

Video: In Search of the Edge: The World is Flat

Teacher Notes: (See the “Flat Earth” lesson for suggestions for using this video effectively in context)

A. Checklist of “Evidence” for a flat Earth:

EVIDENCE?	Seems OK	Not OK	Not Sure
1. Ptolemy said “Earth was flat and circular,” and he was right <i>Ptolemy knew the earth was a globe; in fact, even the “geocentric universe” attributed to him actually reflected his view of the spiritual universe, and not the astronomical universe. See <http://en.wikipedia.org/wiki/Ptolemy#Geographia></i>			
2. Tall buildings are <i>not</i> larger at the top than at the bottom (as you would expect if Earth was a sphere) <i>Size of globe is so large that such differences are trivial, even in large tall buildings.</i>			
3. Hull of ship disappears first because light rays bend down toward the Earth’s gravity <i>Bending is trivial in relatively short distance to horizon.</i>			
4. Flag 6 miles away on Old Bedford Canal still visible above the water instead of disappearing 16 feet below line of sight <i>Curvature in 6 miles is insufficient to obscure the flag. Have your school geometry teacher show you the calculations.</i>			
5. Photos of Earth taken from space appear curved due to the bending of light by Earth’s gravity <i>Bending is trivial in relatively short distances from near space.</i>			
6. Clouds move very slowly, not racing by as they would if Earth was spinning <i>Atmosphere is moving with Earth, and relative emptiness of space removes any opportunity for interface turbulence.</i>			
7. Continents have not moved to the equator by centrifugal force on a spinning Earth <i>Very slow convection currents associated with plate tectonics override any centrifugal effect.</i>			
8. Dirigible over England remained over spot in England (instead of New York moving to a position under it) <i>The atmosphere (and anything in it) is moving right along with the Earth; to reach other locations, much energy is needed to move ahead of that movement, or against it.</i>			
9. The Space – Non-Space / Time – Not Time idea (explaining how Moon and Sun can seem to go around us) <i>These are just nonsense phrases, having nothing to do with science.</i>			
10. Reflectivity and Non-Complementarity are well-known phenomena supporting Space – Non-Space <i>Again, nonsense terms (in this context), with no science legitimacy.</i>			
11. Andrea Barn’s note saying “I have been there... The debate finally comes to an end” <i>A note, especially with no observations, is not scientific evidence!</i>			
12.			

B. CORRECTIONS: For each item you marked “**Not OK**,” briefly describe what seems to be wrong with it. Do this on the back of this sheet, indicating its number and your critical comments. Be prepared to defend your analysis in class discussion. [See the comments above for each item of “evidence.”](#)

C. CONTRADICTIONS? If you notice any pairs of claims that seem to be inconsistent with each other (contradictory), point them out (on the back of this sheet).

Students should certainly see the internal contradiction between #3 or #5, and #4. Numbers 3 and 5 assert that Earth’s gravity bends light rays sufficient to cause those illusions, while #4 invokes no such mechanism. Another contradiction in the video was the demonstration at one point (by the “retired teacher,” George Tinkees) that the Sun moves in a circle above the flat Earth, and later, to explain sunsets and sunrises, he shows the flat Earth moving up and down relative to the Sun.

D. CLARIFICATIONS: What in the video would you like to know more about? Jot it down, and do an internet search for more information about it (or them). Be prepared to share what you find with the class.

Encourage students to Google Dr. **Leo Ferrari**. They will find that he is, indeed, a university professor... of philosophy (he is NOT a scientist of any kind). He was also one of the founders (and past president) of the **Flat Earth Society**! Ask students to find his credentials (publications of research) that qualifies him as a legitimate scientist. There are none. (Picture and bio at <http://www.lib.unb.ca/archives/ferrari/intro.html>).

Likewise, ask students to Google George Vanderkuur, Scientist. It appears that he is an effective and active Canadian high school physics teacher, with no indication of the Flat Earth leanings that the film seems to maintain. Ask students to explain what they think is the reason for that?

Ask Students to search for the terms used in #9 and #10, and share their findings and conclusions with the class.

E. CONCLUSIONS: Why do you think this video was shown to you? What have you learned from this experience? What do you conclude from seeing and discussing this video. Did your conclusions after seeing the video change after discussing it in class?

Hopefully, students will recognize that this is largely a spoof (parody) of a “pseudoscience,” with typical strategies for making an unsupported and discredited idea sound credible and convincing, e.g., the use of supposed “authorities,” technical-sounding words and phrases, mathematical “proofs,” and a mix of credible and questionable information. It also shows how such efforts play on popular misconceptions and lack of skepticism. By critically checking and assessing elements of the video, students will learn some of the skills and attitudes necessary for becoming a critical thinker, and maybe even a scientist.

For Deeper Probing:

Research these four people. Are they real people? Find out all you can about them.

Polar explorer Andrea Barns - Real person? Other info?

Zetetic theory founder Samuel Birley Rowbotham (a.k.a. Parallax) - Real person? Other info?

University professor Leo Ferrari - Real person? Other info?

Scientist George Vanderkuur - Real person? Other info?

Come up with your own evidence that the Earth is *round*. They should be simple enough for a child to understand and still be convincing. The proofs can be based on common experience, or they can entail a simple, inexpensive experiment that you must describe in sufficient detail to actually be carried out.

If the video addressed your evidence, explain why the video is mistaken. For example, if you say, “Look at a picture of the Earth taken from space. It looks round,” remember that Vanderkuur explained in the film that gravity bends light and makes straight things appear curved. You then need to explain the error in Vanderkuur’s argument.

For Honors Students:

The university professor, Leo Ferrari, claims that one cannot feel the Earth moving although the equatorial speed is 1000 miles/hour. He then says that a merry-go-round traveling at 10 miles/hour makes one dizzy.

Calculate the centripetal acceleration for the spinning Earth in m/s^2 and in "g"s (Earth gravities).

Calculate the centripetal acceleration for the merry-go-round in m/s^2 and in "g"s.

How much larger is the merry-go-round effect?

Even if Earth rotated much, much faster, you still would not get dizzy, but on the merry-go-round you do. What is the reason for this? (Think about your senses and psychology.)

Scientist George Vanderkuur claims that buildings are wider at the top than at the bottom because they are built using plumb bobs which point toward the center of the supposedly round Earth.

Research the dimensions of the tallest unit of the Sears Tower.

In theory, how much wider is the top than the bottom, in millimeters?

What percentage of the building width is this?

To what tolerances are real skyscrapers constructed? Cite your source of information.

How far is a horizontal light beam bent vertically after traveling 10 miles in the Earth's gravitational field?

If you were in the middle of the very calm Pacific Ocean perched atop the 16-foot tall mast of a ship, how distant is your horizon?

Source of the Video: <<http://www.bullfrogfilms.com/catalog/search.html>>

SUMMARY NOTES OF THE VIDEO

Andrea Barns, 63 years old, Dec. 31, 1961, snowmobile across Antarctica, looking for the edge of the Earth.

Shape of world: flat, saucer-shape, on a top-like mass, with barrier of ice around the edge.

1585 Marcella, (toy boat)

Eratosthenes:

Dr. Leo Ferrari – University Professor: Syene, sun overhead; 530 miles away to Alexandria, Sun 7.2 degrees off the vertical. Therefore, by triangulation, Sun must be 4000 miles high! Obvious!

Ptolemy: Earth flat, circular [not true]

1543, Copernicus: round Earth, circles Sun

Halley: Earth in concentric spheres

Marshal B. Gardner: Earth a hollow globe, with Sun in center

George Vanderkuur, Scientist (“one of many scientists” supporting a flat earth)

Using plumb bob to build tall buildings, opposite sides point to center of Earth would be further apart at top than at bottom.

Ships would sail downhill

Ships disappear, hull first, then mast: Dr. Ferrari explains this as light beams bending in strong gravity fields (ala Einstein).

Magellan circumnavigated the globe

George Tinkees, retired teacher, showing world as plate

Andrea Barns, 16th birthday, borrowed skis and attempted to cross Antarctica, failed

Sam Rowbotham (“Parallax”) – 1881: Earth not a globe; published in Zetetic Astronomy

Old Bedford Canal: 6 miles long straight stretch. If Earth round, object should appear 16 feet below eyeline, but could easily be seen above the water

Photo from space: light attracted by strong gravity fields, so light takes curved path, giving illusion of spherical Earth. Because of curving of light, straight things appear curved, and curved things appear straight.

People at equator moving at about 1000 mph. If so, clouds would seem to be whizzing by overhead!
Earth is also supposedly moving around Sun at 67K mph, and around galaxy about 600K mph.
But our hair isn't even mussed up!

Scientist: With continental drift, continents floating on fluid, should all congregate at equator due to centrifugal force of spinning globe. But they're not.
Sound is much slower, so if we shout to the East, person to East of us would never hear us.

1929 Andrea Barnes: Dirigible holds stable over England, and should be over New York in 4-5 hours with Earth moving under it, but it's still over same spot in England!

Retired Teacher: Earth (as saucer) goes up and down while Sun stays stationary, resulting in sunsets and sunrises.

Scientist: Space and non-space (like wet and dry as opposites)... obvious! Objects move through space (over our flat Earth), but when they come to non-space (not over Earth), they instantly return to opposite side (through path in non-space and in no time). In non-space, there is no time. This explains satellites, Moon, Sun, stars.

This involves "reflectivity" and "non-complementarity," "well-known phenomena." [????]

1938 Andrea makes second effort to cross Antarctica, but freak blizzard prevents it.

1961 Andrea takes snowmobile... and disappeared. In 1990, meteorologists came upon her camera and a note: "I have been there... The debate finally comes to an end." Meteorologist mistakenly opens camera, so any pics are exposed and lost. If we can believe the note, Andrea Barnes was the first person to see the edge of the Earth. [!]

"We shall not cease from exploration... And the end of all our exploring will be to arrive where we started, and know the place for the first time." T.S. Eliot

Scientist: "What you don't know, you eliminate" according to "Globularists." As flat-Earthers, "we don't know what's at the ends of the Earth, but the ends are there." [This would make for some interesting discussion!]