How The Pyramids Were Built

How The Blocks Were Moved (Pt. 2)

There are a few problems with the popular picture of how the blocks were moved; by men pulling ropes, over their shoulder. That view is mostly accepted in the academic world, I think. It certainly is, in the TV documentary world. 1}It must be impossible to co-ordinate so many people in a uniform effort and get the necessary precision of combined effort over such a prolonged period, as required to get a block so far and many stories high. The lack of small, discreet hauling intervals, magnifies the difficulty. No one can pull, all out, for a prolonged time. If such a system were attempted, their energy would not be consolidated into a single effort, but dissipated, as they pull harder and ease up, each on their own initiative. There is a conceivable way to get the crew pulling cohesively in brief surges. A coach could shout signals. Some device, such as a horn could sound two or three notes to indicate, "Heave-Ho" prompting the haulers for each lift. A flag or two could have served the same purpose; up for "ready", down for "pull". 2}A rope, strong enough to lift such a weight, would be enormously thick. The ropes around the block might be a network of several, but, for people to pull them, they must be merged into one. A rope is only as strong as its thinnest stretch, and the rope held by the haulers, would have to be as strong as the entire network around the block. How would the gang hold a rope, thick enough to hold the block? They would need hands like King Kong. 3}In the rope-over-the-shoulder 'method', the hauler is pulling almost exclusively with one hand. Little or no power comes from the hand, reaching across from the opposite side. They would quickly realize that the only way people could do it, would be with a harness which would allow them to use their whole body, symmetrically, rather than pulling on one side with no more power than arms can supply (an arm and a quarter?). About three nanoseconds after that idea entered any one of their heads, they would remember that they already had harnesses, designed for the beings which pulled their plows and every heavy thing they had ever moved from any one place to another. The waste of time and effort to invent a new harness for the sake of making human effort just a speck less pathetic, compared to animal power, would quickly convince them to just use animals.

Harnessing animals, one in front of the other, was unknown in Europe until sometime between the 7th and 9th centuries. Until then, draft animals could only be harnessed, side-by-side. How many people could be placed side-by-side, before they could no longer face or pull in the forward direction, with even 50**%** of their energy; 8? Anyway, not enough to pull a block that size, even floating on the approach canals. Many fewer animals than people would be needed, and a small number can be kept facing forward. In the absence of in-line harnessing, hauling of the blocks by humans, so pointless, anyway, is eliminated.

If the Egyptians ever had the in-line harness, we would know it because it would never have disappeared. It's not possible to suppress anything so useful. Why would the

government even want to squelch an invention which would increase productivity? If a device doesn't contribute to any aspect of everyday life, or improve the wealth and power of the government, it would have been forgotten, naturally, but the practical value of the in-line harness, to everyone, including the state, would have been so great, it could not have been forgotten, even temporarily. It doesn't seem possible that it could have been suppressed, even by the most ardent efforts of the government, like burying workers alive, etc., as we see in those grand costume blockbusters.

To realize that only animal power makes sense, you can ask the question from a different angle; why would they cut the blocks to be so unwieldy? You would want the blocks to be as big as you could handle, to minimize the amount of surface which must be cut. Larger blocks also cover the space you intend to fill, faster, but that purpose is defeated if the blocks are so heavy that they cannot be moved any faster than a gang of people can manage, pulling ropes, thicker than their own thighs. The blocks must have been designed to be as big as possible, without overwhelming the capacity of the hauling teams. The number of humans, needed to move them, would have been a waste of that resource, even assisted by in-line harnessing, and even if the weight was floating. The size of the blocks, was only limited by the number of draught animals which could do the job on water with moderate exertion.

Donkeys and horses were domesticated between 4000/2000 B.C. Donkeys have been found in "an early pharaonic mortuary complex at Abydos" (3000 B.C.)* The pyramids were completed about 2650 B.C., and they are tombs of kings. Horses weren't introduced into Egypt until ca. 1600 B.C. (by the Hyksos).* Anyone might have bred mules, if they had both contributors. Horses might have been captured, just for breeding with donkeys, without being fully domesticated, or donkeys could have been let free among horses, and the resulting mules, rounded up, later, but the discussion of horses, I have cited, seems to mean that the Egyptians had no contact with wild horses. It doesn't matter because the problem of too many animals, side by side, not being able to face forward, is solved by using the strongest draught animals, available.

Egyptian art depicts pairs of oxen being used for farming. They had those distinctive horns which grow straight up, about two feet, then out, at a right angle, a few inches to the side. An ox can pull its own weight at a regular pace. I don't know if that means dragging something against the ground or pulling a wheeled vehicle, but the pyramid stones were floating, which must mean they were easier to pull than a load on the ground, even on wheels. The blocks weigh about 5,000 pounds. Oxen weigh 1,200. Two on each side of the canal, would only be pulling 1,250 pounds; their own average weight + 50, and floating the weight must make it effectively lighter.

In his show, <u>What the Ancients Knew</u>, Jack Turner says canals were used, but he thinks the stones were dragged on land, the last hundred yards, by humans. "I wondered who the people were, who dragged heavy stones up to the pyramids …"*. If he believes that

humans did the last bit of the haul, uphill on dry land, he might not realize that animals did the easier task of pulling them on the canal. (The image of gangs pulling ropes, over their shoulders, is so ingrained in the popular imagination, that it cannot be completely surrendered. It could be the human propensity to mythologize, or just affection for the familiar.)

Why would anyone think that anyone would think of using people to haul such stones, ever, for any distance, over any surface?! The universal, unconscious dismissal of animal power, might not seem so bizarre, if that were not the only way anything ever got moved, on land, for those 5,000 years, prior to the mid-19th century. Farmers still mostly used mule teams, in the 1930s. Some still do, and the Amish still use horses within 60 miles of Philadelphia. People might overlook or deny the most obvious things, but the failure of 45 centuries, to even think of animals' role in building the pyramids (if that failure has always existed) is just plain weird. The strangest feature of that failure, to me, is my own failure to figure it out, for so long; that I even had to "*figure* it out"! Why modern people, professionally engaged in solving such questions, can't conceive of any force, greater than human muscle, but less than fossil powered machinery, is another topic. The mechanics of how the blocks were moved, is less of a mystery than how to remove the mechanisms which block our thinking.

Elephants

One purpose of building the pyramids was to inspire awe, and they are more awesome for their mystery. No matter how it was done, our astonishment will be diminished when this explanation is known, but it no longer seems that the builders meant to prevent anyone from learning how they did it. If oxen, mules, donkeys or horses were used, that must have been known a long time, before it was forgotten. Oxen were part of everyday life, and donkeys had been around for a long time. It would not be worth hiding their part in building the pyramids, or possible to do so, but, if some exotic creature had been used, the builders might have thought it clever to hide the fact, to enhance the mystery.

I have always heard that African elephants are not as tractable as Indian, but Hannibal used them. If anyone trained them, someone else could have. An adult male African elephant weighs 5.5 - 7 tons. The pyramid blocks are mostly 2.5. (A much smaller number are about 15 tons, with some exceptions of 70 tons. The size of the blocks is partly speculation, and opinion changes. This size description appeared on the web, consistently, on 3/15/12.) I don't know of a formula, comparing the weight of an object to the weight of a creature, necessary to pull it, but either one or two adult male elephants weigh about the same as the average block. Anything can pull half its weight, even on dry ground, but we now realize that the blocks were floating. One elephant on either side of the canal would be pulling 1/4 its weight. (Q: What does an elephant call, pulling 1/4 his weight, floating? A: A holiday!)

The Smithsonian Institution has an Egyptian amulet depicting an elephant (ca. 3650-3300 B.C.) Their web page with the picture, has a caption: "During this period, elephants lived in oasis-like zones in the high desert, created by greater rainfall than today. They were probably a rare sight to floodplain dwellers …" The dating of the amulet means that the elephants' proximity was not news. However rarely they may have been seen, Egyptians were reminded of their existence, periodically, over a long time. The copy also says the face has "... a snout with a defined ridge ..." It's on a disc, so the tusks are directed inward, rather than realistically. Although the face of the elephant is seen straight on, the outsides of the tusks, face you. This intentional distortion allowed the artist to accommodate the round format and still portray the tusks' length in the right proportion. (Some people deny it is an elephant, but I don't know why.)

The web site which furnished the weight of elephants, also says that working elephants eat 300-600 pounds of food per day. That sounds like too much for a narrow strip of arable land, especially a grassland, as Egypt was. Elephants are mostly browsers, so their preferred food must have been harder to get. Importing enough to feed a small number of elephants, would not be impossible for a government, but it seems like an unnecessary and expensive complication when oxen would do as well.

Footnote

1) Donkeys in a "pharaonic tomb complex" (3000 B.C.)

PNAS – Proceedings of the National Academy of Sciences of the U.S.; 3/10/18 (published) 3/11/18 (printed)

www.pnas.org/content/105/10/3715

2) No domestic horses in Egypt before 1600 B.C.

www.shorthistory.org/ancient-civilizations/ancient-egypt/the-horse-in-ancient-egypt; 5/2/17

3) Turner accepts humans as hauling force.

What the Ancients Knew; Wells, Heike G. (Writer/Producer) Edgework Media, The Science Channel (2005)

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