



Do Mountains Suffer From the Moon Illusion?

A full moon is shown rising over a mountain range, with its light reflecting on the water in the foreground. The scene is set against a dark, starry night sky. The mountains are silhouetted against the moon's glow.

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The Moon Illusion – What is it?

- Most people experience a “moon illusion” when they observe the moon close to the horizon. They may report that the moon is larger than when observed when the moon is directly overhead. Some may even report that the moon is closer or farther away, depending.
- One of the oldest psychological phenomena; going back to ancient China and Egypt. It might be the oldest scientific puzzle. There is no single accepted explanation for this phenomena.

The Moon Illusion



Exploring the “moon illusion”?

- Known things about this illusion:
 - Assumption that most people see the horizon moon larger than the zenith moon, some see the moon as closer other farther. Not everyone experiences the “moon illusion.”
 - Moon angular size is constant: .52 degrees
 - People perceive the angular size to be 1.5 to 2 times that amount when they experience the “moon illusion”
 - It is not a physical or atmospheric effect
 - Actually refraction would make the moon smaller
 - Probably not because of image size on retina
 - Not significant enough to make a difference

Theories on the “moon illusion”?

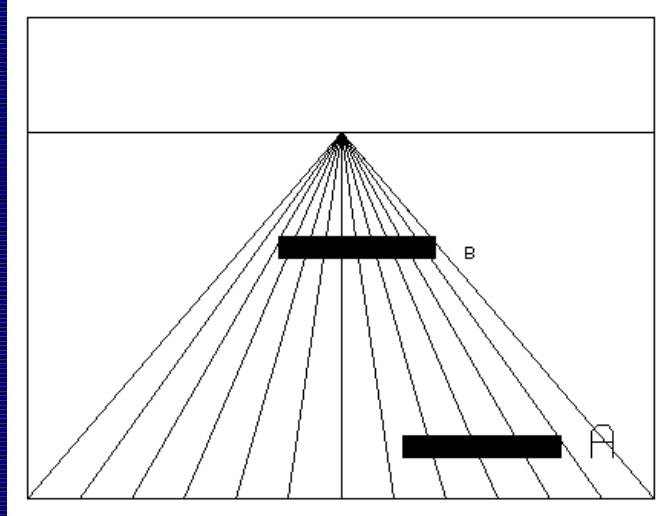
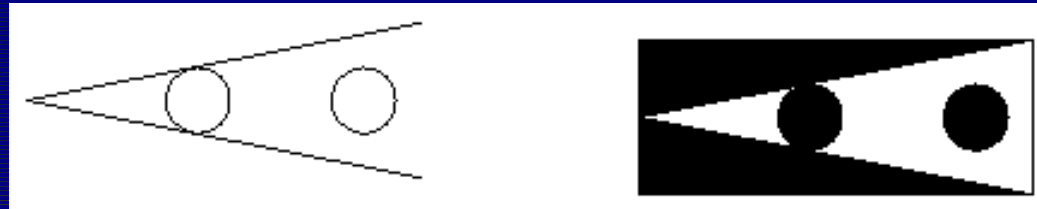
- There are three basic families of accepted theory:
 - Size and Shape Theory
 - Distance Cues: lines and textures
 - Oculomotor micropsia and macropsia
(eye movement compensation for focus)
 - Mental map
flat domed sky – inborn worldview
Genetic programming, etc

Shape and size consistency theory

- We adjust what we see, when we recognize it. We do it constantly...
 - For example, a doorway seen at an angle may be trapezoidal in shape, yet we interpret it to be a rectangle. (Shape consistency)
 - We may see a small car 50 feet away and a huge SUV 300 feet away, we know the SUV is larger, even though the image on our eye is smaller. (Size consistency)
 - So when we see a moon at the horizon, we see it as farther away, so our minds make it larger to compensate. (of course that might make it seem closer!)

Ponzo Illusion

- Visual distance cues play a definite role

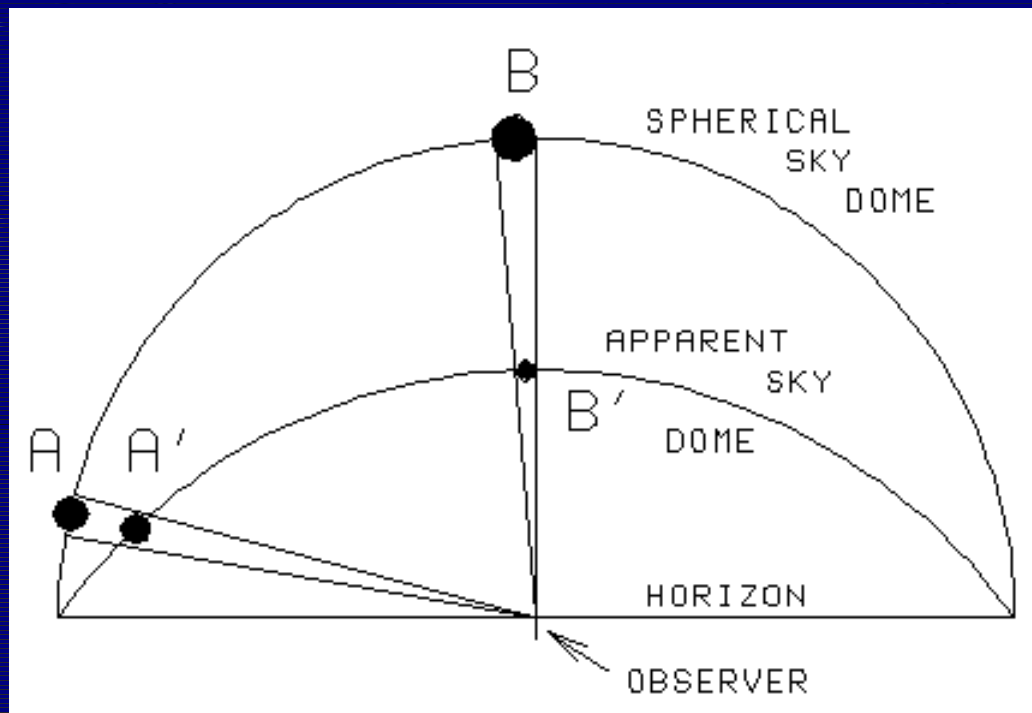


Oculomotor micropsia and macropsia

- Micropsia – focus on near item - makes things look smaller than really are
- Macropsia – focus on long distance item – makes things seem larger than they really are

Mental map visual illusion

- Mental sky model - Flattened sky-dome idea



What's the bottom line?

- The moon illusion, whatever the causes, is a real phenomena and something to consider.
- Most scientists agree that reason the moon looks bigger is purely in our minds. Based on the sensory information we receive, we manufacture that illusion.

What's this got to do with Mountain Cartography ?

- The Moon illusion Lives!!!!
- According to McCready, The Moon Illusion would apply to any promontory at a far distance, the Sun, Mountain Peaks, etc.
- Ours is a communication science – Should we alter our presentations to take these illusions into account?

The “moon illusion” tight rope

- Point:
 - Cartography is science; concerned with accurate measurement, abstraction and portrayal of the Earth. If we forsake these constructs, for artistic endeavors, where is truth? Our publics depend on us to produce reliable, accurate products.
- Counterpoint:
 - There are artistic and communicative considerations here. What good is a map, no matter how precise and factual, if no one can understand it? We have the need to make our products relevant to our customers. It is the presentation that’s important, after all.

What if we emulated the illusion?

- How?
- What's the formula, the technique, the method? Can it be replicated?
- What type of exaggeration program would be needed?
Rubber sheeting or circular warp?
Special camera lens?
- A million questions?

Some examples of the Technique

- Tom Patterson



Figure 7

(left) Looking directly into a panorama. (right) The profiled illustration shows how Berama tilted and curved the projection plane, depicted by line ABC.

To summarize Berama's technique (see Patterson's one for much more detailed illustrated description), one takes the nominally flat surface of the Earth:

Flat, Front Perspective View



Flat, View from Right Side



(Perspective Camera on full side of this terrain)

and place a smooth's surface in its
Curved, Front Perspective View



Curved, View from Right Side



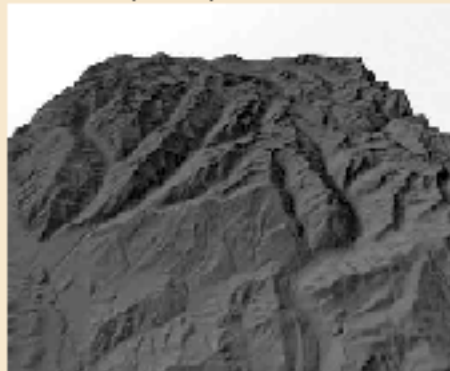
(Perspective Camera on full side of this terrain)

Another example of the technique

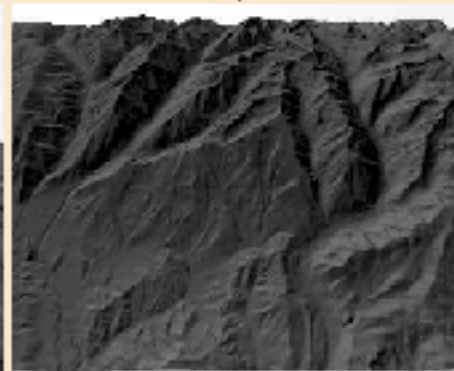
- Chris Hanson



Flat, Perspective View



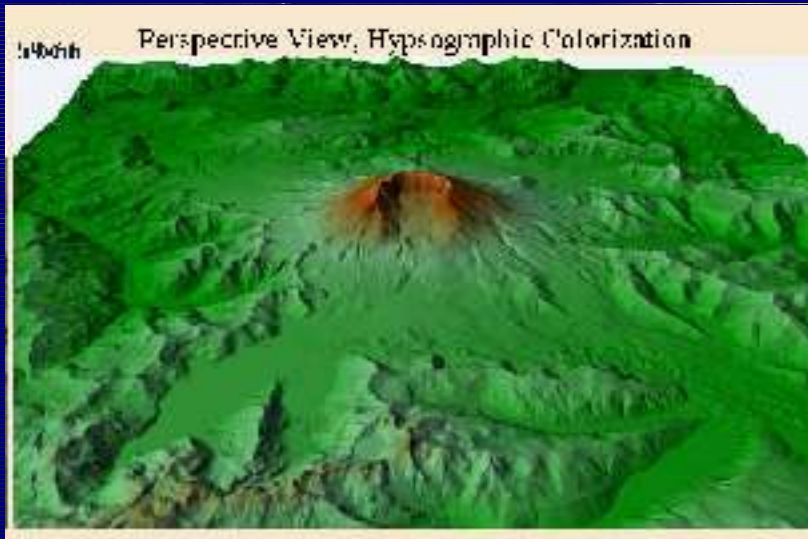
Curved, Perspective View



Conclusions: Tools are Needed



More tools are needed in GIS and Mapping systems to create the “moon illusion” easily, such as “selective exaggeration” and “warping”



A greater recognition of importance of perception, cognition and communication. Perhaps less on meeting rigid conservative rigors of traditional cartography.

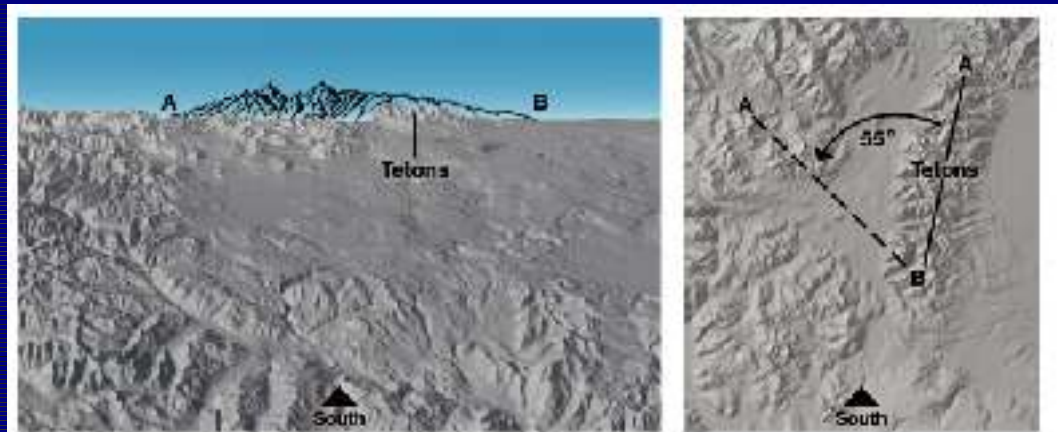


Figure 10

(left) A digital representation of Berann's Yellowstone panorama. In this south-oriented view, the north-south trending Teton Range appears insignificant. (right) The map shows how Berann rotated the Teton Range, shown by line AB, 55 degrees to present a more recognizable portrayal of the range on the panorama.

Conclusions

- The “moon illusion” exists: cartographers and panoramists must take this perception into account in products they create:
Like the great master Heinrich Berann.



Figure 1

(left) Heinrich Berann in his studio, Enns, Austria; (right) Berann's emblem: "The Peace."

Credits/Thanks

- Tom Patterson - Panorama Techniques/ideas
- Chris Hanson - Panorama Techniques
- Donald E Simanek - Moon Illusion
- D. McCready - Moon Illusion

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