

**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
  - But among the most potent and far-reaching are the development of new modes of communication and transportation
  - Innovations in transportation technologies and networks have made travel and the movement of goods faster, cheaper, and/or less onerous
  - As a result, they have had a great impact on history. They have produced cultural, economic, social, political, and military revolutions
- This is what we discuss in the class

# What the Course Will Cover

- Course will focus on the following:
  - Domesticated Horse & Camel
  - Ocean-going sailing ship & steam-powered ship
  - Balloon & Dirigible
  - Railroad
  - Bicycle
  - 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 -2

- 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
- Regardless of the physical environment, they generally had plenty to eat
  - Food supplies were abundant because food gatherers had 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

- Food was shared, with the men hunting game or fishing and the women gathering fruits, seeds, nuts, berries, edible roots, and eggs
- Hunter-gatherers had no effective way of storing meat or food for later use
- Hunter-gatherers had to roam in search of food
  - Thus, personal possessions beyond a bare minimum was a burden
  - Necessary tools and implements were collectively owned and freely shared



# Hunter-Gatherers - 3

- Hunter-gathering life requires fairly low population densities
  - Population densities of hunter-gatherer societies are typically one person or less per sq mile
  - Normally, hunter-gatherers live in small groups of 25-50 related persons
  - Populations were limited by infanticide and by mothers breast-feeding children for at least two years
    - Children normally spaced at 4-yr or greater intervals

# Hunter-Gatherers - 4

- 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
      - From East Asia to Polynesia
  - Become farmers and/or herders

# Hunter-Gatherers - 2

- The discovery by Europeans of hunter-gatherer bands had some very interesting intellectual consequences
  - Led to the creation of the concept of the ‘noble savage’ living in an unspoiled Eden and unaffected by the vices of civilization
  - Led to the concept that private property was the root of all evil – e.g. Jean Jacques Rousseau
  - Led to the concept of “primitive communism” – an era devoid of class struggle and exploitation of man by man – e.g. Karl Marx & Friedrich Engels

# Domestication of Plants

- Domestication of plants led to grain surpluses. This led to:
  - The resultant creation of so-called “tributary” societies
    - Based upon elite expropriation via taxes and rents of the societal surplus
  - The rise of distinct social classes
  - The development of institutions and techniques for grain storage and inventorying
    - Pottery
    - Writing & numbering

# A Note on Animals

- Animals fall into three categories as far as human use is concerned
  - Food animals – animals which are eaten
  - By-product animals – animals whose skin, fleece, fur, or bones are used to produce clothes, footwear, tools, or other implements
  - Transport animals – animal which 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

# Consequences of Plant & Animal Domestication

- Domestication of plants and animals 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

# 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
  2. Slow maturation rate – some animals take too long to grow to adult size
  3. Resistance to captive breeding
  4. Too Nasty – prone to attack humans
  5. Tendency to panic when put in an enclosure



# 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
      - Have an established hierarchy
      - Live in overlapping home ranges rather than mutually exclusive territories

# Food Animals

- The domestication of food animals (who often shared living quarters with their owners):
  - Created a class of nomadic shepherds who raised mobile herds of such animals
  - 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

# Implications

- Only a few potential food, by-product, and transport animals were ever domesticated
  - Except for the llama, these animals existed only in Eurasia and North Africa
- Many large animals were never domesticated
- Both of the above factors were to have immense historical consequences

# Domestication of the Horse

- The horse was first domesticated c4000 BC in the area 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
  - They soon learned 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 - 1

- 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 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
- Wild horses normally form family groups of one stallion, 1 to 6 mares, and their young

# Notes About the Horse -3

- 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 -4

- 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 - 5

- 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 the Horse -3

- 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

# Amerindian Travois



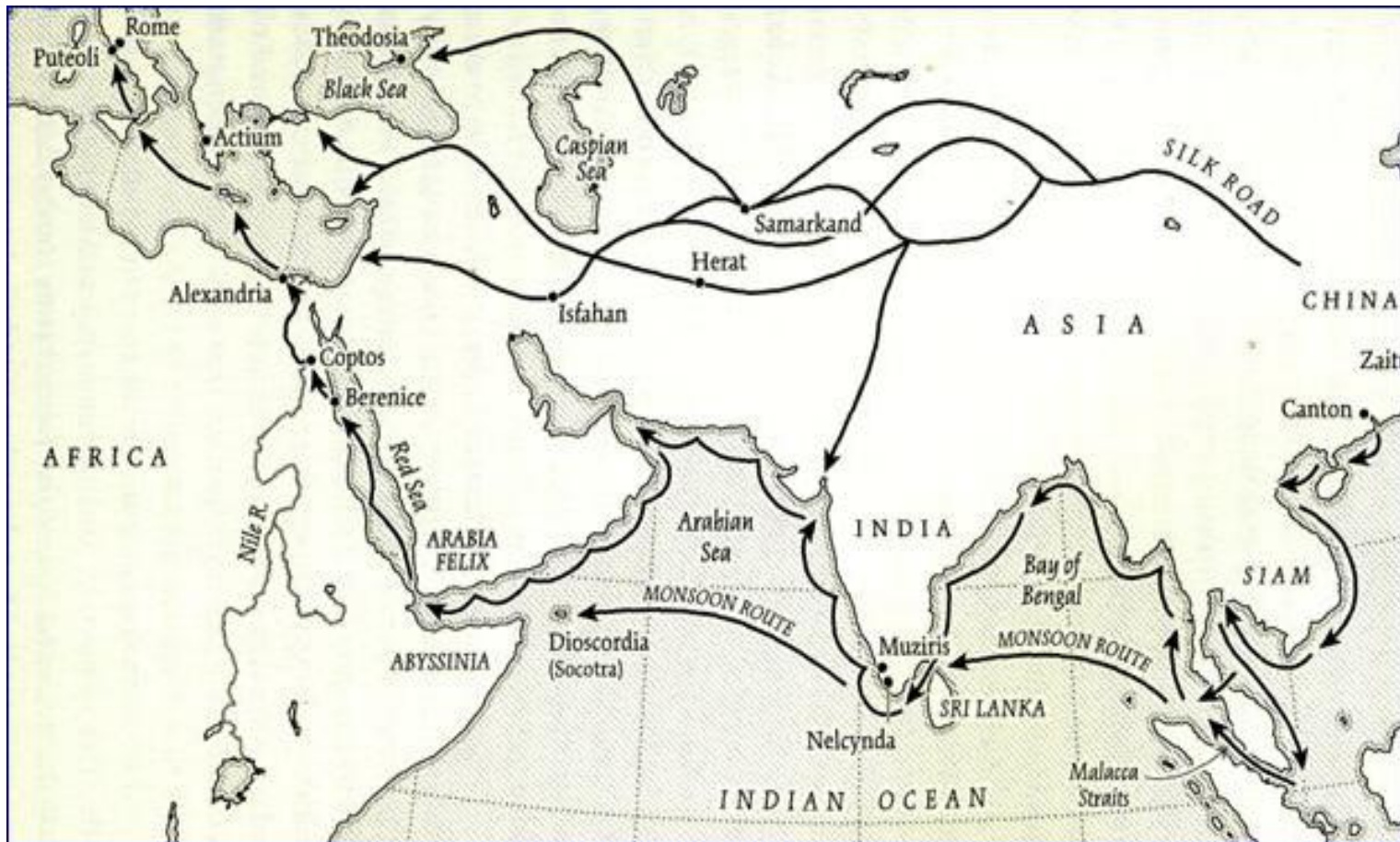
# Notes About the Horse - 4

- 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
- Horses produce a lot of manure
- 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
  - Led to the development of the stick and later the moldboard plow
  - Facilitated the long-distance movement of people and cargo

# The Silk Road



# Effects of the Horse - 2

- The speed and power of the horse:
  - Along with related innovations revolutionized warfare
  - Led to innovations designed to neutralize the horse-related innovations on the battlefield
  - The result was an arms technology race in which a new innovation on offense led to innovations designed to counter the offense

# Effects of the Horse - 3

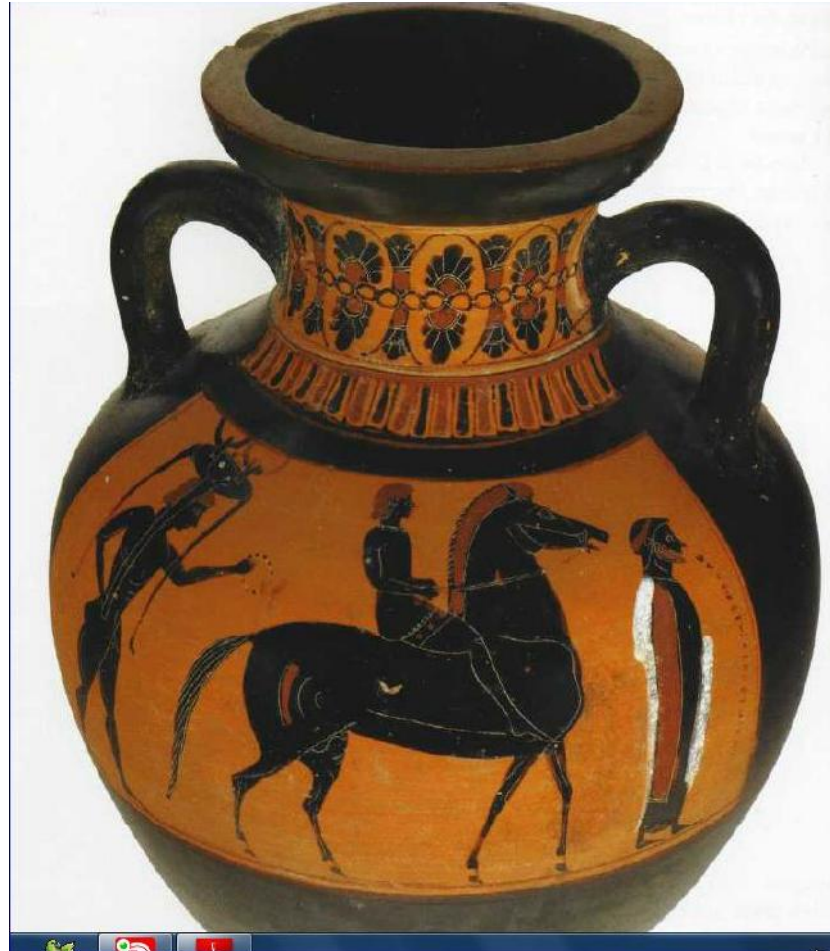
- The mobility of the horse
  - Allowed the Eurasian steppe nomads to raid, conquer (and trade with) the agricultural civilizations of Eurasia
  - Created the equestrian empires that led to
    - Thousands of miles of roads
    - Unitary language and writing systems
    - Standardized coinage, weights, and measures



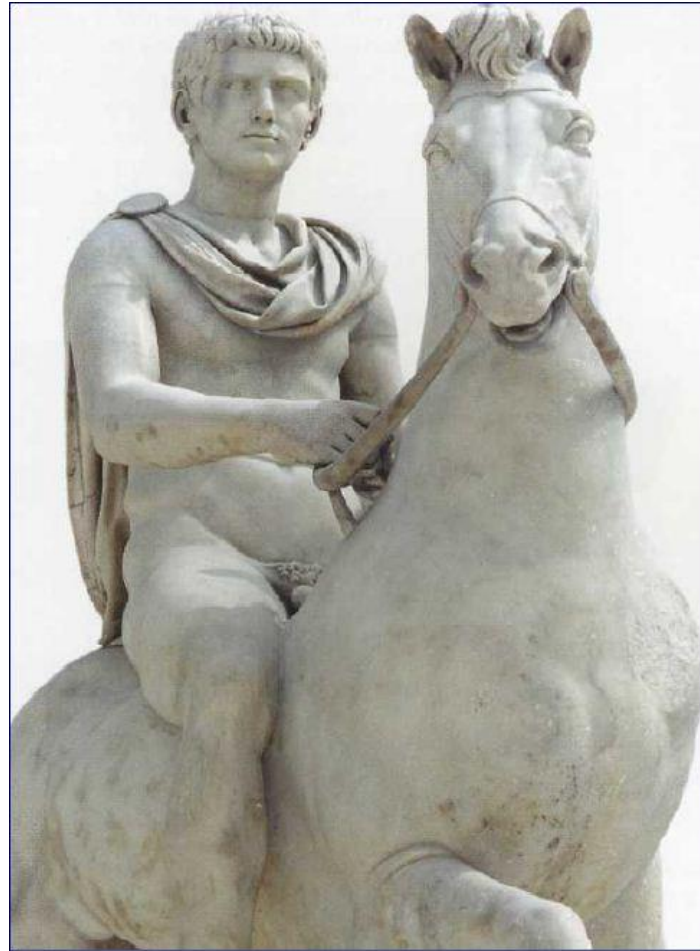
# Effects of the Horse - 4

- The beauty of the horse served to inspire many great works of art and memorialize military heroes
  - The 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

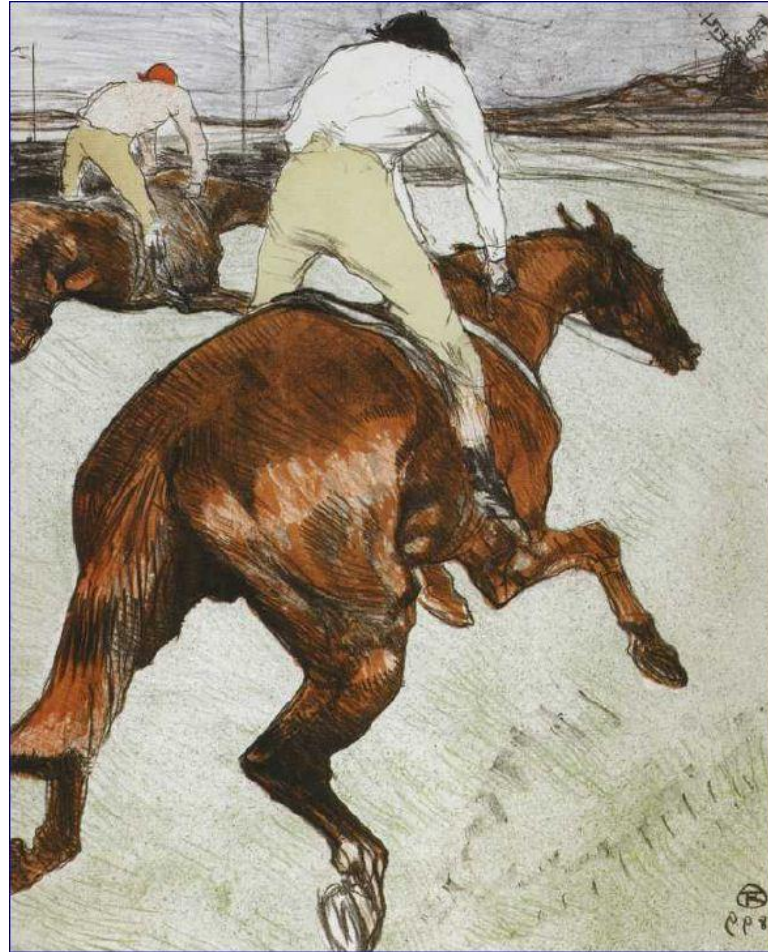


# Amerindian Buffalo Hide Painting





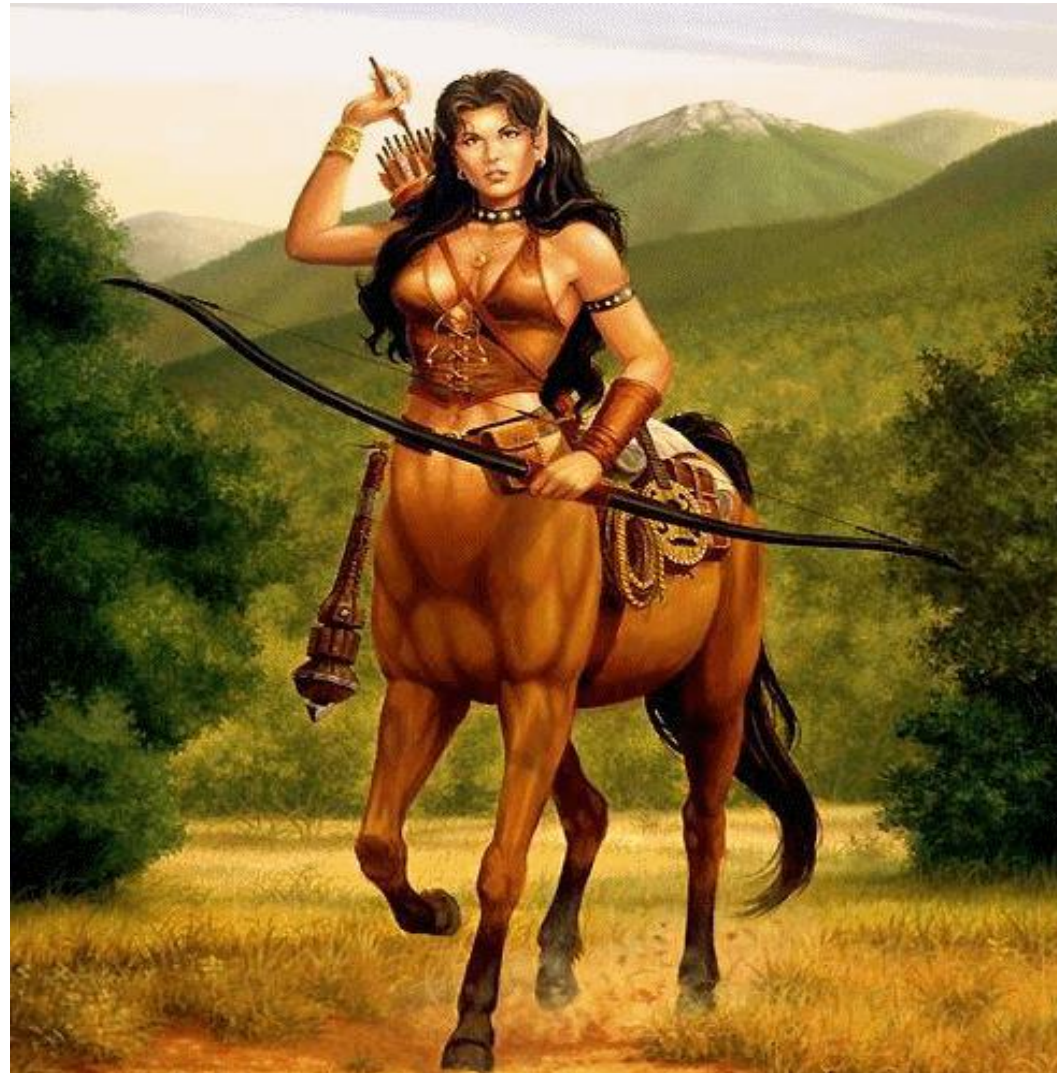
# Toulouse-Lautrec



# 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)
  - The Pegasus (flying horse)
  - The Unicorn
  - The Buddha and Kanthaka
  - Mohammed and Al Burak
  - The Four Horsemen of the Apocalypse

# Centaur





# Pegasus



# Unicorn



# Four Horsemen of the Apocalypse



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# Economic Effects of the Horse

- Owning horses required major land resources
  - Only relatively wealthy people could afford to own horses
- The Horse required a substantial infrastructure
  - Persons to train and care for the horse
  - Persons to make and maintain the equipment and facilities used by the horse

# Political Effects of the Horse

- When military power depended on owning horses and having specialized training, 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

# Socio-Cultural Effects of the Horse

- Gave rise to sports such as thoroughbred horse racing
- Gave rise to entertainment events such as horse shows
- 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

- Since horses like to eat, the steppe nomads had to move in a large area annual circuit to find pasture for their herds
- When climate 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 - 1

- Persian conquest of Southwest Asia
- Alexander's Conquest of Persia
- Second Punic War
- Qin conquest of China
- Fall of the Western Roman Empire
- Arab conquest of Southwest Asia, Central Asia, North Africa, and Spain

# Historically Significant Wars Involving the Horse - 2

- Carolingian conquest of Western Europe and the rise of Feudalism
- The Mongol Empire conquests
- The Era of Firearms
  - Spanish conquests of the Aztecs & Incas
  - The Indian Wars of the American West

# Creation of Persian 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

# 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

# Unification of China

- 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

# The Second Punic War

- Hannibal made use of cavalry to defeat Roman infantry in several major battles
  - Cannae was the most famous because of the tactics Hannibal used
- The Roman defeat of Hannibal's army at Zama was made possible by Numidian cavalry (now allied with Rome)



# The Fall of Rome

- The Fall of the Western Roman Empire was hastened by the migration from northeast Asia of the Huns
  - The Huns displaced other tribes in a cascading pattern
  - Arriving in Europe, the Huns attacked the Goths who fled into the Roman Empire
  - Eventually, the Huns crossed the Rhine and later invaded Italy

# The Avars

- In the 6<sup>th</sup> century, the Avars invaded Europe
  - They introduced the stirrup and a saddle with a reinforced back into Europe
  - These innovations allowed a rider to anchor himself to the horse with his feet, freeing his hands to both carry a shield and sword or lance.
  - The stirrup eventually led to the Medieval knight

# The Arab Conquests

- In 224, Parthian rule in Persia was replaced by Sasanian rule.
  - Led to a long series of wars between Rome-Byzantium and Persia
- After a long, mutually exhausting war, Arab invaders in 636 defeated the Byzantines and conquered Persia with the aid of the Arabian horse and the Arabian camel

# The Battle of Tours

- At Tours in 732, Frankish infantry defeated Arab cavalry
- As a result of the battle, 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

# The Carolingians & Feudalism

- The development of feudalism made possible the supporting and equipping of a professional cavalry force
- With mounted cavalry, Charlemagne was able to create the Carolingian empire
- Later, 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
- 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, sacked Baghdad, conquered China, and reached as far as Breslau and Budapest in Europe
  - 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
  - The gunpowder which the Mongols brought to Europe led to the development of firearms which could overwhelm Mongol archers

# 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 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's role by the 19<sup>th</sup> century became that of:
  - Scouting,
  - Screening infantry movements,
  - Raiding enemy supply lines,
  - Transporting supplies and soldiers to the battlefield
  - Transport of artillery pieces,
  - Removing wounded from the battlefield
  - 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 to meet the massive logistical demands
- 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

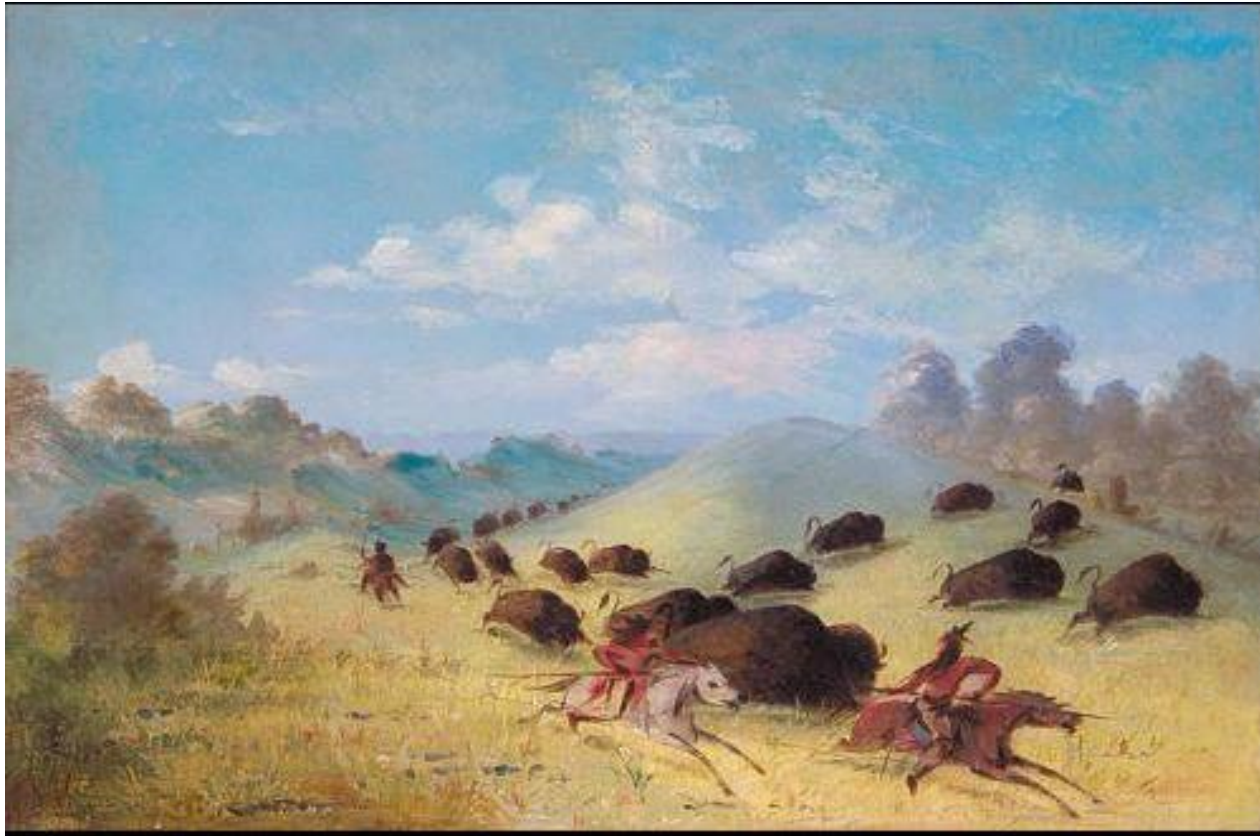
- The horse played a major role in the Spanish conquest of the Aztec and Inca empires
- By the early 1600s, Spanish rule and horses had spread to the Pueblo settlements of the American Southwest.
- In 1680, the Pueblos revolted
  - Led to the escape of thousands of Spanish horses

# 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
  - Buffalo were too fast to easily hunt
- The horse's speed 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.



# Comanche Indians Hunting 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 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
- 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
  - 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 promoted trade in commodities and products that could not be easily carried by human porters
  - Persian, Chinese, and Roman rulers embarked on road construction. There was no such construction in the Americas
  - The Silk Road, especially under the Mongols, promoted extensive trade across Eurasia, There was no equivalent Silk Road in the Americas
- Without horses, ideas and inventions would have spread much more slowly or not at all

# If the Horse Had Never Been Domesticated - 3

- In the Old World:
  - Trade and idea dissemination promoted the growth of metallurgy.
  - The horse permitted the creation of empires.
- In the New World:
  - Metallurgical advances around the Great Lakes did not reach the Aztec or Inca domains
  - Empires were limited by logistic inadequacies
- 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

