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The Virtual Armory

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<u>The Virtual Armory</u>

Interactive Qualifying Project Proposal

Submitted to the Faculty

of the

WORCESTER POLYTECHNIC INSTITUTE

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by

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Abstract

This project developed a QR system to provide an interactive experience at the Higgins Armory Museum. I developed a web page that gives interesting facts on a medieval European helmet. When scanned, a QR Code next to the helmet brings up a mobile-friendly web page with information on the object, randomly selected from a pool of information, and an HTML-based game involving matching Greek, Islamic, Japanese and European helmets to their regions.

Contents

<u>Introduction</u>

Over the course of this IQP, I have focused on generating a few pieces of content for use in the Higgins Armory Museum. These pieces of content are, for the most part, not physically in the museum like most content and exhibits but instead stored online, for people to access through a QR code on their phone if they so choose. In my opinion this kind of content going to the people who want more information on the subject, but the people who just want a brief overview only get a brief overview, is the way forward. Interactive and customizable content that is directly relevant to the visitors' interests is beneficial to the overall experience, in addition to being new and innovative, as electronic content specifically for mobile phones has been attempted by relatively few museums and similar installations.

There are several advantages to using QR codes in this setting. Updating the content is as easy as editing a text file, as opposed to substituting a physical panel into the exhibit. This has the effect of saving time, effort and funding. Additionally the content received by the user can be tailored to their individual experience by altering what they see on the page depending on what other objects they've scanned. As an example, a user who has scanned an older artifact, upon scanning a newer one of the same type could see a comparison drawn between the two artifacts that would not have context if they hadn't seen the older artifact. Furthermore a very interested user will be able to follow a link to the information page within the Higgins Armory Database from the object page to continue branching out to learn even more about the object of interest.

The first thing I worked on relating to QR codes was reformatting the previous groups' object pages to display well on a mobile phone. The pages were formatting well for a browser, but on a phone everything was off-scale and didn't look very nice. The second thing I worked on was adaptive content, meaning depending on what the user had seen what they would see when they checked other artifacts would be subtly different. Originally this would have been implemented with a few paragraphs of text on each artifact that would add or alter a few sentences based on what other artifacts had been scanned prior. However this ended up being far too lengthy for most people to be willing to read, and instead a "fun facts" page was developed. Every time the page loads, a javascript function would randomly select one of about ten interesting facts about the artifact, with an accompanying picture. The third and final major thing I worked on this past year is an interactive minigame involving helmets from varying regions of the world. The player matches the helmet to the region, and receives a score at the end based on how they performed.

Object Type: Helmet
Region: Germany
Date: 1480-1490

HIGGINS
ARMORY MUSEUM
Armory Catalogue

The helmet on display has its visor as a separate piece of metal attached to it, called a bevor. In the early 1500s the visor was attached to the helmet and expanded to cover the entire face.

Tap here to explore helmets from throughout the world!

In the game I created, players are shown a map and a helmet, and they have to select the region of the world that helmet is from. If they get it right, there is a short text telling the player they got it right and giving a little more information on the helmet. If they get it wrong, they get to try again and are given a hint about where it's from. At the end, after going through all the helmets, the player is given a score and a short blurb

linking them back congratulating them if they did well, and asking if they want to try again if they did poorly. Additionally the ending screen links back to the object page,

Select the region this helmet is from!

allowing further exploration of the museums artifacts from there. This game allows the user to get a better understanding of what different cultures used in their armor.

To get background on these topics I researched four helmets- a helmet from Ancient Greece, a helmet from Feudal Japan, a helmet from the Middle East and a helmet from Medieval Europe. The documents I wrote primarily focus on the evolution of the helmet through time, taking it from simple bowl shaped pieces of metal through carefully crafted bronze helms all the way up to artistically designed helmets from Feudal Japan. They also go into some detail about who used these helmets, physical properties of the helmets, and the circumstances of the time that caused the evolutionary path to follow the path it did.

I also did a few other things for the Museum, including proofreading the existing Virtual Armory site and database, and helping to fix the existing database for use on mobile devices.

Ancient Helmet

Over the many years since mankind first began fighting, the technologies used to fight have technologically progressed an incredible amount. We went from throwing rocks at each other to building and using terrifying machines that do nothing but destroy. But in the middle of that, the primary weapons of choice were swords and knives, spears and pikes, bows and arrows. During this stretch of time (from roughly 2000 B.C. to 1500 A.D.), metal armor was very effective at protecting the user from harm.

Some of the first helmets used in serious combat were the ones used by the ancient Greeks and Romans, though as early as 1700 B.C. helmets made from ivory were used. These helmets ranged from simple, for the average soldier, to plumed for the leaders and richer people to differentiate them from their comrades. The overall design stayed relatively consistent in this period, due to the limited knowledge of metallurgy and lack of more advanced metalworking tools and knowledge. Advances in that field had the effect of improving both weapon and armor quality, keeping metal armor as a viable means of defense up until the invention of gunpowder.

The evolution of the ancient helmets went from the Kegelhelm to the "Illyrian" helmet around 700 B.C. which then evolved into the more easily recognizable and better built Corinthian helmet by 500 B.C. A version of the Corinthian helmet was still used as late as 100 A.D. by the Roman Empire.

There are a few types of ancient helmets to note. One of the more popular was the Kegelhelm, easily differentiable from the other designs due to its conical top, was used until around 700 B.C. in Greece. It's very different as it's made of several pieces for the neck, cheeks, forehead as opposed to a face hole in the designs used following it.   (Everson, p73-74)

An example of a Kegelhelm

The other type is the "Open-Faced" Helmet, of which a common subtype is the "Illyrian" helmet. This one was primarily used by Cretans and was made by taking 2
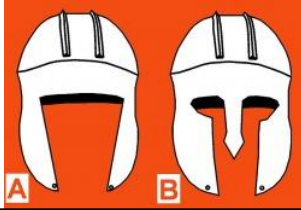
A: Illyrian helmet.
B: Corinthian helmet.

pieces of metal and bringing them together. A few of this variety have a horizontal edge at the bottom, to rest on the shoulders, no discernible cheekpiece and a tall, forward curving crest not unlike the original ones on Corinthian helmets. However, a greater majority had cheekpieces, which is the primary difference that identifies it as an "Illyrian" helmet. The earlier helmets of this type succeeded the Kegelhelm as they had clear influence from it. (Connolly, p60-61)

The most familiar style of ancient helmet is what we know today as the *Corinthian* Helmet. It was used primarily around 600 B.C.-400 B.C. The design of it covers the entire head leaving only a hole in the front for the eyes and mouth. There was usually a nose guard in front, and later models slanted the bottom to have it rest on the wearer's shoulders and provide neck protection.

Example of a Corinthian Helmet
Corinthian Helmet, 650-450 B.C., 2038

This was fairly standard throughout Greece at the time, with minor regional changes such as no nose guard in Crete alongside heavy decoration. (Everson, p80)

The Corinthian helmet is easily discernible due to its increased facial protection, in covering the cheeks and nose. The different designs of the Corinthian helmet fall into 4 main groups, the first of which being the type I'll be talking about whose main defining feature is that it's more reinforced than the other types, especially in the nosepiece. Another is structurally similar to the first type, but has the change of a sharp sidebend, much like the vases of the time. It also has more decorations than usual. The third is very tall compared to the other types and has lower eye holes. The final main type is longer than the third, and is curved instead of straight. (Snodgrass p22-25) However, it's still not as unified as the main type and has a lot more variance. These are not hard and fast divisions, as in many cases a given helmet will exhibit traits of several categories, but this helps to establish a chronology. Additionally, different geographies took the evolution of the helmet different ways resulting in similar but not the same

designs from the same time period, such as the Cypriote helmet that was a variant on the original Kegelhelms. (Connolly, p60)

The Corinthian helmet was primarily worn by the hoplite, Greece's primary infantry of the ancient world. Almost every man who lived in a Greek city had to fight in the army at some point, and due to this they all had to provide their own equipment. Since most of these were middle class workers, they went with the simpler designs that were still practical to use in order to be able to afford everything. Such armor was often passed down through a family to further this, and was emblazoned with the family crest.

The standard helmet for the Greek hoplite was made of bronze. The primary reasons for this were that bronze was easier to manipulate after being cast, and more resistant to cracking than the primary alternative, iron. Though today iron would be the better choice, back then nearly all iron would be impure and more likely to crack. These helmets had to be able to stand up to a lot of abuse without breaking, which is why they were primarily made of a single piece of metal. The helmet used may also have had an impact on the fighting style used, as it restricted both seeing and hearing, forcing the soldiers to stay closer together and fight as a unit instead of individuals. (Connolly, p61)

Oftentimes there would be a plume, or crest, attached to the helmet. This crest would be made of the mane and tail of a horse attached to the top of the helmet going all the way down the back. Few examples of this have survived to the present day due to decay, but by looking at the coins of some of these ancient cities, such as Athens, we can still see what it would have looked like. The crest itself, despite only being there for appearance and serving no physical combat purpose, also evolved with the helmet. It started out attached to a bronze tube on the top, which had design flaws in being too heavy and unstable. Later on it was mounted above the forehead, trailing down to the base of the helmet right above the back of the neck. The primary reasons for having crests on the helmets of the period were psychological in nature. It made the wearer look taller, supposedly striking fear into their opponent. Much later they were even used to rank the soldiers, and make it easier to spot the leader in mid-battle. (Everson, p82-83)

These helmets were unable to keep pace with the new weaponry developed, and eventually the Corinthian helmet design faded into the annals of history. The future designs borrowed from the Corinthian helmet, improving on the design with additions such as a visor, and improved shape/material. The primary reasons for adjusting the design were technological advances that enabled stronger materials to be used and increasing the wearers, as with the visors used on the helmet of a knight over a thousand years later and advances in weaponry requiring the armor worn to be more resilient. Even though the Corinthian helmet was eventually made obsolete, medieval helmets borrowed from the design and it helped pave the way for most helmets up to the invention of gunpowder.

Japanese Helmet

Japanese armor pieces were as beautiful and artistic as they were effective in combat. Oftentimes after the end of the Muromachi Period[1] Japanese helmets would be modeled after an object ranging from an animal, usually with horns to strike fear into the enemy, to an inanimate object, such as a shell or a leaf. The helmet I'm focusing on is one modeled after a conch shell, dating from the early Edo period.

The samurai, Japan's main military of the time, had fairly complex armor consisting of many parts. The chest armor was often made of iron and was called the "Dou or dō". The shoulder blades were covered in large sheets of iron or leather and were called "Sode". The "Kote" were tight cloth sleeves with metal strapped to the outside. "Haidate" and "Suneate" made up the leg protection, covering the thigh and shin with leather or iron. The helmet used is called a "Kabuto" and was paired with a faceguard called a "Mengu". (Galeno, p13)

The helmet was often the hardest part of the armor to create, made up of a few distinct parts. The bowl of the helmet, called a "Hachi" was the source of this difficulty, being crafted of anywhere from a few to a hundred metal plates riveted together. It was then lined with cloth. The difficulty of crafting these made them more expensive than the other parts, leading to re-use within families.

A relatively simple hachi.

 A decorative ring was sometimes added to the hachi, called a "Tehen kanamono". The "Shikoro", or neck guard was a semicircular piece of metal that was attached to the hachi. A cord would be used to keep all of the different parts in place in relation to each other and mounted on the soldiers' head. The "Tatemono" was the crest sometimes added on top of the hachi, which ranged in design from stylized horns to familial emblems.

1. Feudal Japanese history is divided into 3 time periods, the Muromachi Period, which dates from 1333-1573, the Momoyama period which dates from 1573-1603, and the Edo Period which dates from 1603-1868. (Galeno, p11)

There are several different types of mengu as well, the primary type being the "Menpo", which covered the cheeks and nose down to the chin. "Somen" covered the entire face, "Hanbō" covered the nose to chin area as well, but not the cheeks. The final type, the "Happuri" covered the forehead and cheeks. All mengu had an attachment for a chin strap to be attached to the rest of the kabuto. Some had a throat guard, and still others had a hole that perspiration could fall through at the bottom. The top ranking samurai generals wore flamboyant helmets known as kawari-kabuto, which had the same base as a regular kabuto but were extremely ornate.

The decorations on such extraordinary helmets came in four types, the first of which were front decorations known as "maedate". These were often relatively simple, and would serve to display the coat of arms or a religious symbol. Often these were flat, but rare cases would have them be a three-dimensional sculpture attached to the front of the helmet. Side decorations, such as horns, were known as "wakidate". These were less common than maedate but no less impressive. The third type, "ushirodate", were mounted on the back of the helmet. The shell helmet on display has none of these types, and instead has a "kashiradate", or top-mounted design. These decorations were made of bamboo, wood, "harikare" (lacquered leather or paper) or even iron, in some combination, the display has it made out of iron and harikare, though the harikare has mostly been lost with time. The helmet itself was either built off of a hachi or a "zunari bachi", a more protective head covering that used three plates in a trapezoidal formation. This design offered more protection than the bowl of a hachi, and was substituted out almost in its entirety in the late 1500s. (giuseppepiva.com)

The samurai would often select their helmet as a representation of themselves, choosing an animal or nature motif that they thought would fit them. "*kawari kabuto* were made with the idea of calling attention to the existence of one person: the

Portrayal of Date.

wearer." (Sasama)   As an example, Date Masamune (pronounced "Da-te") would always wear a helmet in the shape of a crescent moon and came to be known on the battlefield for it. (samurai-archives.com)

The honor of a samurai was everything to them, to the extent where their entire way of life was based around "bushido", or "the way of the warrior". The overall spirit of bushido is loosely analogous to the European knights' notion of chivalry. The main components are rectitude (righteousness), courage, benevolence, respect, honesty, honor and loyalty. Examining such quotes as Kato Kiyomasa's "If a man does not investigate into the matter of Bushido daily, it will be difficult for him to die a brave and manly death. Thus, it is essential to engrave this business of the warrior into one's mind well." and "One should put forth great effort in matters of learning. One should read books concerning military matters, and direct his attention exclusively to the virtues of loyalty and filial piety....Having been born into the house of a warrior, one's intentions should be to grasp the long and the short swords and to die." show that the most valued aspects of a samurai were his loyalty and honor, followed by his combat prowess. (Wilson)

Armor design that became outdated and obsolete on the field of battle was still used in ceremonies. The development of the helmets, and even the entire shape of the armor, would evolve as the arms they had to face grew deadlier and as the blacksmiths discovered more techniques enabling more intricate designs

The Higgins Armory shell helmet

Helmet in a Form of a Conch Shell, 1618   2973

be crafted. The shell helmet mentioned previously was likely used in ceremonies after its use in combat. It was made by Nagasone Mitsumasa in the year 1618. The conch shell (hora-gai, in Japanese) is a symbol of authority, both worldly and religious. These pieces of armor doubled as pieces of art, making them truly timeless.

From left to right: a helmet with a dragonfly motif, a helmet with attachments in the shape of animal horns, another dragonfly inspired design, a sun inspired helmet. (image source Galeno)

Islamic Helmet

Warfare in Africa and the Middle East was both similar and yet very different from warfare elsewhere in the world. Both regions used swords, ranged weapons and developed armor, but the end results were dramatically different between Europe and the Middle East. Despite the very divergent designs, they all stemmed from the same basic model- the one used by the ancient Greeks and Romans.

The design of the helmet developed a decent amount over the 2 millennia since the Corinthian helmet was designed. I was unable to find much information on the direct evolution, but roughly a thousand years forward (500-600AD) the "Spangenhelm" was used in Turkey. The Spangenhelm was conical in shape, a sharp contrast to the rounded square profile of the Corinthian helmet. Interestingly enough the ones used another 1000 years later (1500s-1700s) in desert warfare went back to the earlier profile design but more rounded.

The 1500s to 1700s also had a few developments in a relatively short span, as shown by the images from "Islamic Arms and Armor" to the right. The early 1500s had the helmet on the top, which was then modified to be more rounded at the top, dating between 1550 and 1600. The early 1600s rounded the top even further and increased the cheek protection, as shown by the rightmost image of the second row. The bottom row shows the further developments made, namely the one piece helm in the later 1600s and the rounded cone of the early 1700s. The helmet closest to what the Higgins Armory has would be number 2, dating it to the late

The Islamic helmet on display in the Higgins Armory.
Helmet, 1500s. 3050
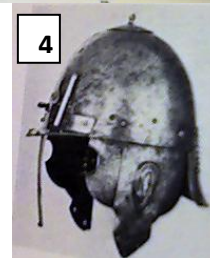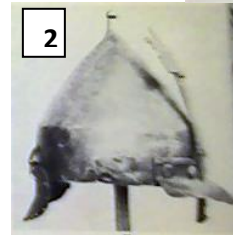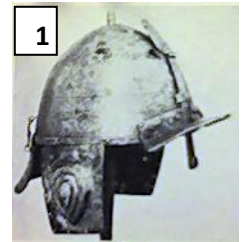
1500s.   However, all of the above images are from a different region, as they have earflaps. The helmet displayed in the armory was reworked in the 1800s.

In Turkey, the construction of the helmet used a shallow bowl called a "chichak", which was an early form of a missourka, or Turkish helmet. It was crafted from horizontal plates connected by strips of mail, essentially building a rounded tower. A sort of 'cloak' of chainmail was added to protect the neck; this was called an "aventail". A hat was worn underneath the helmet to make it rest more comfortably on the head. Overall this design was very stable, albeit very heavy for the wearer. (Oriental Armor)

The Mamlūk region used a conical shape until about 1550, beyond that they used rounded bowls. These are called "kawnas" and "muwa'ama" respectively. Interestingly enough this design shift was made independently of the Turkish design change, and yet shifted at about the same time. The helmet in the armory is likely of Mamlūk design.

A possible reason for the shift to the rounded top was that the swords and other weapons being used in combat were getting better at piercing the helmets, which is obviously not a desirable outcome. So, the rounded top helps with this problem by having a larger surface, increasing the chance of the attack just glancing off of it. This became far more important than thickness, as if a dent couldn't be made, then there was no way to pierce it. These developments resulted in a much rounder profile than other places in this time period. As with the other helmets, these also had a crest, or as it was called in the Middle East, a "kalagi". This served as an identifier in battle mostly, to be able to check at a glance the rank of your allies and see if anyone is an adversary. (Indian Arms and Armor)

To better understand the armor used in combat, we must look at the people who wore the armor and what they had to face on the field of battle. The helmet on display in the armory was used by a member of the cavalry of their army, likely either Ottoman or Mamlūk. The Mamlūk, originally mere slaves but over time became a powerful

military caste, held Egypt from 1250-1517, before being taken over by the Ottoman Empire, while the Ottomans were the powerful military force of the Middle East from the 1300s until the 1600s, though their civilization persevered until 1918. The majority of the Ottoman military consisted of sword wielding cavalry. When the European armies switched to using firearms instead of melee weapons, the Ottoman government tried forcing their troops to use firearms as well, though the "sipahi" (Islamic equivalent of a knight) refused to use such unchivalrous weapons and as such were outclassed by the European military. (Nicolle, p8-18)

Islamic weaponry has not changed much over time, as once a weaponsmith found a working design they stuck with it and passed it down. This is evidenced by the swords and daggers worn in traditional Islamic dress today being nearly identical to those worn in the 15th century-600 years ago! Islamic craftsmen often used 'watered steel' to create their blades, and a skillful smith could make a specific design along the blade. "Watered steel was made from ingots of steel containing a very high carbon content. Particles of iron carbide formed the light areas which contrasted with the darker areas of carbon. The structural pattern of the metal was brought out through etching." (North) Oftentimes the swords were inlaid with gold and other precious materials among the more influential and wealthy people, and sometimes the hilt would be made of a precious stone such as jade. (North, p24-28, p37-39)

There were 5 different types of body armor used, scale armor, which was made of a large amount of overlapping plates of iron or bronze fastened to an undergarment, lamellar armor, which was the same only laced to each other instead of connected to clothing beneath, and mail, which was made of interlinked metal rings. It was easy to make and very flexible, although very difficult to assemble into a finished piece. The other 2 types are mail combined with plates, brought into use in the 13th and 14th centuries, and homogeneous plate armor, which was similar to scale armor except it used much larger plates of metal. Used primarily through the ancient world but was revived in a more resilient manner in Europe in the 15th century. Islamic territories

never used the type. The armor worn alongside the helmet on display was likely mail reinforced by plates, as Islamic cultures never utilized beyond that as their "hit and run" style combat favored speed to defense.

The primary materials used in their armors were iron and steel, ranging from wrought iron with very little carbon present to steel (which could be manipulated in various ways, the most useful of which being cooling it from 900 degrees C very quickly and then reheating) to cast iron, which was too brittle to be used for armor due to its relatively high (2%) carbon content. There was also "wootz" which has ~1.5% carbon content which was primarily used in swords. It was made by heating iron for several days, and allowing it to cool in the same place it was heated. This had the effect of allowing iron carbide crystals to grow. Islamic infantrymen's armor was approximately equivalent to European infantry armor, though surprisingly Islamic cavalry armor was only slightly better than the armor outfitted on their infantry. German cavalry armor was much tougher than its Islamic counterpart. (Williams, p1-6)

European Helmet

In Medieval Europe, the armor set the pace for the weapon development. The slashing and cutting weapons lost some of their effectiveness as the armor was crafted with resisting these in mind. Instead the weaponry shifted to blunt weapons, which though they wouldn't pierce the armor, they would still injure the wearer. This made the armor less useful as time went on, which along with the invention of guns and gunpowder is why full plate armor fell out of favor. However in the late 1400s swords were the main weapon used and so the age of armor was at its peak, but the evolutionary path to get there was very long and winding, the results were the pinnacle of what was possible at the time.

The primary European fighters of the period were the knights, along with their squires. They held chivalry above almost everything else in their lives, similar to the Japanese samurai with bushido. The concept of chivalry, however, is not as focused as bushido. There were three main aspects to it, any one of which could be the primary focus of a knight; warrior chivalry, in which the knight would put following his lord above all else, religious chivalry, where serving God and protecting the innocent took priority, and courtly chivalry, which put the knights lady as that which he served. (Mills)

As with most helmets of the ancient world, the design evolved from the same base helmet: the Corinthian helmet from Ancient Greece. This design was kept with minimal changes for over a thousand years, before advancements resulted in a more solidly built helmet. The 2 most notable changes were the material used and the mouth being covered. Instead of copper or bronze, iron was used as the blacksmiths of the time had the tools to manipulate it better. The mouth being covered shows that defense became a higher priority than it had previously, possibly implying that face hits were being utilized on the field of battle. This design was used from approximately 1055 to 1180, before the evolution of battle forced a shift in design.
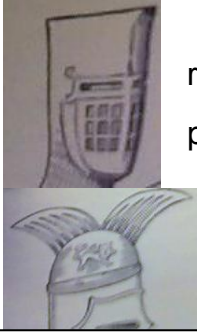
Above: example of a pot helmet. Below: example of a stylized pot helmet.

The next 70 years of innovation removed the rounded top, resulting in a "pot" shaped helmet. Also used frequently during this time period was chainmail armor, especially in the "aventail", a piece of armor used to protect the neck. The pot helmet would sometimes be stylized with horns or decoration, but the standard was a simple design.

The next few developments simply reinforced the mail and added a crest to the helmet. This period of time lasted 75 years, from 1250 to 1325. The period immediately after, however, lasted a mere 10 years due to changes in the weaponry. The improved weapons would result in nearly any hit wounding the target, which would likely remove them from the battle. This resulted in looser hanging armor. The helmet stayed about the same during this period however, with a smaller bowl and a larger aventail. 1335-1360 had very few changes to the helmets, but the armor was stylized further with studs and separated into more pieces.

The "Camail and Jupon" period lasted from 1360-1410. The 'jupon' was a sleeveless outer garment that went from the neck to the upper leg and was very tight-fitting. As the armor could not be pierced with the weapons of the time, this was most effective at preventing wounds as the armor would not bang into the wearer. Camail was an alternate name for the aventail, which was enlarged further. The helmet design added a visor, which was often shaped like a beak. This furthers that defense was becoming more important on the battlefield, as the design of the helmet went from a completely open face to a completely closed face.

An example of this type of helmet.

Helmets of the 1400s often rested on shoulder armor, called a 'gorget'. Around the year 1500, a groove in the gorget was introduced to allow rotary movement. It was similar to a collar made out of 2 plates connected at the sides, and the gorget extended from the base of the neck to the top of the chest and back. The aventail was still used

here as well. This change had the effect of allowing the wearer to turn their head a little easier-peripheral vision was still blocked, however. (Ashdown, Blair)

Before the sallet, the bascinet and kettle-hat were used. Bascinets extended down the neck and sometimes had aventails. Kettle-hats were made in one piece and were often cylindrical, with flattened conical crowns or bell-shaped. (Blair, p92-107) From 1430-1500, the preferred design for the rest of the Medieval era was introduced-the "sallet". This type of helmet was differentiated from the rest by its "backwards brim" protecting against neck hits from behind better than the aventail. (Ashdown)

A depiction of a sallet.

Very few helmets from before 1450 have survived to the present day, but from those that have we can tell that German and Italian helmet designs followed very similar progressions. The earliest German sallets were imported from Italy, and it caught on as by 1460 it was the primary type used in Germany. The Germans put their mark on the helmets, however, as German sallets traditionally had a long tail in the back, as seen on the helmet on display in the Armory. In the decades following the tail was extended farther back, which is shown by the length of the tail.

"The 2 most common forms, which remained in use until the end of the century, had either a half visor, with the sight formed between its upper edge and the top of the face-opening, or were made entirely in one piece with the sight cut in the forward edge. A few German sallets have full visors, i.e. made in one with a cusped and pointed brow-reinforce, while a few examples of the type with the half visor have separate brow-reinforces although this last seems, on the whole, to have been uncommon in Germany." (Blair, 92-107) Many sallets had a spring operated catch lock to hold the visor in the closed position, though a pivoted fork could be used to prop it open instead.

Through the 15th century the sallet, especially in the region surrounding Gremany, was worn alongside by a bevor. "The bevor was a cup shaped plate shaped to the wearer's chin which covered the front of the face, usually to just above or just

below the nose, and was fitted with one or more gorget plates." On German armor these gorget plates were always pointed and extended down, to the breastplate. "Bevors were sometimes fitted with a pivoted lame, which could be raised or lowered to uncover or cover the lower face and which was often equipped with a spring clip to hold it in place." The bevor was often held in place by a strap going around the back of the neck, fastened either at the center of the back of the back or off to one side of the bevor. (Edge&Paddock, p100)

Plate armor was very complicated to produce, requiring at minimum 3 people working on it- the one who forges the plates, the one who polisher the plates, and the one who assembles the complete set. Larger workshops had a locksmith employed to create the smaller, more delicate parts, though most armorers had to purchase those from specialized merchants. The finer specimens still needed to go through artists to get the armor to a finished state. The helmet on display in the armory was worn as part of a set of plate armor by a German horseman. (Pfaffenbichler, p62)

"sallet" helmet, 1480-90. 2608.a

Conclusion

Throughout the year that I worked on this project, the project objectives and goals shifted through various forms. The original plan was to create a short game or interactive piece to accompany each of the four artifacts I selected within the category of helmets of the ancient world, to go along with a brief description page similar to the existing virtual armory pages that I, alongside another team, created mobile versions of. Due to time delays and interactive concepts with a broader scope than a single artifact, this instead became a single larger interactive for each category. The interactive/game I created for the helmets involves selecting the location on a map where a given helmet originates from.

An idea that was originally considered, when I was on a team with 3 others, was to connect the mobile phone artifact pages through a cookie system, adding relevant information as the user scanned more QR codes. This idea was eventually scrapped due to time constraints and underestimating how much additional content would have to be generated, much of which would never be seen. In its place we ended up with a fun facts page, which would show a random fact from a pool of ten alongside a meaningful image. Originally there would have been a "Learn More" page, but this was scrapped due to not really fitting into the mobile aspect of the project. The templates used for the fun facts page can easily be copied over to other artifacts, substituting in relevant information.

The helmets I looked into were a helmet worn by a hoplite soldier from Ancient Greece, a samurai warrior from Oriental Japan, an Islamic horseman from the Sahara Desert and a German knight from Medieval Europe. For the Ancient Greek helmet I focused on the metallurgy, alternative designs and the hoplite itself. For the Japanese helmet I looked into samurai and the symbolism they often put into their helmets, as well as the rest of the armor worn alongside it. For the Islamic helmet I focused on how the environment shaped the design of the helmet. For the European helmet I focused on the evolutionary path of the design and how it reached the distinctive design of the sallet seen on display.

What went well with this project was the final stretch-once everything was planned out it sort of just fell into place. However, getting to that point was a bit of an arduous journey, in which I had deal with HTMLs' annoying quirk of displaying differently on different browsers/operating systems and such, trying to research things that don't have much written on the subject, and deadlines. I'm usually able to meet a deadline effortlessly, but with this project I had trouble meeting them due to having to do some work at home, with internet access, and some work at the armory, for researching things. This resulted in conflicting schedules and combined with a lack of motivation, it made it very hard to get the work done for a deadline, let alone at all. However, in the end I managed to overcome this and learn how to motivate myself-which will assuredly be a valuable skill for my future.

Appendix A

(Game documentation)

Helmets around the World

Description: A map and a helmet are shown. The user must select the correct region, getting either a "correct" message with additional info or an "incorrect" message with a hint to the location.

Link to game text: Click here to explore helmets from around the world!

Introduction text: Helmets were used all around the world, but the design in different times and places was vastly different. In this minigame you will match several helmets to their geographical region. To play, tap the location on the map you think the helmet came from. You will be told if you are right or wrong, and get some additional information on the helmet. Ready to play?

Question: Select the region this helmet is from!

Ancient 'correct': That's right! This helmet was made in Ancient Greece, about 2400 years ago. It was used by hoplites, the primary infantry of the ancient Greeks including the famous 300 Spartans at Thermopylae.

Ancient 'incorrect': Sorry, that's not quite right. This type of helmet has shown up a lot in popular culture recently, including movies like *300*. What region was that set in?

Japanese 'correct': That's right! This elaborate helmet reflects the love of nature in Japanese art. The conch shell also represents authority in Buddhism, and Japanese generals carried conch shells as battle-trumpets.

Japanese 'incorrect': Sorry, that's not quite right. This helmet was created to look like a conch shell, which in Buddhism is a symbol of worldly and religious authority. In what parts of the world is Buddhism traditionally practiced?

Islamic 'correct': That's right! This helmet helped to keep the wearer from overheating in the harsh African and Middle Eastern deserts by using chainmail instead of metal plates to cover the back and sides of the head.

Islamic 'incorrect': Sorry, that's not quite right. Think about the fringe of mail, rather than solid plate, protecting the back and sides of the head. What type of environment might encourage this lighter design?

European 'correct': That's right! This helmet was used by a German horseman in the late 1400s. Knights focused on protection over versatility and speed, and as a result the knights were able to charge into the enemy ranks and scatter them at minimal risk to themselves.

European 'incorrect': Sorry, that's not quite right. This helmet and chin-plate is part of a set of plate armor. What type of person used plate armor in medieval times, and where could they be found?

On any right answer, "next helmet!", on any wrong answer, "Try again!".

Endgame:

You got 4/4 right! Congratulations on a perfect score!

You got 3/4 correct! Nice, but do you want to try again to try for a perfect score?

You got 2/4 right! Pretty solid, but I bet you could do better. All the helmets shown here are on display in the Armory, so maybe a bit of searching around could help you pinpoint the correct choices if you try again.

You got 1/4 right.   All the helmets shown here are on display in the Armory, so maybe a bit of searching around could help you pinpoint the correct choices if you try again.

You got 0/4 right. All the helmets shown here are on display in the Armory, so maybe a bit of searching around could help you pinpoint the correct choices if you try again.

Appendix B

(Fun facts documentation)

Fun facts

 - Some sallets were open-faced to allow
greater visibility. These were favored by
archers and other light troops.

- A distinctive German style of sallet appeared between
1450 and 1460. Its most obvious feature was that the
rear of the helmet was drawn out into a long tail. Most
sallets were made in Italy or Germany.

- The sallet, after becoming obsolete in warfare, was still used for jousting into the late 1500s.

- Helmets had latches on their chin-pieces and visors so that the knight could open them to drink or get a better view.

- The helmet on display has its chin protection as a separate piece of metal, called a bevor. In the early 1500s the bevor was attached to the helmet to create the "close helmet" style.

- The eyeslit of a helmet is designed both for safety and functionality: it's narrow enough that a lance tip can't pierce it but wide enough to be seen through clearly.

- The evolving design of the helmet resulted in an evolution in fighting style. When the eyeslit was narrow to prevent a direct assault, knights would hold their sword halfway up the blade, increasing accuracy, to stab directly into the eyeslit.

- Before the sallet, the bascinet and kettle-hat were used. Bascinets had a fringe of mail to protect the neck while the sallet used solid metal to offer more protection.

Appendix C

(QR Label)

Appendix D

(Biography)

Jeffrey Bardon is a junior at WPI, majoring in Interactive Media and Game Development. Due to this, he sought an IQP that would include real-world game design, leading to the virtual armory project. He chose to research helmets, a passive armor piece as opposed to an active weapon, due to taking a more passive approach to design-rather than looking for ideas, he lets the ideas come to him. When not working on programming and bugtesting new games, he enjoys replaying older games with various challenging goals in mind, such as pure speed or limiting integral gameplay mechanics.