

# **Getting from here to there and back – The impact of a few transportation innovations on history**

Class 1

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# Introduction

- Many things cause historical change
  - Among the most potent and far-reaching causes of change are the development of new modes of communication and transportation
  - Changes in communication and transportation networks produce cultural, economic, social, political, and military revolutions
  - This class will focus on the impact of transportation innovations

# What the Course Will Cover

- Transportation innovations that have made travel and the shipment of goods faster, cheaper, or less onerous have had a great impact on history
- Course will focus on the following:
  - Domesticated Horse & Camel
  - Ocean-going sailing ship & steam-powered ship
  - Railroad
  - Automobile
  - Airplane

# What We Will Cover Today

- The Horse and its Impacts
  - Early Man Before the Horse
  - Domesticating Plants & Animals
    - Issues involved in domesticating animals
  - Domesticating the Horse
  - Notes About the Horse
  - Outline of the effects of the Horse upon Society
    - Social
    - Cultural
    - Economic

# What We Will Cover Today

- The military and political role of the horse
  - The changing role of the horse in warfare
  - Significant wars involving the horse and some of the historical consequences of those wars
  - What if the horse had never been domesticated or had become extinct
  - The horse and the origin of motion pictures

# The Impact of the Horse

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# Hunter-Gatherers

- For most of his existence, man lived as a hunter-gatherer
- Despite their living in harsh physical environments, they initially had plenty to eat
  - Food supplies were abundant because food gatherers have an extraordinary knowledge of the plant and animal life in their home territory
- But as a result of both climate change and population increase, this Garden of Eden life didn't last

# Hunter-Gatherers - 2

- As hunter-gatherer band population increased, or the ability of the environment to support the existing population decreased, hunter-gatherers had two options:
  - Expand into previously unoccupied territory
    - This led to the great pre-historic migrations that took place in the last ten thousand years
      - From Siberia across the Bering Strait into North and then South America, from Southeast Asia to Australia, and from East Asia to Polynesia
  - Domesticate plants and become farmers
  - Domesticate animals and become herders



# Consequences of Plant & Animal Domestication

- Domestication of plants and animals produced food surpluses. These divided humans into three major groups
  - Those who became farmers
  - Those who became pastoral nomads
  - Those who remained hunter-gatherers
- The interaction between these groups led to:
  - Farmers displacing hunter-gatherers onto ever more marginal land
  - Trade and later conflict between pastoral nomads and farmers

# A Note on Animals

- Animals fall into three categories as far as human use is concerned
  - Food animals – the animals are either eaten or produce milk or eggs that are eaten or both
  - By-product animals – the animals' skin, fleece, fur, or bones are used to produce clothes, footwear, tools, or other implements
  - Transport animals – the animal is used to tote a load on its back, pull a cart or wagon, or carry a human rider
- Domestication made animals available to humans when needed. However, domestication was not easy

# Domestication of Animals

- Of the world's 148 wild, herbivorous mammals that weigh over 100 lbs, only 14 have ever been domesticated
  - 8000 BC – goat, sheep, pig
  - 6000 BC – cow
  - 4000 BC – horse, donkey, water buffalo
  - 3500 BC – llama, alpaca
  - 2500 BC – Bactrian camel, Arabian camel

# Why Only 14 of 148? - 1

- Six reasons why animals fail domestication
  1. Diet – some animals are fussy eaters – koalas & pandas
  2. Slow maturation rate – some animals take too long to grow to adult size - gorillas & Asian elephants
  3. Resistance to captive breeding - vicunas
  4. Too Nasty – prone to attack humans – zebras, African buffalo, hippos, rhinos
  5. Tendency to panic when put in an enclosure - deer

# Why Only 14 of 148? - 2

- Six reasons why animals fail domestication
  6. Social Structure inappropriate for domestication
    - For animals to be domesticated, they must
      - Live in a herd or pack so that they are tolerant of each other
      - Have an established hierarchy so they follow a dominant leader and will accept humans as a pack leader
      - Live in overlapping home ranges rather than mutually exclusive territories

# Implications

- Only a few transport animals were ever domesticated
  - These animals existed only in Eurasia and North Africa
- Only a slightly larger number of food animals were domesticated
- Many large animals which because of their size and strength would have made ideal transport and war animals were never domesticated
- All these factors were to have immense historical consequences

# Food Animals

- The domestication of food animals (who often shared living quarters with their owners):
  - Created a class of nomadic shepherds who raised herds of such animals and moved with them from grazing area to grazing area
  - Led to the use of these animals for both their meat and their byproducts
    - Leather products and woolen garments
  - Led to new foods in the form of storable milk products such as yogurt and cheese
  - Led to the emergence of a whole host of new diseases
    - Animal diseases evolved to infect humans

# Domestication of the Horse

- The horse was first domesticated c4000 BC in the area of the Russian steppe where the Dneiper and Don Rivers flow into the Black Sea
  - It is a region of the Eurasian steppe where steppe and forest areas met
- Domestication occurred in stages
  - Farmers and herders initially hunted the horse for food by driving them into corrals
  - They soon realized that horses could be tamed and used as pack animals
  - They also realized that horses could also pull carts and be ridden



# Notes About the Horse

- The horse evolved in North America
- It crossed over to Eurasia during the Ice Ages when a land bridge connected Siberia and Alaska
  - At the same time the ancestors of the American Indians crossed over from Eurasia
- It became extinct in the Americas roughly 9,000 to 10,000 years ago

# Notes About the Horse -2

- Horses were difficult to domesticate because
  - They could easily outrun a man
  - If cornered, they will fight
  - They are difficult to sneak up on or surprise
    - They have a 357-degree field of vision with only two small blind spots
    - They have excellent night vision, but limited binocular and stereoscopic vision
    - They need only four hours of sleep per day which they obtain in 15-20 minute segments
      - They normally sleep standing

# Notes About the Horse -3

- Despite the difficulties, horses were domesticated because
  - They were herd animals with a dominance hierarchy and a tendency to form long-lasting bonds with other horses and with humans
  - They exhibited neoteny – the tendency to retain juvenile traits into adulthood
    - This allowed horses to view many types of work as a ‘work-game’
  - They lacked horns and antlers
    - This made them easier to capture and to train

# Notes About the Horse - 4

- Despite the difficulties, horses were domesticated because - 2
  - They were herbivores that could live on the grass of the Eurasian steppes
    - Thrived on grasses a cow would starve on
  - They possessed a diastema or gap in the teeth that permitted effective placement of a bridle and bit
  - They could move through snow, scrape it away to feed and break through ice-covered waterholes to drink
    - This allowed other animals to forage in snow-covered areas

# Notes About Horses -5

- A horse can carry about 200 lbs on its back
- When properly harnessed, a horse can pull loads of 10-15 horsepower for short periods
  - On a travois, it can pull 300 lbs (4 times that of a large dog)
  - With a wagon on a good road, it can pull 4,000 lbs
  - On a railway, it can pull 14,000 lbs
  - Along a canal towpath, it can pull up to 60,000 lbs

# Notes About Horses - 6

- Horses move naturally with 4 basic gaits:
  - Walk -- 4.0 mph
  - Trot – 8.1 to 12.0 mph
  - Canter – 12.0 to 15.0 mph
  - Gallop – 25.0 to 30.0 mph
    - In a racing gallop, the record is 55 mph
- While a human porter could carry 50 lbs over 20 miles in a day, a horse could carry or pull a much greater load over a greater distance

# Notes About the Horse - 7

- While relatively low maintenance, horses eat and drink a lot
  - Horses need to eat about 2%-2.5% of their body weight each day
  - Horses need to drink 10-12 gallons of water a day
- This meant that horses needed a physical environment with plenty of grass or grain and plenty of water

# Effects of the Horse - 1

- Once the horse was domesticated, it found many uses and had many major impacts
- The pulling power of the horse:
  - Led to the invention of the wheel
    - Horse and wheel gave rise to the 2-wheeled cart, the war chariot, and later the 4-wheeled wagon, carriage, and stagecoach
  - Led to the development of the stick and later the moldboard plow
  - Facilitated the long-distance movement of people and cargo



# Effects of the Horse - 2

- The mobility of the horse
  - Allowed the nomads of the Eurasian steppe to raid, conquer, and trade with the civilizations that arose in the Middle East, India, and China
    - This led to Eurasian civilization being beset by recurring nomad invasions
  - Created the equestrian empires that led to
    - Thousands of miles of roads
    - Unitary language and writing systems
    - Standardized coinage, weights, and measures

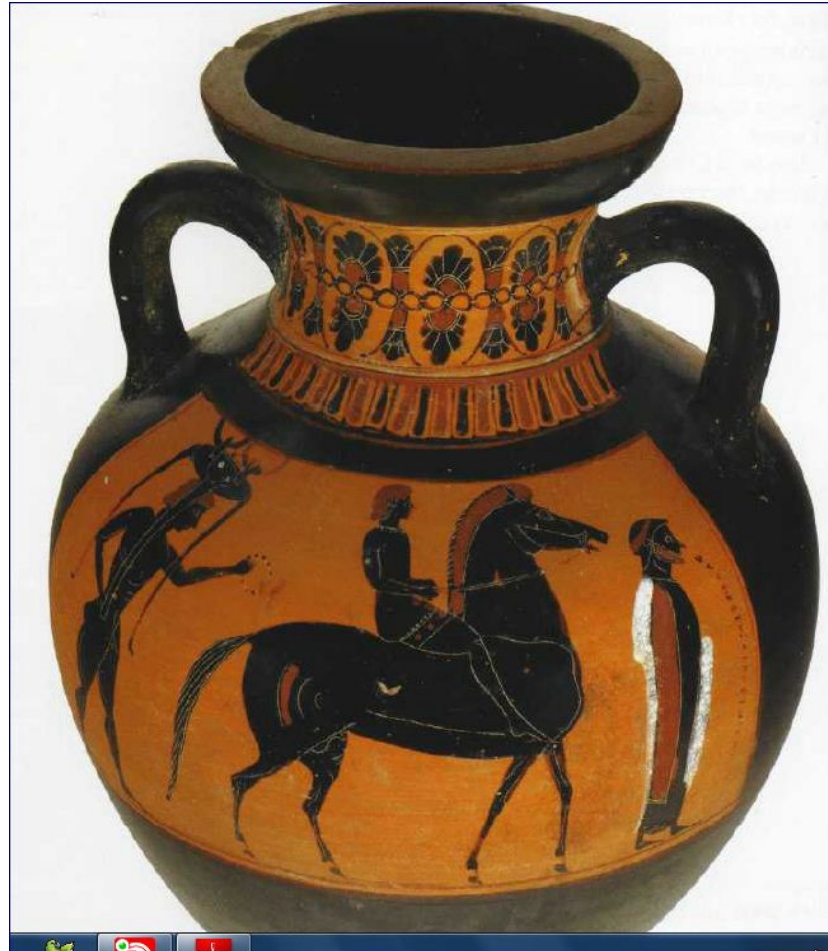
# Effects of the Horse - 3

- The speed and power of the horse:
  - Along with related innovations served to revolutionize warfare
  - Led to innovations designed to neutralize the horse (and horse-related innovations) on the battlefield
  - The result was an arms technology race in which a horse-related innovation or new tactic on offense led to defensive innovations designed to counter the offensive innovation or tactic

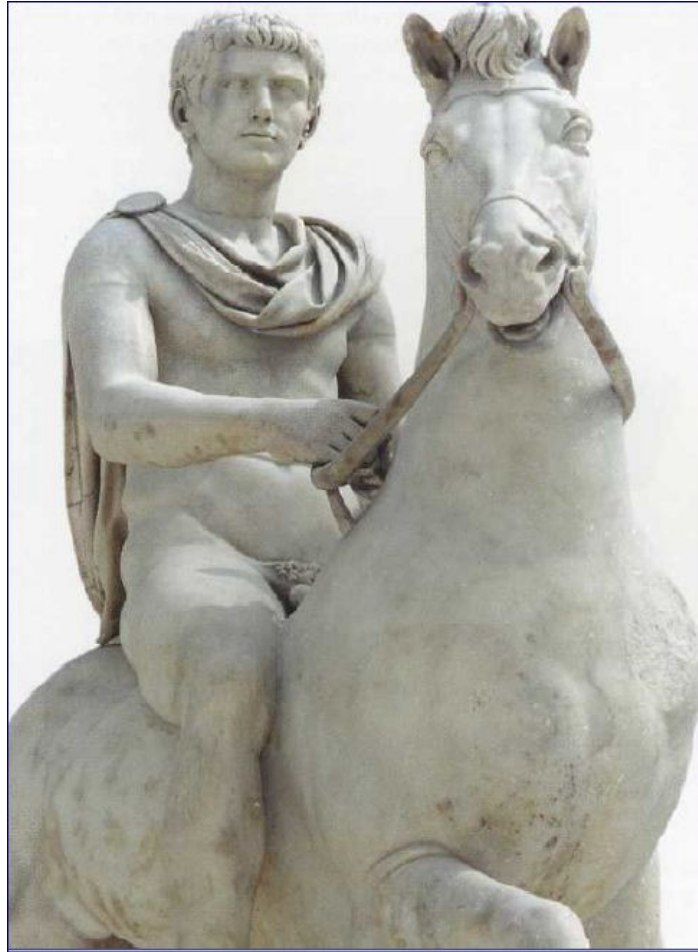
# Effects of the Horse - 4

- The beauty of the horse served to inspire many great works of art and memorialize military heroes
  - The Panathenaic procession of horses-and-riders and horse-drawn vehicles on the Parthenon frieze
  - Roman triumphal arches
  - Equestrian statues of military heroes from Roman emperors to Civil War generals
  - Paintings of horses by famous artists

# Greek Amphora



# Roman Sculpture



# George Stubbs

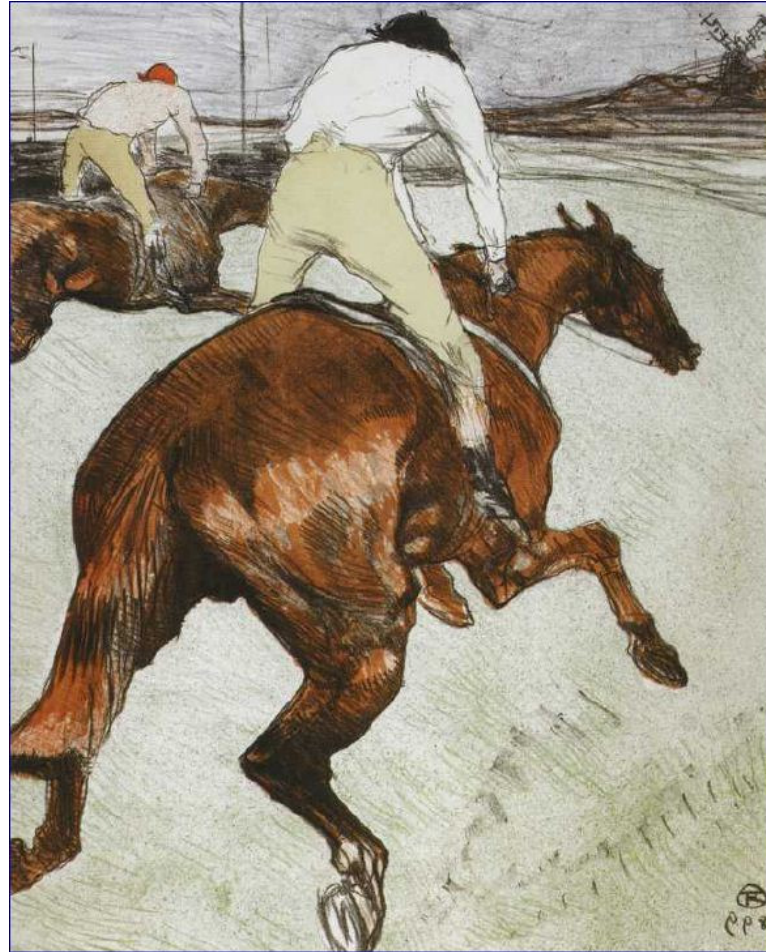


# Amerindian Buffalo Hide Painting





# Toulouse-Lautrec

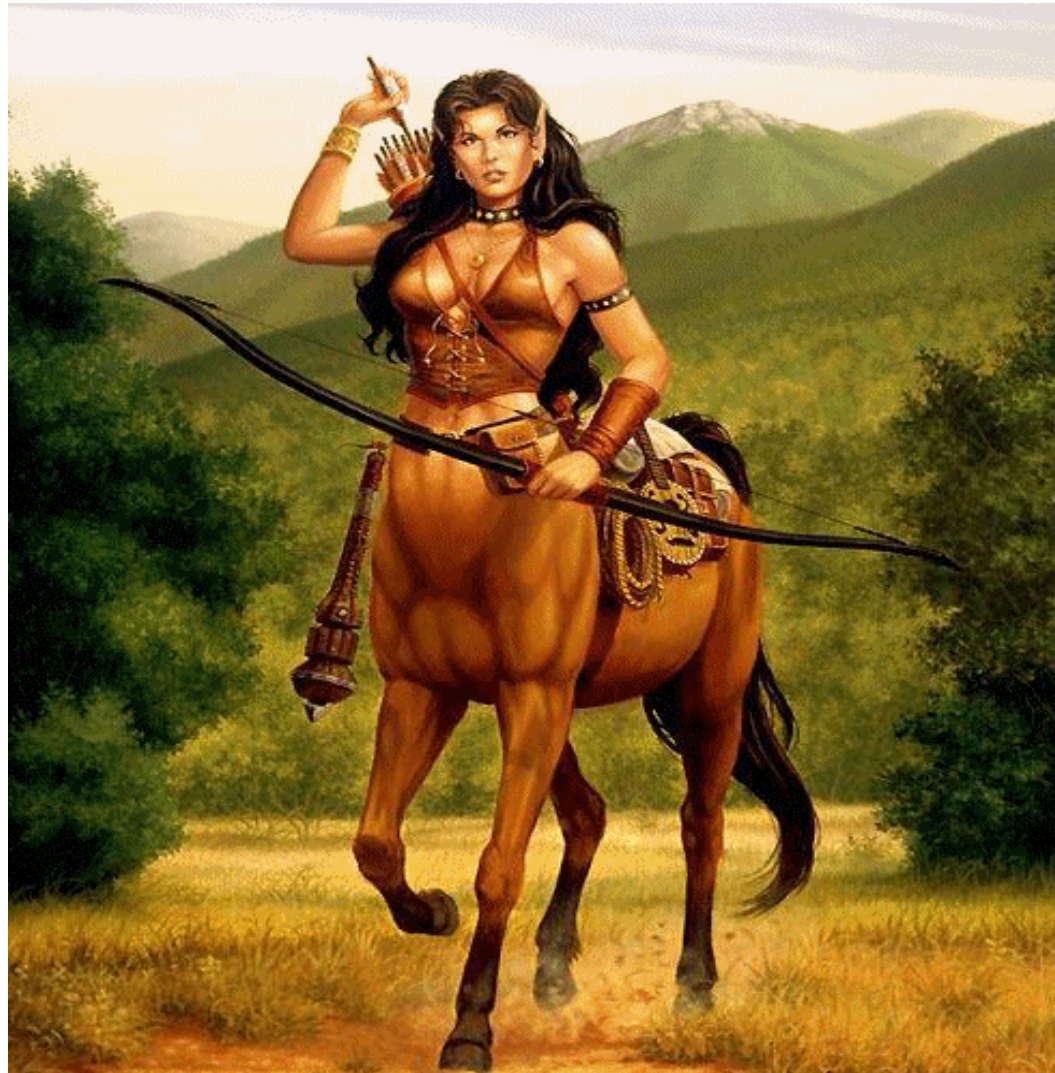




# Effects of the Horse - 5

- The overall prowess of the horse (and its rider) inspired many myths and legends
  - The Centaur (half man, half horse)
    - Became the Zodiac symbol for Sagittarius
  - The Pegasus (flying horse)
    - Became the logo for Mobil Oil and Tri-Star Pictures
  - The Unicorn
    - Mythologization of the rhinoceros and the aurach
  - The Buddha and Kanthaka
  - Mohammed and Al Burak
  - The Four Horsemen of the Apocalypse

# Centaur



# Pegasus



# Unicorn



# Four Horsemen of the Apocalypse



# Economic Effects of the Horse - 1

- Owning horses required major land resources
  - In the land scarce environment of Western Europe and China, only relatively wealthy people could afford to own horses
    - In eras when military power depended on owning horses and having specialized training, it meant that military and political power was monopolized by a relatively small elite
      - In the centralized empires of Eurasia, it meant a form of monarchical despotism
      - In decentralized areas like Medieval Western Europe and Japan, it meant feudalism



# Economic Effects of the Horse - 2

- The Horse required a substantial infrastructure
  - Land dedicated toward growing oats, barley, alfalfa, or grass
  - An employment infrastructure of trainers; grooms; stable hands; makers of carts, wagons, chariots & carriages; saddle makers; blacksmiths & farriers; carpenter builders of stables and way station facilities; and veterinarians

# Socio-Cultural Effects of the Horse

- Gave rise to such sports as thoroughbred horse racing, harness horse racing, polo, horse shoes, dressage, rodeo, and fox hunting
- Gave rise to such entertainment events as horse shows, parades, circuses, and horse riding
- Led men to give up dresses in favor of trousers
  - It was much easier to ride a horse wearing trousers than wearing a tunic



# Roman Soldier in Tunic



# Indian Tunic



# Nomads and the Horse

- Given the voracious appetite of their horses and herds, the nomads of the steppes had to move in an annual circuit of hundreds of kilometers to find pasture
- When climate and ecology conditions changed, nomad tribes had to range further afield
  - This brought them into conflict with other nomad tribes, leading to cascading displacements
- In the resulting wars, military use of the horse evolved through several different eras

# The Horse in War

- Use of the horse in warfare went through several eras
  - War chariots
  - Mounted horsemen with bows-and-arrows
  - Mounted knights with shields and lances, swords, or battle axes
  - Medieval armored knights with chain mail or protective armor and lances and swords
  - Mounted cavalry as firearms make the mounted knight in armor obsolete

# Historically Significant Wars involving the Horse

- Persian conquest of Southwest Asia and Qin conquest of China
- Alexander's Conquest of Persia
- Arab conquest of Southwest Asia, Central Asia, North Africa, and Spain
- Carolingian conquest of Western Europe and the rise of Feudalism
- The Mongol Empire
- The Era of Firearms
  - The Amerindian Horse Cultures of the Great Plains and the Indian Wars of the American West

# Creation of Persian & Chinese Empires

- Persian conquest of Southwest Asia
  - Steppe nomads using horse-riding cavalry created the Persian-Mede empire in Southwest Asia
    - Led to the Persian conquest of Babylon and the return of many Jews from Babylon to Judea
    - Led to the establishment of Aramaic with its consonantal script as the lingua franca of the empire
    - Brought into Judaism certain Zoroastrian beliefs that were to have major impacts
- Qin conquest of China
  - Steppe nomads using chariots created the Qin empire of China
    - Ended the “Warring States” period
    - Created a unified China for the first time
    - Paved the way for the Han Dynasty

# Alexander's Conquest of Persia

- In the 4<sup>th</sup> century, Macedonia conquered the Greek city-states and went on under Alexander the Great to conquer Persia
  - Philip of Macedon combined cavalry with the Greek phalanx to create a military juggernaut
  - Alexander brought with him a staff of scholars to study and report on the lands they traversed
    - Led to the cross-fertilization of Greek, Babylonian, Persian, Egyptian, and Indian knowledge
      - Two eventual outcomes were the Library of Alexandria and the Indian development of the concept of the zero
      - Alexander and his successors encouraged Greek settlement of Southwest Asia and Egypt

# The Carolingians & Feudalism

- As a result of the battle of Tours (732), Charles Martel decided that he needed a significant cavalry force
  - This led to the development of feudalism as a means of supporting and equipping a professional cavalry force
- With mounted cavalry, the Franks under Charlemagne were able to combat the Muslims in Provence and conquer much of present day Germany, creating the Carolingian Empire
  - With the destrier and chain mail/body armor, the armored knight came into his own



# Medieval Knight



# Impact of the Horse Collar

- Another invention that revolutionized Medieval Europe was the horse collar and breast strap
  - These replaced the throat and girth harness which pressed against the horse's windpipe and jugular vein causing the horse to lose 80% of its efficiency
  - The horse collar rested on the horse's shoulders and the breast strap, eliminating the earlier restriction on the horse's air and oxygen supply
- The horse collar enabled Europeans to replace oxen with horses
  - Peasants now could plow land much faster with much less effort and time
  - Merchants, traders, and peasants could also use the horse to pull 4-wheel wagons with heavy loads

# The Mongol Empire - 1

- The Mongol armies consisted of light and heavy cavalry
  - The light cavalry was equipped with bows-and-arrows, sword or battle axe, javelins, and a leather-covered wicker shield
  - The heavy cavalry wore iron helmets, leather body armor with rings or scales of iron and carried a shield, bows-and-arrows, scimitar, and lance
  - During battle, a screen of light cavalry unleashed a volley of arrows, moving to the rear to allow the heavy cavalry to advance in a massed charge

# The Mongol Empire - 2

- The Mongols conquered Russia, invaded the Middle East and sacked Baghdad, reached as far as Breslau and Budapest in Europe, and conquered China
  - The peace and order introduced by the Mongols fostered trade along the Silk Road
- The Mongols introduced several Chinese technological innovations to Europe
  - Paper currency
  - Block printing technology
  - Gunpowder
  - Cast iron/steel

# The Mongol Empire - 3

- Two unintended consequences of the Mongol conquests eventually undid the Mongol Empire
  - Mongol horsemen brought back the bubonic plague from Burma and Yunan which decimated the populations of the steppes, Europe, the Middle East, and China
  - The gunpowder which the Mongols brought to Europe led to the development of firearms which could overwhelm the nomad archers of the steppes

# Firearms and the Horse

- The invention of firearms made the knight obsolete since bullets could penetrate the knight's armor
- Despite the coming of firearms, warrior elites on horseback with their stress on individual hand-to-hand combat resisted acceptance of the longbow and gun since it threatened their elite status
  - Thus cavalry charges persisted into the wars of the 19<sup>th</sup> century and even into World War I

# Firearms and the Horse - 2

- Despite elite warrior resistance, the horse cavalry's role by the 19<sup>th</sup> century became that of:
  - scouting,
  - screening of infantry movements,
  - raiding enemy supply lines,
  - transport of supplies and soldiers to the battlefield,
  - transport of artillery pieces, and f
  - foraging
- Battles of cavalry units, such as the Civil War battle of Brandy Station, were between men on horseback armed with rifles and pistols.

# Firearms and the Horse - 3

- Paradoxically, the large conscript armies of the 20<sup>th</sup> century required large numbers of horses simply to meet the massive logistical demands for supplies and ammunition.
  - In World War I, every army depended on horses to move supplies from railheads to the front
  - In World War II, the German and the Russian armies both relied on horses for their logistics



# Firearms and the Horse - 4

- In the 21<sup>st</sup> century, the horse still has had a role in war
  - In the Sudan, the Arab Janjaweed fighters use horses in their wars in Darfur, western Sudan, and Eastern Chad
  - In Afghanistan, U.S. Special Operations Command (SOCOM) used horses in the northern mountains of Afghanistan

# The Horse Cultures of the Plains Indians - 1

- The horse played a major role in the Spanish conquest of the Aztec and Inca empires
- With the discovery of the silver mines at Zacatecas, Spanish rule and horses spread to north central Mexico
- By the early 1600s, Spanish rule and horses had spread to the Pueblo settlements of the American Southwest.
  - In 1680, the Pueblos revolted
    - Led to the escape of thousands of Spanish horses

# The Horse Cultures of the Plains Indians - 2

- Before the horse, the North American prairie had few human inhabitants
  - The tough sod without a steel plow discouraged farming
  - The buffalo and other plains animals were too fast to provide a dependable food source
- The horse's speed and mobility enabled hunters to single out a specific animal and kill it at close range with a bow-and-arrow
  - The Comanches of Texas were the first to use the horse to hunt buffalo.

# The Horse Cultures of the Plains Indians - 3

- The horse impacted the Amerindians in ways other than that of hunting buffalo
  - Made travel across the Plains easier
  - Led many tribes to relocate to the Great Plains
  - As buffalo-hunting tribes increased in number and size, intertribal wars became common
    - In the Southwest, the Comanche won out over their Apache rivals, forcing them westward where they amalgamated with the Pueblo to become the Navaho

# The Horse Cultures of the Plains Indians - 4

- The horse and the warrior culture that it engendered enabled the Plains Indians to resist Euro-American settlement of the Great Plains
  - The result was a series of Indian wars that lasted through much of the 19<sup>th</sup> century
  - These wars ended only when the Amerindian food base – the buffalo – was destroyed

# If the Horse Had Never Been Domesticated

- The impact of the horse can be illustrated by comparing the Old World which had the horse to the New World which didn't
  - In the Old World, agriculture, metallurgy, and alluvial civilizations all preceded horse domestication. All of these also arose in the New World
  - With the horse, the Old World saw the emergence of the nomad horse cultures of the steppes. Without the horse, the prairies remained undeveloped and largely uninhabited.

# If the Horse Had Never Been Domesticated - 2

- Horses by their load carrying capability and speed
  - Promoted trade in commodities and products that could not be easily carried by human porter or llamas
    - After their equestrian conquests, both Persian and Chinese rulers embarked on extensive road and canal construction to promote trade. There was no such construction in the Americas
    - The Silk Road, especially under the Mongols, promoted extensive trade between China, the Middle East, and Europe. There was no equivalent Silk Road in the Americas, only intermittent sea contacts between MesoAmerica and South America
  - Fostered the dissemination of ideas and inventions to a much greater degree than existed in the Americas

# If the Horse Had Never Been Domesticated - 3

- In the Old World, trade and idea dissemination promoted the growth of metallurgy. In the New World, metallurgical advances around the Great Lakes did not reach MesoAmerica or the Inca domains
- In the Old World, the horse enhanced military capabilities, fostered technological innovation, and permitted the creation of empires. In the New World, empires were limited by logistic inadequacies and Aztec-Incan armies were technologically inferior to their Spanish enemies



# If the Horse Had Never Been Domesticated - 4

- Without the horse:
  - Old World civilizations would have remained isolated in their alluvial valleys
  - The Central Asian steppe would have remain undeveloped and largely uninhabited
  - The empires of Persia, Alexander, Rome, and Genghis Khan would never have been created
  - The great inventions of steel, paper, printing, gunpowder, and the zero might well have never been diffused across Eurasia

# Muybridge Horse Photographs

