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The Sling: A Brief History and Experimental Recreation

The sling is a very ancient weapon that has been understudied in the field of archaeology (Korfmann, 1973, p. 42). Originally used as a weapon for hunting and self-defense, it rose to prominence as the shepherd's weapon for protecting their flock (Korfmann, 1973, p. 35). The sling is a very simple yet effective weapon. Consisting of two equal lengths of cord with a woven or leather pocket to hold a projectile in the middle, the sling is spun in a circle to build momentum before one end of the sling is released, launching the projectile along the tangent of the circle at high speeds. The projectile is released with great force, capable of puncturing skin or inflicting internal injuries (Korfmann, 1972, p. 40). The primary purpose of this project was to determine the difficulty of sling production and the expertise required to both spin yarn from raw wool with which to make the sling and to weave the sling itself. By attempting these processes myself, I hoped to gain an understanding of the difficulties faced in this process and the skill required to perform it well. Before stating the results of my experiments however, I believe it is important to understand the history of the sling.

Figure 1. A woven sling.

Despite the technology being up to 8,000 years old, the sling flies under the radar compared to its cotemporary ranged technologies like the javelin or the bow and arrow (Korfmann, 1973, p. 38). Its most notable representation is in the biblical story of David and Goliath. In this story, David is said to have killed the much larger and better armored Goliath with a single slung stone directly to Goliath's forehead. This biblical story portrays the immense power and accuracy of this simple and ancient weapon. The sling's effectiveness was understood by many varied peoples across the world, with evidence of sling use in every notable region of the planet excluding Australia and Antarctica (Korfmann, 1973, p. 42). Though few slings survive in the archaeological record, evidence of sling use is clear from large deposits of the more durable sling projectiles, found in most areas of the world. Later in this essay I will discuss why so few slings themselves survived the passage of time. The sling has a long and varied history. Evidence of its use for hunting and protection from predators exists from as far back as 6000 BC (Korfmann, 1973, p. 38). As the first civilizations arose, it quickly became used as a weapon of warfare. Slings were used in the armies of Mesopotamia, Greece, Rome, Medieval Europe, and many more. They even saw continued effectiveness after the invention of firearms. As stated by a Spanish observer of the conquistadors' battles with Peruvian natives, “Their chief weapon is the sling. With it they throw a large stone with such force that it could kill a horse. Its effect is indeed only slightly less than that [of a Spanish firearm]; I have seen how a stone flung from a sling over a distance of 30 paces broke in two a sword that a man was holding in his hand.” (Korfmann, 1973, p. 40) The sling even saw use in 20^{th} century warfare, where in 1936 they were used in the Spanish Loyalist siege of Alcazar Fortress to sling grenades over the fortress walls (Korfmann, 1973, p. 41). In some parts of the world slings remain is use today, used by shepherds for their age-old purpose of protecting their flock.

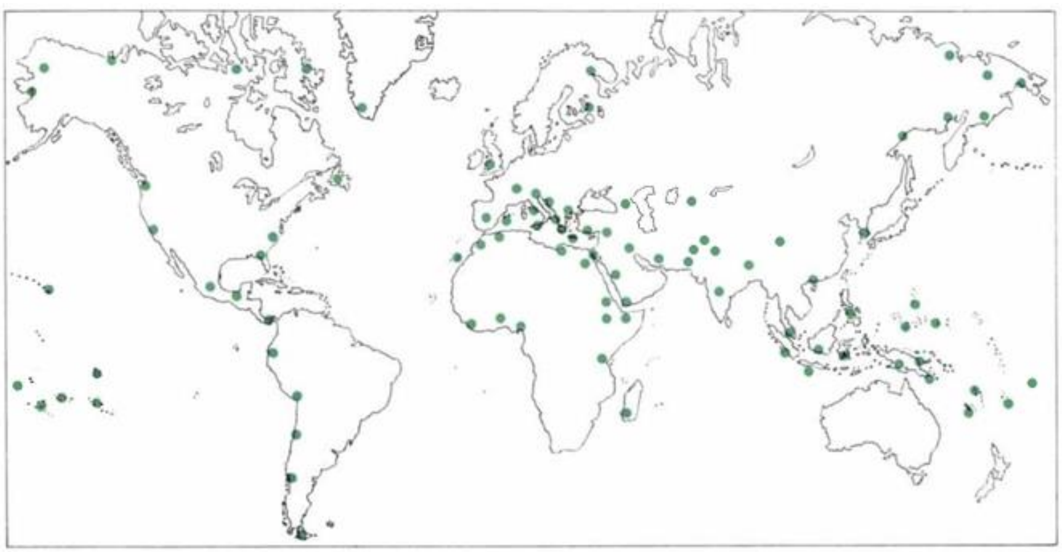

Figure 2. A map showing the widespread distribution of sling technology. Each dot represents a region in which evidence of sling use has been identified (Korfmann, 1973, p. 42).

If the sling was so prevalent throughout history, why is it so underrepresented in historical memory? There are two major reasons, both culturally and scientifically. Historically, many civilizations considered lightly armed ranged troops to be less honorable than front line armored soldiers (Korfmann, 1973, p. 37). Slings were the weapon of the lower class, who lacked the armor and metal weaponry of nobility. They belonged to shepherds and peasant infantry, who were also less likely to be buried in durable sealed tombs with their weapons.

Despite their lackluster place in history, slings actually carried many advantages over other ranged weapons. A well-slung projectile thrown by an experienced slinger could be launch further than the furthest fired arrow (Korfmann, 1973, p. 37). Slings were also far cheaper and easier to produce than bows and arrows or javelins, being made solely of string or string with a leather pocket. Despite their prevalence in ancient armies, far fewer slings survived than stone or metal artifacts. This is due to the fact that slings fall within the realm of perishable technology.

Perishable technology is a term used to describe artifacts made from organic materials such as plant and animal products (Jolie & McBrinn, 2010, p. 154). These artifacts are subject to degradation and decomposition over time if not preserved in ideal conditions. This is in comparison to more durable artifacts like ceramics or stone tools, which are relatively resistant to degradation, and often remain identifiable as artifacts even if broken down. Perishable technology has been under researched in comparison to durable technologies for a variety of reasons. There are far fewer perishable artifacts to research due to how few survive the passage of time and exposure to the elements. Many perishable artifacts such as woven materials or baskets also have seen less research due to association with "women's work", which until recently received less academic attention then "men's work" like warfare or architecture. Perishable artifacts also prove more difficult to research due to greater variation in form and function across time and geography (Jolie & McBrinn, 2010, p. 154). Because they are far less durable than items like pottery or stone tools, perishable tools must be remade more often, resulting in greater variation across generations and cultures. This greater variation makes detection of patterns more difficult. For these compounding reasons, there has been a dearth of research into perishable technologies.

Since few perishable artifacts survive, experimental archaeology is essential to gaining a greater understanding of perishable technologies (Jolie & McBrinn, 2010, p. 153). With few artifacts available already, it is far too risky to manipulate or to experiment on most artifacts. Only by replicating, reconstructing, and recreating perishable technology (Jolie & McBrinn, 2010, p. 160) can we discover the methods of production, usefulness, and relative effectiveness of perishable technologies. It can also be difficult to appreciate the skill of ancient craftsman without personally working with their materials to recreate their product. Jolie and Mcbrinn use the example of weaving to demonstrate this point: "...during their analysis of Paracas textiles from Peru, Junius Bird and Louisa Bellinger (1954) found it difficult to appreciate the weaver's skill without having personally worked hands-on with Alpaca hair, the original raw material, and backstrap loom, the weaving apparatus." (Jolie & McBrinn, 2010, p. 157) For certain areas of research, such as determining the personal skill required for a certain product's production, experimental archaeology is the only way to gather data besides preserved written accounts of production. There are also periods of human history for which experimental archaeology is crucial to our understanding, as perishable technologies played a far greater role than durable technologies. Some evidence suggests that hunter-gatherers used perishable technologies at a 20:1 ratio with durable technologies like ceramics or lithics (Jolie & McBrinn, 2010, p. 155), making research of perishable technology crucial to understanding how these hunter-gatherers lived. Despite this prevalence of perishable technology in ancient society, it has been researched far less than durable technologies (Jolie & McBrinn, 2010, p. 159).

However, when performing experimental archaeology on perishable technologies, Jolie and McBrinn state some important considerations that the researcher must account for. Since there is little archaeological evidence of many perishable technologies, it is often required to make some assumptions when designing the processes of the experiment (Jolie & McBrinn, 2010, p. 168). It is important to note what assumptions were made in your data and in publications in order to clearly establish the circumstances of your experiment. It is also important to examine the assumptions made in previous experiments in case any of those assumptions prove themselves to be inaccurate to reality. Next, it is important that the researcher collects data on their experiments. These experiments should not be done solely for the sake of doing them, but to gather quantitative, qualitative, or experiential data (Jolie & McBrinn, 2010, p. 170). A researcher must be aware of the limitations of store-bought materials, as these can vary greatly from the cruder materials available to ancient craftsmen (Julie & McBrinn, 2010, p. 171). The differences between modern store-bought materials and ancient materials must be accounted for in the experiment's results. These materials will affect the accuracy of the experiment compared to real-world conditions. The limits in skill of the researcher should also be taken into consideration (Jolie & McBrinn, 2010, p. 173). Your results will not be entirely accurate to the results of a skilled craftsmen using the same processes. This should be accounted for when recording data, or used to evaluate the skills of an ancient craftsmen. You can possibly account for this difference in skill by using modern tools or aids in your experiment (Jolie & McBrinn, 2010, p.174). This may lessen the skill gap between the researcher and the craftsmen, but it will dilute the analysis of the effectiveness of a specific process as performed without an aid. At the conclusion of the experiment, it is necessary to reflect on the experiment's design to determine what worked and what did not work, such that the experiment can be improved in the future (Jolie & McBrinn, 2010, p. 174). The experiment's findings should be reported on in order to enhance perishable technology's sparse archaeological record and depth of research (Jolie & McBrinn, 2010, p. 176). With these many considerations in mind, I prepared to conduct my own experiments. In order to get the most authentic experience of sling production, I wanted not only to recreate the sling, but to recreate the hand-spun yarn used to weave the sling.

A fair amount on information on hand-spun fiber comes from artifacts originating from the Mochica people of Northern Peru. Lila O'Neale examined the archaeological collection of artifacts gathered from numerous sites across northern Peru and made a number of conclusions regarding hand-spun fibers. (O'Neale, 1942, p. 142) Like most artifact collections, the Mochica site contained a large number of ceramic artifacts, but relatively few preserved textiles (O'Neale, 1947, p. 239). Despite this, O'Neale was able to determine that the majority of ancient Peruvian yarns and cords were all-wool, all-cotton, or a combination of the two materials (O'Neale, 1947, p. 241). These fiber cords were likely spun using wooden hand tools known as spindles, implied by the unevenness in the amount of twist throughout the yarn. The level of twist can be identified by the angle of this lines between the fibers in the yarn, ranging from nearly straight with a 'soft' twist to nearly horizontal with a 'hard' twist. O'Neale also identified 'super-twisted' yarn, in which the twist no longer travels up the cord, but causes the yarn cord to twist and bunch up on itself (O'Neale, 1947, p.241). With this information, I set about to design and perform my own yarn spinning experiment.

I chose to replicate this Peruvian form of spinning, so I spun my yarn using a hand spindle. I am not experienced enough to get any useful results using complex techniques like hand rolling fibers into string. More complex technology like looms appear later than the hunter-gatherer civilizations that I am attempting to analyze. In order to perform this experiment myself, I required two key materials. First, a tool with which to spin my fiber into string. For this I used a wooden drop spindle that I ordered online. My spindle was not entirely accurate to what would have been historically used, as it has precise machined parts and uses a metal hook to twist the fiber. However, this was the only commercially available hand spindle I could find and I do not have the expertise to make my own spindle. Second, I need a fiber to spin into yarn. I chose 100% roving core sheep wool. I chose wool due to the O'Neale journal stating its use in ancient American string production (O'Neale, 1947, p. 241). Llama wool was what was commonly used by South American tribes and civilizations for sling construction, but llama wool was expensive and less accessible to me. I also saw wool recommended in more modern sources on yarn spinning as a good material for beginner spinners (Alicious, 2017). One additional inaccuracy in my raw material is that it is roving, not raw wool. Roving is wool that has had impurities removed and has been combed to orient all the fibers in the same direction. This is not what ancient Americans would have used, but it is far easier for a beginner like myself to utilize. When examining the results of my experiment, I also had to take into account my own lack of skill in spinning wool, which muddied my results regardless of accuracy in my process or materials.

Figure 3. My drop spindle and roving wool.

To spin my wool into yarn, I followed a modern tutorial made by user alicious on instructables.com (Alicious, 2017). The first step is to stretch out the wool roving to decrease the density. You need to stretch the wool until there is a suitable amount of wool fiber per length for the thickness of yarn you desire. To start the process of spinning, you tie a starter piece of string around the spool of the spindle, and thread it through both the notch in the whorl and the hook of your spindle. Then carefully roll the starter string with the fiber from the wool roving to intertwine them. When the starter string and the wool fibers are suitably intertwined, the spindle is spun until the yarn is twisted to the desired level. The yarn is then unhooked from the hook and wrapped around the spool until there is just enough left to thread back through the notch in the whorl and the hook. Pinching the top of the already spun yarn, you stretch out more wool roving to the desired density. Pinching the top of the stretched-out wool and releasing the pinch on the top of the yarn, the twist will travel up from the hook to where you are pinching the wool. This gives it an initial twist to hold the wool fibers together. It can now support the weight of the spindle, which allows you to release the spindle and freely spin it, further twisting the yarn. Repeating this process of spinning the spindle to twist the wool, wrapping the spun yarn around the spool, stretching out the next length of wool, and twisting the next length of wool into the completed yarn is performed until you have spun the desired amount of yarn.

Figure 4. Raw wool roving (around my arm on the left) being spun into yarn (spooled around the spindle on the bottom right).

Now I will examine the results I achieved from this process. The main data I gathered from this experiment was the difficulty of the production process, in order to determine the skill required by ancient craftsmen who performed this task. Spinning the yarn proved to be both mentally and physically exhausting. Attempting to spin the yarn with a consistent diameter, amount of twist, and durability desired is very difficult. It is very easy to stretch the wool too much and break it, or to stretch it not enough, making it un-twistable. It is also physically exhausting to keep spinning the spindle with one hand while applying constant tension on the yarn with the other hand to prevent losing the twist, often with this hand held far above your head. My shoulders and fingers quickly became very tired, and I required frequent breaks despite being fairly fit and in good health. The string I ultimately produced was poor quality, being incredibly inconsistent in diameter, amount of twist, and varying degrees of success in converting the wool roving into proper yarn. My string frequently was either not twisted enough, making it fragile, or was twisted too much, resulting in the 'super-twist' that O'Neale warned about. In two hours of yarn spinning, I produced what I estimate to be less than ten feet of yarn, most of it unusable due to its incredible inconsistency.

Figure 5. My spun yarn. It is very inconsistent in diameter, twist amount, and durability. Some is also 'super-twisted'.

It is clear that my experiment had a number of inaccuracies to ancient methods and materials, as well as suffering from my own lack of skill in spinning yarn. I did produce yarn, but it is of quite low quality and quantity. I would like to try spinning yarn again when I have more time in an attempt to improve my skill in spinning. It is clear that spinning is a very difficult skill that required a great deal of expertise and physical strength to perform. Ancient craftsmen would have to have been quite skilled in order to produce string of consistent proportions in useful quantities. As seen in the fibers O'Neale examined (O'Neale, 1947, p. 241), even ancient craftsmen had somewhat inconsistent twist in their fiber production, though I am certain their string must have been far better than my replication.

My original goal for this experiment was to both spin yarn from raw materials, and then to use the yarn I spun to weave a sling. However, I made the decision to use store-bought string to weave my sling. The yarn I spun was far too variable in diameter and twist amount, as well as being quite fragile, for me to attempt to weave with it. It also suffered from 'super-twist' in many sections, making it rather unsuitable to weave with. The yarn spinning process was incredibly exhausting, and I would not have been able to produce a sufficient amount of usable yarn within a reasonable amount of time. With these factors in mind, I decided to buy some cotton string with which to weave my sling. In retrospect, I should have bought wool yarn to more closely match my yarn spinning experiment, though that did not occur to me at the time. Cotton is still a viable material for this experiment however, as single ply fiber production and sling weaving both utilize cotton as well as wool (O'Neale, 1947, p.241).

In my research on slings, I mainly researched a particularly well-preserved sling from Lovelock Cave in Nevada researched by Heizer and Johnson. In order to remain consistent with my research of hand-spun fibers, I had hoped to find a journal article written by O'Neale on Peruvian slings that Heizer and Johnson frequently referenced, but unfortunately I could not find the article. However, Heizer and Johnson frequently reference and build upon O'Neale's work, so their research on the Lovelock Cave sling is a suitable substitute. The Lovelock Cave sling was found in near perfect condition, wrapped around the head of a partially mummified child (Heizer & Johnson, 1952, p. 139). It is so well preserved due to the dry Nevada desert air and protection from the elements due to its location in a cave (Heizer & Johnson, 1952, p. 139). The sling was woven with a fairly unique technique in which paired warp cords are wrapped with a weft element made of the same length of string as the warps (Heizer & Johnson, 1952, p. 139). In simpler terms, it was made of pairs of vertical strings, made of a continuous curved length of string, through which the same string was woven to create a pouch. Heizer and Johnson acknowledged that though the sling appears to be made from multiple prepared batched of fiber woven together, the design is similar to slings found in Peru by O'Neile which used continuous wool yarn (Heizer & Johnson, 1952, p. 142). The Lovelock cave sling was made from twisted Indian hemp fiber, though very similar slings were found by O'Neale, which were made from all-wool or "two flat plaits of maguey fibers" wrapped in cotton weft (Heizer & Johnson, 1952, p. 140). The pocket of the Lovelock Cave sling measured approximately 7 inches long by 2 ¾ inches wide (Heizer and Johnson, 1952, p. 142). Another notable feature is that the pocket is more loosely woven in the center and gets tighter near the ends of the pocket, helping to wrap around the projectile (Heizer and Johnson, 1952, p. 145).

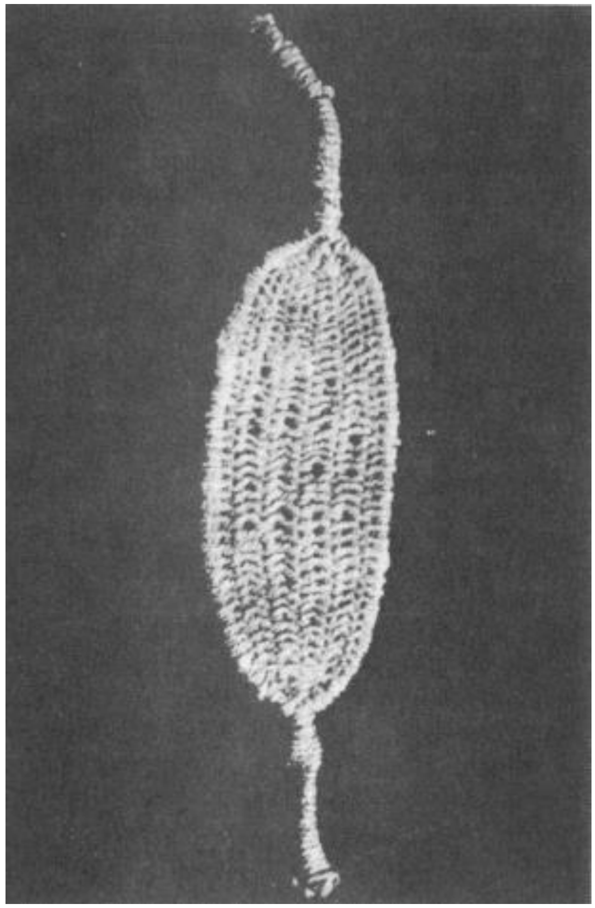

Figure 6. The Lovelock Cave sling.

Figure 7. The cotton string with which I wove my sling.

Now I will discuss my own experience in weaving a sling. The pattern I followed in weaving my sling is a combination of the pattern found in the Lovelock Cave sling and a pattern in a modern tutorial that I could more easily follow (Hutchinson, 2019). I wove my sling out of store-bought cotton string that appears similar in diameter to the string used in the Lovelock Cave sling and is similar in material to some slings from Peru. Again, when examining the results of this experiment, it was important to account for my lack of skill in weaving. The sling came out better than my spindle-spun yarn, but the final dimensions made it difficult to use. To start the weave, I took my length of string and measured out three feet to form one of the swinging arms of the sling. I then made four loops in the string to act as my four pairs of warp strings. To aid in my weaving, I secured these four loops to my desk with duct tape. Though this technology would not have been available to ancient weavers, it made the process far more doable for me. I believe it could be replicated more accurately by using sticks stuck into the group to secure the warp loops. Next, I took the same string composing the warp loops and started weaving it through the warp strings, alternating going over and under each warp. Whenever I reached one edge of the pocket, I would go back the other direction, continuing with the alternating under over pattern. When I had filled the entire length of the warp strings with weft string, the pocket of the sling was completed. I measured out three more feet of the same string to act as the other swinging arm. At the end of this length of string, I made a loop and tied it off. This loop wraps around one finger of the throwing hand.

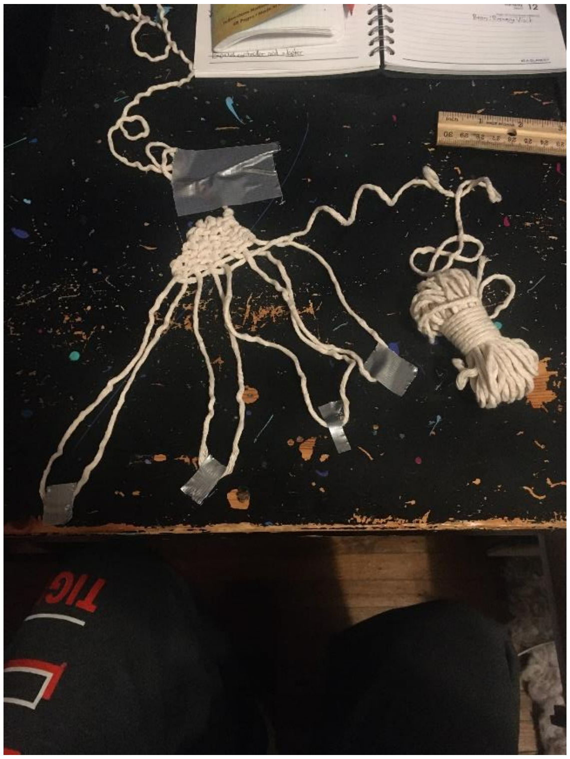

Figure 8. My sling is the process of being woven. The warp loops are held down by duct tape while I weave the weft through them.

Again, the purpose of this experiment was to discover the difficulty of making a sling for an ancient craftsman. I personally found the weaving of the sling to be a far easier process that the spinning of yarn. My sling came out rather neat and well put together but lacked some key features in its dimension. Most notably the pocket was a bit too small, measuring about 6 inches long and 1 ¾ inches wide, smaller than the pocket of the Lovelock Cave sling. The size makes it very difficult to keep the projectile in the sling while it is thrown. I had aimed to create a larger pocket, but when all the strings were pulled tight it ended up too small. The swinging arms are also perhaps slightly too long, though this is more a matter of preference. They do have a penchant for getting tangled up with each other if the projectile is not heavy enough or I am not careful in my swing. It took me about two and a half hours to weave this sling.

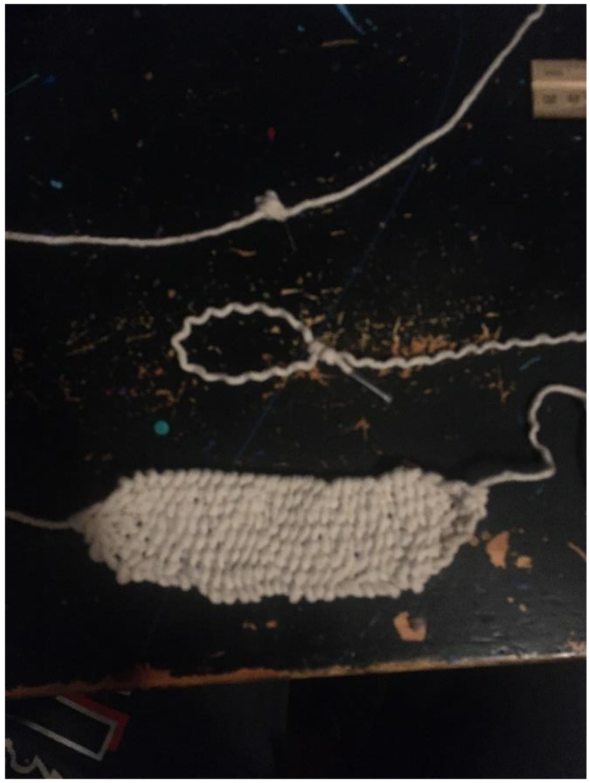

Figure 9. My completed sling.

The act of weaving the sling itself was fairly simple and not very time consuming compared to other weaponry; It is clear why the sling was so widely available and considered a lower-class weapon. It does not appear that the sling requires very much expertise to produce. I believe in only two or three more attempts I could produce a much more effective sling than the one I created. The spinning of yarn with which to create the sling is a far more difficult process than weaving the sling itself. If one person were performing both stages of production, it would require a fair amount of expertise on their part. However, one skilled yarn spinner could likely produce enough cord for less skilled producers to make slings out of.

After producing the sling, I also wanted to understand how difficult the sling was to use. In function, a sling is very simply. The loop on one end is wrapped around any finger of the dominant hand, while the other end is pinched between the thumb and index finger. A projectile is placed in the pocket. The sling is then spun in a circle to build momentum. When the projectile is spinning in the direction it is meant to be thrown, you release the pinched string from your fingers. This opens the pocket, where the projectile is released along the tangent of the circle with great force and velocity. I used a method in which the sling is spun vertically next to the body and is released underhand once momentum has been built up. As stated previously, the pocket of my sling was too small, and the spinning arms potentially too long. This made it very easy for my projectile to fall out or to be released at the wrong moment. In many attempts to use the sling, I managed only a handful of successful forward throws. During most attempts the projectile would fall out of the pocket on to the ground, and a few terrifying attempts occurred when the projectile would be launched straight up, in which case I would have to run and hope the projectile didn't hit me. According to many accounts slings are very easy to use, so I believe with a better sling I could have been more successful. Though basic sling usage is quite simple, gaining power, speed, distance, and especially accuracy requires a lot of practice. The most effective sling users were those with pinpoint accuracy, such as the biblical David and his killing stone delivered directly to the forehead of Goliath. I would like to attempt to weave another sling with more proper dimensions and see how the ease of use improves.

Figure 10. My sling with a rock in its pocket. The pocket is too small and struggles to properly secure the projectile during spinning.

Due to the nature of perishable technology and the lack of surviving artifacts, experimental archaeology is one of the most useful tools for researching perishable technology. Replicating ancient technology allows you to appreciate the skill required by ancient craftsmen to practice their craft. In these experiments I attempted to replicate the ancient crafts of yarn spinning and sling weaving to determine the difficulty of these tasks and the mastery required to perform them. I determined that yarn spinning is an incredibly difficult task, both difficult to do well and very physically demanding. Producing a reasonable amount of string takes a fair amount of time, though it is certainly done faster and better by a skilled craftsman. Spinning yarn requires a mastery of technique and physical ability to perform well. Comparatively, weaving a sling is a fairly simple task. On my first try I created an almost functional sling.

Practice and experience would allow for production of a more well-proportioned and useful sling, but I believe this could be achieved with a relatively small amount of practice. The ease with which a sling is made explains why it was a lower-class weapon infantry and shepherds. Performing these experiments proved useful for determining the skill required to perform ancient crafts and was an effective way of researching technology that left behind little physical evidence in the archaeological record.

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