



Hemieniu to Houdin: Building A Great Pyramid – Introduction

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This is the story of two architects, separated by 4,500 years, both trying to solve the same problem—how to build a pyramid measuring 756 feet on each side of the base, 480 feet high, and consisting of 5.5 million tons of stone.

Our master builders have different goals, however. The first, Hemieniu, was determined to build the greatest pyramid ever, and the second, Jean-Pierre Houdin, was equally determined to figure out how he did it.

Jean-Pierre Houdin and Bob Brier wrote a book—*The Secret of the Great Pyramid*—about this very subject in 2008 and the paperback edition is due to hit bookstores October 6, 2009.

Ahead of the paperback, *Em Hotep!* is providing you with a multi-part primer to Houdin's work, to be followed with an interview with the man himself.

But first, who are these two architects?

Hemieniu, son of Nefermaat—or Snefru



Hemieniu: Vizier, Master of Works, and architect of the Great Pyramid (courtesy of Wikimedia Commons)

Although the Great Pyramid bears the name of Pharaoh Khufu, Hemieniu was the genius behind its construction. It was no coincidence that Hemieniu should be selected for the job, and his pedigree would have well prepared him for the task. What we don't know from primary sources we may infer from what we do know about his probable history, and history in general.

There are two main theories regarding Hemieniu's childhood. According to one theory he was the son of Pharaoh Snefru's vizier, Nefermaat. Vizier Nefermaat also bore the title "King's Eldest Son," which taken literally would have made Hemieniu Snefru's grandson. As the positions of Vizier and Master of Works usually went hand-in-hand, it is believed that Nefermaat probably designed and built Snefru's pyramids, including the Red Pyramid, the first true pyramid

If Nefermaat was Hemieniu's father, it is not difficult to imagine the two of them visiting building sites together, the youngster rapt with his father's instructions to the workers, his discussions of geography and topography as he surveyed locations, and geological reports delivered from distant provinces. He would have witnessed firsthand the difficult and painful lessons of the failures of the collapsed pyramid at Meidum and the second guessing that led to the oddly shaped Bent Pyramid at Dashur.



Pharaoh Snefru (courtesy of Wikimedia Commons)

The other theory is that Hemenu was the son of Snefru, the pharaoh himself. As a son of the pharaoh, Hemenu would have had an elite education leaving him well versed in the principles of mathematics and astronomy, and with an appreciation for the importance of architecture in religion. His days at the court would have familiarized him with the intricacies of leadership and logistics.

While Hemenu, as the son of Pharaoh Snefru, may not have visited the building sites of the pyramids (although he very well may have), he would have been privy to the discussions of their construction. We may safely assume this from the fact that regardless of who his father may have been, he eventually became vizier and Master of Works himself for his brother—or uncle—Khufu. And as such, he showed clear signs of having learned from, and improved upon, the methods used by pyramid builders who preceded him.

The Pyramid Age had been ushered in by Imhotep, the vizier and master architect of Pharaoh Djoser. Imhotep invented the pyramid, and while the form he designed may have changed, his template for pyramids and the complexes associated with them would set the standard for centuries to follow. Before Imhotep, pharaohs and other nobles were buried under mastabas, rectangular stone buildings that contained mortuary shrines to the deceased and often symbolically mirrored the homes they occupied in life.

Imhotep conceived of a burial monument consisting of a number of mastabas stacked on top of each other, growing smaller as they rose. His invention was the Step Pyramid, and he arrived at it through a process of modification and experimentation. Like a Third Dynasty Einstein, Imhotep started with the idea of a pyramid and by devising, testing, and refining his idea, he achieved what had never been done before.

Hemenu, on the other hand, was more like Michelangelo. He knew exactly what he wanted from the beginning, and by precisely executing his vision he achieved what has never been done since. He had a plan which underwent very little modification, nor could it have. Hemenu understood how every layer had to look and function—from the underground provisional tomb to the pyramidion—before he began digging.

Jean-Pierre Houdin, son of Henri



Jean-Pierre Houdin (center) with Farid Atiya (left) and Dr Ali Radwan (right). An architectural solution to an architectural question (courtesy of Jean-Pierre Houdin)

Jean-Pierre Houdin also grew up among the construction of great monuments. His father, Henri Houdin, was part of the generation of French children born after WWI whose lives would be shaped by the events of WWII. At the end of the war, he earned a Ph.D. in engineering from Paris's prestigious École des Arts et Metiers. With more than 7,000 bridges to be rebuilt, young engineers were given tremendous responsibilities. Thus in 1947 24-year-old Henri Houdin was placed in charge of rebuilding the Conflans Bridge outside of Paris (Brier and Houdin, pp. 2, 38).

Jean-Pierre was born in 1951, the younger of two sons, and spent much of his childhood playing at construction sites with his brother, Bernard. Henri had been assigned to the Ivory Coast, a French protectorate, where he was instrumental in the rebuilding of that country, and family outings often consisted of picnics at construction sites (Brier and Houdin, pp. 38-40).

It was thus no surprise when Jean-Pierre decided to become an architect. He entered the *École des Beaux-Arts* in 1970 for that purpose where, as part of his final year studies, Jean-Pierre designed a solar house that would be considered cutting edge green technology today. The year was 1976.

Henri Houdin first became intrigued with the construction of the Great Pyramid in 1998, when he viewed a television program on the subject, *The Mystery of the Pyramid*. He watched with interest as the theories of construction were spelled out, but his instinct told him that the conventional theories didn't quite add up. They were illogical to the trained eye of an experienced master builder and were neither based on true civil engineering techniques nor masonry processes.

The engineer immediately spotted two misconceptions. The first was that blocks were always depicted being delivered to the site from the base to the top from the outside. The second misconception was that the pyramid facing was shown being installed at the end of the process, from top to base, with no means of controlling the shape of the monument. Henri didn't see how that could be possible. He then had an ingenious idea: if he would have to build a pyramid, he would build it from the inside.

Henri Houdin now had a project to keep him busy in his retirement, and he tackled the quandary with relish. How would he, as an engineer, build the pyramid? He worked and reworked his ideas, and in 1999 went so far as to publish his theory in the journal of the French National Society of Engineers and Scientists (Brier and Houdin, p. 126).

Henri discussed his newfound passion often with Jean-Pierre, but just as the engineer had seen flaws in the approach of the non-engineers, the architect son began to notice things his engineer father had missed. For instance, Henri had envisioned an internal ramp spiraling up the inside of the pyramid in a circular fashion. Jean-Pierre knew that it would be impossible to move heavy blocks in a circular pattern—there is no efficient way to push or pull such weights around a constant curve.

Jean-Pierre also knew that there was no way the internal ramp could accommodate some of the larger blocks used in the construction of the King's Chamber (Brier and Houdin, p. 126). Somehow Hemienu had found a way to move granite slabs, some of which weighed more than sixty tons, to a height of nearly 200 feet and maneuver them into exactly the right place.

So the architect stepped in where the engineer left off. How had Hemienu done it? Or more to the point, how was Jean-Pierre going to do it? How do you reverse engineer a five and a half million ton pyramid?

Synthesis

About a hundred feet to the east of the Great Pyramid, cut into the limestone bedrock, is a sixty-foot trench first surveyed in the 1880's by Sir William M. Flinders Petrie. The trench contains, rendered in 3D, an exact model of the descending and ascending passages of the pyramid, around which the rest would be designed. Although the halls are much shorter, they are the exact dimensions of the real thing, a veritable walk-in blueprint, right down to the narrowing of the ascending passageway to allow blocks to be wedged in (Brier and Houdin, pp. 114-17).

As it turns out, Jean-Pierre Houdin would approach the problem in exactly the same way Hemienu did. Thinking like his architect predecessor, Jean-Pierre used architectural software to produce the first true 3D model of the pyramid since Hemienu. Other models had been made of the pyramid, to be sure, but Jean-Pierre was able to use specialized computer imagery that allowed him to turn the pyramid in any direction, to see the interior through its external skin, and to virtually travel through its passages just as Hemienu did in his 3D model.



Jean-Pierre's life experience as the son of an engineer, his professional training and experience as an architect, and his technological savvy made him an ideal person to reexamine the question of how Khufu's Pyramid was conceived, planned, and ultimately built. His zeal would bring him to the attention of Dassault Systèmes, the world leader in 3D imaging, where he would assemble a dream team of modern pyramid builders and gain the resources to give his project the attention it deserves

The Great Pyramid of Khufu - Does a mile-long ramp lie hidden within?

Hemieniu to Houdin—Building a Great Pyramid

Over the next few weeks *Em Hotep!* will take you inside Jean-Pierre Houdin's ideas, explore his vision, and evaluate his conclusions. The first part will be an examination of the internal ramp theory. What are the shortcomings of the traditional theories and how does his internal ramp resolve these issues? Then we will go into the core of the pyramid itself and explore Houdin's explanations of some of the pyramid's abiding enigmas, such as the purpose of the Grand Gallery, and how those titanic granite blocks were put into place. Finally, we will end with an exclusive interview with Jean Pierre Houdin himself to get clarification and find out where he will take us next.



Jean-Pierre Houdin's mind is in perpetual motion, and describing Khufu's Pyramid as his *passion* is actually an understatement—it is his magnum opus, his mission. With his and Bob Brier's book, *The Secret of the Great Pyramid*, just going into paperback in October, you can rest assured his work has continued. In addition to the coming interview, he just might provide some clarification as we explore his theory. Who knows what new insights may arise?



Work Cited: Brier, Bob and Jean-Pierre Houdin. *The Secret of the Great Pyramid*. New York: Smithsonian, 2008.

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