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Poor Dad's **STUDY NOTES**

(I.) Applied Earth-Geometry: A SHORT HISTORY OF GPS *

* (Using The Concept of Compu-Think =
Computer-like modes or ways of human Thinking)

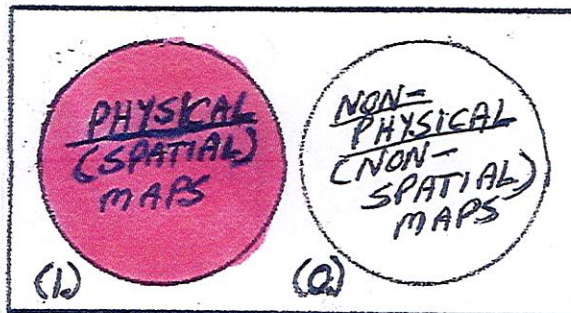
(A.) RELATED BACKGROUND

(1.) It all starts with cart/o/graph/y = "the process of" (-y)
"writing" (graph) "maps" (cart)

(a.) The two main types of "maps" - - shown via
"Compu-Think," using a series of Venn Diagrams:

Figure 1.

**TYPES OF
"MAPS"**



>>Robowatch is an international human rights advocacy group whose chief purpose is to keep a watchful eye on the continuing development and evolution of high-level computers and advanced artificial intelligence as found within certain robots. This organization does not advocate the complete abolition of computers and robots. Rather, it seeks to act as a watchdog and early warning system for those aspects of artificial intelligence that may have damaging effects upon Psyche (the natural mind) and Soma (the natural body) of Man.

[CRITICAL THINKING: Describe two ways in which Figure 1 demonstrates Compu-Think; i.e., computer-like ways of human thinking.]

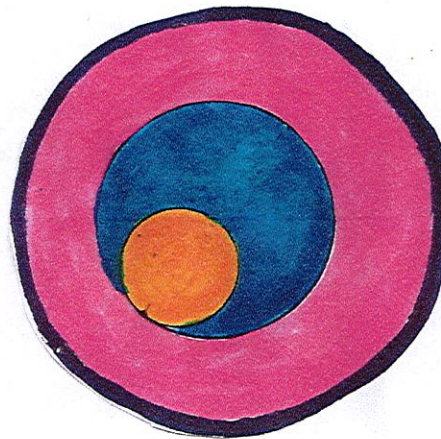
(b.) Two broad types of spatial maps:

(1.) Geo/graph/ic = "pertaining to" (-ic) "Earth" (geo) "writings" (graph); also known as Glob/al = "referring to" (-al) a "globe" (glob) - - the entire ball-or-globe-shaped planet, Earth.

(2.) Cosm/o/log/ical = "pertaining to" (-ical) "study of" (log) the entire "Universe" (cosm)

Figure 2.

TWO
BROAD TYPES
OF
SPATIAL MAPS



[CRITICAL THINKING: What color is used in the above, Figure 2, Venn Diagram for Cosmological Maps? Why do we see three circles, with each of the two bigger circles surrounding a smaller circle?] What color is used for the Geographic or Global Maps?]

(c.) Specific types of smaller, subdivided, spatial Earth-Maps:

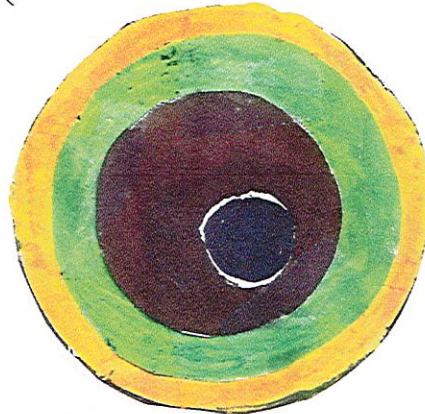
(1.) Sub/geo/graph/ic maps = "referring to" (-ic) something "below" (**sub-**) entire "Earth" (**geo**) "writings" (**graph**); also known as Sub/glob/al maps = "relating to" (-al) something "below" (**sub-**) the entire "globe" (**glob**) of Earth.

(a.) Region/al maps = "pertain to" (-al) particular "regions" (**region**) of the Earth or Globe

(b.) Top/o/graph/ic maps = "refer to" (-ic) "writing" (**graph**) at the "top, summit, or crown" (**top**) of something (such as the surface of the Earth).

Figure 3.

SOME SPECIFIC
TYPES OF
SPATIAL MAPS



[**CRITICAL THINKING:** What Broad Type of Spatial Map does the biggest circle (in Figure 3, above) represent? What Specific Type of Spatial Map does the green circle, represent? Why does the green circle lie completely within the biggest circle? The brown circle inside of the green circle, makes up the _____? _____ Type of Spatial Map. What Specific Map level does the black circle, represent? Explain the reason why it lies completely within the brown circle.]

**(B.) THE GEOSPATIAL REVOLUTION:
Satellites Now Dance Around
The Earth! . . . or, "How in
Heaven, did we ever GET here?"**

(1.) The New Revolution is Geo/Spat/ial = "pertaining to" (-ial) "Earth" (Geo) and (Outer) "Space" (Spat)

[CRITICAL THINKING: Modern Computer Science is largely built upon collections of digits arranged into bin/ary - - literally, "referring to" (-ary) "two" (bin) - - numbers arranged into pairs. These digits generally represent opposite states of either, (1) [Electrical] Current "On," or, (0) [Electrical] Current "Off;" that is, "NOT On."

Now, let us apply this electrical circuit concept, to a different situation, and ask two Probing Questions: (a.) "If we arbitrarily assign Earth (Geo) the number, 1, then to what will we assign the number, 0?" (b.) Write a literal translation of what this number, 0, exactly means - - in words - - in this case.]

(a.) Major Parts of the Geospatial Revolution

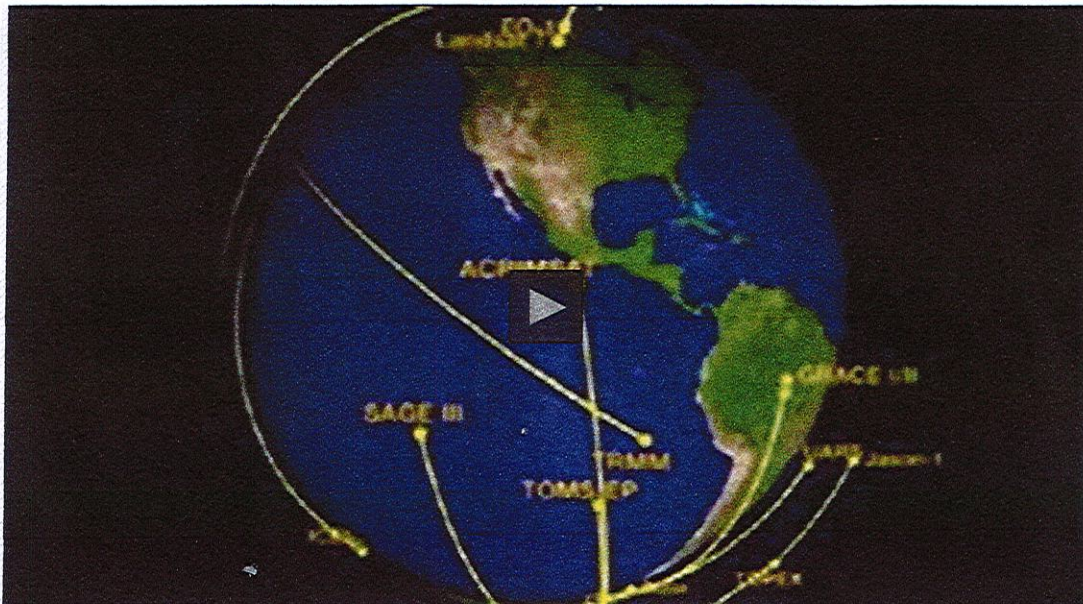
(1.) GPS - - The Global Positioning System

- - is a **Worldwide Navigation System** of 24 satellites, that have been placed into orbit by the U.S. Department of Defense. Figure 4, below, shows not the 24 GPS satellites, but, rather, the, "Satellites Orbiting Earth."

In particular, this is an animated diagram that has been adapted from NASA (National Aeronautics and Space Administration). It shows - - very beautifully - - and accompanied by music, a great visualization of what the orbiting satellites in the **Earth Observing System** are doing. It has been beautifully produced by Penn State University scientists, and PBS LearningMedia. (Please look this video up on their website:

<http://www.pbslearningmedia.org/resource/ess05.sci.ess.elu.earthorbit/satellites-orbiting-earth/>)

Figure 4 :
SATELLITES ORBITING EARTH



(2.) **GIS - - The Geographic Information System**
- - is a system designed to capture, store, manipulate, and organize, many types of spatial and geographical data, such as the data being recorded by the Worldwide Network of 24 GPS satellites

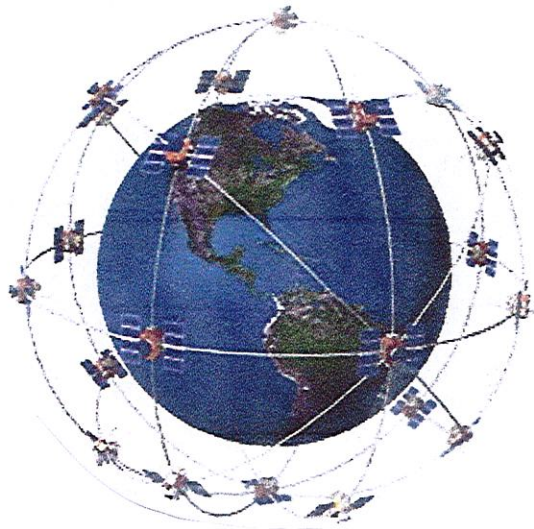
(b.) Exact Functions of the GPS

Figure 5 depicts the orbits of the 24 satellites in the **GPS Satellite System**.

Figure 5:

A MODEL OF THE GPS SATELLITE SYSTEM

(Source: <http://www8.garmin.com/aboutGPS/>)



"This constellation of satellites sends radio signals to a **GPS receiver**, that it can use to determine its position" ("Probing Question: What is the geospatial revolution?/Penn State Univ., 9/14/2010.) "GPS satellites circle the earth twice a day in a very precise orbit, and transmit signal information to earth. GPS receivers take this information and use trilateration to calculate the user's exact location."

Why Study GIS?, Penn State Public Broadcasting, and PBS LearningMedia, ask us. "Say, you're in California, and you want to know how susceptible your home is to a wildfire.

So, we put sensors (like our eyes) on satellites. We collect information, and then computers create maps. So, you want to analyze that map. You take the information about the slope [of your house's land plot], and ask, 'Are you on a dead-end street? Do you have a lot of fuel [dry vegetation] around your house?' You put all of that information into a computer, and it can tell you at how much risk you are, of losing your home to a wildfire."

(2.) A Brief History of GPS

Wikipedia, *Global Positioning System*, explains that, "GPS..., also known as **Navstar**, is a global navigation satellite system (GNSS) that provides location and time information in all weather conditions, anywhere on or near the Earth, where there is an unobstructed line of sight to four or more GPS satellites. The GPS system provides critical positioning capabilities to military, civil, and commercial users around the world."

The article, **GPS inventor inducted into hall of fame** (<http://news.stanford.edu/news/2004/february18/parkinson-218.html>), explains that, "Using the satellites as reference points, GPS receivers calculate positions based on the difference in arrival time of signals from the different satellites."

The United States Government created the GPS system in 1973, to overcome the limitations of previous navigation systems. The U.S. Department of Defense (DoD) developed the system, which originally used 24 satellites.

"Although GPS was initially developed for the U.S. military to guide missiles to targets, it is now routinely used for air traffic control systems, ships, trucks and cars ... "

Historical predecessors of GPS. "The design of GPS is based partly on similar **ground-based radio-navigation systems**, such as **LORAN** and the **Decca Navigator**, developed in the early 1940's and used by the British Royal Navy during World War II."

Source: *Wikipedia*

Radio navigation - - "the application of radio frequencies to determine a position of an object on the earth."

LORAN - - ". . . short for **long range navigation**, was a hyperbolic radio navigation system developed in the United States during World War II. ... It was first used for ship convoys crossing the Atlantic Ocean, and then by long-range patrol aircraft, but found its main use on the ships and aircraft operating in the Pacific theatre.

LORAN, in its original form, was an expensive system to implement, requiring a **cathode ray tube (CRT)** display. This limited use to the military and large commercial users. Use was never widespread, and by the time new receivers were available in the 1950's, the same improved electronics led to new systems with higher accuracy."

[CRITICAL THINKING: Draw a crude rectangle. Start a Venn Diagram by sketching two circles. 1st, draw a large circle within the rectangle. 2nd, draw a smaller circle, so that it lies completely inside of the larger circle.

Now, which of these two circles represents radio navigation? Which of the two circles symbolizes LORAN? Finally, draw a third circle, which represents the subject matter of GPS. So, *how* should you draw it? Should this third circle intersect with either one of the other two circles? - -*Why, or Why NOT?*]
