

Sumerian War Chariots deconstructed

A digital “de-construction” of the chariots on The Royal Standard of Ur.

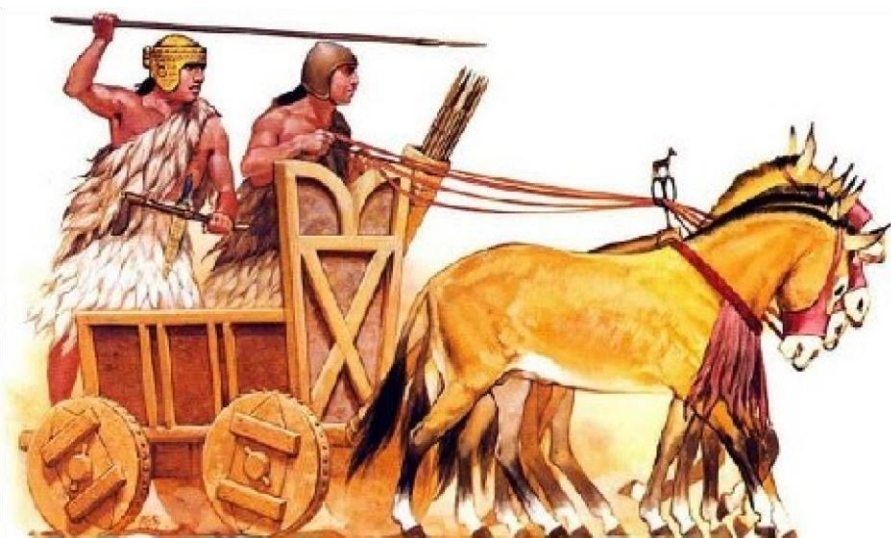
By Jerald Jack Starr. This page originally appeared in SumerianShakespeare.com.



Sumerian war chariot (restored) on the Standard of Ur. See it in its [original condition](#). (Hint: press the CTRL key when clicking on a link to make it display in a separate window.)

What did a Sumerian war chariot really look like?

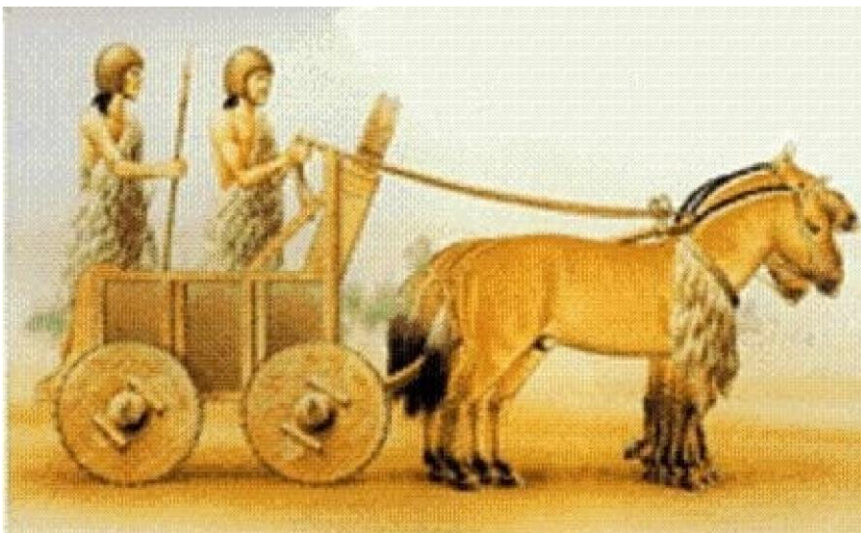
On the Standard of Ur, the panel with the double-curved top is shown on the side, though it actually represents the front of the chariot. The artist has turned it toward the viewer to show its details, in the same way that the rein rings are turned sideways to show their shape. Modern depictions of Sumerian war chariots sometimes show the panel in front, sometimes on the [side](#), and sometimes [both](#). The panel is actually the front shield of the chariot, as illustrated below.



The gold helmet, dagger, spear, battleaxe, and rein rings topped with a horse figurine, used by the warrior-king in this picture, can also be seen in [Weapons, The Royal Tombs of Ur](#).



Note the quiver of javelins slung on the side. Sumerian war chariots are always depicted with the weapons in a separate container mounted on the exterior of the chariot.



When viewed from the side, the flat shield appears as just a straight vertical line. All modern depictions of Sumerian war chariots show the front shield as completely flat and vertical. They also show a Sumerian chariot as being very "[wagon-like](#)." This is perfectly justified because there are ancient models of Sumerian chariots that have the same configuration:



Bronze chariot model with a flat shield, circa 2500 BC. See a [profile view](#) and [hi-res picture](#).

Perhaps there really were Sumerian chariots with this configuration. Then again, perhaps these models were overly simplified because they were merely meant to be children's toys and not accurate scale models of real chariots. In either case, the war chariots on the Standard of Ur are different. All of them have a distinctly angled front:



Why do the chariots have this angled front? It seems to be a needlessly complicated design. It would be much easier to nail a flat shield to the front of a wagon and call it a chariot. It would be quicker and cheaper to build them this way, something to be considered when many hand-built chariots needed to be manufactured during an ancient "arms race."

The angled front is too obvious to be ignored. It has to be accounted for.

There must have been a good and necessary reason for the Sumerians to go through the added effort and expense of manufacturing a complicated structure instead of a simple one. A flat shield is the simple and obvious design choice, so why isn't it used?

I've always been interested in aircraft design, so I tend to look at vehicles from a structural point of view. I also know that an ancient war chariot, like a modern warplane, needs to be strong but lightweight, fast but maneuverable. This is the design criteria that best explains the unusual configuration of the chariots on the Standard of Ur.



Sumerian two-wheel chariot, from Ur. See a [picture of the chariot](#) with its relevant features labeled for the purpose of this discussion.

Notice how the front shield has a side panel (partially obscured by the leopard skin covering). It's not just a flat board. This chariot also has the same angled front as the chariots on the Standard of Ur. There's a reason for this:

Imagine a driver standing in the chariot, above the wheel axle. He would have his hands at shoulder-height, holding the reins above the front shield. The top of the shield, being slanted forward, creates more space for his hands while allowing him to remain standing aligned above the wheel axle. The shield is also angled forward on the bottom to provide more foot room and it probably also housed some structural reinforcement for the attachment of the central shaft. If the front shield were straight-up vertical, the driver would have to stand further back on the chariot to have the same amount of room for his hands, but on this chariot there is no "further back." Of course the chariot could be built longer in the back (or the front) to accommodate a vertical shield, but this would add extra structure and weight, thus making the chariot heavier and therefore slower. The forward slant of the front shield effectively increases the interior space of the chariot without increasing its overall length and weight. This is an important consideration because the Sumerian horses (asses, donkeys) were rather small and not very strong, so the chariot needed to be as lightweight as possible.

It's important that the driver stand close to the wheels for "center of gravity" reasons, to make the chariot more maneuverable. The center of gravity (CG) is the "balance point" for an object.

In this case, the CG is the balance point for the combined weights of the chariot structure and the occupant(s). Without going into a lengthy technical explanation, a chariot is most maneuverable if the CG is very close to the wheel axle. The angled shield of this chariot is designed to minimize the weight of the structure and to keep the CG as close as possible to the wheel axle. This is the lightest, fastest, most maneuverable design possible for a two-wheel chariot.

The angled front of the four-wheel chariots on the Standard of Ur serves the same purpose. It minimizes the overall weight of the structure while maximizing the interior space. It also helps to maintain a favorable CG by allowing the driver to stand as far forward as possible to compensate for the rearward shift of the CG when another soldier is in the back.

A forward CG, closer to the front wheels as the chariot changes direction, improves the chariot's maneuverability.

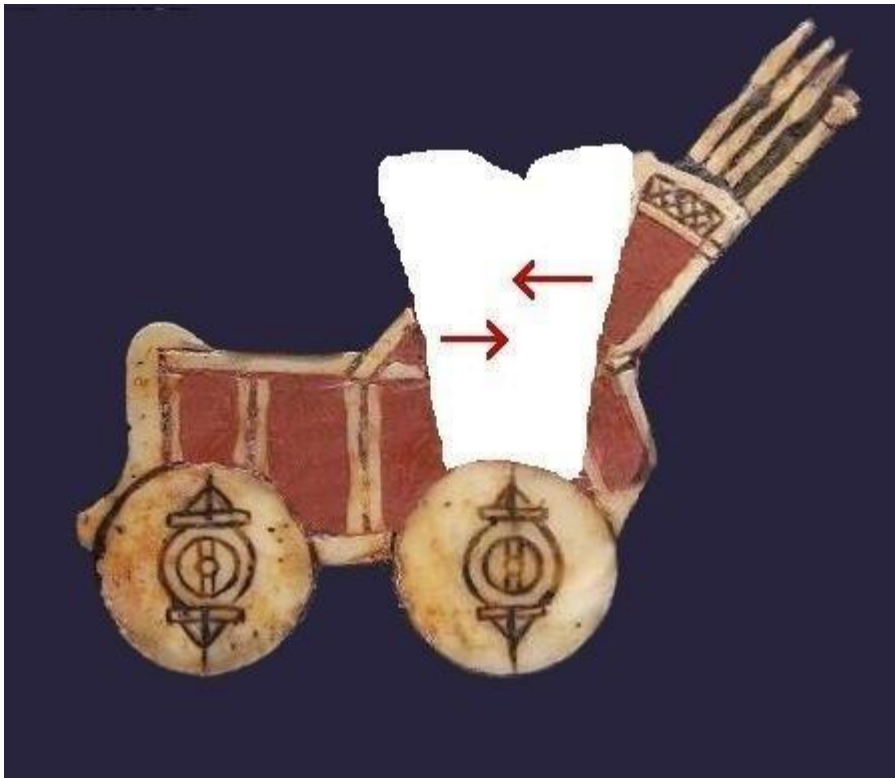
The Sumerians took the same design principles of the two-wheel chariot and applied it to the four-wheel chariot. It's their attempt to offset the inherent disadvantages of a four-wheeler: greater weight and less maneuverability. They were willing to sacrifice ease of production for increased performance on the battlefield. In combat, even a marginal increase in performance can mean the difference between life and death. (Increased performance is the same reason why the British were willing to invest the additional labor necessary to manufacture the complicated elliptical wing of the [Spitfire](#) during WW II.) It's not at all surprising that the Sumerians took this sophisticated approach to chariot design, since they're the ones who invented chariots in the first place.

Getting back to the subject of the true appearance of a Sumerian war chariot:

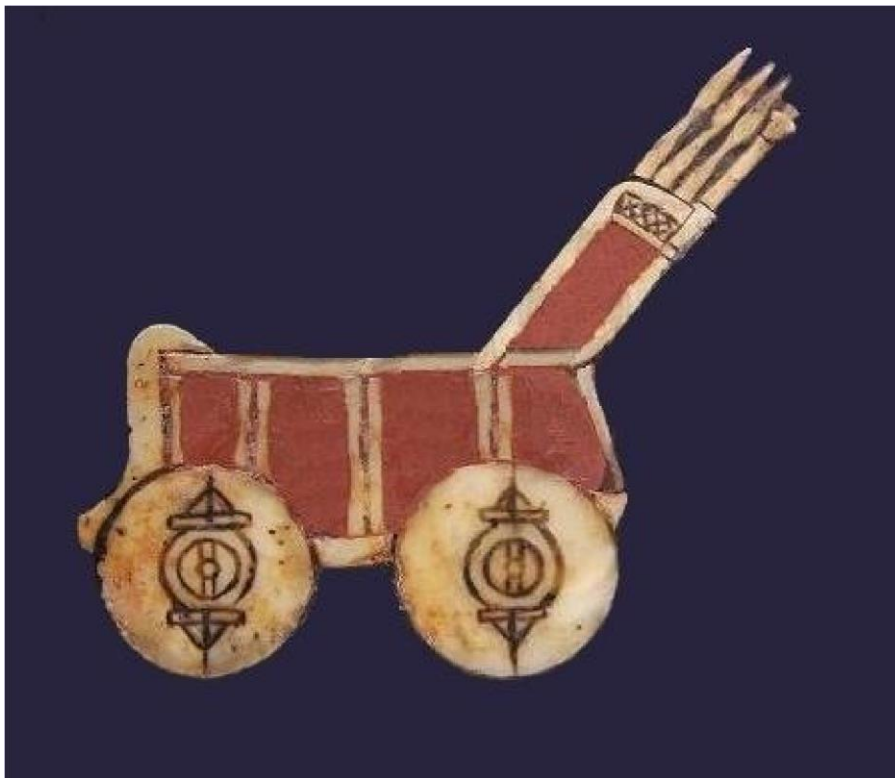


The weapons compartment is shown as an integral part of the chariot, and not as a separate attachment. A triangular corner brace behind the shield seems to reinforce the unsupported part of the shield above the railing. The reinforcement is absolutely necessary to prevent the shield from bending. The mark at the angle in front, seen on most of the chariots, indicates that the side railing, the angle, and the point where the diagonals cross, were all in alignment. It also suggests that the side railing continued around the front to the edge of the shield.

To get an idea of what a Sumerian war chariot really looked like, we need to remove the shield from the side and then rejoin the front and back, like so:



Watch what happens to the triangular corner bracing on top of the railing:



Sumerian war chariot deconstructed. The shield is on the front so it's no longer visible when the chariot is viewed from the side. The upper portion of the shield has a side panel that wraps around to the railing. It is wide enough to accommodate a rather large decorative square of woven reeds at the top. Notice how the triangular corner brace behind the shield has disappeared. That's because it's

actually the bottom corner of the side panel. It merged seamlessly with the side panel at the [exact same angle](#). The triangular corner bracing is no longer necessary because the side panel by itself gives the shield enough structural rigidity to prevent the shield from bending backwards and forward. The railing continues around to the front of the chariot and terminates at the edge of the shield at the same level where the diagonals on the shield intersect. In this way, all the lines converge at a central point to create a dramatic and unifying effect.



Additional proof that some chariots had this configuration is found on a cylinder seal. The chariot in the lower register has an angled-front and a wide panel on the side of the shield.

Notes on the chariot model:

Additional proof that some chariots had this configuration is found on a cylinder seal. The chariot in the lower register has an angled-front and a wide panel on the side of the shield. The [chariot model](#) has the bottom front of the chariot very rounded, resulting in the conical section on the lower half. I believe the bottom front was more square, and the flat shield (basically an infantryman's shield) was creased/folded across the entire front of the chariot.

The front wheels of a chariot were not steerable. They were on fixed axles. The model has a rigid steering shaft that does not rotate in the left-right directions. This would make the chariot almost impossible to turn. The rigid shaft would so apply tremendous side-torque on the back wheels during even the slightest turn. I believe the steering shaft had a simple pin mechanism that allowed the shaft to rotate left and right. In this way, the chariot could easily follow behind the horses when they changed direction, much like a four-wheel trailer with fixed axles easily follows behind a car when it turns.



If this chariot were drawn realistically, it would look something like this:



[Enlarge](#)

With the shield removed, the driver can now be pictured further forward, so there is room in the chariot for the other soldier and he needn't stand with just the tip of his toes on the back of the chariot. Imagine if the shield was rotated to a straight-up vertical position, how it would force the driver to stand farther back, crowding the passenger, who in turn would also have to stand farther back. Now both men are standing toward the rear of the chariot. This leaves the front wheels lightly loaded, which decreases the steering authority. The aft CG makes the chariot highly unstable during a sharp turn, causing the back wheels to skid to the side, and possibly inducing the chariot to tip over.

The forward slant of the shield allows the driver stand further forward, above the front axle. The passenger can also stand further forward. This shifts the entire CG forward, and makes the chariot more maneuverable. During an attack, the driver stood as close as possible to the front of the chariot. He also leaned ahead, practically laying on the front shield, to shift his weight forward.

The passenger stood close behind him and also leaned forward while holding on to the driver's shoulder strap. With both of their weights close to the front wheels, the four-wheel chariot could maneuver more like a two-wheel chariot. During combat, the passenger stepped back so that both soldiers had more room to wield their weapons.

The weapons (spears and maces) are stored inside the chariot, and not in a separate quiver attached to the side. This made the weapons easily accessible to both the soldier and the driver, but not accessible to the enemy during close combat (the driver fought when he could while maneuvering the chariot; most of the drivers in the attack scene on the Standard of Ur are wielding weapons). The spears were arranged along the interior walls of the front shield and the side panel with the minimum amount of attachment necessary to hold them in place. The spears were not in a quiver, so the soldiers could just grab a spear as needed without pulling its full length out of a quiver, like pulling a nine-iron out of a golf bag.



A quiver mounted on the outside of a chariot is completely impractical. Look again at this picture of a war chariot. It would be quite difficult for the soldier in back to pull a long spear out of a long quiver that is placed far ahead of him, up high, and tilted away from him.



Assyrian four-wheel chariot. This picture illustrates how the side panel flairs into the curves at the top of the shield.



Higher-resolution photograph of the two-wheel chariot previously shown: The wheels have the same construction as the chariot wheels on the Standard of Ur. Note the leather tire around the wheel. The chariots on the standard would likewise have the same kind of tires to protect the wheels against splintering and damage. The Sumerians not only invented wheels, they also invented tires. See treaded tires on a [ceremonial chariot](#) from the period of Gudea.

The above photo clearly shows the reed and wicker construction of the body of the chariot. Woven reeds are also used to reinforce the chariot's central yoke. Reed (such as bamboo) is a

tough yet lightweight material, an important factor in keeping the chariot as light as possible to enhance its speed. The Sumerians made extensive use of reeds because they didn't have a lot of wood. There weren't many forests in Sumer, but there were plenty of marshlands; so the Sumerians didn't have a lot of timber but they did have plenty of reeds. Like the chariot pictured above, a chariot on the Standard of Ur was constructed of reed and wicker panels stretched over a wooden frame, which brings up an interesting point:

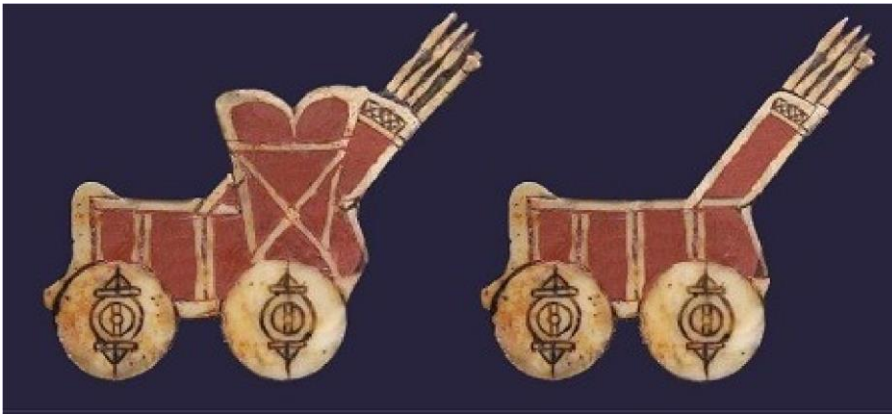


Chariot #1, which I reconfigured above, and the king's chariot which is shown below, have sharply angled fronts. The other three chariots are more rounded in front. I suggest that Sumerian war chariots were a lot more "curvier" than is generally supposed, because of their wicker construction. They were not so wagon-like. Wicker construction readily lends itself to compound curves and complex shapes (such as wicker baskets and furniture). Although the sides of the chariots were probably flat, it's difficult to imagine why Sumerians would build boxy chariots when it's so easy to form the wicker into smooth shapes and transitional curves (like around corners). Even if the shield itself were flat (except where it's folded) the corners at the front of the chariot would have been rounded off. It is also possible that the entire front of the chariot was rounded, with the shield composed of compound curves. In either case, a chariot on the Standard of Ur would more closely resemble later chariot designs. It would look more like a chariot and less like a wagon.

It is possible that a chariot had a thin leather covering on the sides for aesthetic purposes, to provide a smooth surface over the wicker. It is also possible that the front shield had a thick leather covering for greater protection against arrows, assuming the additional weight was not too excessive.

Throughout the ancient world, chariot warfare was always the domain of the wealthy nobility because chariots were expensive to build (a modern estimate says it took 600 man-hours to build a two-wheel Egyptian chariot). Horses were also expensive to buy and costly to feed and to maintain. It seems that Sumerian war chariots were quite flashy and sporty, as befitted the nobility, with the bright red chassis and light-colored trim, the crossed diagonals, and spotted rear fenders, the double-curve shield with a decorative panel on the side, and the brightly caparisoned horses. On the Standard of Ur, the king himself is driving a chariot, and it's highly doubtful that he would be seen driving a boxy, glorified hay wagon.

There is one final adjustment that needs to be made to the appearance of the war chariot:



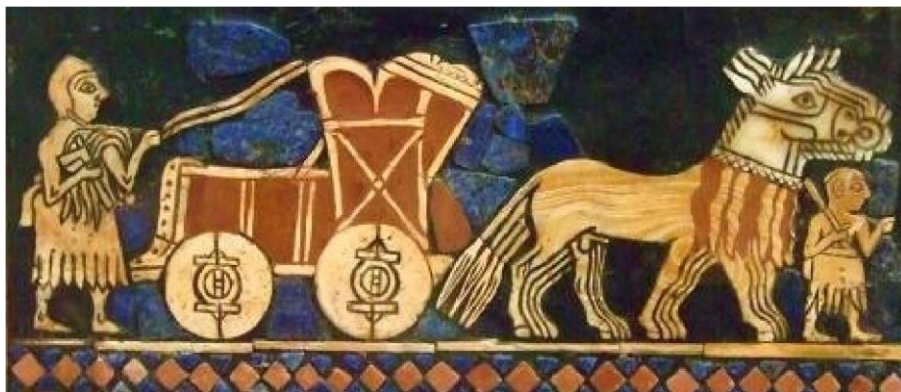
Chariot profiles, before and after.

When reconfiguring the war chariots on the standard, I tried as much as possible to preserve the same dimensions used by the artist. However, I believe that the necessity of having to place the shield on the side forced the artist to draw the chariot longer than it really was. Otherwise there wouldn't be enough room in the chariot to accommodate the two passengers (even so, they just barely fit). I believe the artist lengthened the chassis by increasing the distance between the front and back wheels. In the above picture, I have moved the wheels closer together. The chassis of a Sumerian war chariot would be as short as possible, the minimum length necessary for the soldier and the driver to effectively do their jobs. This would ensure that the chariot was lightweight and therefore faster. A shorter wheel base (the distance between the front and rear axles) would also make the chariot more maneuverable, for the same reason that a sports car has a tighter turning radius than a Cadillac.

So, to summarize: A Sumerian war chariot had an angled front with a side panel on the upper part of the shield. The weapons were carried in the interior of the chariot, not in a quiver attached to the side. In addition, the front of the chariot had some curvature because of the wicker construction.

Just for the fun of it, I also deconstructed the king's chariot:

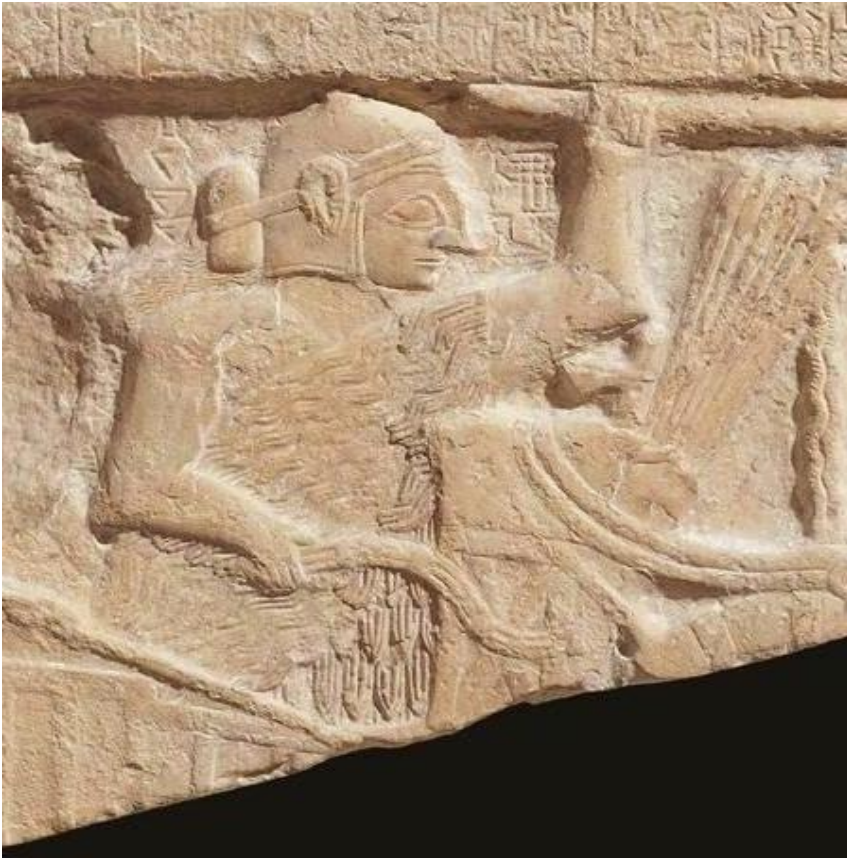
(Click on either picture to enlarge it.)



The King's chariot. The royal prince is seen in front of the horses.



The king's chariot has a peaked panel on the side that is different than the other chariots.
See the different [chariot panels](#).



Eannatum. His chariot on the Vulture Stele is like the chariots on the Standard of Ur, with the same angled front and the crossed diagonals on the shield. The chariot is drawn in the same unusual manner, with the front on the side and the side on the front. His chariot also has the same peaked panel as the king's chariot on the Standard of Ur.

More chariot pictures can be found in "[Sumerian War Chariots Reconstructed](#)."

Because of the perishability of wood and wicker, there is no example of a war chariot that has survived the millennia, so we only have pictorial evidence for its true appearance. Fortunately, we have the artist of the Standard of Ur as our main authority on the subject. He is an expert on military hardware. The structure of the chariot wheels, the spears, maces, battle axes, helmets, rein rings, etc., are exactly like those found in the Royal Tombs of Ur. Were it not for his detailed and accurate depiction of a Sumerian war chariot, we would have no idea what it really looked like.



[Enlarge](#)

See a [scale model of the Sumerian war chariot](#).

January 12, 2012