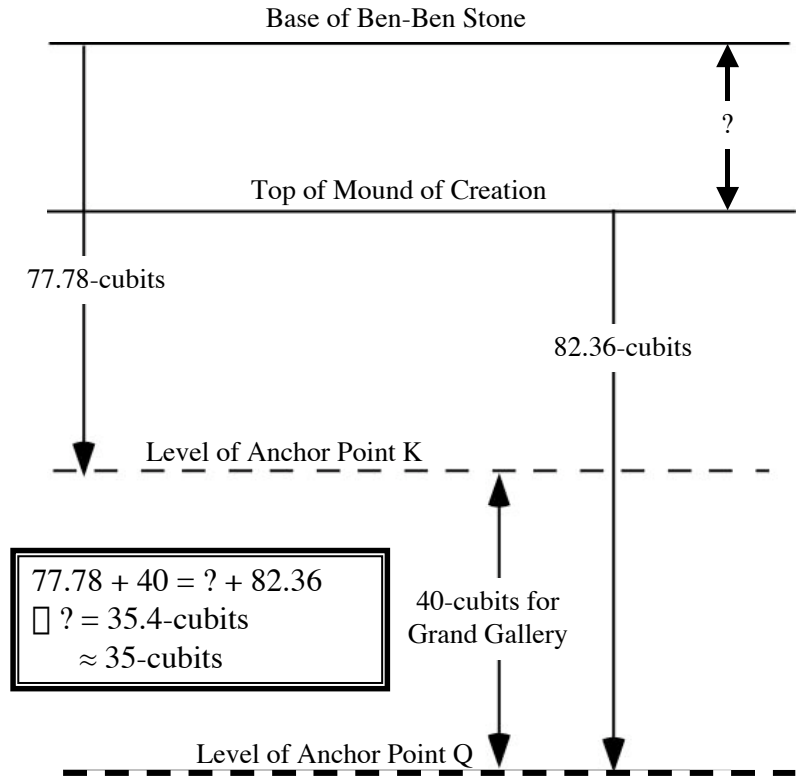
Hemiunu had still to calculate the height of the layer representing Egypt and its atmosphere that lay between the Mound of Creation, and below the *benben* stone. He did,



however, know the two drops of 77.78 cubits from the *benben* surface and the 82.36 cubits from the Mound. He had also fixed the height of the Grand Gallery, based on his Dahshur experience, at 40-cubits. So, he was able to draw one more diagram that helped him to solve his problem.

As the graphic at right shows, the layer between the top of the Mound and the bottom of the *benben* stone ends up being some 35-cubits.

Last in the area of height budgets, Hemiunu had to locate the King's and Queen's Chambers. They had to be above their respective *ka*-conduit intersections, which defined their centre-lines. He had also set their widths, i.e., their internal north-south dimensions at 10-cubits each. He now chose a height above their respective *ka*-conduit intersections of some 7-1/2-cubits to define the bottom of the passages leading into the Queen's Chamber and the King's Chamber. This reduced the 77.78-cubit drop from the *benben* stone to the *ka*-conduit intersection to a 70-cubit drop to the King's Chamber entrance. As the *benben* and the Mound were separated by 35-cubits, this created a symmetrical division of the 70-cubit drop into two 35 cubits parts—see graphic on page 158.



Note. Hemiunu did not use decimal notation, nor did he use fractions as they are shown in the text. The ancient Egyptians used unitary fractions; that is to say, the numerator had to be '1' and no two fractions could be the same (e.g., 2/7 could not present as 1/7+1/7, but instead as 1/4+1/28.) So, 2/9th presented as 1/6th+1/18th. Similarly, 6/17th presented as 1/4+1/17+1/34+1/68. Hemiunu did not have to work out these unitary fractions; he knew them off by heart. However, he was quick to round up or round down to the nearest cubit, rather than carry such cumbersome notation.

With his magical design set out in drawings and models, Hemiunu was ready to face King Khufu and his many questions.

Early Design Review—*Akhet* Khufu

Hemiunu made an appointment to see the King. When he arrived, the King kept him waiting all day and then sent him home. Hemiunu did not make a second appointment. Instead he set about organizing the return of his family from Southern Egypt to White Wall. After a week, Khufu sent for him, but Hemiunu decided to be busy on other matters.

Another week passed, and Khufu sent a platoon of marines to escort Hemiunu to the palace. Hemiunu's agents told him they were coming. Avoiding them, he slipped quietly into the King's palace and sat waiting patiently in the audience chamber anteroom.

The marine captain came bustling into court, sweating profusely, and explained in a loud voice to the King that he was unable to locate Vizier Hemiunu. At that, Hemiunu stepped quietly into the audience chamber and asked if someone had been looking for him.

King Khufu exploded. He had been outwitted yet again by the very person he felt a need to put down. Hemiunu did not understand why the King wanted to treat him in this way, but Hemiunu also knew that the King needed him; he, and he alone, could deliver Khufu's Horizon, his pyramid, and his final resting place. King or not, Khufu had to learn a little respect; his father would never have behaved in this way.

Khufu calmed down enough to ask where the plans were for his pyramid. Hemiunu replied that they had been in the anteroom for the last two weeks, and that he presumed the King had been too busy with matters of state to look at them.

Khufu: Do you presume to trifle with me, you worthless, useless, excuse for an architect?

Hemiunu: Not I sire. I am your majesty's most loyal and devoted servant. As your majesty is clearly not pleased with my work, even although I have yet to present it, may I beg your majesty's leave to spend some more time trying to improve my work. Or perhaps your majesty would prefer another architect to takeover the work?

Khufu: You do trifle with me, Hemiunu. Have a care, you miserable man.

Hemiunu: Miserable man? Surely, sire, you can do better than that?

The officials in the court shrank back in fear at this impudence. Khufu was thunderstruck. No one ever spoke to the King like that. After a long pause he was heard to utter a strange, strangled sound. The king, it seems, was laughing—not something to which he was prone.

Khufu: You are a bold young man, indeed, Hemiunu. I like you, indeed I do. Enough of this banter; let us get down to work.

Khufu had the audience chamber cleared. Hemiunu showed the king his drawings, but withheld the calculations; he was aware that calculations made the layman glaze over with disinterest. Instead, Hemiunu showed how the various features in the design were intended to resolve the king's concerns.

Khufu was interested and attentive. He liked the idea of the *ka*-conduits for navigation, and he particularly liked the idea of the map of Egypt and the map of the heavens within the pyramid. Khufu was ecstatic when Hemiunu told him about the burial pit; this was the most original and the best idea the King had ever seen.

Khufu: I have one or two concerns, Hemiunu. As you may know, the High Priest of Heliopolis—a friend of yours, I believe—is keen to ensure the pyramid design and the spells to be used at my entombment ensure my relationship with our supreme god, Ra. I will have other responsibilities, besides those afforded to Ra.

Hemiunu: In designing your burial pit, Sire, I was conscious of this dilemma. Ra is located at the pyramidion, and will send his powerful rays to the surface of the Mound of Creation. There his gaze will fall upon the gabled roof of your burial pit. He will, however, be unable to see through the five layers of granite underneath it. Your divine *ka* will be free to do as it, as you, wish.

Khufu: Hm. My other concern is about the Nile. You have the Nile flowing through the centre of the Mound. My sarcophagus chamber will be under the Mound. Will not the water from the Nile enter the chamber and drown my *ka*?

Hemiunu: I had thought of that. (Hemiunu had not thought of it, but he felt that he had to be quick witted if he was to keep ahead.) Everything in the Mound of Creation will be watertight. The burial pit and the King's Chamber, and the *ka*-conduits; they will all be watertight.

Khufu: And where the *ka*-conduits enter the chambers? Surely there is a place where water could rush in?

Hemiunu: We will seal the conduit entrances to the chambers with a thin layer of stone, so that you, and only you, will know where the *ka*-conduits enter and leave.

Khufu: Does that mean that the High Priest of Heliopolis need not know that the *ka*-conduits even exist?

Hemiunu could sense some friction between the priests of Heliopolis and the King. Hemiunu was not surprised. It was all too easy to fall out with King Khufu...but Hemiunu could use that knowledge.

Rising Threats to Khufu's Spiritual Authority

Developing Social Hierarchy

Hemiunu's wife, Neferhetepes, arrived home with the family, and with news of unrest in Southern Egypt. She had been travelling up and down the Nile, visiting and managing Hemiunu's farms and estates while he had been making his "progress," one step ahead of Khufu. As a result, she had become aware of some discontent.

Neferhetepes' news was not good. The Inundation had been indifferent for the last few years, and Khufu's accession to the throne had not seen any improvement: if anything, matters had got worse.

Khufu was not the great traveller that his father had been, either; Khufu had yet to make a full progress up the Nile, preferring instead to stay within his power base at White Wall.

The combination of these two factors was causing the rise of factions. Usually, the king appointed nomarchs from among members of the wider royal family, and it had come to be expected that, when a nomarch died in post, his eldest son would take his place. This had, in fact, happened in several nomes, leading to the beginnings of mini-dynasties. Some nomarchs were beginning to see themselves as all-powerful, to the extent that they had their own priesthood, their own temples, administration and taxes.

As part of their administration, they had properly set aside food stores against lean years. Such stores usually consisted of grain, salted fish and salted meat. With the poor Inundations, these stores had increased in value. Instead of sharing the food out to the most needy under the supervision of the king, some nomarchs were retaining their stores exclusively for their own people. Other nomarchs, with hungry mouths to feed, and seeing plenty of food in adjacent nome stores, were getting sufficiently angry to attack and loot their neighbours' supplies. This had the smell of trouble about it.

The Rising Cult of Re

The Priests of Heliopolis were fanning the flames of civil war, although whether this was conscious or not, Neferhetepes was unsure. They were promoting the cult of Ra up and down the river. Ra had always been the supreme god in one sense, but he had not held sway over the god-king. Prior to Khufu, the king alone had a guarantee of everlasting life, as he and he alone identified with Osiris in death. He also identified with Ra upon death, becoming one with the sun god.

Now, the cult of Ra was indicating that there could be eternal life for anyone who could afford the necessary processes to preserve their mortal remains, and ritual spells to ensure safe passage to the other world. Moreover, the king was seen as being subservient to Ra, and helping others to row the solar barque daily across the sky.

From this evolving viewpoint, the king was still the link between the people and the gods, he was still the purveyor of *ma'at*, and he was still both god and king in one. However, Hemiunu sensed that the exclusivity of his position was being prejudiced.

Khufu was aware of this threat to his singular status, and he was aware that the Priests of Heliopolis were the source of the threat. Their proselytising would enhance their power, status and income at the expense of the king's position, and he was ill placed to argue with them on such theological matters.

Khufu was not, Hemiunu believed, aware of any threat of civil unrest, however. Hemiunu pondered in his diary as to his best course of action. Finally, he decided to seek an audience with the king.

Khufu: More designs for my "place of landing" (death), Hemiunu?

Hemiunu: No, sire, something rather more urgent: your majesty will live for many thousands of years before landing

Khufu: Enough nonsense, you poor excuse for a dung beetle

Hemiunu: That is a much better insult, Sire—well done. However, I bring you news of unrest up country that may require rapid reaction

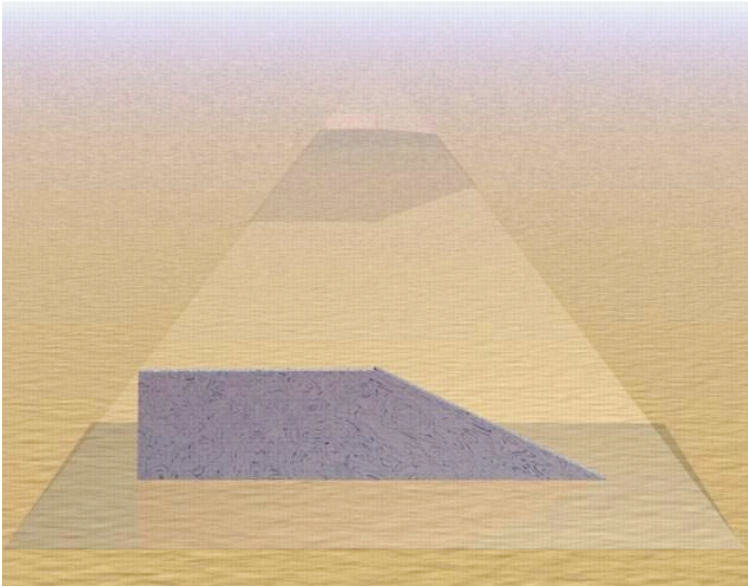
Hemiunu recounted what Neferhetepes had told him, without mentioning her by name. Khufu listened gravely, then thought, before asking what Hemiunu advised in the circumstances. Hemiunu had already worked out what he would have done had he been king.

Hemiunu suggested that the king should send out a large marine contingent to restore order, and should immediately replace the offending nomarchs with other relatives close to him at court. The marines should take control of all food stores up and down the Nile and reserves should be distributed according to need and regardless of nome. Finally, Hemiunu suggested that the king should order a fresh census and that the king should announce a royal progress to take place throughout the land within three months.

King Khufu was pleased with Hemiunu. It turned out that Khufu had been aware for several days of the unrest, and felt that Hemiunu's reporting of it confirmed the King's faith in him. Khufu had already detached a contingent of marines, but on Hemiunu's advice would send backup. Khufu had not considered replacing the offending nomarchs; surely, he observed, that would be unnecessary.

Hemiunu heard within just a few days that three nomarchs had mysteriously disappeared, and that the king had dispatched replacements to take up office immediately. The following year, Khufu ordered a fresh census, and conducted a progress from the northern delta to Abu in the south.

Construction Strategies



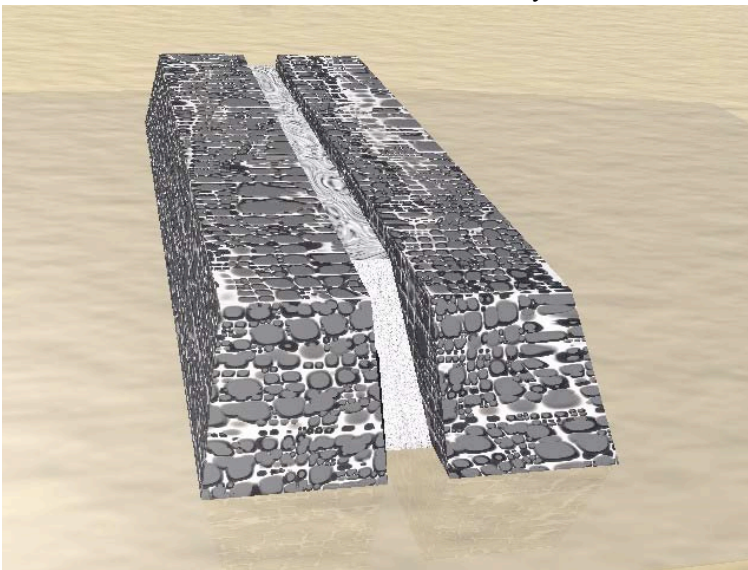
Above. The central ramp, on, or in, which all the internal features are built.

Below. The two battered construction walls, with the central ramp in the middle. The construction walls and the ramp rise together...

His basic plan was to build a narrow central ramp from the ground up, sloping upwards at fourteen *seked* in the northern half of the pyramid—see graphic. The up-passage and the Grand Gallery would be built on top of this ramp. The King's Chamber would be built on top of the ramp structure where it levelled out in the southern half of the pyramid. The Queen's Chamber and its entrance passage would be built on top of part of the ramp as it was being raised, and would then be covered in by further courses in the ramp's construction. The

Queen's Chamber would, therefore, end up inside the ramp and forming part of it.

The ramp was too narrow to stand on its own. Two battered (sloping) construction walls would be needed, one on either side of the central ramp. The three items would be raised progressively in concert, with the construction walls always marginally higher than the central ramp, so that granite girdle stones, limestone beam corbels, and other constructions could be lowered from the walls on to the ramp.



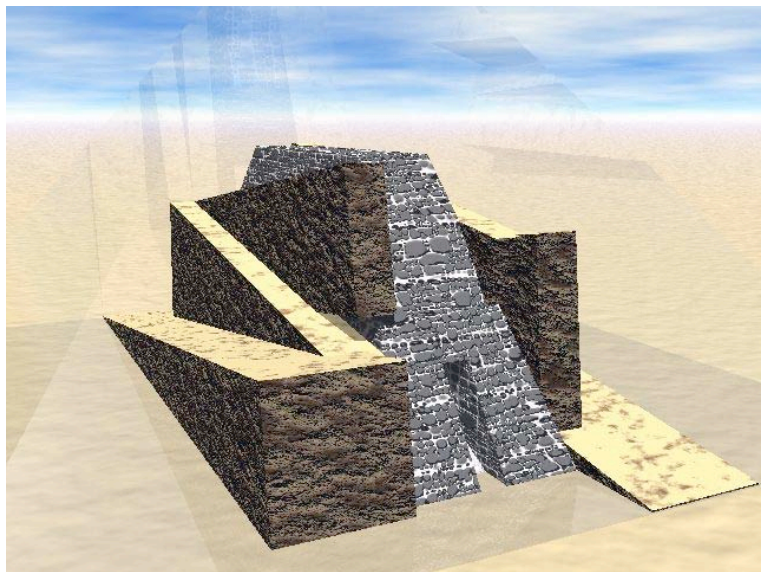
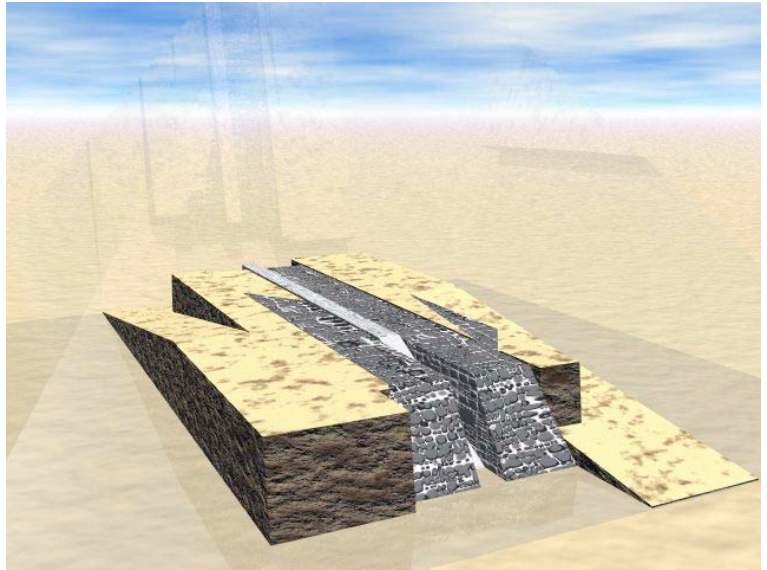
Hemiunu had discovered at Dahshur that lowering the parts down—as opposed to raising them up—was the only practicable way to build internal structures, and that building passages and chambers from the outside was much simpler.

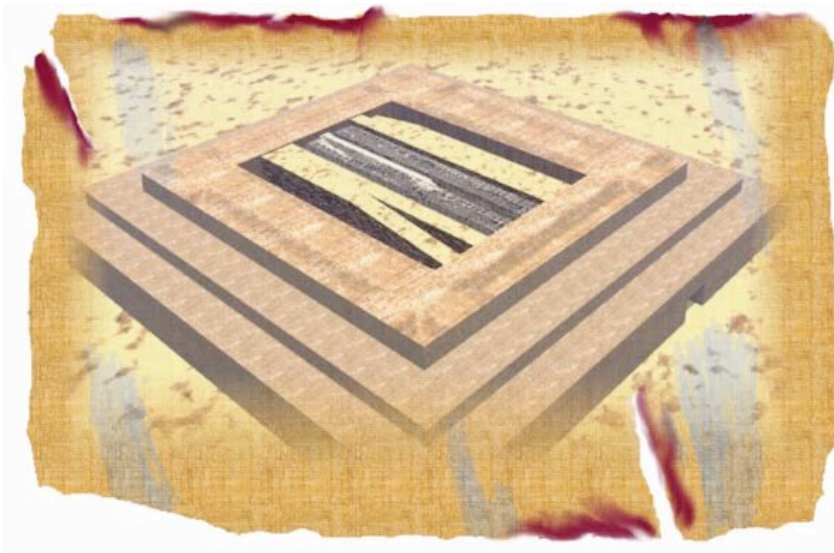
This left the issue of how to raise the building materials on to the construction walls, and here was Hemiunu's most ingenious idea. He could raise ramps on the outsides of both battered construction walls. Such haulage ramps would not only feed stones to the central support ramp, but also to the rest of the pyramid construction.

The ramps would not need to be dismantled after building was finished. Instead they would form an integral part of the building. In that way, they could be made as wide and as permanent as was needed. Hemiunu had worked out that, with a slope of 56-*seked* (7-1/8 degrees), there would be a need for only three spans (as shown in the graphic at right) to cover all the internal construction, up to and including the surface of the Mound of Creation.

The internal ramps would also serve to raise stone for the bulk of the pyramid that lay outside of the two construction walls. In effect, therefore, the pyramid would be built from the inside, working outwards.

Hemiunu envisaged the pyramid structure as it might look when the central structure had reached the level of the *serdab* (Queen's Chamber). As the graphic below shows, much of the rest of the pyramid had also been raised at this point. The two large ramps, one leading from the north face and the other from the south face, are still in evidence, but the pyramid exterior had been built around the





Hemiunu's strategy for building the Great Pyramid was to build only what was to be permanent within the pyramid. He knew from experience as well as calculation that the amount of effort that would go into external ramps around the outside of the pyramid would be enormous, only for all that effort to be discarded when the ramps were dismantled.

One idea was to build substantial internal ramps that would become covered up and would form an inherent part of the central structure. This would be a much more economical and efficient way of working.

As the graphic showed, the central ramps fed both the centre section with its battered construction walls, and the growing stepped pyramid, that forms the core of *Akhet Khufu*.

Note the entrance to the ramp, at the right; this opening required a substantial roof. Note too that the top tier is being laid in rectangular sections. Hemiunu planned to have hauling lanes on the upper surface of the masonry, on top of the ashlar-faced buttress walls. He also envisaged stones being cribbed up the exterior steps of the pyramid

periphery, with access at ground level to the ramp system shown at right.

Apparently, Hemiunu was not so much setting out his strategy, as experimenting with different approaches to see how he could manage the construction practically using ramps.

One of Hemiunu's concerns, expressed in his notes, was how

to raise stones that would be used to construct the Grand Gallery and, in particular, the granite beams for the "burial pit in the sky." To haul each beam up a 56 *seked* ramp would, by Hemiunu's reckoning, need up to 250 men pulling on ropes. That would involve at least eight ropes with 32 men per rope. Hemiunu considered that to be bordering on the impractical.

He knew from his time at the granite quarries at Abu that it was possible to move granite on diorite "marbles." If he could use that technique, he might reduce the number of men to about 130, as the beams would then slide very easily.

Even then, it would take about four ropes with 35 men per rope; this was feasible on a straight run, he considered, but still very difficult on corners. The zigzag approach he envisaged, as shown in the graphic reconstructions, was simpler; the ropes could be taken off at the top of one ramp, and fitted the other way around to start pulling up the next ramp, without turning the stone beams.

Hemiunu decided that he needed an alternative approach to the use of ramps for these heaviest of stone beams. He had used the method known today as "cribbing" at Dahshur, with mixed success.

Cribbing is simple enough in concept. A heavy beam is balanced at its centre of gravity and tipped sideways. A piece of wood, or other material is placed under the raised end, and the beam is tipped in the other direction, to reveal the other raised end. A second piece of wood is placed under this end, and the process repeated. Gradually, the beam will rise, inching its way upwards as it is rocked back and forth.

Hemiunu had added a new dimension to cribbing. He had made two diorite wedges, as shown in the reconstruction. When placed end to end, they created two pivot points maybe a palm or two apart. Three

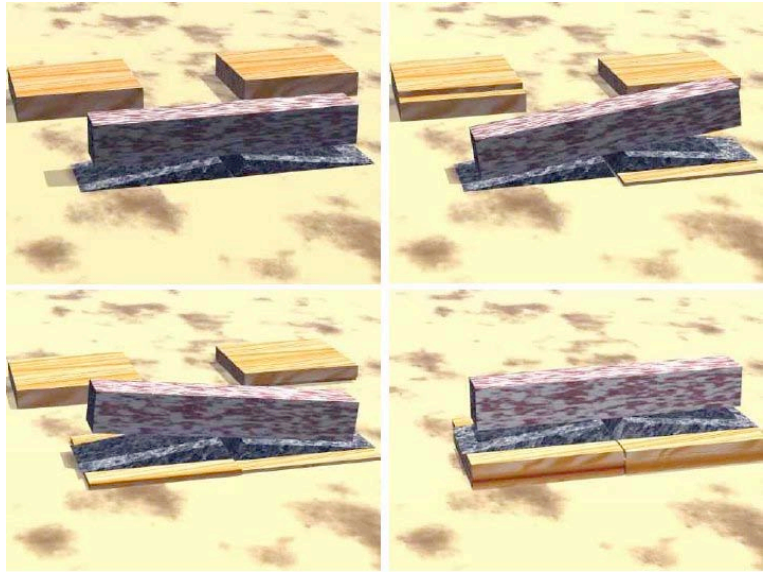
or four men would stand on the stone and walk from end to end to tip the stone so that it rested on one of the pivots only. The other pivot would be removed, a flat piece of wood some two fingers thick placed on the stack and the pivot then replaced above it, and the process repeated.

Once the men got into a rhythm, this process could be conducted quite quickly, and the beam would rise steadily. Problems arose as the pile of wood became unstable, and when the beam had to be shifted sideways on to the next step in the pyramid structure.

One of Hemiunu's plans for the great pyramid was to build a series of steps into the ends of the battered construction walls so that heavy beams could be cribbed up them easily. In the event, he expected these end steps to be used by the builders for many other purposes: raising corbels; manhandling lighter stones that could be carried by a handful of men; and just for getting up and down the building work quickly.

Some quick calculations convinced him that he needed the steps at one end only, and that the south end was preferred: the north end had the entrance passage to contend with; besides the granite beams were needed for the King's Chamber which was in the southern half. Hemiunu promised himself in his diary to revisit that decision. It might prove necessary to have steps at both ends, and to delay work on the entrance—he was uncertain at this stage.

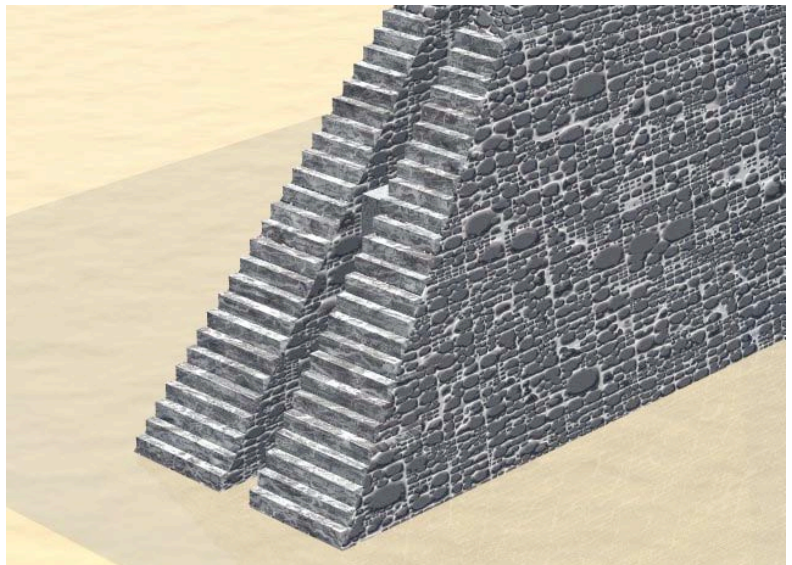
Hemiunu felt that he had gone far enough with his planning to reassure himself; he knew how to build the pyramid. All he had to do now was make it happen, and for that he was going to need a lot of help and cooperation...



Hemiunu's cribbing method, above, and the cribbing staircase cut into the south end of the battered construction walls, below.

Cribbing was slow, but could raise the heaviest stones. Moreover, cribbing could be employed all around the growing pyramid, with many parallel teams at work.

Hemiunu was clearly warming to cribbing as more effective and efficient than using ramps.



Court Intrigues

Hemiunu had been so busy that he really had little idea what was going on around him. Neferhetepes had told him what was going on to the south, but he knew little of royal palace intrigues, and cared less; all that, however, was about to change.

Hemiunu had not involved himself in the numerous palace intrigues, being totally absorbed in his work.

However, the developing rivalry between the stellar and solar dominant theologies was beginning to threaten his ability to maintain the flow of resources needed to build Khufu's Pyramid.

Hemiunu had become an unwilling focus for the more conservative leaders of society, in the face of Djedefre's radical support for the cult of Ra.

The cult was encouraging devolution of the king's authority. Hemiunu realized that he would have to act to assure his material and manpower resources.

King Khufu's eldest son, Kawab, had been Crown Prince for several years. He was a pleasant, effete, young man, more inclined to literature and poetry than to drinking and fighting. In this, he could not have been more different from his brother, Djedefre; he was a rebellious, arrogant and cruel young man, with scant respect for his elders—including his father, the king.

Kawab had married the tempestuous Princess Hetepheres, she of the lurid reputation. Hetepheres was still an unprincipled troublemaker; with her great beauty and personal magnetism, this made her dangerous. Hemiunu believed that she and Kawab were wholly unsuited, but their marriage was inevitable within the contemporary system of royal inheritance.

From the start, Princess Hetepheres ran Crown Prince Kawab ragged. She flirted outrageously at court in front of her husband. On those few occasions when he remonstrated, she rounded on him with a barrage of insults about his manhood, or lack of it from her perspective. On one occasion, the mild-mannered Kawab was so incensed that he raised his hand as though to strike her for her extreme rudeness: instead, Prince Djedefre intervened and knocked his elder brother to the ground. Kawab left the scene with a bleeding nose. Thereafter, Kawab went everywhere with his personal bodyguards.

Hemiunu's intelligence system now detected that Djedefre was becoming friendly with Memi, the High Priest of Heliopolis. Memi was getting rather old, and did not have too much time left. Presumably he saw in Djedefre an opportunity to enhance the standing of the priesthood and to advance the cult of Ra, with its radical teachings. For Djedefre's part, he professed that the teachings of the Priests of Heliopolis were more in keeping with his own views. He neither saw, nor wanted to see, his father as the supreme man-god, or as becoming Ra. For Djedefre's part, he was quite content for the king to be seen in the afterlife as subservient to Ra; but then, Djedefre had no overt pretensions to the throne at that time.

Hemiunu now became aware that many at court looked upon him as something of a cause célèbre. His long trip to the south, and the apparent ease with which he had evaded Khufu, had made him the stuff of legend. It was also widely known that he had little time for the Princess Hetepheres, who had instigated his problems with her thoughtless "entertainments." Hemiunu found himself the focus of attention from a wide range of the more conservative courtiers, who

appeared to see in Hemiunu a counter to the radical, immoral and unethical behaviour of Hetepheres and Djedefre.

Hemiunu was not pleased to be the centre of attention. He was interested in building the King's eternal resting place. However, he was also aware that he was going to need friends if he was to get the resources he needed for his construction work. As he saw it, he had to draw a fine line between becoming involved in the struggle for power that he saw brewing between Kawab and Djedefre, and keeping such a low profile that he commanded no support for his work.

Hemiunu was aware that building the Great Pyramid would create a major drain on the country's resources. He would need resources from each and every nome, in terms of workers and their families, food, materials to make clothing, ropes and tools, wood, and-of course-stone. Such resources were not going to be forthcoming if there was inter-nome rivalry and conflict. Hemiunu saw himself firmly on the side of *ma'at*: justice, order, balance and harmony had to reign if he was to succeed with his venture. This placed him somewhat firmly in opposition to anything that caused trouble along the Nile—and that included the spreading of the cult of Ra in such a way that it set nomarchs against each other and against the king.

Like it or not, Hemiunu would have to “get involved.” With his usual thoroughness, he weighed up the pros and cons in his diary. He had already conducted a progress up the Nile on behalf of the king, spreading *ma'at*, and fostering cooperation between neighbours. It was the role of the king himself to make such progresses, so Hemiunu decided to encourage the king to operate a “floating palace,” making annual and biennial trips, and spending more time in Thebes, Abu, Edfu and others, as well as Abydos—where the King already visited.

Hemiunu also decided to play up the threat to Egypt from beyond its borders. He would warn the king that there were threats from the north, from the Libyan Desert to the west, and from the desert people to the east, as well as potential problems from the Nubians to the south. There was nothing quite like an external threat to stop internal wrangling, Hemiunu mused.

Hemiunu had maintained his work with the “games” held annually throughout the Nile Valley to identify the finest young men and women. He decided to step up efforts in this direction, and so to increase the numbers of people who might volunteer for the military and for pyramid building. Hemiunu believed that it was a rare privilege to be chosen to build the king's pyramid, and that only the best should be eligible for that privilege. He had already discovered that, by making it difficult to become a pyramid builder, the role acquired status, and competition intensified.

So, Hemiunu entered the fray quietly, subtly, but with great effect. Not surprisingly, however, he soon incurred the wrath of Djedefre and Hetepheres in the process.

A Narrow Escape

Hemiunu started his political career quietly and subtly. He had developed an excellent information network both up and down the Nile. Now he used it to pass information, as well as collect it. He let it be known that he was having troublesome, prophetic dreams, but that the information in the dreams was secret, and not for anyone to hear but the nomarchs themselves. This guaranteed that everyone would hear of them directly.

Hemiunu used his reputation as a prophetic dreamer to spread rumours of Bedouin invasion to the north.

This was sufficient to bring the various nomarchs together, at least in the short term.

Hemiunu's part in the charade had not gone unnoticed, however, and he narrowly escaped an attempt on his life for his "interference."

Hemiunu used his authority as a vizier to have the would-be assassin eliminated by his own masters.

In his dreams, Hemiunu saw attacks and invasions by the desert people to the north, with Egyptian villages burnt down and looted, and the people slaughtered. In this, he was pushing at an open door, as the Bedouin had been a constant source of trouble in the Sinai for decades.

Before long, news reached King Khufu that there was trouble brewing in the Nile Delta region. King Khufu reacted as Hemiunu had hoped. He called on the various nomarchs to supply armed men to quell the troubles. The nomarchs, realizing that there was a threat to them all, swiftly decided to cooperate and sent soldiers to repel intruders.

Hemiunu hoped and initially believed that his part in this subterfuge had gone unnoticed; he was wrong. He was on site at Giza, directing building operations on the Great Pyramid as usual. On passing under an overhang, a large block of sandstone suddenly fell from a ledge.

Had he not been rather nimble, Hemiunu would have been crushed and killed. Perhaps it was an accident? There was no one in the immediate vicinity, and nobody on the ledge when he climbed up to it. However, he could see marks on the ledge where the perpetrator had levered the stone over the edge: it had been no accident.

Hemiunu had initiated a construction system in which stones were marked by the quarrymen. Hemiunu was able to find out who had quarried the stone, and who had taken it from the quarry to the pyramid and up on to the ledge. He called for the man in charge of the block's transportation, and the man appeared, looking frightened. His workmates, seeing what was going on, had frogmarched him in front of Hemiunu, who was a popular overseer.

Hemiunu asked the man what had happened. The man stuttered, and fell silent. Hemiunu asked him who had ordered the attempt on his life. Again the man would not, or could not, speak. Hemiunu then asked the other men what was to be done with the would-be assassin. They were all for throwing him off the steep scarp nearby. Hemiunu had a better idea. He set up a party that evening, to which all the workers were invited, and the assassin reluctantly took pride of place on Hemiunu's right hand. Next day, his paymaster, evidently suspecting treachery, had him stabbed to death.

Insubordination in Kush

Hemiunu creates external threats

Having started his political intrigues, Hemiunu decided that he really had no choice but to keep going. As he noted in his diary, there was an ironic inevitability. In order to promote peace within Egypt, so that he could continue to get the resources he needed to build Khufu's Great Pyramid, he found it necessary to promote conflict and rumour of conflict on Egypt's borders.

This time, Hemiunu had a more direct route by which to stir conflict. From his visit to Kush, he knew that there was no love lost between their respective peoples. He sent a message to Toshka, using a code that his erstwhile guide and mentor had taught him. In the message, he asked Toshka to explain his problem to the Wawat Confederate Chief.

It was several months before Hemiunu heard any results from his message, and even then he could not be certain that his message had been the cause. News filtered through to Khufu's palace that there were problems to the south of Abu.

In particular, there seemed to be problems at the gold mines and in the extraction of diorite. Both of these resources were important to Egypt, and successive kings of Egypt tacitly assumed that they had the right to them, even though they were mined in a different country. The gold was used in the making of religious artefacts, and for jewellery. Diorite from the quarries near Buhen was some of the hardest rock, and of the best quality available; it was essential as a source of tools for quarrying granite, and in pyramid construction.

Khufu and his aides were alarmed by this news, and Khufu dispatched senior officials from Abu to negotiate with the Confederate Chief: they did not return. (It later transpired that they were held incommunicado and under very comfortable house arrest, but completely unharmed. In fact, several were so comfortable that they were reluctant to return to Abu when released over a year later.)

Khufu next decided to mount a military expedition against the Kushites. This was unsuccessful, too, as the Egyptian soldiers could not find the Kushite forces, which simply melted into the hills.

The net result was just as Hemiunu had wished: without casualties on either side, Egypt's attention once again focused on supposed border issues, with the effect that the various nomes and nomarchs swiftly overcame their differences and bound themselves together to withstand expected troubles from the south.

As much of the resource difficulties that Hemiunu was anticipating came from the more southerly nomes, this stratagem worked perfectly, and Hemiunu's part in this second enterprise was not detected.

If Hemiunu was going to complete his pyramid, he needed to keep Egypt united, so he repeated his idea of creating trouble outside the borders of Egypt, as a means of promoting unity and peace within.

This time, however, he was subtler. The Kushites started to become "difficult" about parting with their gold and diorite, both of which were seen as vital to Egypt.

The result was better than Hemiunu could have wished for. The southern nomes, those nearest to Kush, and also those most independently minded, came swiftly into line, as they could otherwise see themselves exposed

Hemiunu's plan had worked again.

The Secret Diaries of Hemiunu

Part D. The Greatest Challenge

He realized that the

Chief among his

The principal resource was manpower. The games ensured a plentiful

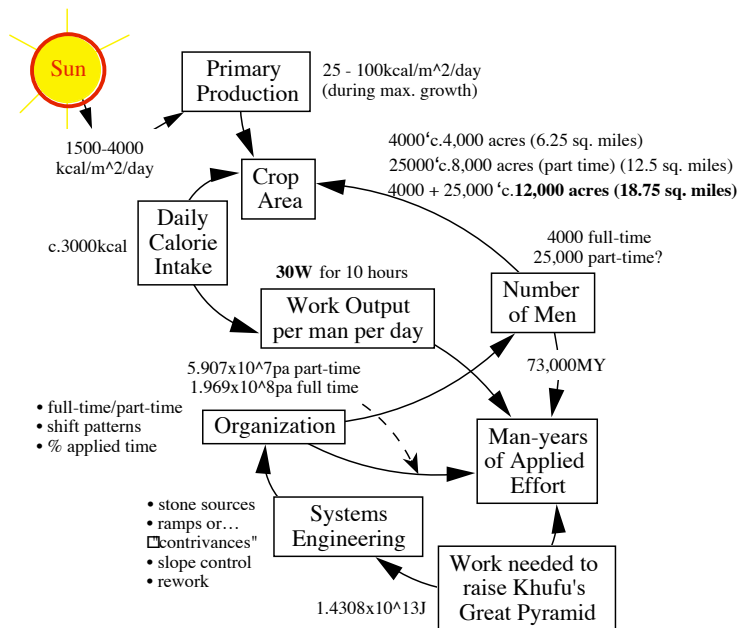
The graphic shows how some of these various jobs became mutually



The Greatest Challenge

Some of the calculations in Hemiunu's notes seemed obscure until one of the IXT realized that Hemiunu was calculating the impact of different options. He could operate a workforce that was full-time only, or one that was a mix of full and part-timers. He could use ramps of various kinds for hauling stone from quarry to pyramid, and from base to pinnacle.

Each option was estimated by calculating the number of men it would take to do the job in a year, and that number was then adjusted by altering the time allowed. So, if Hemiunu estimated that it would take 1,000 men to do a job in a year, he might then estimate that 550 men could do the same job in two years; he always made upward adjustments to his estimates to allow for things going wrong over increased time.



As his father had done before him, Hemiunu established a workers' village near the Giza site, which grew until it was able to accommodate some 4-5,000 workers and their families in comfort. Hemiunu provided fires, blankets to keep out the cold desert night air, and entertainment, usually in the evening, at the end of the week.

It is clear from his calculations that Hemiunu had a sophisticated concept of his main resource. He had worked out, using experience on other projects, how much work would be needed to build the Great Pyramid complex, in terms that we would call man-years.

He was able to estimate the amounts of food that would be needed to support such a labour force, and the area of crops that would be needed to generate such amounts of food. He was even able to "commandeer" suitable amounts of acreage, for and on behalf of the king – much of it came from the king's lands anyway.

Hemiunu also understood how to nurture and motivate his workforce, and there are lessons in his approach that stand the test of time.

Of particular importance to the maintenance of high morale, then as now, was the provision of good food and drink. Ankhaf had already set up extensive baking and brewing facilities, and Hemiunu extended them even further. Hemiunu calculated that the workforce would consume (in today's units) some 20 tonnes of beer per day and some 8 tonnes of bread.

A modern calculation, showing how energy flowed from the Sun, into crops, from there into men, who used their acquired energy to raise stones on the Great Pyramid.

It is possible, in principle, to undertake this kind of calculation because the building process employed no machinery, and no technology – only manpower.

Such calculations tend to provide an underestimate, since many detailed activities remain unaccounted. Nonetheless, the results coincide with those using more conventional work-study and project management methods.

The Secret Diaries of Hemiunu

Bread was prepared in two stages; the graphic shows the first stage. Large earthenware pots were set up in sand beds, above furnaces. Each furnace was stoked up and the empty pots, each about 0.8 cubic metres volume, were slowly heated until the air above them shimmered. Water and flour were then poured in and stirred. The mixture warmed up almost instantly, taking heat from the earthenware pot and the sand. When the mixture had cooled to the temperature of the baker's hand, beer, or some of yesterday's bread, was added as yeast, and the mix was covered with a hide and allowed to rise.



Once the dough had risen, it was knocked back and divided up into portions about the size of a large fist. Each portion was then allowed to prove, and baked to a finish in small, conical earthenware pots, in individual ovens. This second baking often took place near the living quarters, so that the workers had fresh bread straight out of the oven.

It is a mark of Hemiunu's attention to detail that he described this whole process and how important he felt it to be in maintaining a happy, dedicated workforce

He was just as conscientious about the workers beer, which was always a subject of discussion. Hemiunu had beer served on site to the men as they worked: it was delivered and passed around by young women recruited for the purpose. He also had the beer brewed at different strengths according to when it was to be drunk.

The Greatest Challenge

At the construction site, beer was for quenching thirst and preventing dehydration, so it was brewed to be relatively weak. By trial and error, the brewers had learned just how much brewing was needed to make the brew safe to drink, unlike the river water, which was its principal constituent. Using girls to serve the beer on site distracted the workers, so that they paid less



attention to the strength of the beer and more attention to the persons serving it. Besides, as Hemiunu noted, strong beer seemed to make dehydration worse, not better.

Beer served at the workers camp and consumed in the evening, was brewed stronger, since it was as much for pleasure as thirst quenching. The beer was brewed from barley paste which was put into large earthenware pots identical with those used for bread baking, except that the beer pots were salt-glazed on the inside. Water was added to the hot brewing pots, and the mixture was allowed to cool to hand temperature before bread was added to start the fermentation process. The pots were then covered and left for three days. The furnace was relit at night if the desert was particularly cold, but the heat from the sun was sufficient to keep the fermentation going by day.

The food supplied to the workers was of the best quality, and included fish, beef, poultry, and a wide variety of fruits and vegetables. Hemiunu regarded the high quality of food as essential, not only to energize the workforce, but also to maintain the high status of being a pyramid builder. He depended on this status for a continuing supply of volunteer recruits.

Hemiunu was assiduous in his arrangements for all the resources that would be needed for *Akhet* Khufu. This was of particular concern for supplies of stone that came by river, since the level of the Nile was conducive to offloading stone in the harbour for only 2 or 3 months in each year. Hemiunu extended the docks at the foot of the escarpment, so that stone could be brought much closer to the causeway, and for much more of the year.

The reconstruction shows the living area of the workers, which was some distance from the Great Pyramid. Mud brick buildings can be seen at the back, some covered with cracked plaster.

Sun shelters were provided, foreground, so that people could work outdoors in the cool northern breeze, yet shaded from the sun's hot rays.

At left, a woman is rolling and kneading dough, while a man falls asleep as he waits for lumps of dough to prove (i.e. to rise for the second time.)

At right, a stalwart young woman is engaged in mixing up barley paste in a large earthenware pot, preparatory to making beer.

Both women are naked to the waist, perhaps by convention, but possibly to keep cool, yet they both wear wigs, which would be expected to make them hot....

Cities of the Dead

Hemionu hit upon the idea of creating a City of the Dead at Giza. The dead “inhabitants” of this city would have enhanced prospects for their afterlife by virtue of their proximity to the King’s Pyramid.

Hemionu designed the “city” with rows of streets, each containing mastaba tombs. Partly to exemplify the importance of locating one’s tomb there, and partly to enhance his own prospects, Hemionu marked out one of the biggest “plots” for himself and Neferhetepes.

He also offered a prime plot location to Memi, the High Priest of Heliopolis, as an inducement to moderate his promotion of the Cult of Ra.

This worked better than he had hoped. Memi accepted the offer, thereby alienating his fellow priests. Although this did not stop the spread of the cult, it certainly slowed it for a time – which was all Hemionu needed.

Hemionu’s first forays into international politics had been successful: with rumours of conflict on both her northern and her southern borders, Egypt was significantly less troubled internally. The evolution within the Cult of Ra was, however, still something of a concern. Nomarchs, particularly those some distance from White Wall, were evidently taken with the idea that the king was not the single, omnipotent being that had been previously thought.

Hemionu wondered what to do about this. He had no authority to stop the spread of such ideas, even if he could. Nor did he have the intellectual authority to challenge such teachings, although he felt them to be divisive and unreasonable. Finally, after wrestling with his conscience, he elected to try a little old-fashioned bribery.

He knew that Memi, the aging High Priest of Heliopolis, was eager to establish himself in eternity as soon as possible. Hemionu hit upon the idea of creating a City of the Dead, like the one at Dahshur, made up from the Houses of Eternity, or tombs, of the nobles, courtiers and other important people. This City would have streets and crossroads, and there would be “fashionable areas,” just as in the real world.

The more Hemionu thought about this, the more he liked it. He positively enthuses in his diary. Without delay, and without recourse to the king, Hemionu asked Memi for a private meeting, to be held at Heliopolis.

At the meeting, Hemionu explained that, through his crystal ball, he had become aware that people who were interred within the sphere of influence of the Great Pyramid had a much greater prospect of joining the king in the afterlife, perhaps even gaining their own stellar palaces among the Imperishable stars. During one of his dreams, he said, he had seen Memi standing by a mastaba tomb very near to the new pyramid, looking into its entrance, but seemingly reluctant to enter.

Hemionu asked the High Priest what he thought the dream could mean. Memi thought for a while. Finally, he concluded that the dream meant that he, Memi, was destined to go to the stars, that he should have a mastaba in the western desert near *Akhet Khufu*, and that Memi’s apparent hesitation had arisen because he did not consider himself worthy – until now.

Hemionu expressed his relief at the explanation, and showed Memi his plans for the City of the Dead. Memi quickly picked out what he considered to be the prime location for his House of Eternity, and Hemionu left, hoping that his plan would work. Soon his intelligence network told him that Memi had modified his teaching, that Khufu was, after all, supreme among the gods, and that it was, indeed, possible for certain mortals to share an everlasting life among the stars with the king. Later reports suggested that other priests of Heliopolis were less than ecstatic...

Hemiunu's Medical Research

Hemiunu remembered his predecessor Imhotep, who had built the Stepped Pyramid for King Djoser. Imhotep had a formidable reputation as a healer, and Hemiunu was encouraged by this knowledge to explore the art of healing for himself.

Hemiunu had been interested in healing for many years, but had done little to follow up his interest until now. Once building got underway in earnest, there were inevitable injuries. While many were minor (sprains, cuts, back pain, etc.) some were more serious, ranging from crushed limbs, to crushed bodies and heads, to instant death.

None of this was new or unexpected: Hemiunu had seen it all at Dahshur, and he had arranged for healers to live on site with the workers. However, Hemiunu was unimpressed with many of their methods, so he set about learning to heal for himself.

He started by trying to understand the human body. He realized that blood was essential, and that it was vital to stop the bleeding when there was an injury. He found that squeezing could stop bleeding at extremities, and he noticed that pressing in certain spots had the same effect.

He also suspected that there could be internal bleeding in the body, but that squeezing the body made matters worse, not better. Healers had already found that astringents could stop bleeding from an external wound, so he reasoned that swallowing astringents might similarly reduce internal bleeding. This had the effect of making the subject even more ill, however.

He experimented with different kinds of splints and wound dressings. Cleaning the wound thoroughly was essential, and he found that astringents from plant extracts not only stopped some of the bleeding, but seemed to aid the cleaning and healing process, too. He also advocated the use of honey as both an antiseptic and as a healing agent.

Hemiunu cut up a number of bodies of those who had died working on the Pyramid, in order to better understand the human body. He tracked the alimentary canal, having worked out beforehand that there must be a continuous connection from mouth to anus. He found the heart to be of great interest, as the supposed seat of intellect, but could not understand how it worked or what it did. The brain was a puzzle, appearing to be a grey mass largely without purpose, other than to house the eyes, ears, nose and mouth...

He concluded that people could live without their limbs, provided they could survive the shock of losing them. He formulated a process by which a damaged limb could be amputated, the loss of blood checked, and the wound healed, so that the person might survive.

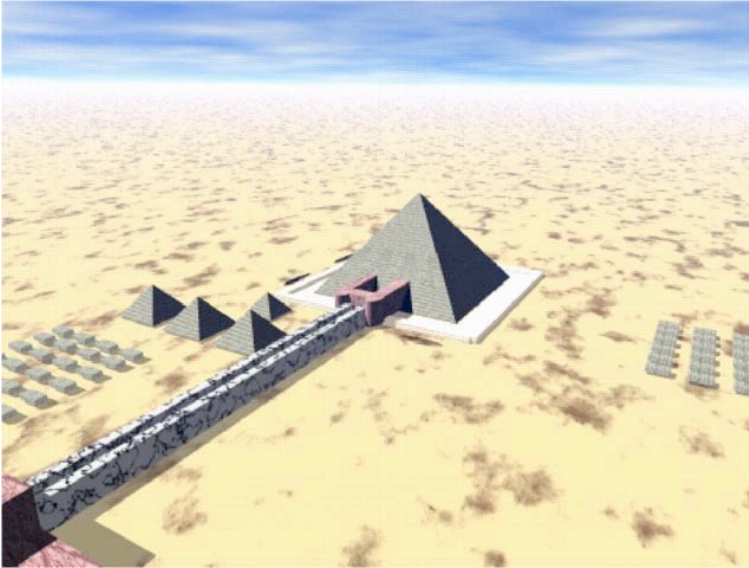
Hemiunu had been interested in healing, but now it became much more than an interest. The official healers, with their magic spells, had little success when treating the kinds of injuries sustained by the pyramid builders.

Hemiunu experimented and found that bleeding in the limbs could be controlled, but not in the body.

He also defined a process for saving the life of a man with a severely damaged limb; this included applying honey to the amputation wound to act as a healing agent.

The Final Design Solution

By this time, Hemiunu's journal showed that he had a complete design, not only of the pyramid *Akhet Khufu*, but also of the complete complex of which the pyramid was to be a part.



In addition to the pyramid, and the enormous causeway, there were to be a Valley Temple at the river end and a Mortuary Temple set against the east face of the pyramid. The causeway, used throughout the project as an access way from the river to the pyramid site, was to be paved, covered and decorated internally, providing a pathway for the gods and *ka*-spirits.

The pyramid was to be surrounded by a sacred area, paved with marble, and enclosed by a temenos wall; neither the paved area nor the

In Hemiunu's sketches of the pyramid complex, he showed the main pyramid as much, much smaller than real size.

Presumably, this was to permit other features to be shown that would otherwise be too small.

It was the practice of the time, however, to represent importance by size; the more important, the larger the representation.

One possible interpretation of Hemiunu's sketches, then, is that he did not regard *Akhet Khufu* as the single, dominant feature, but rather looked upon all the structures as contributing towards the whole ethos and magic of the site...

If so, then Hemiunu was taking what would today be called an "organismic" view, i.e. that all the structures combined to create a single entity.

Note the incorrect location of the western cemetery, which is shown to the north of the pyramid. No explanation is given for this seeming error...

wall could be constructed until the pyramid itself was completed, with its final casing of white, Tura limestone.

There were to be four additional pyramids: three were to be for Khufu's three principal queens, while the fourth was to be a *ka*-pyramid, supposedly for the king himself, but in Hemiunu's view it was for the *ka* of the Great Pyramid itself, as *Akhet Khufu* was already becoming known among the older workers.

Khufu had identified the need for seven boats, each to be buried in a precise location so that Khufu's royal *ka* could travel at ease and in style wherever and whenever he wished. The boats were to be stored in pieces, not only to constrain the burial pits to a reasonable size, but also so that only the king's *ka* could use them, since he, and he alone, would have the magical power of reassembly and re-rigging.

There were to be two boats on the south side of *Akhet Khufu*: these were to enable Khufu's *ka* to cross the spiritual Nile running through the centre of the pyramid, starting from either the west bank or the east bank. (Khufu, ever the practical man, did not wish to find himself on one side of the river, while the boat he needed was on the other side...)

There were to be two boats also on the eastern edge of the pyramid: one was for sailing on the Nile to Lower Egypt, the other to Upper Egypt.

There were two more boats, one each located between the three Queens' Pyramids. Khufu was strangely coy about these, but it transpired that he envisaged sailing with one or other of his wives in the hereafter...but never more than one at a time!

Finally, there was to be a seventh boat set alongside the north face of the causeway, at the pyramid end. Khufu wanted this boat for hunting trips to the marshes in the Nile Delta, one of his favourite leisure spots. This boat was to sail on the real Nile, spiritually and invisibly, of course.

Finally, there were the two cities of the dead that Hemiunu had conceived and which Khufu had been lead to believe that he had invented. In keeping with the stratified class structure of the time, the two cities were for people of different social standing in the community.

How Long Would it Take

Hemiunu was naturally concerned with the length of time it would take to build the pyramid complex; after all, it had to be ready in time to house the king when he died. How long the king would live was unknown: it could be two years, in which case the burial chamber would not be ready; on the other hand, it could be 30 years, in which case Khufu would be a very old man.

All that Hemiunu could do was work as fast as practicable, ensuring that work towards the creation of the burial chamber was always given priority. His strategy of building the two construction walls beside a central ramp had been formulated with this need in mind.

Hemiunu knew that the pyramids at Dahshur had taken up to 20 years to complete, allowing for all the features in each complex. He mentally set himself a similar target for *Akhet* Khufu, reasoning that although the pyramid was larger than those at Dahshur, he also had a larger, better-trained workforce.

Work Patterns

Hemiunu faced something of a dilemma, according to his journal: he knew that the work of raising each tier increased up to a peak at one third of the pyramid's eventual height (i.e. about tier 68 in his case), and so he had the choice of employing a fixed-size workforce, or of increasing the workforce tier-by-tier to reduce the overall time to build.

He chose the latter approach, reasoning that beyond tier 68 he could progressively divert workers on to the many other projects within the complex. Only in this way could he hope to minimize the time that the whole job would take. (Note: there is no mention of any *corvée* in Hemiunu's diaries.)

Hemiunu also split the workforce for the main pyramid into two groups: one group, the seasoned veterans, worked on the central slice

The possible use of ramps for construction exercised Hemiunu's mind at this time.

He knew that the rate of laying stone would be some 90 tonnes per hour averaged out over c. 20 years. He also knew to be very wary of averages...

Towards the end of the project, the rate of setting stone would be quite slow; that meant that the rate at the start would have to be higher than the average.

He also understood about queues forming, and how to prevent them.

Taking these factors together suggested to Hemiunu that external ramps would need to have many parallel paths and would, in consequence, be very broad.

Building the pyramid quickly would be hard enough, without having to build, and then dismantle, enormous ramps...

with the ramp, the battered construction walls and the central chambers and passages, while the other group worked on the bulk of the pyramid. Using the experienced workers on the central "slice" had two advantages: first, the work was much more demanding, so needed greater experience; second, Hemiunu trusted the older workforce to keep to themselves the details of what they were working on.

Hemiunu also calculated the mean rates at which stones would have to be laid in order to meet his 20-year construction target. He knew that the average rate of laying stones over the 20-year period would be about 90 tonnes per hour (using modern measures). He also knew that this average rate was deceptive: towards the end, the rate would be much less than this average, as stones had to be raised through great heights in cramped conditions near the pinnacle. It followed that the rates of laying stones had to be much higher than average at the start.

Hemiunu estimated that the rate of laying stones at the beginning needed to be some three-times the 20-year average, i.e., about 270 tonnes per hour, or over 100 stones per hour where the average weight per stone weight was 2-1/2 tonnes; but he had ideas about that, too.

Hemiunu may not have known any queuing theory, but he clearly recognized the problems of queuing. If the mean rate of stones coming off the top of a ramp was 100 stones per hour, then the capacity of the ramp would have to be significantly greater than that, otherwise queues of teams with stones would form, waiting their turn to climb the ramp. This would mean that many of Hemiunu's crack construction teams, having hauled stones from the quarry to the foot of the ramp, would then stand idle, doing nothing. Hemiunu further estimated that the ramp capacity would need to be at least 200 stones per hour to prevent serious queues forming, i.e., twice the mean rate of setting stones in place on top of the developing pyramid.

Hemiunu's notes are filled with calculations at this point, many of them impossible to follow. However, Hemiunu appears to have concluded that a single line of stones being hauled up a ramp would not suffice. Instead, as many as 50-100 parallel pathways up the ramps would be needed to satisfy the necessary building rate up to tier 68. The problem was exacerbated by Hemiunu's plan to progressively increase the workforce tier-by-tier; more men meant more stones being hauled up more parallel pathways. His problem then would not be insufficient numbers of men, but an inability to apply the men to work, as they would be getting in each other's way..

On this basis alone, he expressed serious reservations about the use of ramps for much of the work on the pyramid itself. Such wide ramps constituted a serious building project in their own right, and if they were to be subsequently dismantled, they were a major diversion from the proper building program. Hemiunu concluded that there were better ways to achieve the high and sustained rates of laying stones.

We have already seen his ideas for internal ramps that would not need dismantling, but which would, instead, form a central part of the final

The Greatest Challenge

structure. We have also seen that he considered cribbing, and indeed this was his favoured solution for the central part of the pyramid, with its heavier stones. However, he also examined other approaches.

One of these was the use of much smaller, rougher stones between smooth walls faced with ashlar and quoins. The idea was to retain the concentric shells, as at Meidum, but to fill in the spaces, still on a layer-by-layer, tier-by-tier basis, but using smaller, rougher stones that could be manhandled by four or five men using rope slings, wooden cradles or wooden trays to physically lift the stones.

Hemunu had seen this done at Dahshur, and it worked well. It also addressed another problem that concerned Hemunu: the amount of time it took to dress stones accurately. If every stone were dressed to be accurately rectangular, the time taken per stone was too great to be able to keep up the necessary flow rate.

Luckily, the nearby quarry produced stones that cleaved very neatly and precisely along horizontal lines. Hemunu elected to use many such stones, even though their vertical faces were rough and unfinished, to save time and effort. Laying these smaller, manhandled stones side-by-side left gaps, but they could be set in place swiftly and easily, no ramps were needed. Once covered by the next layer, nobody would be any the wiser. The buttress walls, with their ashlar and quoins, retained the integrity of the structure, and the height of each layer was precise. Hemunu experimented with filling in any gaps with fine sand, and found that to be a useful stabilizer where the horizontal gaps between rougher stones were uncomfortably large.

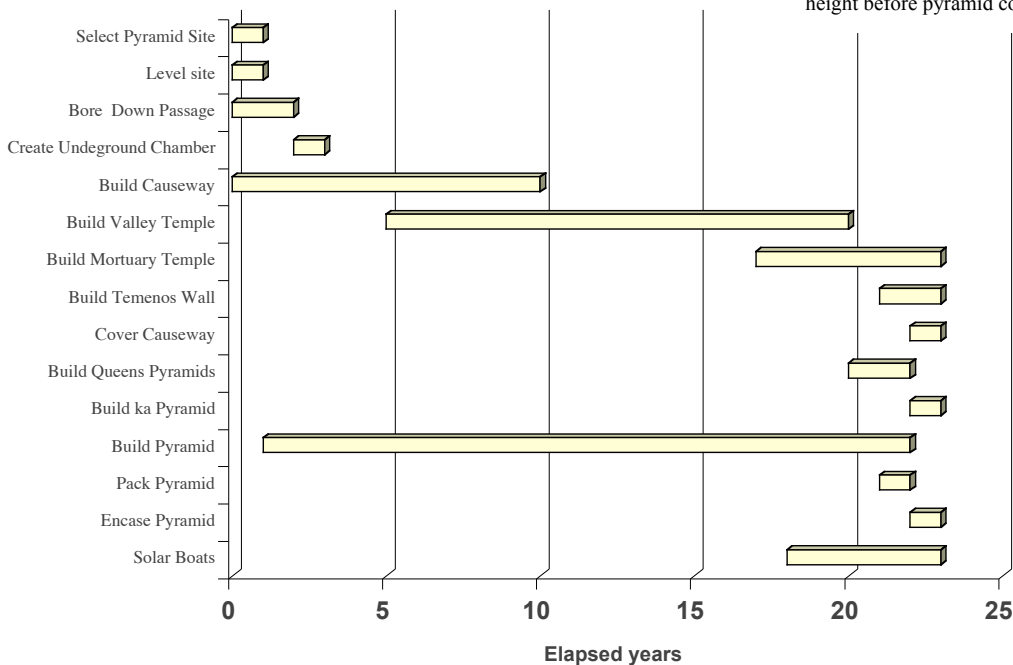
Hemunu's copious notes were used by the IXT to create the following simple GANTT chart, showing Hemunu's construction plans in a more familiar format for today's project managers.

The chart contains few surprises. The causeway has to be started early and finished early too; else the flow of materials to the rest of the site will be inhibited. Covering the causeway occurs towards the latter third of the project

The pyramid itself takes the longest time to construct, and the basic structure cannot be packed and encased until it is virtually complete.

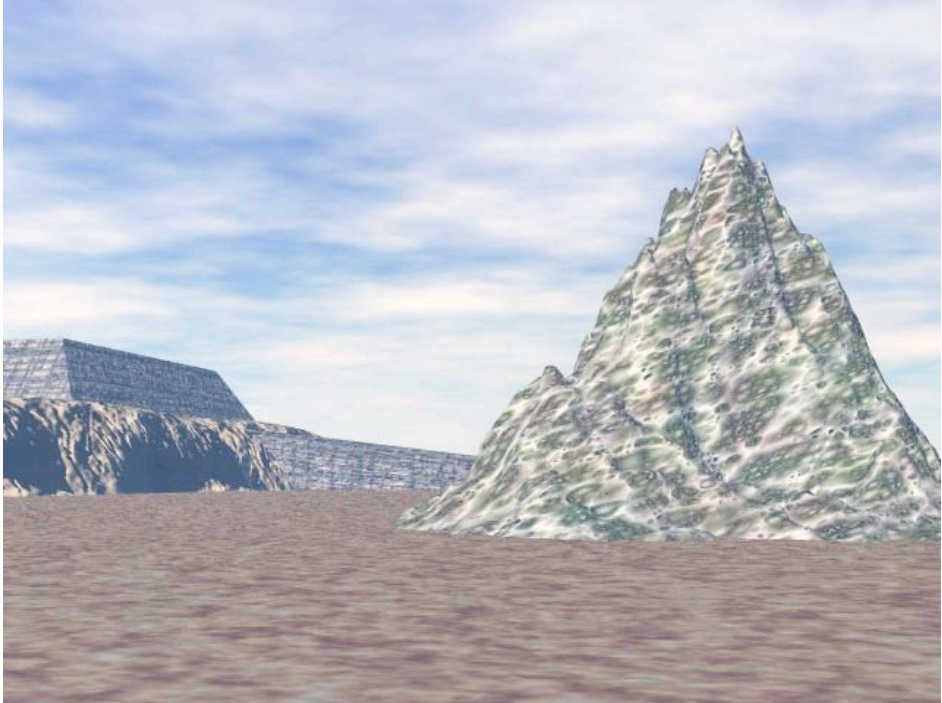
Once this has been completed, the temenos wall, with its paved enclosure, can be started.

Note that the Mortuary Temple can be started well before the main pyramid is complete, as its eastern wall will have risen to an acceptable height before pyramid completion.



The Moaning Rock

Hemiunu records that he was approached by a delegation. The quarry masters had heard rumours about a rock at the bottom of the escarpment; the rumours suggested that the rock moaned, screeched, and even roared as though in pain.



The moaning rock made a noise early in the morning as the sun arose in the east and warmed up one side. This side expanded and the strain in the rock caused internal movement, which made audible sounds.

(This phenomenon would occur again over 1,000 years later with the Colossi of Memnon, at Thebes.)

Note Khufu's pyramid and the ramp up from the Nile in the background of Hemiunu's sketch.

Early the next morning, before sunup, Hemiunu went with the men to experience this phenomenon for himself. The rock was an outcrop made up from several horizontal layers of limestone, covered with a white deposit that Hemiunu recognized as salts that had permeated upwards through the rock bed. Hemiunu knew that fine fissures sometimes acted like the wick in an oil lamp, sucking up liquid from under the ground beneath, which then evaporated leaving a salt residue.

As the sun game over the eastern horizon, sure enough low moaning sounds emerged from the rock. Hemiunu suspected that the sounds came from parts of the rock rubbing past each other as the side facing the sun heated up and expanded. He explained this to the quarrymen, who were clearly unconvinced; as far as they were concerned, the stone was magic, and there was most probably some beast magically imprisoned within it.

Hemiunu realized that the stone was a problem, not only because of the frightening noises, but also because the stone itself was not ideal

The Greatest Challenge

for building. He toyed around with some ideas, noted in his diary, and then proposed that the men may indeed be right and that perhaps the *ka* of a lion may be imprisoned within the rock.

Hemiunu's solution was to propose that the rock be carved into the shape of a lion's head, facing the rising sun. This would ease the animal's torture; it could then praise Ra audibly each morning at sunrise, and it could also act as a guardian for the Giza necropolis. It might be called *shetep-on*, the living image, he suggested.

Working with this idea, Hemiunu further proposed that the body of the lion should be "exposed" by carving into the bedrock. From his perspective, this carving may reveal a useful source of high quality limestone. His project did not need any more limestone, so he made his proposals to King Khufu, to be passed on to Crown Prince Kawab. Kawab already had plans to build his pyramid on the plateau next to Khufu's Great Pyramid, so the great stone lion could act as guardian to his pyramid and to the site.

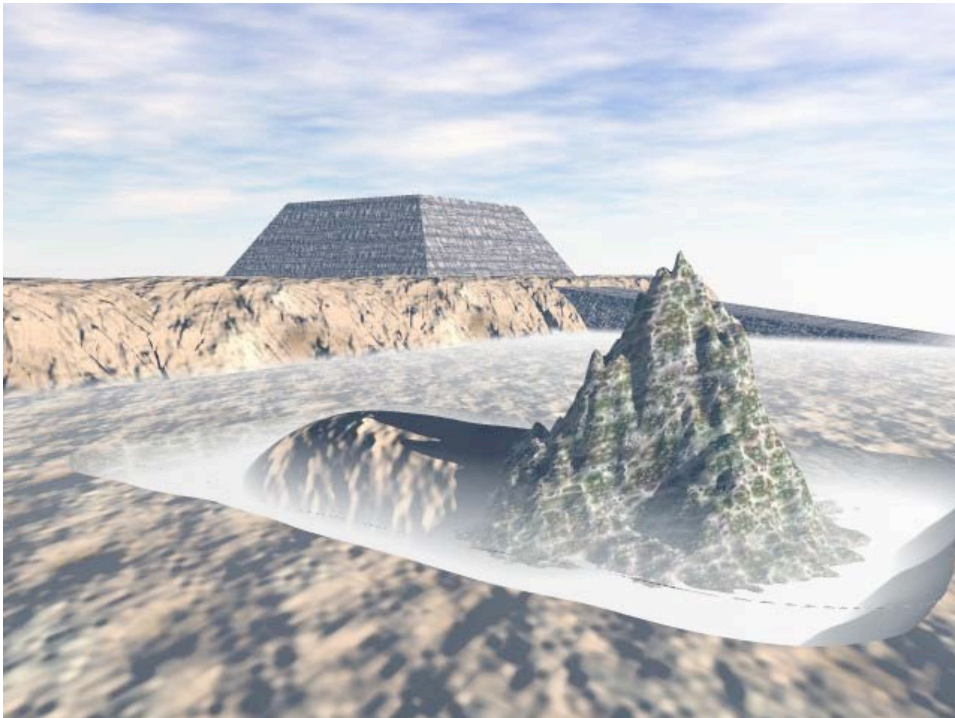
Prince Kawab needed no further encouragement. He assembled a team and they started to dig around the rocky outcrop, creating the general body-shape of a lion, surrounded by a pit out of which they quarried some fine, large stones that Kawab apparently intended for some future temple.

No one, not even Hemiunu, was aware that Kawab's work in carving out the lion-shape, and his future intentions for a temple, were to be so cruelly frustrated....

Once the outline of the lion's body had been carved out, the now-familiar shape of the Sphinx began to take shape.

Although the upper part of the outcrop is good, hard limestone, lower parts are not so good, while the body is made from indifferent limestone.

Rock surrounding the body was much better however, and was to be used for building a temple.



Organizing the Project

Hemiunu spent much of his time organizing the many different aspects of the overall project that was *Akhet Khufu*. There was no aspect, no task that was inappropriate. He took an active interest in everything, from the technicalities of logistics to the entertainment of the workers.

Hemiunu's journals show that he was instrumental in organizing:

- Planning. Hemiunu had done much of the outline planning himself. He also set up a planning group comprised of overseers and senior scribes.
 - They planned out the pyramid tier-by-tier in meticulous detail, marking out the location of each stone, together with its dimensions and material.
 - They also drew up a list of stone requirements, which one of them – the overseer of the quarries – presented to the quarry masters each week, including long-lead items needed weeks, months or even years ahead.
 - Plans included nominating the route to be taken by stones from the quarry to the appropriate part of the pyramid base, and nominating the team that was to raise it and set it in place.
 - All of this ensured that there would be no queues, no unexpected shortages of teams, and no delays.
- Estimating. Some of the many scribes supporting the building program were capable mathematicians, so Hemiunu had them trained as quantity surveyors and estimators, working for the planners
- Locating Resources. Teams were organized and sent out to locate suitable resources, since the known resources would be inadequate for the completion of the Great Pyramid. There were teams out looking for stone, of course, but also for papyrus groves, foodstuffs, bee hives, wood supplies, date palm groves (palm fronds were used in rope-making) and many more.
- Quarrying, particularly in the opening up of new quarries, and in the way in which each quarry was worked. Ideally, the stone that was being quarried at any time matched the need of the contemporary build-level on the pyramid, in terms of block height, overall size, quality, etc. Hemiunu encouraged the quarry masters to actively seek out from the various overseers their forthcoming needs and to work those parts of the quarry that best suited the impending need.

Hemiunu organized a team of planners who set out the detailed design of the Great Pyramid, tier-by-tier.

The planners also designated the route that a stone was to take from the relevant quarry to its final position on the pyramid.

Finally, they designated the teams that were to transport the stone.

This procedure was designed to ensure that all parties knew what was going on; that there should be no queues or overlaps, and that the requisite manpower would be in place.

- Tooling. Hemiunu established a significant industry in the making and refurbishing of tools of all kinds, from stone hammers to copper chisels. Toolmakers also made tools for ditch digging, carving, setting slopes and right angles, levelling, rope making, and many more.
- Rope making. Ropes were fundamental to the building of the pyramids, and the making of ropes was raised to an art form under Hemiunu's guidance. The basic cord was made from intertwined papyrus stems and palm fronds; these cords were then braided into thin ropes, which were then further intertwined to make stout ropes up to five or six inches thick. Hemiunu instituted formal rope testing, using weights, to evaluate different braiding and joining techniques, and experimented with different materials to enhance performance. Under Hemiunu, rope technology reached new heights.
- Transporting. Hemiunu encouraged experimentation with different ways of transporting stones, both by river and over land. He brought quarry masters from the granite quarries of Abu to the site of the Great Pyramid, to demonstrate moving the very heaviest of stones using diorite marbles.
- Raising. Hemiunu was not averse to using ramps to raise stones, but he had calculated that ramps would be wholly inadequate for the job unless they were so enormous that they would challenge the pyramid itself as the biggest building task. He instituted trials and experiments with cribbing, and developed simple cribbing techniques that could be learned and used by unskilled men in short order.
- Managing and supervising. Hemiunu instituted a management structure, in which there were overseers for various parts or sections of the pyramid. There were overseers for:
 - each of the four sides.
 - the central battered construction walls, and for the ramps that wound their way up the sloping sides.
 - the passages and for the chambers, and so on.
- There were even overseers managing the flow process of stones moving from quarry to pyramid.
- Each overseer had executive authority – his word was law. However, each overseer was also charged with maintaining the well-being and morale of his workers. If Hemiunu found out – and he would – of any malpractice, bullying, or even disrespect of the workers, the responsible overseer would be instantly reallocated as a worker.
- Quartering. Hemiunu took a special interest in the way in which the workers were quartered, fed, and entertained. He wanted the workers to be proud of their roles in building the Great Pyramid,

Hemiunu instituted formal rope testing, using weights, to evaluate different braiding and joining techniques, and experimented with different materials to enhance performance.

Under Hemiunu, the technology of ropes reached new heights.

He also instituted a supervisory structure, with overseers for each of the separate parts of the pyramid. He divided the pyramid into parts so that the various supervisors would find themselves competing with each other. They were also charged with ensuring the welfare and morale of their workers.

The Secret Diaries of Hemiunu

and he wanted their experience not only to be hard-working, but joyful and satisfying, too.

- **Creating Competition.** Hemiunu had an abiding belief in competition as a sound means of raising morale. He also believed that competition should not be between individuals, as that could be divisive. Instead, he emphasized inter-team competition.
 - This was at its most apparent in competition between teams in raising stone by cribbing. Teams were encouraged to compete for the title of team of the week; this team wore a yellow bandana to signify their (temporary) superiority.
 - Once a month there was also a competition between cribbing teams, for which there was a prize of several oxen, which would be roasted and eaten at a feast at the end of the last week in the month. Since there was far too much meat for any one team, this meant that all the teams joined in the festivities, and Hemiunu laid on music, dancing and wine so that the party lasted well into the night.
 - Hemiunu recorded in his journal that getting really drunk once a month seemed to be very good for worker morale!
- **Recruiting.** Hemiunu continued tirelessly with his organization of, and support for, the annual games to be held up and down the Nile. The games had become an institution, and continued to supply a steady flow of high quality young people to help in the raising of the Great Pyramid
- **Training.** Hemiunu formalized the school for trainee pyramid builders, even teaching many of the largely illiterate trainees how to read a little, and particularly how to measure, calculate volumes and weights, and to predict such things as how many men it would take to raise a stone of a given size and composition.
- **Medical Support.** Ever mindful of the health of his workers, Hemiunu had healers brought to the site, so that those with injuries could be treated. Hemiunu was not a great believer in spells as a healing agent, but he was interested in potions, and the use of certain leaves, bark and roots as medications.

Déjà Vu in the Quarry

The Giza Plateau offered plenty of good quality limestone for building. Hemiunu found that the best stone came in layers, sandwiched between others where the quality of the stone was not so good.

In searching for new sources of limestone near to the Great Pyramid, the quarrymen came across the unexpected remains of an old quarry.



The area had been covered in sand. On clearing the sand away, they found a series of ledges where stones had been cut away, leaving short stubs to mark where the stones had been cut off at their bases. As the graphic above illustrates, the exposed ledges had been badly eroded.

At first, the quarry master thought that the erosion might have been caused by water from the annual Inundation. A timely sandstorm swept sand from the overhanging scarp, however, and the sand poured down the ledges, convincing the quarry master that the erosion had been caused by sand. Hemiunu thought it would have taken several hundred years to create such erosion damage. He knew of no previous construction in the vicinity, and there were certainly no stone built buildings at Giza.

The Secret Diaries of Hemiunu

Hemiunu experienced that strange feeling that we would call *déjà vu*: had this pyramid been built before; had he, perhaps, been here before working with this ancient quarry?

Hemiunu had no sooner overcome his experiences with the quarry than the quarry master called him again. This time he was taken down nearly to the base of the scarp. The workers had exposed a large stone door, with two enormous uprights. The lintel had broken, but had held up the roof. As the men cleared the debris away, they revealed a large carving on the back wall.



The carving was of a bull goring a man who was struggling face down on the ground. Hemiunu was familiar with the picture. He had seen it before in miniature at school and university, on old artefacts from Upper Egypt. The bull, he knew, represented the king, and the figure represented the foreign enemies of Egypt.

Although the cave stank, and was filled with a strange, damp fog, Hemiunu climbed over and around the carving trying to understand it. He did not even recognize the stone from which it was carved, but he had to admire the workmanship. Was this find some kind of omen? Was it a warning, perhaps? Or did it confirm the magic of the place?

The Builders' Village

Hemiunu took an especial interest in the living conditions of the workers. He built workers villages to the south of the pyramid plateau site, and he established a standard design for their accommodation, based on the symbol *hotep*.



As the reconstruction above shows, the basic village building block was comprised of fifteen mud brick houses laid out in the hieroglyph,



transliterated as “hotep,” often taken to mean “peace,” “pleased,” or “satisfied,” according to context. The shape was commonly cut into stone offering dishes, with the offering being placed in the depression formed by the upper part of the symbol. In the reconstruction, two such shapes have been laid out back-to-back.

The various houses forming this shape had particular purposes: some housed workers of different levels of experience; some were storehouses; and others contained shrines to those gods that were local to the group of workers occupying the buildings. An acacia tree was planted in each of the oval shapes, and the villagers sheltered under it from the strong sunlight during the day. The oval areas became relaxation centres and meeting places for each of the “mini-hotep villages.”

Hemiunu was also concerned with hygiene, and he remembered the dreadful smell that met him when he first visited a village in Kush. He

The Secret Diaries of Hemiunu



The villages were built on low mounds, which were covered with mimosa. Most houses were of simple mud brick construction; they started out as single story buildings, but many were soon extended upwards. The workers then slept out on the roofs on hot nights, protecting them from mosquitoes, which did not fly that high.

Many of the houses were externally featureless, but some had windows, external staircases, courtyards, corner embellishments, etc. Most were heavily plastered in an attempt to keep the heat out by day, and in on colder nights.

Note the wall in the background, separating secular and sacred.

built latrine areas to the south of each village block, so that the prevailing wind, which blew from the north, would carry any smell away from the village. Designated workers, using water hauled up from the river beneath, washed the latrine areas out each day. Hemiunu had a duct installed so that the latrine runoff was channelled back down to the river.

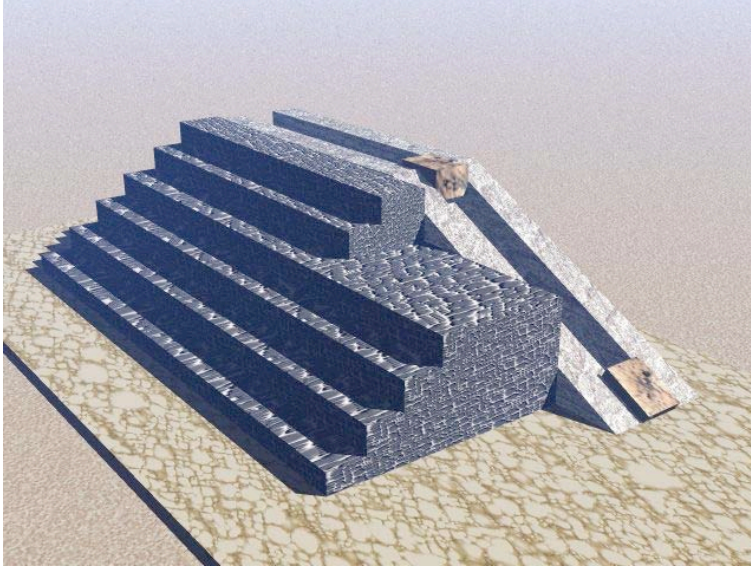
At ground level, the symbolism in the village layout was not evident. However, the arrangement of houses resulted in small communities, and Hemiunu encouraged these communities to form their own councils, to arrange their own entertainment, and to compete with other, similar communities. He arranged for monthly and annual fetes, with sideshows, children's races, swings, weight-guessing competitions, home-cooking stalls, and so on.

The overall result of his efforts clearly gratified him. The workers villages became social and family centres, and contributed greatly to the workers morale. Younger workers, who might otherwise have experienced severe home-sickness, were encouraged to join in with the social life of their community, and this evidently relieved their natural suffering.

Trials of Novel Features

Hemiunu experimented continually during the construction of the Great Pyramid, to ensure that the many features of the pyramid would work correctly, first time. He used representative materials, and full size, rather than model, setups. If the trials were successful, he then transferred the experiment on to the pyramid, assured that it would work *in situ*.

Sliding Plug Stones



Hemiunu planned to block the entrance passages to the pyramid with large plug stones, which would slide down, one after the other, to fill the passages. Stones in the down section of the passage would be loaded from the entrance, while those to block the up-passage would be stored in the Grand Gallery until needed for use. It would clearly be unacceptable to find that the plug stones in either section failed to slide, jammed and blocked the passage, leaving parts of it unsealed. Apart from any other considerations, this would occur after the king had been entombed and the pyramid was complete, leaving no opportunity to rectify the situation.

Hemiunu built a 14-seked ramp with two construction walls in the Western desert, near the Great Pyramid. The slope might be pre-determined, but there still many variables to consider: how long should the plug stones be; should they be smooth underneath and on the sides; should a lubricant (sand, water, diorite marbles) be used to make them slide more easily; was there a danger of runaway, with stones smashing into each other; how could the stones be made to stop at the precise spot at the bottom of their respective passages? And so on.

With the Great Pyramid being such a vast enterprise, Hemiunu was intent that nothing should go wrong. He was particularly keen to avoid making mistakes that would take time and effort to rectify.

Apart from careful planning, his other main practice was experimentation.

Hemiunu used full-size experimental models, so that once the experimental results were satisfactory, he could dismantle the experiments and transfer it to the pyramid site, secure in the knowledge that it would work first time.

The Secret Diaries of Hemiunu

Hemiunu found that it was important to make the plug stones only slightly less wide than the passage; otherwise they could easily jam on the way down, especially if the stones were too short. A little sand could be a good lubricant, but was only necessary to get the stones moving; thereafter, gravity did the rest. Hemiunu solved the problem of making the stones stop where he wanted simply by narrowing the passage at that spot.

Note on the graphic above how the upper of the two plug stones is poised on the point of balance; it could be set into motion from there by one man with a simple shove ...

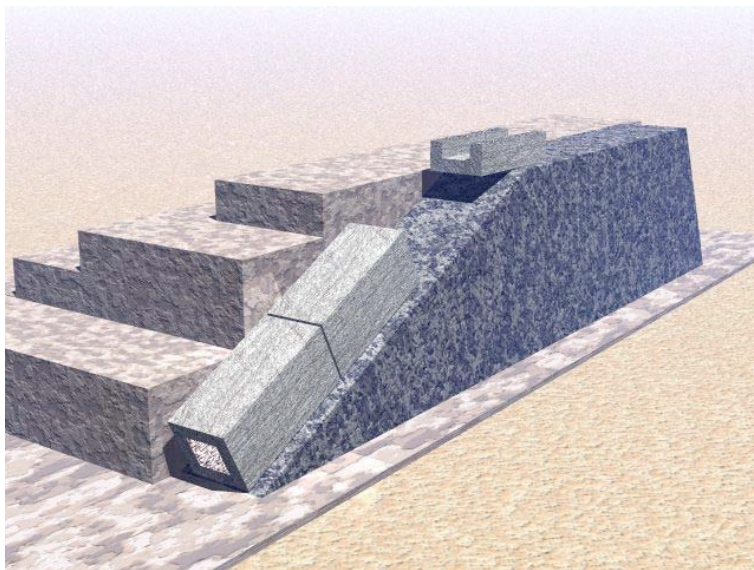
Fitting Girdle Stones

Down and up passages were prefabricated. They were made up from 10-cubit sections of granite, with the passage pre-cut through the centre, so making them lighter to handle and obviating the need for lengthy carving in situ.

The resulting passage stones may be referred to as girdle stones, as they form a girdle around the passage.

An alternative that Hemiunu also sketched in his journal was to use two girdle stones, one representing the lower half of a passage, and the other representing the upper half.

The graphic shows how each prefabricated section can be cribbed up to reach the ramp at its point of balance. To build the passage, this necessitate that the ramp, the construction walls, and the girdle stones are all part of a progressive, coordinated building system.



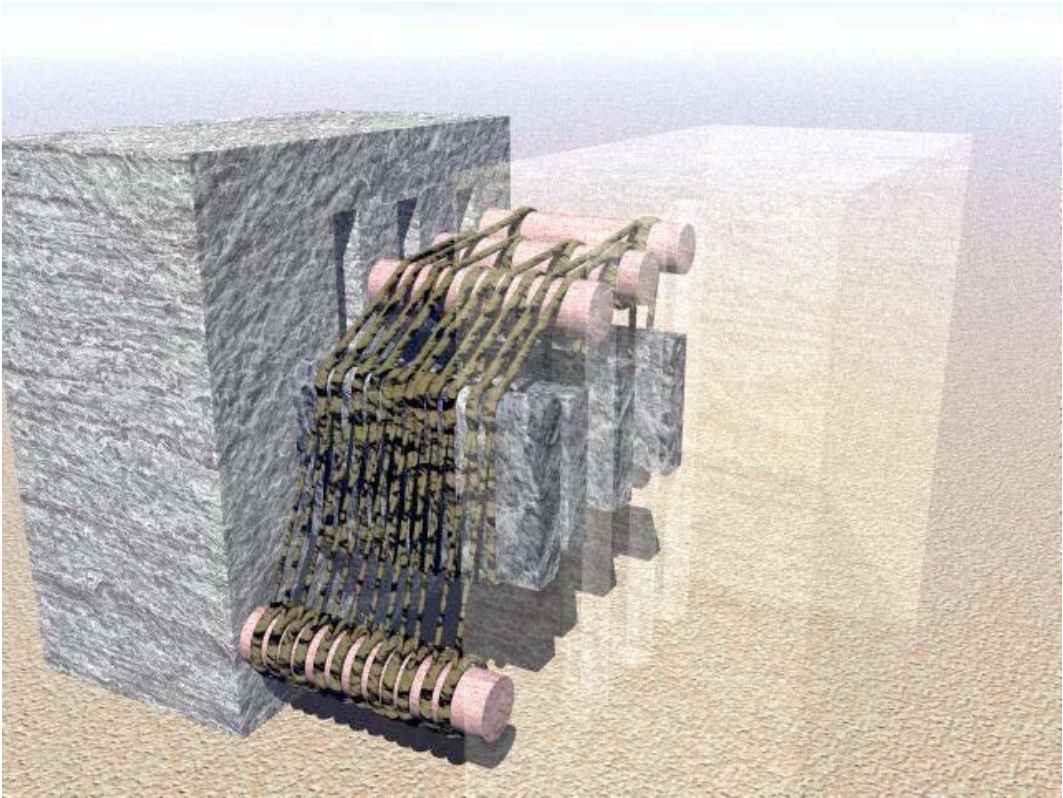
Hemiunu constructed the up passageway from preformed granite blocks, each ten cubits long, referred to as girdle-stones. These came in two forms: complete, that is with the passage already cut through the solid stone; and halved, that is in two parts – the upper and lower halves. Both types are shown in the graphic.

In this laboratory, Hemiunu built a 14-seked ramp and only showed one of the two construction walls used in practice. Experiments included cribbing the ten-cubit sections of passage up the construction wall, to reach the ramp at the junction between the ramp up-section and the ramp horizontal section. This is the point shown in the graphic at which the semi-girdle stone is shown.

The physical location of this junction depends upon how high the ramp has been raised. The lower girdle stones would have been set in place when the ramp and the construction wall were lower, and the junction nearer the viewer's position. This means that building the ramp and the construction wall, so as to be able to locate the girdle-

stones at their optimum point of balance, had to be synchronized and coordinated – this was very much a construction system.

Sealing With Portcullis Doors



Hemiunu spent some time puzzling out how best to seal the King's Chamber with the customary three portcullis doors. These were the final protection to prevent entry into the chamber, and it was vital that, once set in place, they could not be opened again.

The graphics show one method with which Hemiunu experimented. Three portcullis stones were set in two sets of three grooves, carved in two massive support blocks. The stones were suspended using two ropes per stone, draped over round cross-section marble bars. Each stone could be lowered independently by untying and slacking off the corresponding two ropes, each of which was wound around the hitching bar shown in the foreground. In this way, two people could lower the stone without undue effort, although they had to coordinate their actions to avoid the door twisting and jamming.

Once the door was lowered, one end of each rope could be released and the other end pulled through so that there was no means left to raise the door again; or at least that was the idea. Hemiunu found this to be difficult to achieve in practice. To make a good seal, the door really had to fit into a prepared groove in the floor. Letting the stone

The Secret Diaries of Hemiunu

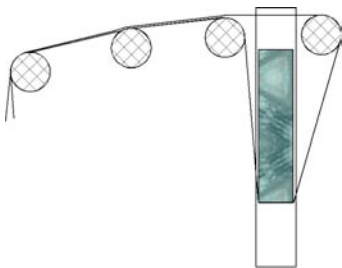
Portcullis doors generally occurred in threes. It was the intention that, once lowered into place, they should not be removable, so sealing the chamber or passage they guarded.

The reconstruction shows Hemiunu's test bed for the portcullis doors guarding the King's Chamber in the Great Pyramid: the near jamb has been omitted so that the rope-work may be seen.

Each door is suspended in its two grooves (one in each wall) by two ropes. Each rope starts and finishes at the hitching rail, bottom left. Each rope goes from the hitching rail, over the intervening round bars, under the relevant portcullis door, up and round the back of the next bar, and so back to the hitching rail.

Each door may be lowered by two people, one on each rope. The ropes were wound around the hitching rails several times, not unlike a capstan, although the hitching rail did not rotate. The multiple winds, however, allowed two men to lower one portcullis door, using the rope friction to control the rate of drop. The intent was to lower the inner door first, then the middle, and then the outer, retrieving ropes as they went.

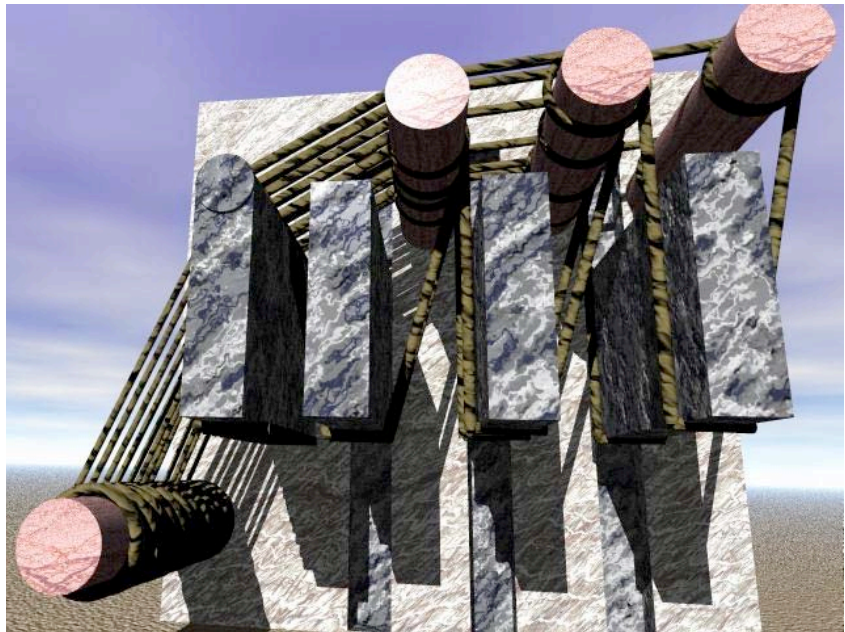
The detail below shows the rope pathway for just one of the doors, which is set in its groove in the jamb



into the groove pinched the ropes, preventing them from being removed. His solution was to make the groove such a perfect fit that the rope was effectively cut by the weight of the door as it sank into the groove.

The plan was to lower the three doors, starting with the rear door first, then the middle door and finally the outer door. Provided the doors were fitted accurately into their side and bottom grooves, there was no opportunity for any would-be intruder to gain leverage needed to raise the doors again.

The second graphic shows the extensive rope-work associated with this method of lowering the portcullis doors.



Hemiunu was not impressed with this method of lowering portcullis doors, although he used it to protect the King's Chamber in the Great Pyramid. In his journal he expressed concerns about the safety of the mechanisms for the builders, in case any of the ropes snapped. He had palm tree trunks fitted into the side grooves for each door, to take their weight until they were to be lowered.

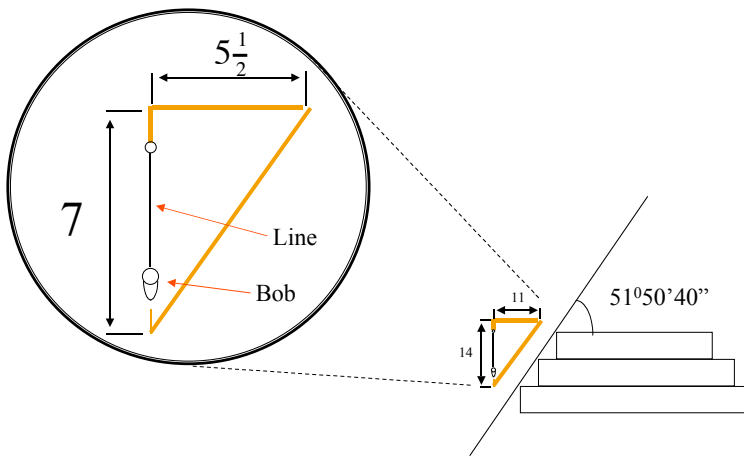
Neither did he like his solution to the problem of the ropes being snagged on lowering. He sketched out rough ideas for fixing protrusions on the front or back of each door, so that a rope could be passed over the protrusion for lowering. He also experimented with counterbalances, so that portcullis doors could be raised and lowered with ease by an individual.

Constructing the Grand Gallery

See the graphic on page 96: this graphic shows how Hemiunu constructed the gallery in Snefru's *ka* pyramid at Dahshur. Hemiunu's approach to constructing the Grand Gallery in Khufu's Great Pyramid was virtually identical. So much so, that Hemiunu did not sketch the Grand Gallery's construction, but instead referred back to his earlier drawings...

Setting Slopes – Hemiunu's Setsquare

During the construction of the Great Pyramid, Hemiunu carried with him what today we might call his "signature" tool: a setsquare carefully fixed in the vertical to horizontal proportions of 7: 5-1/2, the proportions of the Great Pyramid.



The setsquare incorporated a plumb bob to ensure that the vertical was, indeed, vertical when making measurements. Hemiunu observed in his notes that the setsquare was most effective when setting stones in place on a new tier that was of a different height to previous tiers.

Using a very large version of his setsquare, his supervisors would set the device against the edge stones, and then bring the edge stone for the next tier up to just touch the setsquare. In this way, the slope was accurately preserved no matter what individual tier thicknesses might be – and, as Hemiunu had intended, they varied not only from generally thicker at the bottom to thinner at the top, but also from layer to layer according to the best available stone from the quarries. This meant that it was not unusual to find a new tier to be slightly thicker than the one before. Hemiunu was unconcerned by this, so long as each tier was of uniform thickness.

Single Vs. Double Gable

Hemiunu was, as ever, concerned about gabled, or pitched, roofs. One of his experiments was designed to finally allay his concerns. He set up first a roof with a gable comprised of just one layer of limestone, loaded the gable at the point where the two sloping layers, or pents,

Hemiunu sketched a variety of tools in his journal, possibly as a guide for the toolmakers. The tool with which he became associated was the setsquare that was set to the precise slope of the Great Pyramid.

His bearer carried a modest version of this setsquare with him when he was on site, but Hemiunu had much larger versions constructed and put at the disposal of each of his four "Overseers of the Side." These became icons of their authority.

One particular value of these large setsquares was in maintaining an accurate slope even when successive tiers were of different thicknesses.

Hemiunu would not have recognized the angular slope measurement in the figure, of course...but he may have recognized the ratio of 14:11 as the same as 7:5-1/2.

The Secret Diaries of Hemiunu

met and observed, as expected, significant side thrusts as the weight attempted to flatten the gable.

Next, he set up the experiment shown in the graphic, in which he tested a double gable, or double pitched roof. The double-pitched roof was set in a large granite jacket above and to one side, but the other side was left uncovered. Instead of granite, three layers of wood



opposed the expected side thrust. He had flags set on top of wood: holes were drilled in the top, two layers, and the flags inserted into the lowest layer. As a result, if there were any shift of one layer of wood relative to another, the flags would tilt. Hemiunu had invented the world's first recorded strain gauge!

To his surprise, there was very little side thrust indeed, especially when compared with the single pitched roof. It seemed to Hemiunu that the double-pitched roof had much of the quality of a corbelled roof, but without the uncertain control of height.

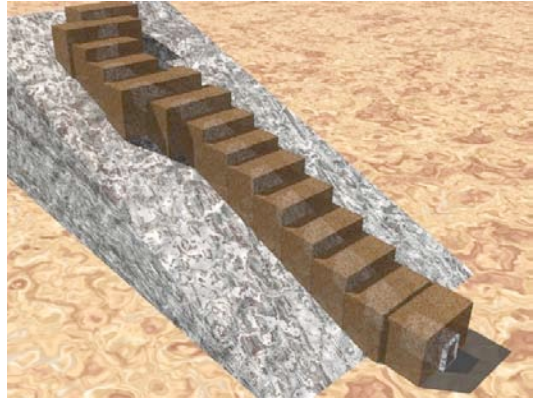
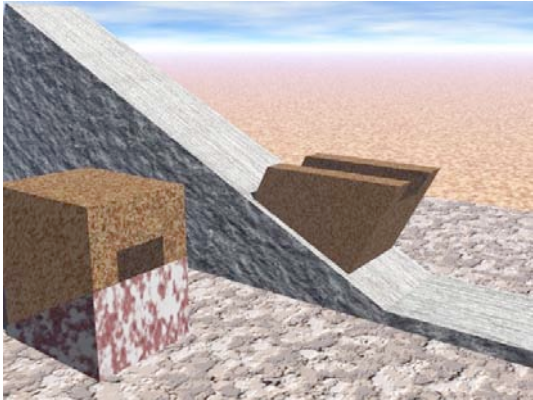
Hemiunu was evidently puzzled as to why a single gable tended to flatten, yet a double gable hardly shifted at all. He worked out that there must be as much force on the lower gable tending to make it collapse inwards, as there was tending to make it flatten outwards.

As a result of his experiments, Hemiunu used a double gable over the entrance to the pyramid in its north face. This location did not experience too much down thrust, as there was only a modest amount of stone directly above it, being on the side of the pyramid. Hemiunu may have done the experiments, but he was still a cautious architect.

Prefabricating Conduits

Hemiunu had the conduits leading to and from the interment chamber and the *serdab* constructed in secure premises, to avoid arousing the suspicions of the Priests of Heliopolis, who would have been curious about their purpose. Each conduit was prefabricated from carved pairs of blocks, which were transported to the pyramid site and fitted as the central ramp arose.

The two north-going conduits had to curve around the Grand Gallery, and the method of establishing a base at the appropriate slope was used in an ingenious manner to facilitate fabrication. A stone bench was set up at the appropriate slope for each north-going conduit. See graphic on left. Grooves were cut into the top surface of blocks set on ramps at the appropriate slope, e.g., 8-1/2 *seked* for the Queens Chamber north (QC(N)) *ka*-conduit.



The groove and the upper surface were then precisely levelled using water levels as a guide. Once inverted, the block took its place on the assembly ramp; see right-hand graphic. This second graphic shows how the grooved stones were assembled to mark out the linear and curved sections of the conduit, as it eased its way around the underside of the Grand Gallery: see graphic on page 210. The shape of the overall *ka*-conduit can just be seen through the rock that has been represented semi-transparent for the purpose.

The conduit materials corresponded with their position; near to the surface of the Mound of Creation, the conduits were marble; elsewhere they were granite. Three small portcullis doors were set in the marble sections at the top of each conduit, and the recesses for these were also carved out during the pre-fabrication processes.

The whole pre-assembly process made a potentially complex task seem relatively straightforward.

The left graphic shows the grooved stone being levelled precisely on the ramp, before being mounted on top of its partner stone, which would form part of the conduit ramp on the pyramid.

Before that, the upper sections were assembled in the correct order on a ramp set to the appropriate slope, 8-1/2-*seked* in this instance.

The path of the conduit can just be seen inside the blocks. The right-hand sides of the higher blocks, where the conduit curves, would butt against the side of the Grand Gallery when fitted *in situ*.

Trouble in Sinai

As time progressed, the building work of the Great Pyramid complex became routine for Hemiunu. Day blurred into day, month into month...There were always problems, of course, but he had done so much planning and preparation that he and his team of overseers were prepared for most eventualities. All was not well either within, or beyond, the sacred enclosure of the pyramid, however...

Inundation Woes Increase

The annual Inundation was not behaving quite as might have been hoped. It was erratic, as it had always been, but the average inundation height seemed to the king's viziers to be falling. Not only that, but the river in Lower Egypt towards the Nile Delta seemed to be silting up, so that the Inundation, when it did come, did not rise as much in relation to the land, which itself rose by as much as a palm-width or more year-on-year.

In one respect, Hemiunu welcomed a lower average Inundation. The lowest courses of stones in the pyramid were showing signs of the exterior salt deposits he had already seen on *shetep on* – the Living Image. That rocky outcrop was significantly lower down the scarp towards the Nile than the base of the pyramid, however, so he had not expected this phenomenon to affect the pyramid. He wondered if the whole of the rock in the plateau was porous, and was gradually soaking up moisture from the river like a great sponge...

He met with Prince Ankhaf, who was still trying desperately to dig out the chamber deep under the Great Pyramid. Ankhaf had other worries however. He had managed to complete the passage to reach the underground chamber, and was well into digging out the chamber, which was to be massive. Difficulties were mounting, however.

His men kept being taken ill, generally with breathing difficulties. There was a lack of air in the chamber, which was filled with limestone dust and smoke from the oil lamps that the men needed to work by. The usual trick of reflecting sunlight down the passageway using a metal mirror did not work because the mouth of the passage was on the north side of the pyramid and did not see much sun. Besides, the passage was far too long...

Hemiunu suggested that Ankhaf should install bellows at the mouth of the passage, connected to a long pipe passing down the passage so that fresh air would emerge at the chamber.

Ankhaf dispelled Hemiunu's concerns about moisture in the rock – he had not encountered a significant amount, and the walls of his passage and chamber were generally dry. He had noticed water running down the walls on occasion, but it had not presented a problem – so far.

Hemiunu travels north

Mounting concerns over the Inundation decided Hemiunu that it was time to travel north, to the Nile Delta region. He took an armed guard with him.

There were problems with the harvest to the north, and there were continuing reports of problems in the Sinai from marauding bands of nomadic tribesmen who had taken to raiding stores of food, killing farmers indiscriminately in the process. There was already a military post in the Sinai, principally to protect the turquoise mines at Wadi Maghara, but that was too far to the east, away from the Delta's normally-rich farmland, to be of any value.

In his inimitable style, Hemiunu made plans to establish several new military outposts on the eastern side of the Delta, to operate under the operational control of the military commander at Wadi Maghara, organized the troop deployment, and then advised King Khufu of what he was doing. To his surprise, the king had been aware of his preparations, and cordially gave his approval. Hemiunu was surprised: the king's intelligence service was evidently improving...

Hemiunu Visits Lower Egypt

Hemiunu set out from White Wall ahead of the troops, making initially for Per-Bastet, the House of Bastet, (Greek "Bubastis") on the eastern side of the Delta, which had been the source of most of the reports of trouble. With servants and guards, he travelled in a convoy of small boats. He took his time, stopping frequently to survey the area and talk to people.

The nature of the land started to change radically as he pushed further north. The Delta region consisted of thousands of islands, some large, many quite small, all covered with lush green vegetation. At times the branch of the River Nile that he was on looked more like a stream, with many inlets and branches: it would have been easy to get totally lost, except for the weed in the river, the flow of which indicated the main channel.

As he approached Per-Bastet, he saw an unusual sight, for which he had not been prepared. Many of the islets were joined by wooden walkways mounted on stilts – sharpened tree trunks that had been driven into the riverbed. One such walkway led towards a complex that looked like a temple. The temple consisted of a number of squat obelisks surrounding a larger building, which looked like a double-sloped pyramid. There were also truncated pyramids, but there was no sign of anyone working on them.

Further off, Hemiunu could see a tall tower, which he took to be a lookout. In this he was correct, as his small flotilla had already been spotted.

Hemiunu was welcomed; news of his visit had preceded him. He found out from the town officials that they had been living in some



fear of attack, but that their main problems were to do with the uncertainty of the Inundation. Some years, the waters did not rise sufficiently to flood enough of their land, and they were beginning to run short of food.

Hemiunu discovered that many of the channels that had previously provided natural irrigation had silted up, forming natural barriers to the flow of Inundation water. He organized the people of Per Bastet into dredging teams, and they set to work dragging leather buckets, suspended on ropes between two boats, along the various streambeds. On raising the buckets full with rich, ooze and mud, other boats took the spoil ashore and spread it over the farmland.

Hemiunu explained to the farmers that this dredging would have to be repeated every year, and that it would restore their farmland as the Inundation would once again cover their land – but only if they worked hard at it each year. Meanwhile, they should be aware that King Khufu was interceding with the gods to restore the Inundation.

The building he had seen as he approached Per-Bastet evidently intrigued Hemiunu. Before moving on, he put his trusty artistic skills to good use, producing several fine pieces of artwork. The first painting showed the temple, the tower and the raised walkway. The walkway was on stilts to raise it above the level of the annual

Inundation, which was neither as fierce nor as high as Hemiunu was used to higher up the Nile valley.

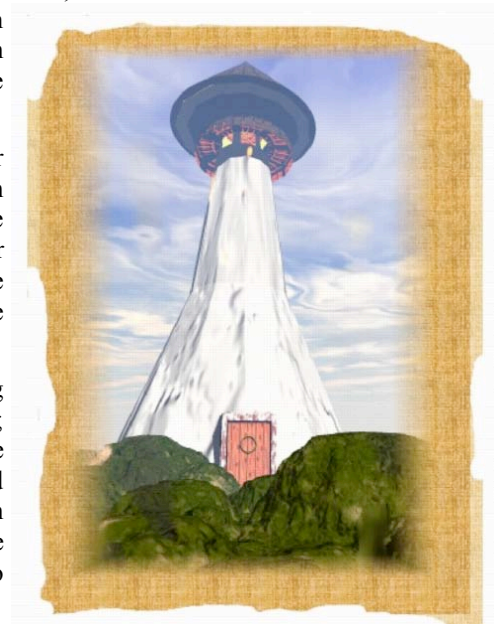
The walkway was stoutly built and had been in place for many years. The inhabitants went across such walkways, of which there were many, very nimbly, and children enjoyed running up and down the small hills made by the wooden boards.

Hemiunu visited the temple, which was not so large close up as it had appeared on the horizon. He had thought that the buildings were made of stone, but to his surprise he found that they were made of wooden frames woven with saplings, and covered first with mud, then plaster, and finally with sand.

The tower particularly intrigued him. This also turned out to be made from wooden frames. Two conical frames had been formed; the smaller had been mounted on the larger, and a roof fitted on top. As with the temple buildings, the structure had been formed into wattle, covered in mud, and in this instance finished off with white clay.

Hemiunu left Per-Bastet after three days, and went further north to Per-Benabjed (Mendes), where he went through much the same process of reassuring and advising the people, and showing them how to dredge out their streambeds. He also told them about the increase in the military garrison, and that soldiers would be posted in the towns to protect them.

Hemiunu travelled west to Per-Wadjet (Buto) offering similar help and guidance without mention of military aid; there had been no reports of raids in this westerly part of the Delta. He then returned home, satisfied that his activity had both highlighted the continuing dangers to Egypt from across its borders, and having taken action to alleviate the difficulties faced by the people, whom he had come to respect and admire during the course of his brief visit.



Progress Meeting—*Akhet* Khufu

Prince Ankhaf was still having great difficulty in digging out the underground chamber. Hemiunu's advice to use a bellows had not worked.

Khufu was angry. Despite Hemiunu's design for a pit burial "in the sky," Khufu still wanted his underground chamber.

Hemiunu proposed to build an extra passage from the mouth of the underground chamber up to the foot of the Grand Gallery, and to light fires in this passage. This, he assured the king, would draw fresh air down the long entrance passage to the chamber, so relieving the workers. Khufu was temporarily mollified...

Hemiunu records a difficult meeting with King Khufu.

Present: The King, Prince Ankhaf, Overseers of the Sides, Counter of the Sacred Stars, Guardian of the Sacred Numbers, and others. The Priests of Ra was not present, to Hemiunu's relief.

Khufu Why has digging on my burial chamber been halted?

Hemiunu Several diggers have died in the last three days, and many are ill, your majesty. The men think there is a curse or an angry god in the rock, that is killing them.

Khufu And what do you think, you miserable excuse for a festering dung heap?

Hemiunu My lord, I believe that the men are dying because they cannot breathe, due to the fumes from the torches and the lamps.

Khufu *I will have my chamber.* The future of all Egypt depends on my travelling to my star. And for that, I need my underground chamber.

Hemiunu I believe there may be a way forward, my liege, and one that is in keeping with your being the greatest ever King of Egypt, with the greatest ever pyramid.

Khufu This had better be good, you snivelling pustule, or else!

Hemiunu Your command of invective is indeed superlative, my king. Truly have you mastered the art of overseeing. I propose to cut an extra passage through the rock and the masonry from the mouth of the underground chamber to the junction between the Grand Gallery and the *serdab*. Fires will be lit in this new passage, which will suck air down the entrance passage towards the underground chamber. This will draw in fresh air and relieve the workers.

Khufu Will not the smoke from these fires impede the building of my Grand Gallery and *serdab*?

Hemiunu Fires will be needed only while your underground chamber is being dug out, Sire. And, thereafter, the new passage will serve as an escape route for those who fill the up passage with plug stones.

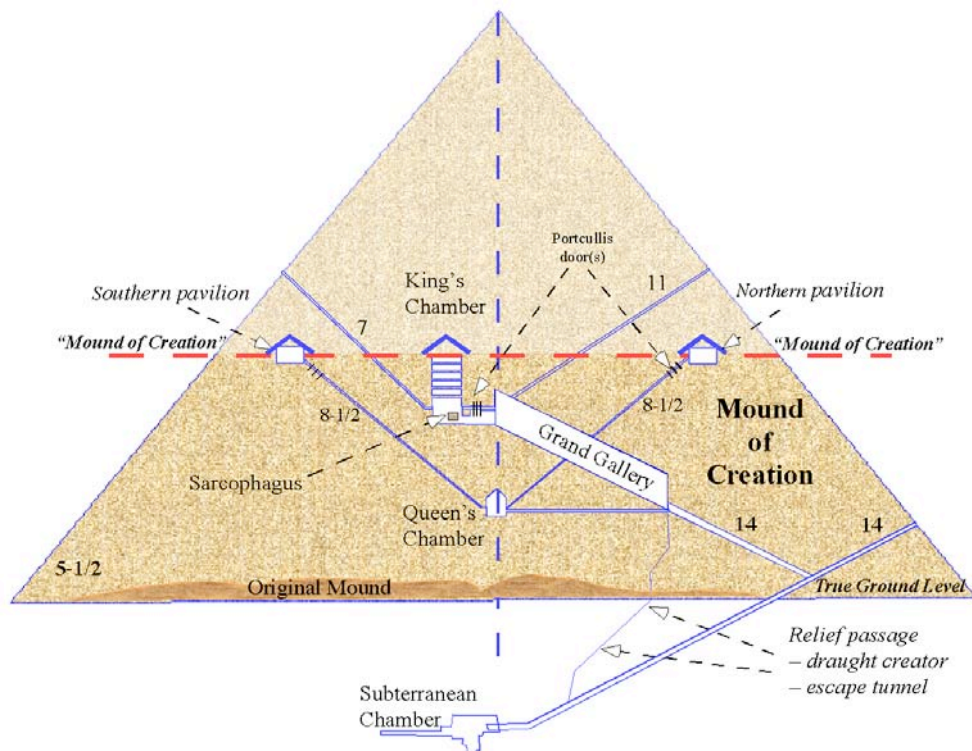
Khufu Hm-m-m. I suppose they really do need to escape, do they Hemiunu?

Hemiunu Your great mercy is legendary, my King.

Khufu ...as you may need it to be, you pathetic excuse for a pregnant camel.

Hemiunu (quietly, to the king) Not your best effort, sire, not your best. Snivelling pustule was better.

The Greatest Challenge



Khufu stifled a smile; these exchanges had become a distinct pleasure for him. The ruder he became, the more Hemiunu seemed to enjoy it, while the other people in the court were shocked and horrified.

Hemiunu then presented drawings of the proposed new passageway, superimposed on outline drawings of the internal structures of the pyramid that Khufu had not yet seen. Hemiunu knew that the king would be so interested in the drawings that he would soon forget any problems with his underground chamber – in which Hemiunu had little interest. As far as Hemiunu was concerned, the “burial pit in the sky” that he had designed for the king made the underground chamber redundant. Not that he would have said anything to Prince Ankhaf, of course...

The king pored over the drawings, asking questions like an excited schoolboy. He wanted to know where the fires would be lit in the new passageway to create the necessary up draught. How and when were the portcullis doors in the various passageways to be released? Had there ever been anything like his, the king's, elevated pit burial before? Why had nobody thought of it before? After all, it was pretty obvious, he added, grinning slyly in Hemiunu's direction.

Hemiunu sighed in relief. Things could have been nasty if the king had lost his formidable temper...Hemiunu winked at Ankhaf.

The graphic shows the first drawing of the complete internal structure that Hemiunu presented to King Khufu, although the original in the diaries had neither writing nor legend on it.

Instead, Hemiunu explained everything by pointing out on the drawing.

He described the relief passage and its two functions. He also pointed to the three structures that would appear at the top of the Mound of Creation: the capstones above the interment chamber burial pit; and the northern and southern pavilions.

He explained the logic/magic of the passageway and conduit slopes (marked in *seked* on the graphic.).

He highlighted the three sets of portcullis doors showing where they were located, and explaining how and when they would be released. Once released, of course, they could not be raised again...

At the time, the pyramid had nearly reached the level of the Queen's Chamber, or *serdab*

Eclipse and Curse

Princess Hetepheres was still engaged in subversion against the King, and Hemiunu was still a prime target.

She tried to stir up trouble among the pyramid builders at the Giza site, choosing a time when Hemiunu was not there; he arrived in the middle of her harangue.

By sheer good fortune, Hemiunu was able to use the happy coincidence of a full eclipse of the Sun to reassert Osiris' rule over Ra in matters of the dead – and of their pyramids.

He used the opportunity to lay down a curse on any who would disrupt the work, and on the families.

The curse was to incur ramifications far beyond anything that Hemiunu might have expected...

It was the start of the month of *pnamenoth*, in the season of *proyet* (spring). As usual, Hemiunu arrived early at the Giza site, but not as early as some. The fiery Princess Hetepheres was already there, accompanied by a retinue of servants, armed guards and a delegation of some ten or more the Priests of Ra from Heliopolis. A large crowd of pyramid builders had gathered around to hear her denounce the whole Giza plateau as an unholy place, not approved by the supreme god Ra as suitable for the interment of kings.

Hemiunu joined the crowd, unnoticed by the visitors, and listened for a while, growing more and more angry. He could sense that his workmen were upset by the thought that they were working against the will of Ra. Hemiunu was also initially puzzled as to his best course of action: Hetepheres had a platoon of soldiers with her, and he knew that she would need little excuse to deploy them.

He also realized that this intrusion was part of the ongoing malaise between the followers of Osiris, with their rule of the heavens and the followers of Sun with Ra as the supreme deity. This was another episode in the on-going struggle between the two faiths. If he was to fulfil his duty to Khufu and keep faith with Osiris, Hemiunu could not allow this diversion to be successful.

As he looked around, Hemiunu noticed that the sunlight was taking on a strange glow. He had seen this before, in Kush. A glance toward the early morning Sun confirmed his suspicions.

Hemiunu suddenly drew himself up and strode forward, holding his mace aloft, and calling on all blasphemers to repent. He must have made an imposing figure, with his great height, his cloak and the long mace. The princess faltered in mid sentence, as the crowd parted to let their overseer through.

Hemiunu seized his opportunity: “This site is ordained by the god Osiris as the most holy necropolis of the Lords of the Two Lands, *neb tawi*. Osiris, god of the heavens, of the dead and of the underworld, has decreed it. Osiris is pre-eminent in all matters of the dead, and the God Ra will now make his obeisance to Osiris.”

At this, Hemiunu pointed his mace dramatically toward the Sun, rising in the east. The workers, who had had their backs to the sun, turned around to witness the first stage of a total solar eclipse.¹ The men were terrified, and fell to their knees, along with Princess Hetepheres. The Priests of Heliopolis, who were not unfamiliar with eclipses in theory,

¹ The IXT observes that there were several eclipses visible from Giza during the construction of the pyramid. The one that fits best, time-wise, was the full, central eclipse on 26th January 2579BC, starting at 07:07 and ending at 08:37.

were also taken aback by this sudden display of Hemiunu's power to summon Osiris, and to overcome their supposedly supreme Ra.

As the light faded even further, stars could be seen in the western sky. Hemiunu observed loudly that even the Gods of the Netherworld had re-appeared to denounce the princess and the foolish priests. The air became cold. Birds started to roost. Men started to shiver, nervously, as a cold breeze sprang up from the east. Hemiunu stated that Osiris had brought back the night, and that night would persist until Princess Hetepheres and her retinue left the site, no matter how long that might take. (Hemiunu knew that many of his workers were afraid of the dark.)

The crowd of workers started to grumble angrily, and the soldiers looked wary; they would be no match for an angry mob. Princess Hetepheres recovered herself sufficiently to bluster that the matter was not over, she would be back, and next time Hemiunu had better watch out...

At that point Hemiunu decided that he needed a longer-term solution to the problems posed by the princess and the priests. He climbed up on to a rock, faced the east, raised his arms and mace high, and pronounced a curse in the name of Osiris. Death would be visited upon all those who entered the holy site at Giza to do harm to the structures or the people working there. Death would be visited on any of those unwelcome visitors today if they ever returned to the Giza site. Death would be visited upon their families to the next generation. And those who died would not pass to the afterlife.

The princess recoiled at this terrible curse. Cynical she might be, but she had every hope of eternal life, the more so because she was of the royal family, married to the crown prince, who would become king in his time. Prince Kawab intended to build his pyramid on the Giza site, right next to *Akhet* Khufu, his father's pyramid. She would be granted a queen's pyramid of her own, beside her husband's, just as there were to be three queen's pyramids beside *Akhet* Khufu. This was ordained: this must be so, but not if Hemiunu's curse took effect.

Having delivered his curse with all the authority he could muster, Hemiunu then advanced on the princess and her party, and his men followed him in their anger. Princess Hetepheres and the Priests of Heliopolis beat a hasty retreat, and they did not return. Hemiunu was left contemplating his good fortune in noticing the eclipse, and wondering if he might have rather overplayed his hand. After all, banning the royal princess from Giza for all time might seem a little excessive. His men were eying him somewhat nervously, too...

Hemiunu could not have known the impact that his curse would have on the royal succession and on the location of the next pyramid to be built after *Akhet* Khufu...

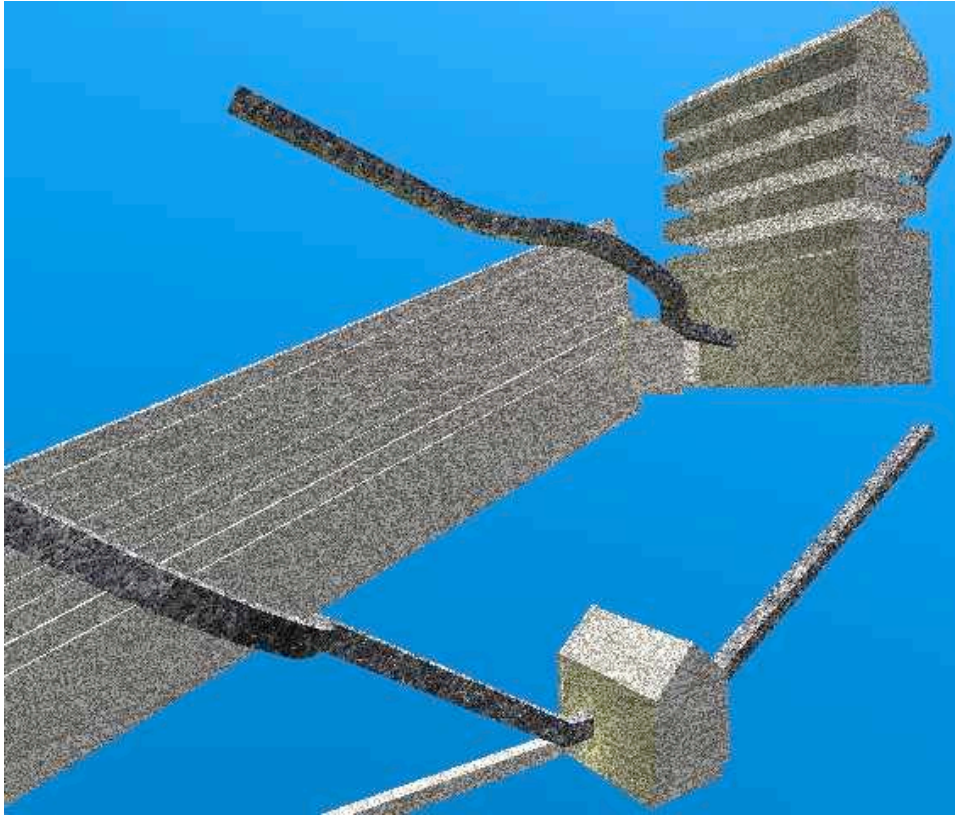
"...Death will come to those who enter the holy site of Giza to do harm to the structures or the people working there.

"Death will be visited on those unwelcome visitors today if they ever return to this place

"Death will be visited upon their families to the next generation.

"Those who die will not pass over to the afterlife..."

The *Serdab*, the Niche and Horus-Khufu



The structure going from bottom left to top right is the Grand Gallery, sloping upwards at 14-*seked* (26.5°).

At the top right is the King's Chamber, with the "burial pit" above it, both made from granite. (Today these layers of granite are referred to as relieving chambers, although they are neither chambers nor do they relieve.)

On top of the burial pit is a pitched limestone roof.

Below the King's Chamber is the *serdab*, or Queen's Chamber as it is generally called, which is made from limestone blocks and which also has a pitched limestone roof.

Hemiunu now turned his attention on the *serdab*, which would come to be known as the Queen's Chamber – a title he would not have recognized. From his perspective, the *serdab* was the focal point for the *ka*, Horus-Khufu, to contemplate, observe and journey throughout the Two Lands of Upper and Lower Egypt.

Compared with other internal structures, the *serdab* was relatively small, but it was rich in architectural detail. As the graphic shows, it sits underneath the King's Chamber, and the conduit that emerges from its northern face has to skirt around the Grand Gallery, which is directly in the way.

Hemiunu clearly saw this as neither an issue nor a problem. The *serdab* was to be constructed on top of the rising central ramp, which would then continue around and above it, finishing as the underside and support for the Grand Gallery and the King's Chamber.

Hemiunu had decided that the *serdab* should have appropriate magical dimensions, to help in energising the structure. This magical energy was essential to enable the *ka* of the dead king to continue its

protection of Egypt through eternity; that was why it had to be locked into the stone.

He elected to give the *serdab* internal dimensions of 10 by 11 by 12-cubits. Further, the height of the north and south internal walls was 9 cubits, giving dimensions of 9x10x11x12-cubits. This had the magical power of the successive integer in it, an established formula for success. (It was used in pyramid slopes: at Dahshur, the Red Pyramid and the upper part of the Bent Pyramid both had a slope of 17:18, for example; and, it was the basis of the ubiquitous 14-*seked* slope used for main passageways in nearly every pyramid. 14-*seked* was a slope of 2:1, after all.)

Hemiunu knew from his experiences that choosing a particular height for a chamber meant that he would have to use a pitched roof, rather than a corbelled roof.

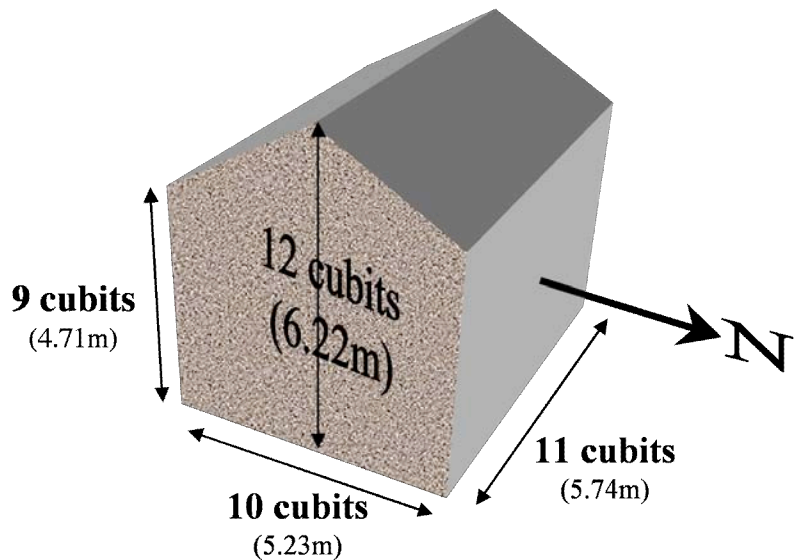
This was an innovation; no *serdab*, indeed no internal pyramid chamber, had ever been constructed with a pitched roof, before. He was unconcerned by this, however: experiments had convinced him that he could either fit the pitched roof within a corbelled space above the chamber, or he could use a double-pitched roof.

He elected to use the internal corbelled space as it was easiest to build within the rising ramp, and because it afforded him the greatest assurance of supporting the heavy load that was yet to be placed above: the King's Chamber, the granite burial pit reaching up the surface of the Mound of Creation, and then the *Benben* stone reaching right up to the pyramid pinnacle on top of that.

The four sides of the *serdab* were raised on top of the horizontal section of the growing central ramp – see graphics below. The first graphic, based on Hemiunu's sketches, shows a view looking northeast. One of the huge pent slabs used for roofing the *serdab* is shown in place. This would have necessitated that both construction walls were already raised to the top of the *serdab* walls: Hemiunu was evidently using these sketches to illustrate the general idea; had he shown both walls at full height, details of the chamber's interior would not have been visible.

The Queen's Chamber, or *serdab*, had internal dimensions of 9 x 10 x 11 x 12 cubits, so making full use of the magic associated with sequential integers.

Moreover, the sequence of dimensions was chosen to be mutually orthogonal: i.e., height, width, depth, and height again. This contributed to the magical power inherent in the chamber, its shape and size.



The Secret Diaries of Hemiunu

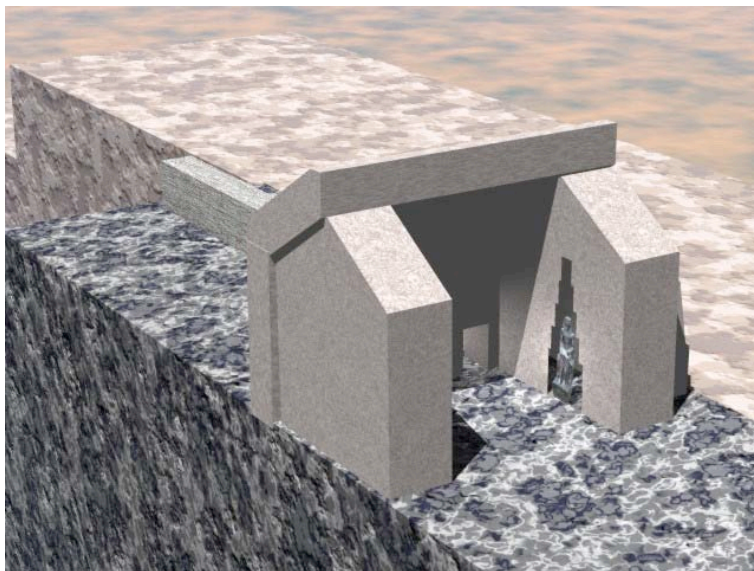


Hemiunu's restored artwork above shows a rare image of Khufu, identifiable by his distinctively-fat face.

Hemiunu's fine picture indicates that Khufu's mortuary statue in the *serdab* niche was in the same style as those of Khafre, his son. Like Khafre's well-known statue, see below, Khufu's had a hawk at the neck, probably representing either the God Horus who was guiding his actions, or perhaps an early form of Ra-Horakhty, God of the Rising Sun.



Inside the chamber, the entrance door in can be seen in the corner, and the *serdab* niche can be seen on the east wall. This already houses a statue of Khufu, seated and looking towards the west, but firmly located in the east, the land of the living, since his purpose within the *serdab* was to oversee the living in Egypt. The sun rising in the early morning would have entered the Horus hawk on his neck and empowered his *ka* each day. (The statue would have been installed at this early stage, presumably, because it was too large to bring through the various passages once the pyramid was complete.)

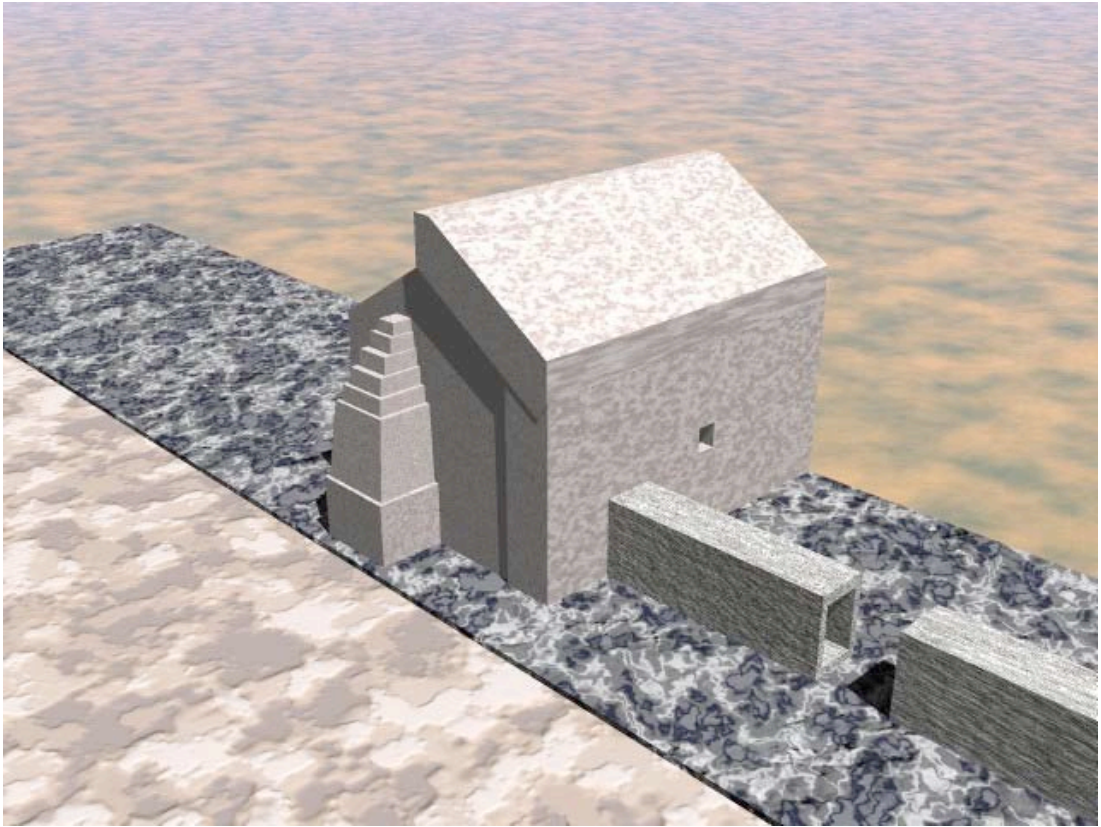


The walls of the *serdab* were constructed from large limestone slabs. The size of the slabs can be gauged by the height of each step in the *serdab* niche; the slabs were set inwards one above the other to create the conventional corbelled arch.

The second graphic of the pair illustrates a problem that arose, one that upset Hemiunu. The view is looking towards the southwest, i.e., from the opposite corner of the previous picture. The entrance passage leading to the doorway can be seen, together with the back of the niche, which would eventually be swallowed up along with the passage and the chamber in the rising central ramp.

Note the recess at centre right for the north-going *ka*-conduit. This recess did not go all the way through the north wall: instead, it stopped short by about two fingers, so sealing the conduit, which would be invisible from within the chamber. This was to fulfil his promise to Khufu to seal the conduit against any ingress of water from the spiritual Nile.

The problem that arose concerned the passageway. It was assembled from pre-fabricated parts as previously, but the section that fitted over the door into the chamber had been inset into the ramp, so that those entering the door did not have to step downwards as they ducked to



enter through the low opening. Unfortunately, subsequent sections of passage had not made allowances for this inset, so that when the final section was put in place, there was a height mismatch.

Hemiunu was clearly not pleased, but ever the pragmatist, he agreed to overcome the problem by creating a step down where the two passage sections met, provided they workers levelled the ceiling so that heads would not strike the sharp edge that would otherwise protrude.

As the *serdab* was built, the two construction walls and the central ramp rose in synchronism, so that stone blocks and slabs could always be lowered, rather than lifted, into place. The start of the Grand Gallery coincided with the start of the *serdab*. As time moved forward, the central ramp rose around the *serdab* and its passageway, just as it created the underside of the Grand Gallery. When the central ramp reached the height of the *ka*-conduits, the prefabricated sections for the start of each conduit were set in place. And so on. Each level was methodically and systematically completed before moving on to the next.

The *serdab* during construction, looking southwest. The entrance passage approaches from the north, bottom right. Due to a misunderstanding, the two sections of passageway were vertically misaligned, resulting in a step down when approaching the *serdab*.

Note the protrusion, centre left, caused by the *serdab* niche, and the hole on the northern wall cut for the *ka*-conduit. This hole did not pass completely through the wall; it stopped short by two fingers, so sealing the conduit to prevent “spiritual” Nile water from seeping into the *serdab*. This was done to satisfy Khufu’s concerns.

The Strange Case of Queen Hetepheres I

Hemiunu was working at the Giza site when a royal messenger came running up the slope from the Nile, calling Hemiunu's name. Hemiunu had never been on the receiving end of such a clearly urgent message, and was instantly alert. The tomb of Queen Hetepheres, Khufu's mother, had been vandalized. Hemiunu was to come immediately.

Hemiunu needed no second urging; he knew only too well how Khufu had doted on his mother. Her tomb, at Dahshur, was one of the finest, and had been well sealed and guarded – Khufu had seen to that.

Hemiunu was puzzled, too. Why would anyone want to break into the old Queen's tomb? She had been universally popular, and there was no great treasure to be found in her tomb.

Hemiunu pondered. Could he see the hand of Djedefre and his evil Nemesis, the Princess Hetepheres in this? Nothing could have been designed to upset King Khufu more, and that seemed to be their joint aim in life. How ironic that the lovely old queen and the poisonous princess should bear the same name. Still, surely even she would not prejudice her grandmother's afterlife...

He arrived at the tomb in Dahshur to be met by a distressing sight. Robbers appeared to have broken into the tomb. Burial goods were strewn around everywhere. The Queen's furniture, which had been her pride and joy during life, had been turned over and disassembled: her famous canopied bed had been pulled apart; two armchairs and her sedan chair were upside down; and smaller items in gold, copper and alabaster were strewn about. Hemiunu noticed the presence of the gold in particular. The Queen's sarcophagus was still sealed, however, along with her canopic chest.

Considering the evidence, Hemiunu was certain that this was not the work of tomb robbers. Items made of gold had not been taken. The sarcophagus, which any robber might have expected to contain valuables, had not been touched. The supposed robbers had not even opened the canopic chest. So Queen Hetepheres had not been deprived of any of her personal possessions and valuables, and her sarcophagus – which everyone would expect to contain her mummy – had not been touched. Everyone, that is, except Hemiunu, and perhaps King Khufu.

Hemiunu had never discussed the matter of interment with King Khufu. Would the king's mortal remains actually be interred in his red granite sarcophagus, which Hemiunu was on the point of installing in the King's Chamber prior to roofing? Or would his mummy, like that of his father and grandfather before him, be spirited away to Abydos? And if so, by whom? Hemiunu certainly did not have the close relationship with Khufu that Hemiunu's father, Prince Neferma'at had had with King Snefru. So Hemiunu was not about to undertake any spiriting of Khufu's remains—always supposing Hemiunu outlived

him. (So uncomfortable was Hemiunu's relationship with Khufu that he had dissuaded his sons from becoming royal architects.)

On the subject of interment, then, would the king have expected the mortal remains of his mother to be in the sarcophagus, or would he, perhaps, have known that they were already safely interred at Abydos? Khufu had, after all, supervised the interment of his mother personally.

Khufu had set up camp near the vandalized tomb. Hemiunu went to see him immediately after inspecting the damage. Khufu was deeply upset, and exhibited a mixture of intense anger at whoever had perpetrated this terrible act, and equally intense anguish at the sacrilege perpetrated upon his beloved mother.

Hemiunu tried to calm the king down. After a time the king started to consider who might have done this terrible deed. He had worked out that nothing had, apparently, been stolen. Had the robbers been discovered in the act and frightened off? Unlikely – they could easily have pocketed items of gold as they searched, which should then be missing...

Could it be enemies of his mother or father? Unlikely, they were both universally loved. Could it be personal enemies of Khufu himself? Unlikely, he thought out loud, but then he paused and directed the question at Hemiunu: "Who do you think did this terrible thing?"

Hemiunu replied that the most likely explanation was that someone was deliberately trying to upset the king, but that same someone did not wish to disturb the mortal remains of Queen Hetepheres. Hemiunu added: "You can work out better than I sire, who that person, or persons, might be."

Khufu nodded, and agreed. He had also put the evidence together and come up with Djedefre and the Princess Hetepheres, dreadful though the thought might be to him.

Khufu asked what should be done next. Hemiunu proposed that, since the contents of the tomb were all intact, they should be covertly transported to a new and secret location, one that nobody knew about. The king agreed and was about to nominate Hemiunu to undertake the task, until Hemiunu pointed out that, as the King's chief overseer, he, Hemiunu, would be under close surveillance by the perpetrators.

If they saw what he was doing, the new location might constitute a second target for their nefarious activities. Instead, he suggested to Khufu, better to employ Prince Ankhaf on the task. Nobody took any interest in his activities; he was permanently out of sight, underground trying to dig out the King's subterranean chamber.

So it was arranged. Guards were posted over the vandalized tomb. The King returned to White Wall. Hemiunu returned to Giza, briefed Ankhaf, helped him locate and design a suitable tomb, and then advised him to see Khufu with the draft plans.

The Secret Diaries of Hemiunu

The bottom left graphic shows the twelve-step entrance to the new tomb, with the entrance to the shaft visible around the corner at the bottom.

The entrance was carefully cut so that it could be filled in again to leave no trace of the tomb, although

Hemiunu proposed that a small pyramid should be raised above the shaft in the future, to honour the Queen Mother in the same way as Khufu's three wives were honoured. (This was, of course, never done.)

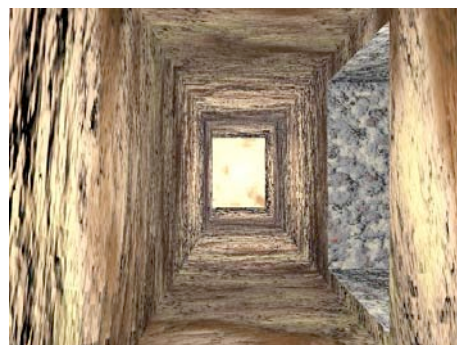
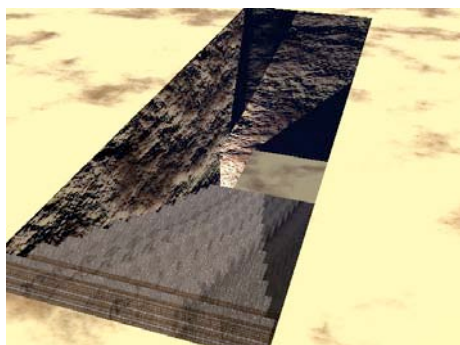
At right there is a view, vertically down, of the shaft that descends some 56-cubits (80 feet.) This was the same depth as Djoser's pit burial at Saqqara, and was designed to ensure communication through the underground Netherworld. A recess is visible part way down on the right.

Hemiunu had made Khufu's pit burial in Great Pyramid the equivalent of 56-cubits deep, to ensure that Khufu and his beloved mother could remain in Netherworld communion throughout their afterlife.



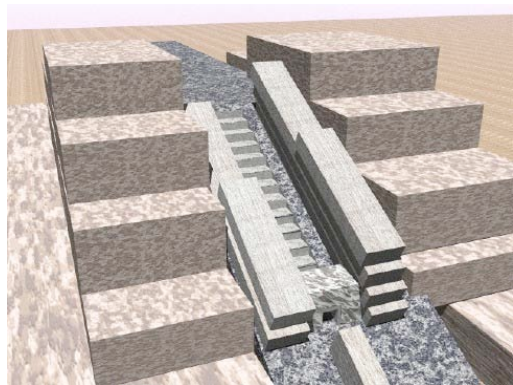
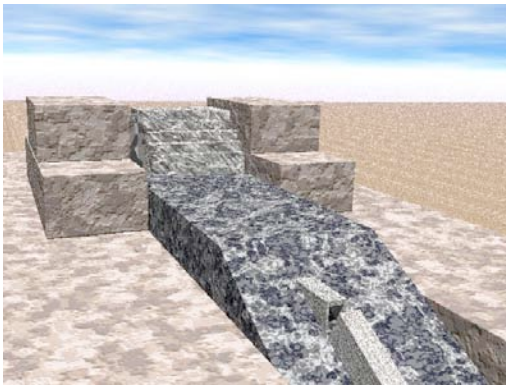
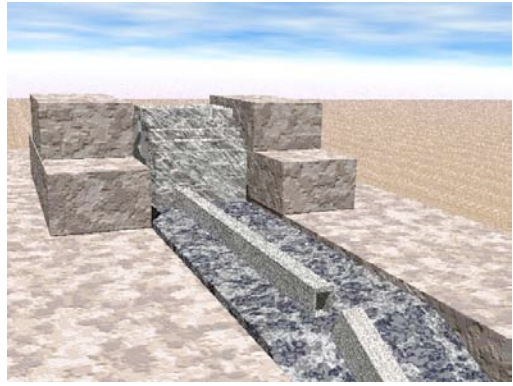
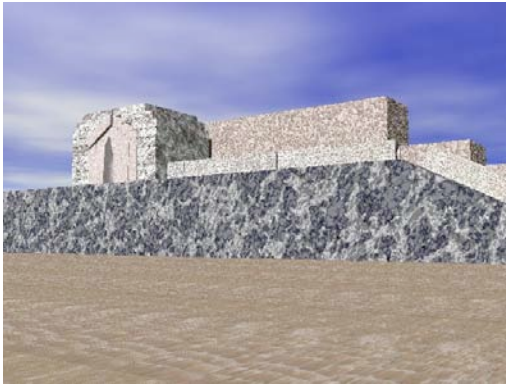
The graphic above is based on a sketch in Hemiunu's notes. Queen Hetepheres sarcophagus, still sealed, sits in a chamber at the bottom of an 80-ft shaft. The chamber has two doors off, one to the right and a second at the back. Over the sarcophagus is a nebulous canopy woven from the sheerest linen, suspended from six posts.

The original sketch may have been used to brief the king. In the event, things did not work out quite as depicted. The Queen's personal treasures were loaded hastily under cover of darkness into this deep pit site near Khufu's three Queen's Pyramids. There could not have been lamps to maintain illumination, as shown, since the shaft would have been filled in straight away to seal the tomb. However, the King seems to have been satisfied. It is unlikely that either he or Hemiunu visited the chamber personally, in any event: it would have been a very difficult climb for them, both now advanced in years.



Building the Grand Gallery

Hemiunu returned to work, to tackle his next step in the Great Pyramid construction. He was immensely proud of the Grand Gallery, as it is called today. Rightly so: it is considered by experts to be one of the finest examples of the mason's art anywhere in the world, and it has to be one of the reasons for the Great Pyramid being the Seventh Wonder of the World.



Yet Hemiunu considered the actual construction of the Grand Gallery to be straightforward, especially after the “trial run” he had undertaken at Dahshur in Snefru's *ka*-pyramid. The graphics, from Hemiunu's sketches, show preliminary stages in the construction.

- Top left, the *serdab* can be seen completed, and with its corbels set in place. (Hemiunu's sketch omitted the near construction wall) Note the ramp on which all the central structures are mounted, and the passageway, centre right, rising from the entrance in the north face of the pyramid.
- Top right provides a second view of this stage of construction, this time with the construction wall in place, as would have been necessary to fit both the roof slabs on the *serdab* and the corbels around the chamber. Note that the horizontal and rising sections

The reconstruction shows the starting sequence of activities in raising the Grand Gallery.

First, the *serdab* (Queen's Chamber) is enclosed in corbels to protect its pitched roof – top left and top right.

Then the central ramp is raised to enclose the *serdab*.

In the final graphic, the construction walls are raised to facilitate the cribbing and placing of the massive Gallery corbel stones. The central ramp has risen to its full height, enclosing the *serdab*; the flat top section is ready to support the King's Chamber

The Secret Diaries of Hemiunu

The photograph, looking upwards inside the Grand Gallery, shows the corbels and the capstones at the top.

It also shows the original ramp at left and right, on which the Grand Gallery was raised. Slots have been cut into it at left and right, at the base of the east and west corbels, respectively.

A modern staircase, with handrails, has also been cut into the centre of the ramp.

The central ramp is the only evidence remaining visible of Hemiunu's original construction strategy.

of the passage are not joined; there is a space at this junction, partly to allow for the vault of the Grand Gallery.

- Bottom left, the central ramp has been built up, so that it rises halfway up the *serdab*, covering part of the passageway.
- Bottom right, the central ramp has been raised to its full height, with the horizontal section visible; the King's Chamber will be built there. The *serdab*, or Queen's Chamber, is no longer visible; it is now encased within the ramp. The first massive corbel stones are set in place. Each corbel was cribbed into place on the construction wall, swivelled on to the ramp with the aid of ropes from the opposite construction wall, and then nudged down the ramp to butt, gently but firmly, on to the next corbel below. The first cut has been made at the stairs in the Grand Gallery, although they do not look like today's steps...
- Each corbel was keyed into the one below to avoid further slip.

The construction wall was then fitted to the outside of the corbelled Grand Gallery, to eliminate any space and prevent any sideways movement.

- Not mentioned in Hemiunu's sketches or notes is the north-going *ka*-conduit, which would have been encased within the construction wall on the west (right-hand) side of the graphic

The walls rose in synchronism with the ramp, as course upon course of corbel was laid. The floor of the Grand Gallery is the construction ramp itself. The photograph at left, looking up the Gallery from the bottom, clearly shows the ramp at left and right, with the corbels laid upon it. The steps are carved into the ramp, which is clearly of different stone from that of the corbels. Note the slots cut at intervals into the ramp at its junction with the corbels; these were concerned with retaining the plug-stones that would later be used to seal the up passage.

There are nine rising courses of corbels, which do not meet at the top. Instead, the narrow gap between the corbels is covered with slabs.



Murder in the Palace *Hareem*

Hemiunu's diary clarifies an issue that has puzzled Egyptologists for decades, concerning the premature death of Kawab, Khufu's eldest son. Kawab was the Crown Prince. His marriage to his sister, the young, overheated Princess Hetepheres, had been blessed with a daughter, Meresankh.

Khufu had heard of the princess' behaviour at the pyramid site. He had flown into one of his now-famous rages, and confined her to the *hareem*, and not for the first time. He then summoned her husband, Kawab, and gave him firm instructions about controlling his errant wife.

Apparently, Kawab tackled his wife in the *hareem*, there was a scene, followed by a fight, and Prince Kawab lay dead with a dagger in his chest.

Rumour had it that one of the concubines had gone to the aid of Princess Hetepheres, and that Crown Prince Kawab had stepped forward on to the point of the dagger, effectively killing himself. (It is clear from the diaries that Hemiunu found this explanation unlikely.) Princess Hetepheres, fearful for her part in the affair, immediately put herself under the protection of her brother, Djedefre.

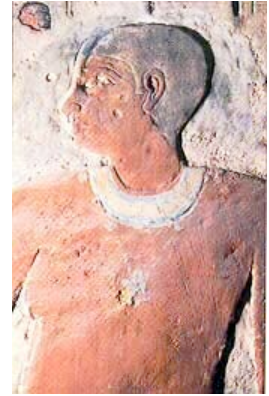
Rumours spread, and the people of White Wall in particular were scandalized. King Khufu was obliged to set up an investigation into the killing, and Hemiunu, as cousin to the king, was appointed as one of three investigating viziers. It turned out that the concubine in question belonged, not in the *hareem* of Khufu, but in the *hareem* of Djedefre, raising further speculation that he, along with Princess Hetepheres, was somehow implicated in the murder of his brother.

Meanwhile, having gathered around him a group of young nobles as supporters, Djedefre declared himself Crown Prince in place of his dead elder brother, and married their sister Hetepheres. In so doing, he put himself above the law, rendering further investigation pointless.

Hemiunu reported the situation to King Khufu. Although furious at the turn of events, Khufu was obliged to accept the situation, but rumours persisted that Djedefre had, indeed, killed Kawab.

For his part, Hemiunu was consumed with guilt. Djedefre had made it plain that he was not going to build his pyramid next to Khufu's on the Giza site. Instead, he was going to a new site at Abu Roash, to the north; unlike Giza, Ra, the Sun God, sanctified this new site. Since Djedefre ("Supported by Re") was his birth name, he was able to declare that he had the blessing of the Sun God.

Hemiunu saw in this an unfortunate outcome of his curse. Banned from Giza, Hetepheres had encouraged Djedefre to kill his oldest brother Kawab, so that she could marry Djedefre and have her Queen's pyramid at Roash. In persuading Djedefre, she was "pushing on an open door," as he had every intention of usurping his brother.



A relief representing Crown Prince Kawab was found in the mastaba of his daughter, Meresankh III.

Source: [KMT](#) 7/4, p. 47)

When Khufu heard of Hetepheres' behaviour at the Giza site, he confined her to the hareem, and instructed her husband, Kawab to control her.

When he tried, one of Djedefre's concubines stabbed Kawab.

Implicated in the assassination, Djedefre appointed himself Crown Prince in place of his dead brother, to avoid any retribution. He also married Hetepheres to assure his succession.

Creating Khufu's Egypt Map

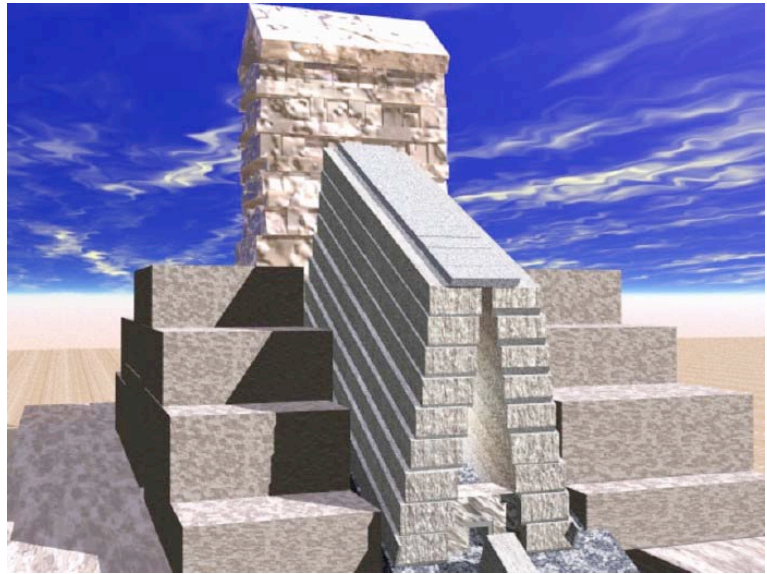
Raising the Mound of Creation

Grand Gallery and Burial Pit.

This reconstruction, based on Hemiunu's sketch, prevents a view that even he would never have seen. He omitted the full construction walls from his sketch, presumably for clarity.

The graphic shows the Grand Gallery completed, and with its capstones in place. At the bottom, in between the sets of corbels, the entrance to the *serdab* is still visible, and gives an idea of scale, being the height of a stooped man.

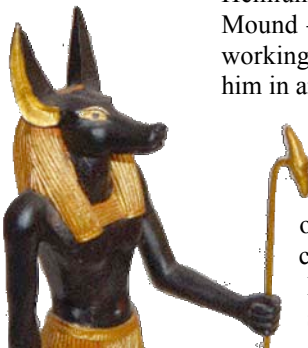
Beyond the end of the Grand Gallery, the stack of granite beams forming the burial pit, widely – but erroneously – known today as relieving chambers, is shown with a single pitched roof made from two canted limestone slabs.



In spite of the drama at the palace, Hemiunu continued steadily with the construction of the Great Pyramid, *Akhet Khufu*. If anything, he appears to have experienced a greater sense of urgency, as though, somehow, time was running out.

His target at this time was to complete the Mound of Creation – the lower part of the Great Pyramid, with its upper surface shown by the roofing slabs of the King's Burial Pit and the two pavilions. In completing the Mound, he would have completed, and concealed, all the internal structures (construction walls, ramps, steps, etc.), passageways, chambers, conduits and portcullis sets. Indeed all the complex and original work would be finished, and the remaining work to raise the upper part of the pyramid, the representation of the *benben* stone, packing and encasing, would be routine.

Hemiunu wanted to mark this achievement – the completion of the Mound – with a notable ceremony and occasion. He spent some time working out what he should do; eventually, he records that it came to him in another of his famous dreams.



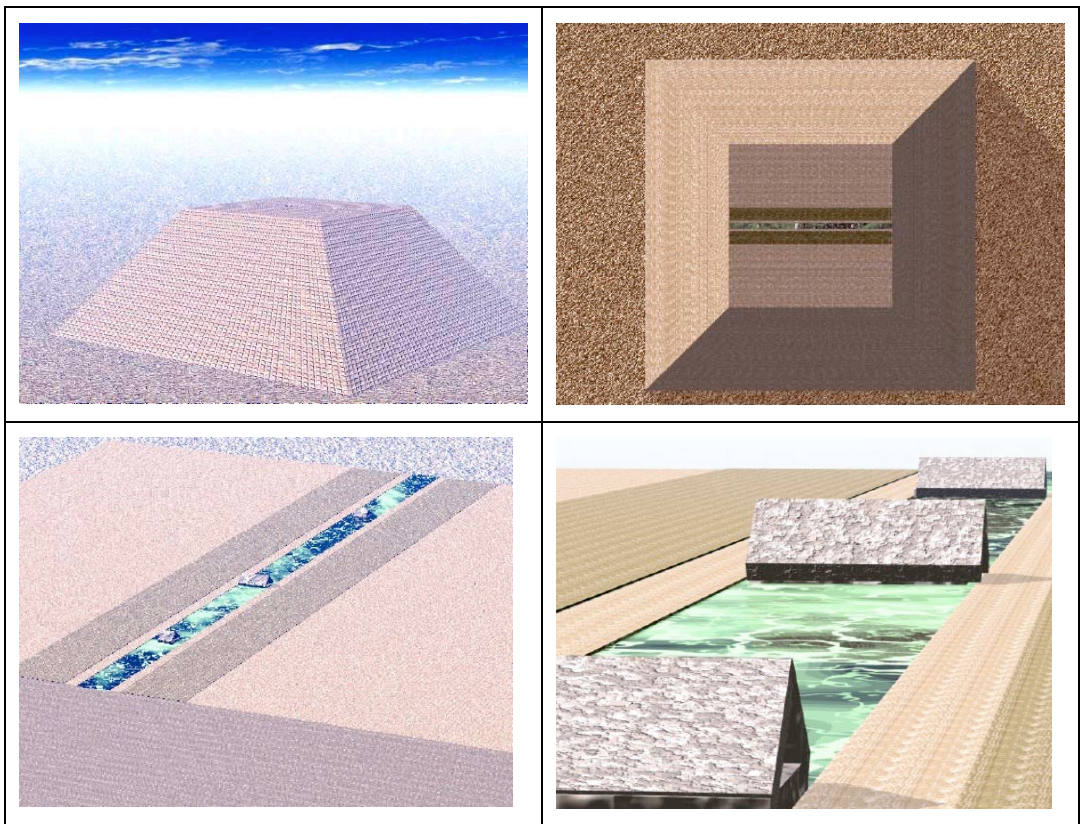
“Frames” from his dream sequence are shown below. In the first, he records that he was flying towards the pyramid, which is standing in splendid isolation at Giza, with no other constructions in sight. The pyramid is truncated, of course, but he can see that it is the height appropriate to the Mound of Creation, and he can faintly make out some structures on the flat top surface.

The Greatest Challenge

In the second frame, he is directly above the pyramid, looking down. There is a striped band running across the centre of the upper surface from south to north.

In the third frame, he circles and descends like a vulture (his simile), and gains a perspective view of the top of the Mound. He can just see the three sets of pent slabs, apparently in the middle of a water channel, which he recognizes by its green colour as a representation of the Nile. On either side of the Nile is a wide, brown strip that he recognizes as the fertile banks of the Nile, the residues of countless Inundations. This is Egypt, or rather an idealized map of Egypt.

Finally, in the last frame, he comes in to land and sees the structures in close-up. All of the representations are in stone, including the Nile, which is made from coloured marble gravels cleverly strewn to look like foaming river water.



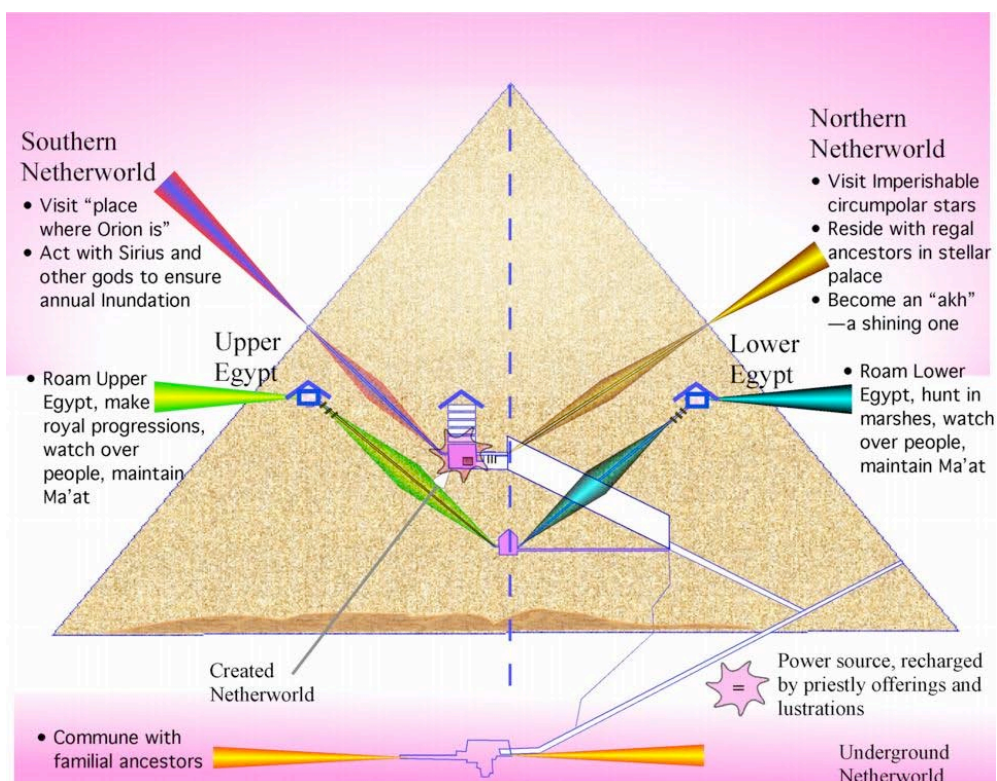
Hemiunu records that he was impressed with the ideas that had come to him in his dream; surely none other than Osiris himself had presented them to him. The following morning he called an overseers meeting, told them about the dream, and set them produce a coordinated plan to finish the Mound of Creation. This would mean that men would be transferred from work on other projects on the site,

The Secret Diaries of Hemiunu

such as the mortuary temple, or the Western City of the Dead, but Hemiunu's vision had shown in which direction the priorities lay.

The sarcophagus had already been installed in the King's Chamber; that had been part of the plan, since the sarcophagus would be much too large to fit through some of the passageways and doorways. Now it would be necessary to bring forward the installation of artefacts in the two Pavilions. Hemiunu must consult with the King.

As always, Hemiunu approached the King only when prepared with something to divert or interest the King. On this occasion, Hemiunu took along a map of the pyramid showing how the King would operate from the Pyramid throughout his afterlife. The map is reproduced below with little change other than the labelling; the idea of writing on diagrams had not, apparently, occurred.



The figure shows the various activities, routes and spiritual power ducts built into the Pyramid for the King's exclusive use. At the heart is the King's Chamber with its central power source, the sarcophagus containing the King's mortal remains, charged with magical power. That power was to be reinforced daily by the prayers, lustrations and offerings of the priests who would be in the Mortuary Temple, as part of the Cult of Khufu which was to be established for all time.

Hemiunu explained to the King, not for the first time, how the “burial pit in the sky” had created an effective Underground Netherworld, by being effectively some 56-cubits under the surface of the Mound of Creation. This meant that the King could commune with his familial ancestors either from within his sarcophagus in the King’s Chamber, or from the Underground Chamber, which was no further forward in its construction. (Hemiunu’s idea of creating a chimney to draw in fresh air had worked after a fashion; the fresh air rushed down the descending entrance and up the escape passage, but did not enter the Underground Chamber at all. Men still could not work in the Chamber for more than a few minutes at a time, before rushing out to the escape tunnel to gasp in fresh air.)

Hemiunu passed over the delicate subject of the Underground Chamber. He observed that the King would be in direct contact with his mother, Queen Hetepheres, who had recently been re-interred at the appropriate 56-cubit depth nearby on the Giza plateau, and moved quickly on to the Pavilions of the South and North. Khufu was delighted to see them on the map, and wanted to know what they were like, and when his *ka* emerged from, say, the Pavilion of the South, just whereabouts in Southern Egypt would he be?

Hemiunu patiently explained, yet again, that the King’s *ka* could choose to travel either in the real world, in which case he would emerge anywhere in the south that he chose, or in the spiritual world, in which case he would move spiritually across the surface of the Mound of Creation, on the map that Hemiunu was creating for him. Khufu still looked baffled, so Hemiunu made it simpler:

“If you choose to visit Thebes, then you will emerge from the South Pavilion in Thebes. If you choose to go in this world, then you will emerge on to the deck of a boat. You, the crew and the boat will be invisible to the people there, but you can see them, you can land and move among them, visit the temples, and (in response to an interjection) yes, you will be able to command them. They will, of course, experience your commands as though they had conceived the ideas in their own minds...” Khufu liked that; he could envisage years of endless fun telling the people what to do. “You will also be able to fly, as I do in my dreams, but you will be able to much more. You will soar like a hawk, glide like a vulture, and dive like an eagle.”

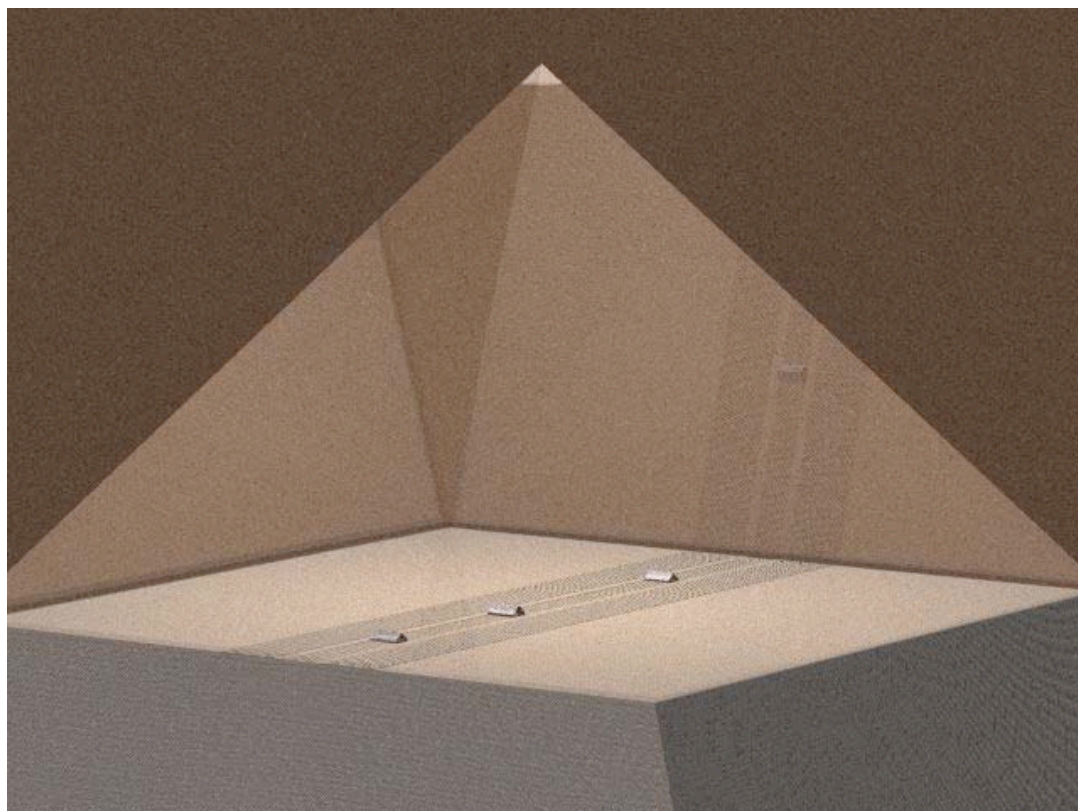
“So, if the South Pavilion is at Thebes, then where is the North Pavilion?” Hemiunu explained again how it worked, but Khufu was unhappy with not knowing precisely where he would emerge, so Hemiunu elected for the simple approach and the North Pavilion became associated with Djedu (Greek Busiris).

Looking at the map, Khufu started to work things out for himself at this point. “So, my *serdab* is in the centre, at the junction of the two lands. That must be Saqqara?” Yes. “And my sarcophagus chamber is to the south, so it must be at Abydos?” Your majesty understands perfectly.

The Secret Diaries of Hemiunu

The king then reverted to the problem of the real world versus the spiritual world. Hemiunu had prepared a suitable drawing, on which the graphic below is based. It shows the pyramid at night, with the top of the Mound of Creation clearly visible. On its surface can be seen the representations of the Nile and the Black Lands, and the three sets of pent slabs. All of this exists under the upper part of the pyramid, representing the *benben* stone. In the illustration it is shown transparent, and with an illuminated pyramidion. This is consistent with Hemiunu's previous conceptions. The pyramidion represented Ra, and provided sunlight by day and by night, so that in Khufu's spirit world there was no night. Hemiunu had remembered Khufu's fear of the dark. Between the pyramidion and the Mound were the heavens – the stars and the planets – so that Khufu could travel there spiritually while still remaining within his pyramid physically, as it were.

Khufu was impressed, but wondered about stone that let light through. Hemiunu produce a piece of quartz, as a present for the King, who had never seen its like before: "Your majesty's *ka* will be so powerful that changing the rock of the *benben* stone to this see-through rock will be no problem. Mortals outside will see nothing. Your *ka*, inside, will see everything." Hemiunu liked that turn of phrase; he was definitely getting better at public speaking, even if it was a little late.



Hemiunu finally worked his way around to the contents of the Pavilions. He proposed to Khufu that the King might care to choose what was to be installed in the two chambers.

The King considered this suggestion for some time. He asked what had been in the first pavilions at Saqqara. Nothing, the buildings were solid except for mock doorways, since they were for the use of the spirit only.

The king thought for a moment. "I do have a suggestion. The South Pavilion could be solid, except for a niche to hold my visceral remains. The North Pavilion could be similarly solid except for niche to hold my placenta."

Hemiunu was impressed with the King's suggestions. He had expected the King to install golden statues of Osiris, perhaps, or Horus. Hemiunu knew that the so-called South Tomb of Djoser's Pyramid at Saqqara had been constructed to safeguard Djoser's visceral remains.

Khufu had decided. Or had he? After some further thought, he said that he would consider the matter further and call for Hemiunu later.

The king's suggestion left Hemiunu with a major headache. The king would need to be dead for his viscera to be available, and Hemiunu had planned to cover in the whole of the surface of the Mound, including the pavilions, with the *benben* stone. So, no access to install the king's viscera when he eventually died...hopefully not until *Akhet* Khufu was completed.

Hemiunu was dismissed, but he was satisfied. The king was pleased and had agreed the plans in principle. Hemiunu returned to Giza, and set about putting his plans into action. He would have to work subtly on the king to change his mind about the two pavilions.

He was hurrying up the causeway leading from the river to the plateau when he felt a tightening of the chest, and pains shot across his chest and into his left arm. Hemiunu fell to the ground, panting for breath and writhing in agony. His workers rushed to his aid, and he was carried up to the site and laid down in his day-tent.

After several hours, he slowly started to recover. He realized what had happened; the symptoms were not uncommon in people of his age. Men in particular were prone to this affliction, which killed some, left others debilitated, and from which a few seemed to recover unharmed.

It was evidently an affliction of the heart. This concerned Hemiunu; the heart was the seat of intellect and emotion. Had he committed some error? Was this a sign, a warning, perhaps?

That night, writing up his journal, Hemiunu evidently had sudden feelings of mortality. He realized that the sign had been a warning that time was running out for the completion of his life's work...

Khufu's Sarcophagus



Khufu's sarcophagus was a magnificent structure with a massive lid and a huge base, carved with the traditional palace façade. The red granite box we see today in the King's Chamber may have been the inner coffin that fitted inside the main sarcophagus.

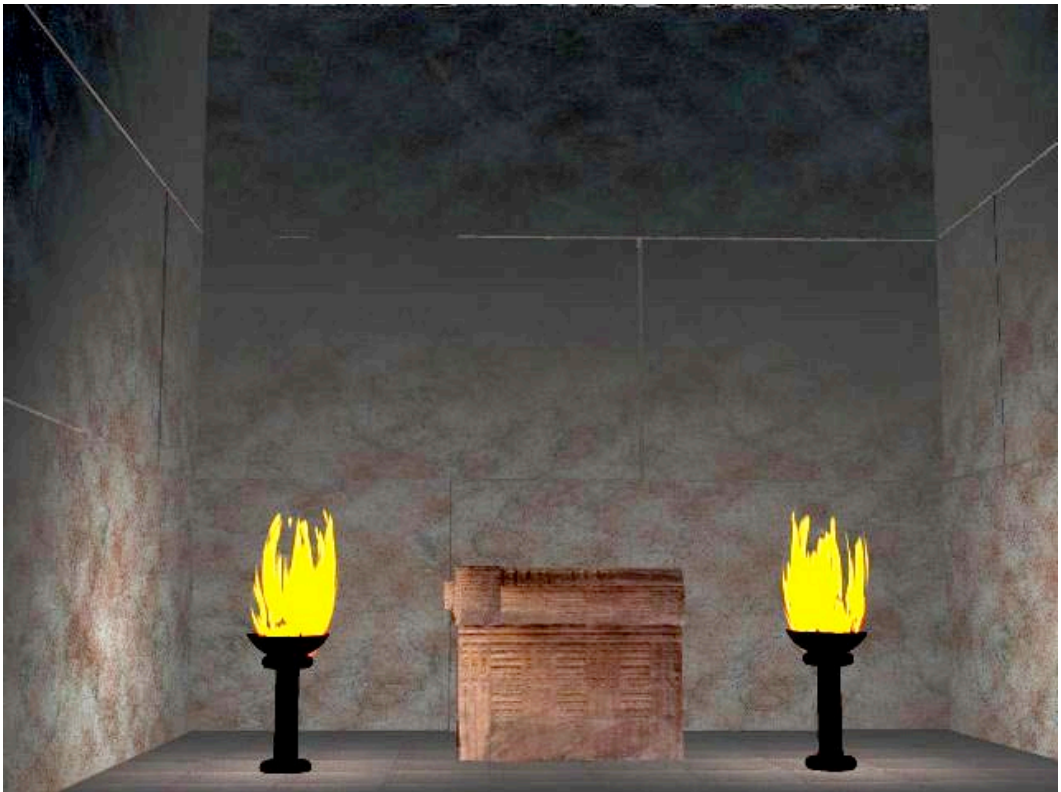
Robbers attempting to force their way into the inner box may have destroyed the magnificent, carved, outer sarcophagus.

Khufu's sarcophagus was huge. It was made from granite, and was carved with the traditional palace façade design. Hemiunu had the sarcophagus set in the King's Chamber and lit, so that the whole structure would accumulate spiritual power.

The presentation was numinous. Although those privileged few who were allowed into the chamber knew the sarcophagus was empty, they could all feel the strange power emanating from the granite box.

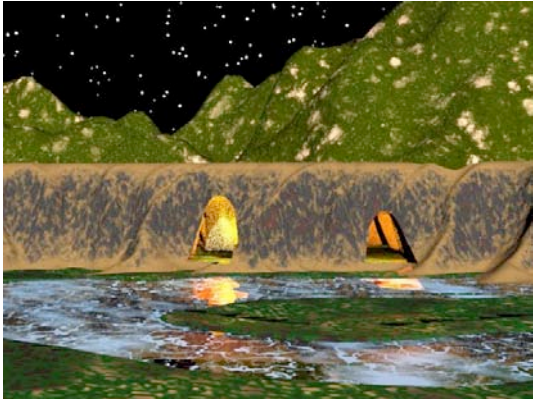
Note: Hemiunu's drawings of the sarcophagus look nothing like the red granite box we see today in the King's Chamber. In one of his drawings, however, the sarcophagus is shown without its massive lid. A lip is visible, inside the sarcophagus, which the lid would fit over – see Hemiunu's tattered sketch above left.

It seems likely that the stone box we see today was merely the lining, or insert, that fitted into the outer sarcophagus like one magician's box into another. This may explain the damage to one corner of today's stone box, which could have occurred when tomb robbers, trying to pry the lid off, had to break through the inner lip to gain leverage. It also suggests why one of the most powerful kings of the fourth dynasty appears to have been buried in such a plain stone box.



Hemiunu Visits the Healers

Hemiunu does not appear to have recovered immediately from his (presumed) heart attack. He was short of energy, and when he undertook even modest activity, he became short of breath. Neferhetepes, his ever-faithful wife, was concerned. To satisfy her, he agreed to visit Sinuhe, the King's river healer.



Hemiunu visited the river healer by appointment on the night of a new Moon, as directed. He went into the left-hand (male) entrance as instructed, and followed a corridor that ran through a number of caves. The ground was covered in green moss, water ran down the walls, a curious fog swirled around at ankle level, and the whole place stank.

The river healer's acolytes directed Hemiunu to each cave in turn; in each, he underwent a different test. In one he gave some urine. In a second, the acolyte smelled his breath, and made some notes. In a third, the acolyte examined his mouth, teeth and nails. Finally, he reached the central chamber – right-hand graphic. As instructed, he lay on the table and waited.

The curious face spoke. There was no cure for Hemiunu. His condition was life threatening. He could put off death for some time by losing weight, by avoiding strenuous exercise – such as climbing pyramids – and he should consider retiring to the country with his wife, children and grandchildren. Otherwise...

According to his journal, Hemiunu had not taken the visit seriously up to this point. He had been expecting the usual spells and mumbo-jumbo. That Sinuhe spoke such sense, and refused any form of reward, both impressed and concerned Hemiunu. He left the river healer's cavern a more sober person than he entered.

On returning home, he told Neferhetepes and his children what had transpired, and they had a family conference. No one wanted Hemiunu to die, but Khufu's Pyramid had to be completed. What to do?

The river healer lived and worked in a large cavern set into a steep scarp by a wide part of the Nile just south of White Wall..

The left hand graphic shows the scene from the river. There were two entrances, clearly visible at night owing to the braziers burning inside.

The cavern had a number of large chambers. The central chamber, right-hand graphic, was illuminated by a large fire-bowl. To one side was a life-size golden statue of Ra as an Apis bull. In the centre was an alabaster table.

On the wall behind the table was a large plaque in the shape of a head. The head sported a beard and long curly hair, in the manner of the sea-people to the North. This was Sinuhe, an Egyptian who had learned the art of healing from the sea-people after being shipwrecked.

Hemiunu was directed to lie on the table, whereupon the head spoke, indicating the nature of Hemiunu's problems and what might be done to alleviate them.

Hemiunu's Last Dream

Hemiunu was tired. He had been working in the desert all of his adult life, first for Snefru and, for the last 18 years, for Khufu. As was his custom when he felt weary, he went out into the desert on his own, and wandered around with only a donkey for companionship. As the evening drew on, he made camp under an overhanging shelf of rock, got out his trusty crystal ball in the hope of finding inspiration, and settled down.



In his final dream, Hemiunu flew out into the desert. The landscape and the sky changed. He found an oasis with plentiful food and water, a strange Temple of Isis, and the weirdest ruined city he had ever seen. There was even a pyramid in the nearby sand dunes, made of a stone he did not recognize.

Here were interests and conundrums to last a lifetime
– or an eternity...

He had a dream such as he had never had before. He was flying, as many times previously, but the land below looked different, and the sky was very strange indeed. So strange, that he was not sure he was in Egypt, or even in this life.

As he flew over the endless dunes, he saw a spot of green. Making for it, he came upon an oasis, bubbling life over the floor of an enclosed valley. The oasis was surrounded with trees, grass and flowers, with fruit on the trees. He could hear the water gurgling in the pool.

Beyond the pool was a very large, very strange, domed temple. He did not recognize the architectural style, but it was evidently a temple to Isis, as she appeared in three enormous statues on each face of the

The Greatest Challenge

building. The temple was in excellent repair, he noted. Behind the temple, there appeared to be a small pyramid made of a stone he did not recognise.



To one side of the temple was a collection of the weirdest buildings Hemiunu had ever seen. They were partly ruined and seemed very old. There were blocks and avenues, openings and protrusions, towers and turrets in a riot of architectural features. The whole structure was the colour of pottery throughout. As he looked, he found that he could change the colours and shapes simply by imagining them. This was surely the architect's ultimate dream.

Hemiunu woke with a start, feeling elated and reinvigorated. He immediately set to work to record what he had seen in his dream. In his diary, he records as one of his last entries that he believed he had just seen a vision of his afterlife. Everything was there. Food, clean water, peace, a temple for Neferhetepes, a lost civilization for him to explore, instant "thought building..." Would he go first, and wait for Neferhetepes? Or would they somehow arrive together?

Hemiunu was finally at peace with himself. Khufu's Great Pyramid was not yet finished, but it would be. Hemiunu had managed to construct the greatest building on Earth for his king, whose name would live forever. What more could have been asked of him? Who could have done more?

As Hemiunu watched, he found that he could change the shapes, colours and textures of the buildings, the temple and the vegetation, simply by exercising his imagination.

He realized that this was a glimpse of his afterlife – the perfect place for Hemiunu and Neferhetepes to spend eternity together...



The Diaries End Abruptly

At this point, Hemiunu's writings stop. Instead a fresh, steady hand takes up the story, but only as part of the last scroll. It is not clear quite what has happened. Someone, perhaps Hemiunu's personal scribe, has effectively "filled in some of the gaps," but has not related specifically what happened to Hemiunu.

The Mound

The unnamed scribe relates that Hemiunu's plan to complete Khufu's Pyramid as far as the Mound of Creation, with its spiritual map of Egypt, proceeded apace. Hemiunu had a "summer palace" nearby, to the south of the Giza site. He stayed there with Neferhetepes, and the various overseers reported to him daily. He visited the site only occasionally, carried by eight stalwart young men on a sedan chair. Once there, he would sit on a specially made stone chair, protected by a white linen shade from the heat of the Sun.

Finally, the Mound was finished according to the plans, and a major ceremony was organized. Khufu was to attend, with Djedefre who, as his heir, would officiate at the eventual entombment: Djedefre was accompanied by a delegation from the Priests of Heliopolis. Princess Hetepheres did not attend.

Steps were constructed so that the king could climb to the top of the Mound with relative ease. Hemiunu's stalwart porters carried him up the same steps with some difficulty, causing him to fear for his life at one point.

Khufu was thrilled and delighted with his Mound of Creation. He was particularly taken with the coloured-stone representation of the Nile, and he did not comment on the two *ka*-conduits, which he might have expected to see sticking out from the "river." (Hemiunu had had these conduit openings covered over and concealed from the prying eyes of the Priests of Heliopolis.)

A throne had been set up, and the overseers were presented to the king, one by one; Khufu was uncharacteristically charming, and full of praise for them all.

He proclaimed that a sculpture of Hemiunu should be carved and placed in the entrance to royal palace at White Wall. This was, apparently, unprecedented; sculptures were usually funerary objects, so a sculpture of Hemiunu, seated in his stone seat as though still supervising the building of Khufu's Pyramid at Giza was a singular honour.

The "topping out" ceremony for the Mound of Creation was followed by three days of feasting and revelry. All of the pyramid builders joined in, and a great time was had by all. But then it was back to work. Prince Ankhaf was given the responsibility of overseeing the adding of the to *benben* stone representation to the Great Pyramid, not

forgetting the packing and encasement in white Tura limestone. Hemunu was, it appears, content however; he had taken the project through all its major trials and tribulations successfully. Now he could hand over the reins, relax and look forward to his landing.

(Reading between the lines, the scribe seems to be stating that Hemunu died peacefully at this point.)

Plans for Denderah

The scribe records that extensive plans for a temple to Hathor were found among Hemunu's effects. Khufu had commissioned him to draw up the plans. They were forwarded to the royal palace, and were used by the architects and overseers of Hathor's Temple at Denderah. (Note: This temple predates the Ptolemaic temple we see at Denderah today. Hathor was worshiped at Denderah since pre-pharaonic times.)

The Beginning of the End

Hemunu's scribe accumulated some notes that Hemunu left. Hemunu was concerned that the sublime civilization of which he had been part could not last. Already he saw signs of looming disaster. He cited the worsening Inundation as part of the problem. He knew from the regular census that the population was increasing up and down the Nile valley. The population increase was founded on the abundance of food, with several crops often grown in any one year. However, as the population went up, the Inundation – on average – seemed to be falling. Hemunu could only forecast disaster, unless either the population stopped rising, or Khufu managed to restore the Inundation to its former glory, once he attained his role in the afterlife.

Hemunu was also concerned about the new theology, with its diminution in the role of the king. Building a pyramid such as *Akhet* Khufu depended on the king being able to call upon the resources of the whole of Egypt. The modern generation (*young population*) were showing rather less respect to the god-king, and rather more interest in their own aspirations.

Hemunu could see only problems as a result of this progressive sophistication in the younger generation. It would, he thought, be impossible to sustain the building of ever-bigger pyramids. Without such structures, the ability of the god-kings to operate within the spiritual sphere to ensure the Inundation for all time would surely be prejudiced. And that would prejudice the whole of Egypt. Hemunu



Artist's impression of the topping out ceremony. The king, Khufu has had a throne set up on a dais, on the top of the Mound of Creation.

Hemunu, now rather unwell, has been carried to the top of the Mound, and has been set up in his stone chair, with his white linen sun shield protecting him from the Sun's direct rays. He sits with his crystal ball and staff in his left hand. He appears to be taking little notice of the activities...

As a singular honour, Hemunu has been placed on the dais, although at a lower level than the king's throne.

Meanwhile Khufu, decked out in all his finery for the occasion, comes down the steps of the dais to meet the overseers who have worked on his pyramid, some of them for eighteen years or more.

N.B. there is no direct evidence that Khufu had a royal costume and headdress in this style. Indeed, very little is known about him, or his regalia.

The Secret Diaries of Hemiunu

saw the “modern generation” as effectively defeating themselves, sowing the seeds of their own downfall. Djedefre was typical...

Djedefre Goes to Abu Roash in Anger

Crown Prince Djedefre started work at Abu Roash, to the north of Giza, even before his father Khufu had died, and before *Akhet* Khufu had been completed. Father and son were, it seems, rarely seen in public together, unless some ceremony demanded their combined presence.

Djedefre rejected the advances that had been made in the design of pyramids in recent decades, and opted for an old-style pit pyramid, with a central burial pit excavated from the plateau rock after the style of King Djoser at Saqqara.

Djedefre set up a royal palace to the north, and Princess Hetepheres went with him, but not as his principal wife; that was Khentetenka, who would go on to bear him three sons, Setka, Baka (Bakare) and Hernet. She also bore him a daughter, curiously named Neferhetepes, although whether that was after Hemiunu's wife is not mentioned.

Princess, now Queen, Hetepheres II, does not appear to have prospered by her rebellious attitude. Interestingly, after a long life, she was interred at Giza with her first husband, Kawab. Her daughter by Kawab later married Khafre, brother to both Kawab and Djedefre, to become Queen Merysankh III. Hetepheres therefore retained some vicarious power as the queen's mother.

Note: When Khufu died, some four years after Hemiunu, Djedefre presided over the King's funeral rites, arranged the burial of boats at the site, etc. While much of this may have been for show, and to legitimize Djedefre's accession to the throne, it does suggest that a rapprochement may have occurred.



The remains of Djedefre's pyramid at Abu Roash, looking downwards into the deep central burial pit.

Postscript

Hemiunu's diaries are a most fortuitous discovery. Happily, he was an obsessive diarist, sketcher and artist. There is, however, much work yet to be done, both in deciphering them, and – once deciphered – understanding what Hemiunu was portraying, recording and conjecturing. His diaries cover so many different aspects of life in the 4th Dynasty of the Old Kingdom – at least, the life of a privileged member of the aristocracy.

The Old Kingdom of ancient Egypt was, perhaps, the first, and perhaps, therefore, archetypal society in recorded history. Modern scholars, who look back on this period as the Golden Age, may find that the trials and tribulations experienced by such an eminent man as Hemiunu speak more of a life balanced on a knife-edge. One wrong foot, and the king's wrath would have been swift and terrible. There are also hints of savage punishment for wrongdoers and foreigners...

On the other hand, there appears to have been a high degree of sexual freedom, sexual equality and marital fidelity at all levels in society. Homosexuality is not mentioned anywhere, suggesting that it was not practiced; in such an atmosphere of sexual freedom, it would surely have been observed upon.

Many of the exchanges between Hemiunu and Khufu throw a new light, not just on the work that was being done, but also on the social relationships and interactions in the courts of the time. Hemiunu was never subjugated to the will of the two kings for whom he worked. On the contrary, he was able to manipulate them, and on occasion he treated Khufu with something approaching the disdain that he appears to have warranted.

As so often in such cases, the normality of interpersonal relationships is perhaps the most striking aspect. The human condition, it seems, has not changed that much down the millennia.

The topics presented in this book are but a small part of the information available from Hemiunu's diaries. The extraction and exploitation teams are still working in Paris. And, paradoxically, it seems that today's systems engineers, civil engineers and architects may have something to learn from Hemiunu. Many of his methods of strategizing, tailoring process to problem, experimenting, estimating and surveying, his choice of materials, and especially his visionary construction strategies, are proving superior to those in common practice today. One can hardly fail to be impressed by his capability, drive and integrity; few could match it then; even fewer today.

He would be pleased. He has rightfully achieved the immortality that was the goal of the ancient Egyptian. He is justified. His name is alive. His work lives on.