How The Compass Affected World History

The compass changed human history. With such tools as a compass, travelers could go around the world, exploring places that were unknown to their cultures. Before the invention of the compass, there was no way to determine your location in the open ocean, making the oceans black voids on the crude inconsistent maps of the time. The seas were man’s trade and communication routes, but the only lanes open were the ones that followed landmarks. While many people think they intuitively have a sense of direction, it is only their ability to notice and remember landmarks that helps people stay oriented. Going around an ocean following the land was an extremely slow and limiting way to travel.

Trade was important in history because it provided a mutual reason to communicate. Tea from India, glass from Venice, and olive oil from Greece were all cheap at home but priceless abroad. The further you could transport goods, the more they were worth. With commerce as a capitalist driving force, sailors connected the world. But before the 12th century, trade and communication were slow and erratic.

The compass changed this trade and communication network so quickly that it isn’t even certain whether the Chinese or Europeans made the first compasses. Word spread so quickly using this new tool, that we aren’t even sure who invented it. The compass provided all-weather orientation for travelers; this easily cut many travel times in half, and opened other trade routes that were formerly un navigable.

There are actually three primary developments that opened the wide-open seas to our use: the compass, systematic map making, and the chronometer (a good clock). A limitation of the compass was that it could just help you find Magnetic North. Systematic map making made it more practical for captains to share their notes and learn from each other. It was routine for sailors to use the altitude of the mid-day sun to find their latitude on clear days, but they couldn’t determine their longitude until the development of the chronometer. They would take a series of mid-day sitings of the sun to locate its zenith over their current position. If they knew the exact time of day relative to Greenwich England, they could use the time of the zenith to determine their longitude. With the ability to determine latitude and longitude, sailors could now cross the oceans.

Timeline

**Pre-compass navigation:** Most sailors just use landmarks to navigate. At night and in clouds, sailors pulled ashore and waited. The Vikings and other pre-compass navigators used the sun and stars to orient themselves at sea. The sun rose in the East, set in the West, and told them how close to the equator they were by the sun’s mid-day angle (adjusted for seasons). If conditions became cloudy, they pulled in their sails and drifted downwind rather than risk sailing the wrong way. Few sailors used these bold and risky techniques to cross wide-open spans of water though.

**12th century AD:** The first known compass is made with Lodestone. Lodestone is also called magnetite (Fe₃O₄) which is a black magnetized iron ore. Chinese and European mariners
floated the lodestone on wood in a large container of water. The Arab sailors suspended the lodestone from a string. Eventually the lodestone was used to magnetize a needle that was floated on a small piece of wood in a small container of water. Thus, compasses were easier to make and became more common and cheaper to own.

13th century AD: modern map making techniques evolve in Western Europe, developing both land maps and nautical charts, some of which are still in existence today. The techniques caught on, and this system spread around the coasts of the connected "old world."

16th century: the first globe is produced, using 360 degrees of longitude marked on the equator. Magellan circumnavigates the globe in 1521, but few people dared cross the oceans because maps were so crude.

Late 17th century: astronomers and map makers develop the concept of longitude, and now have a reproducible system for entering map data anywhere on Earth. With the new lat/long mapping system, exploration increased dramatically. But without the fourth dimension of time, explorers still can't cross oceans with confidence.

18th century: A reliable chronometer is invented by John Harrison. The major sea powers dedicate resources to mapping the world’s coastlines. They wanted them to develop commerce, and to expand military influence. Many resulting land claims of the sea powers of the day are still honored.

19th Century: David Brunton develops the first “pocket transit” by balancing a magnetized needle on a jewel. He suspended the needle in a fluid to keep it from swinging back and forth as much. His pocket transit is so successful, it is still used by some professional surveyors for specific applications.

20th century: Much of the Third World is still relying on 100 year old charts made by sailing vessels, or on horseback. The military continues to map strategic priorities, and some countries like Kenya make owning topographic maps illegal, because they consider them to be important military tools. First World nations map their own terrain, on foot during the first half of the century, and by airborne stereographic photos during the latter half of the century. During the end of this century, the satellite-based Global Positioning System (GPS) is developed by the US military and is eventually released to the public, offering inexpensive precision to global navigators.

21st century: 21st century: On the eve of the 21st century NASA mapped most of the planet to a higher resolution than anyone has ever seen with the STS-99 Shuttle Radar Topography Mission. They used stereographic radar to map 47.6 million square miles at the rate of 40,000 square miles per minute. The project took about nine days. Learn more at: http://spacelink.nasa.gov/NASA.Projects/Earth.Science/Land/Shuttle.Radar.Topography.Mission/
The December 1999 spaceflight of STS-99 was eager to get up and down well before New Years Eve, because of Y2K compliance problems. But as the space shuttle landed, John Harrison’s clocks of the 1700’s still ticked away in a British maritime museum.

Research these topics:
1) Magnetize a pin or needle by stroking it with a common refrigerator magnet. Build an Arabian string-suspended compass. Research how much a boat could sway without hindering your ability to find North.
2) Magnetize a pin or needle by stroking it with a common refrigerator magnet, and build a Chinese-style compass by floating it in water. You can just stick it through a piece of styrofoam to get it to float. Suspend your bowl of water from three strings to put it in gimbals so it will work in your favorite sailing vessel.
3) Read the small book “Longitude” and explain why the chronometer was so important to the development of navigation across open oceans.
4) Research NASA’s Shuttle Radar Topography Mission. Report to the class on how they did it and why they needed such a long arm to get high resolution.

Resources:
1) “Longitude” by Dava Sobel, Penguin, 1995, is an excellent synopsis of the development of the chronometer. The book is as much about politics and psychology as it is about scientific invention, and it thoroughly explains why a good clock was essential to determining longitude.