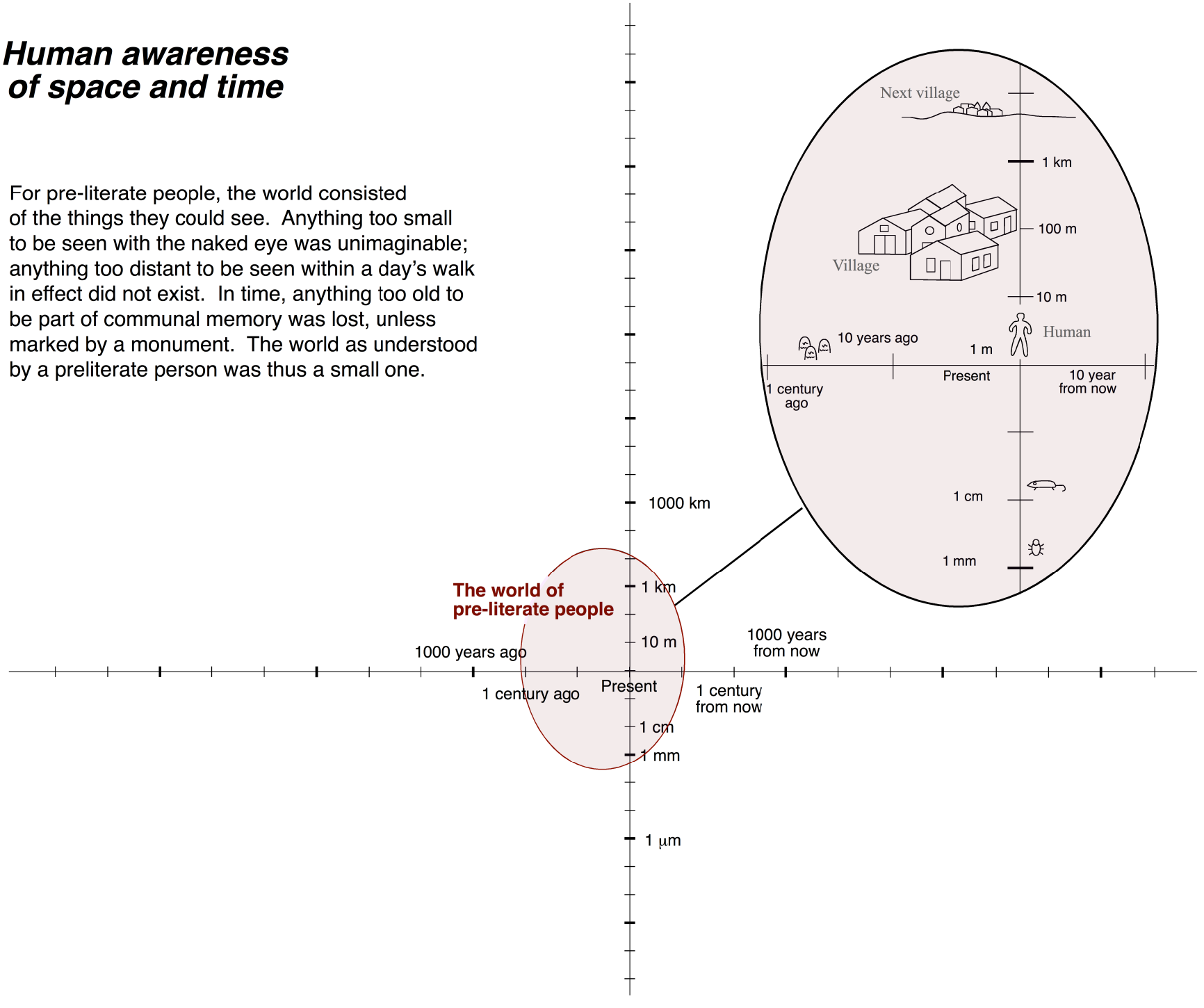
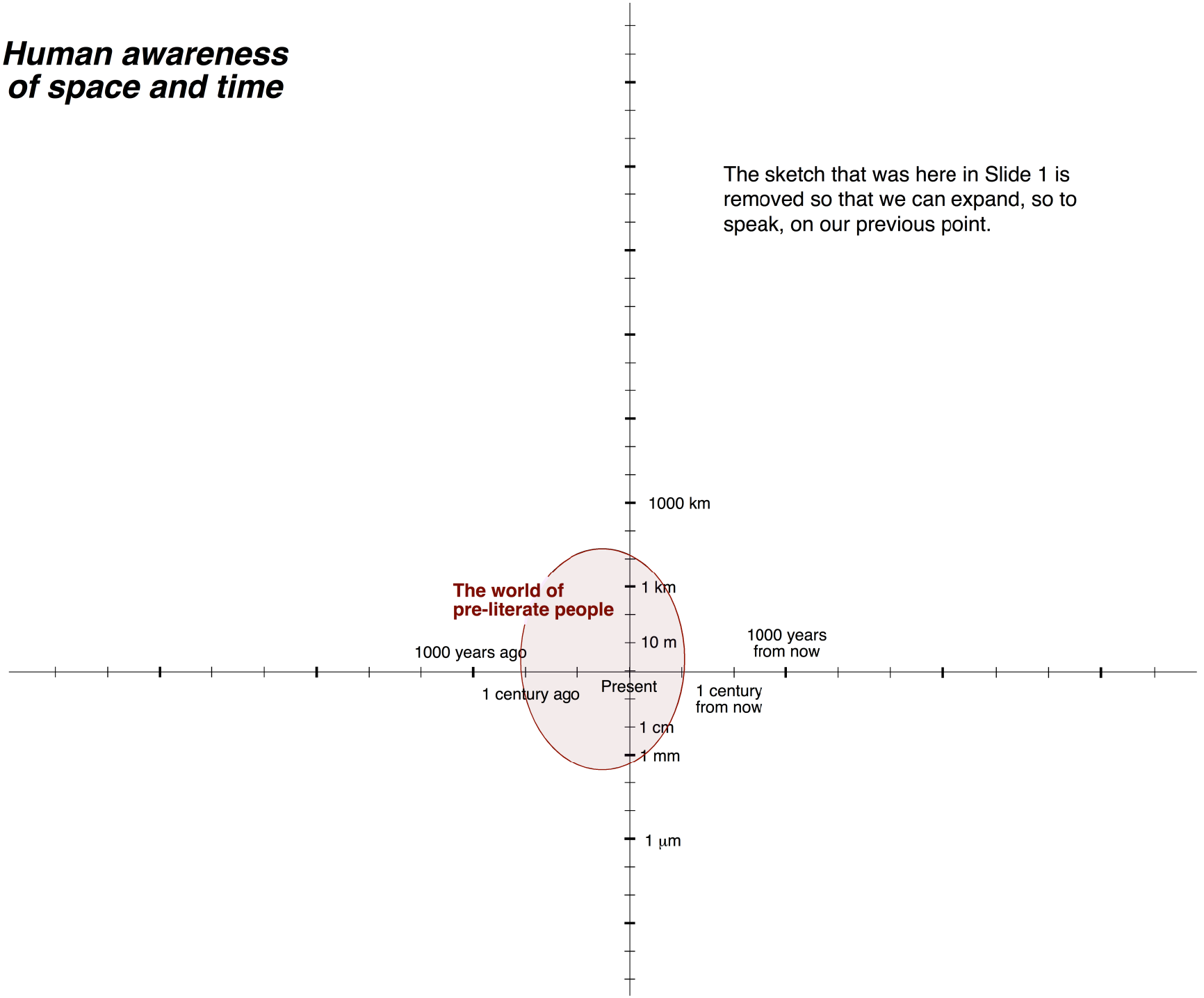
Human awareness of space and time

For pre-literate people, the world consisted of the things they could see. Anything too small to be seen with the naked eye was unimaginable; anything too distant to be seen within a day's walk in effect did not exist. In time, anything too old to be part of communal memory was lost, unless marked by a monument. The world as understood by a preliterate person was thus a small one.



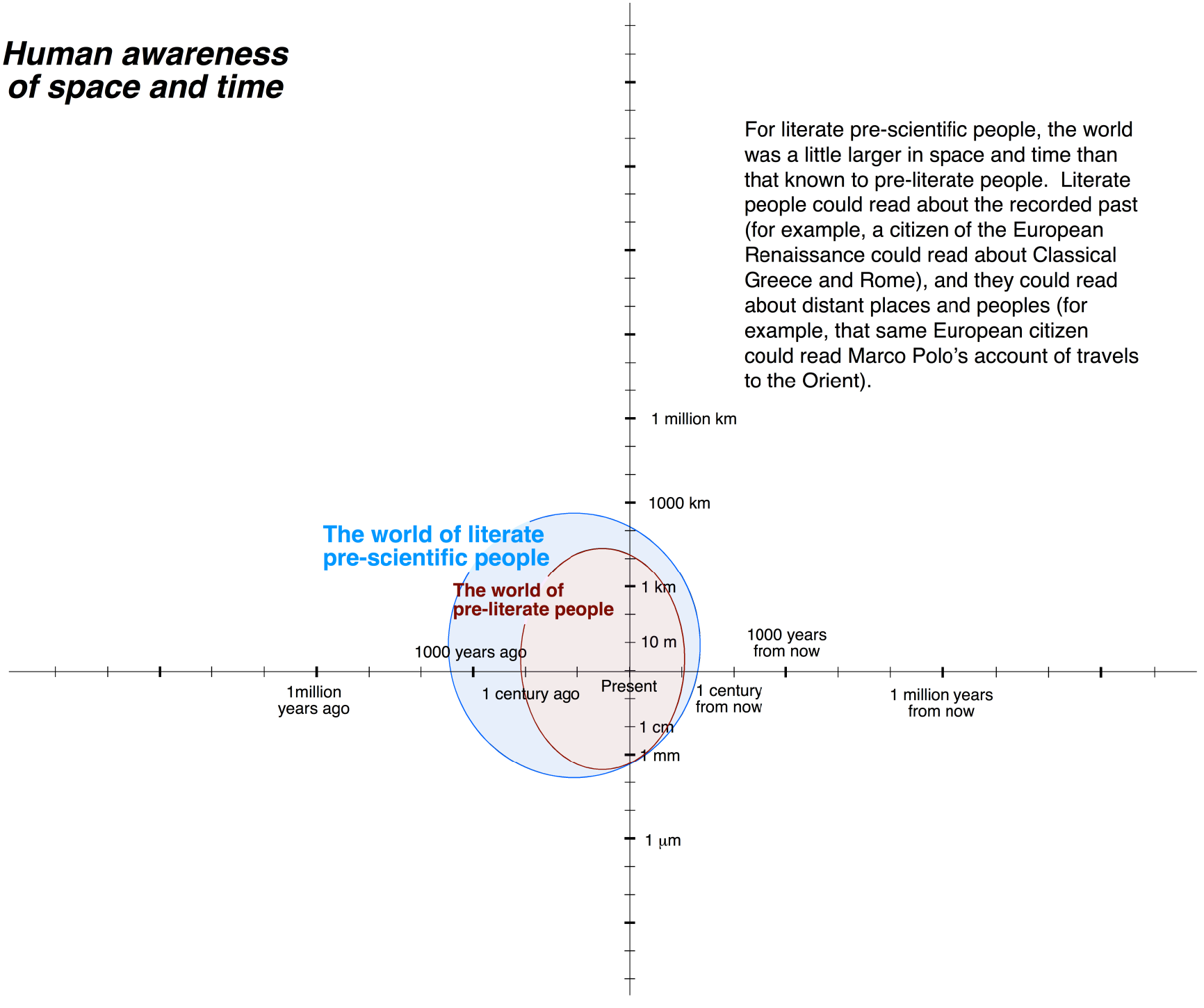
Human awareness of space and time

The sketch that was here in Slide 1 is removed so that we can expand, so to speak, on our previous point.



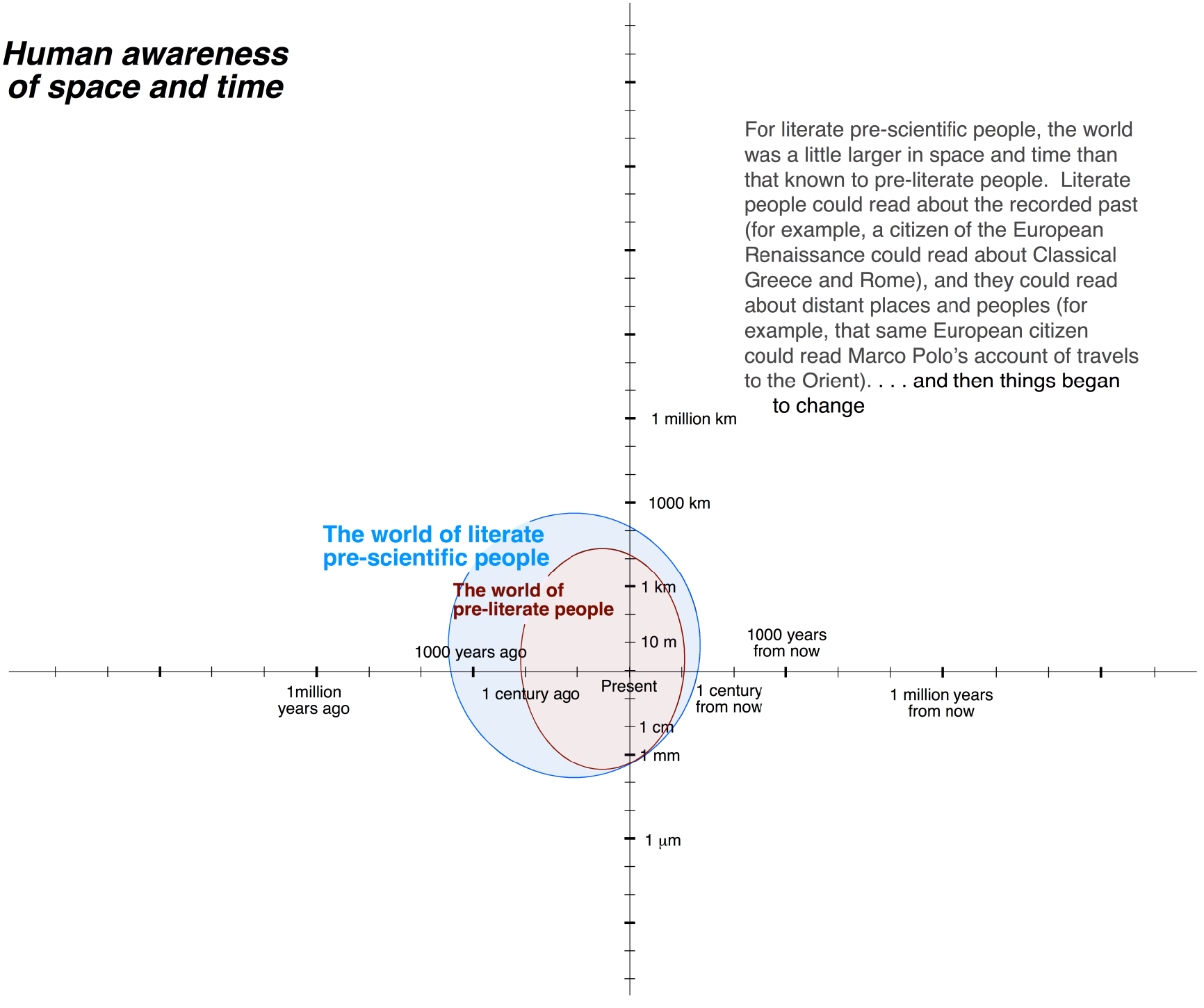
Human awareness of space and time

For literate pre-scientific people, the world was a little larger in space and time than that known to pre-literate people. Literate people could read about the recorded past (for example, a citizen of the European Renaissance could read about Classical Greece and Rome), and they could read about distant places and peoples (for example, that same European citizen could read Marco Polo's account of travels to the Orient).

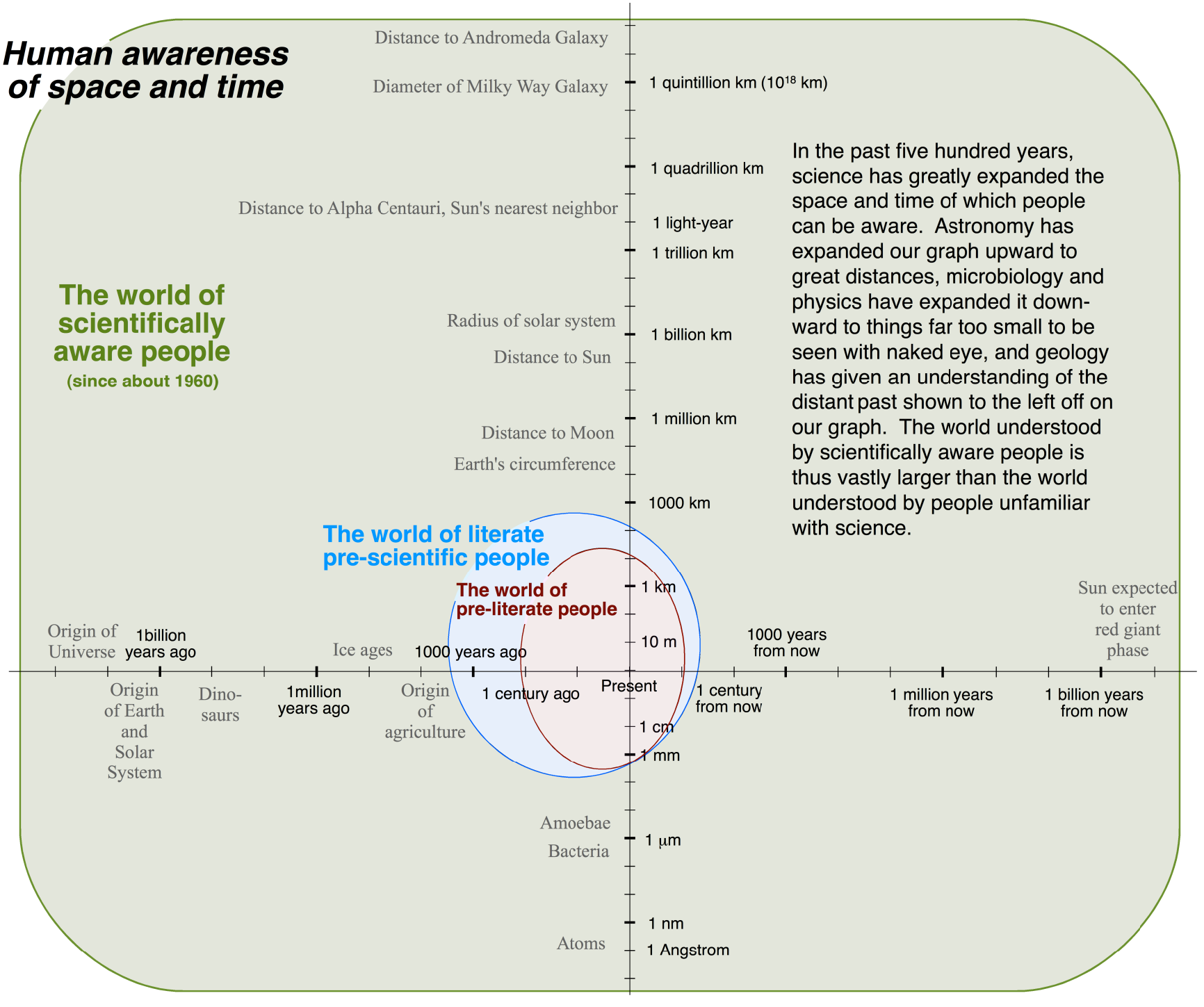


Human awareness of space and time

For literate pre-scientific people, the world was a little larger in space and time than that known to pre-literate people. Literate people could read about the recorded past (for example, a citizen of the European Renaissance could read about Classical Greece and Rome), and they could read about distant places and peoples (for example, that same European citizen could read Marco Polo's account of travels to the Orient). . . . and then things began to change

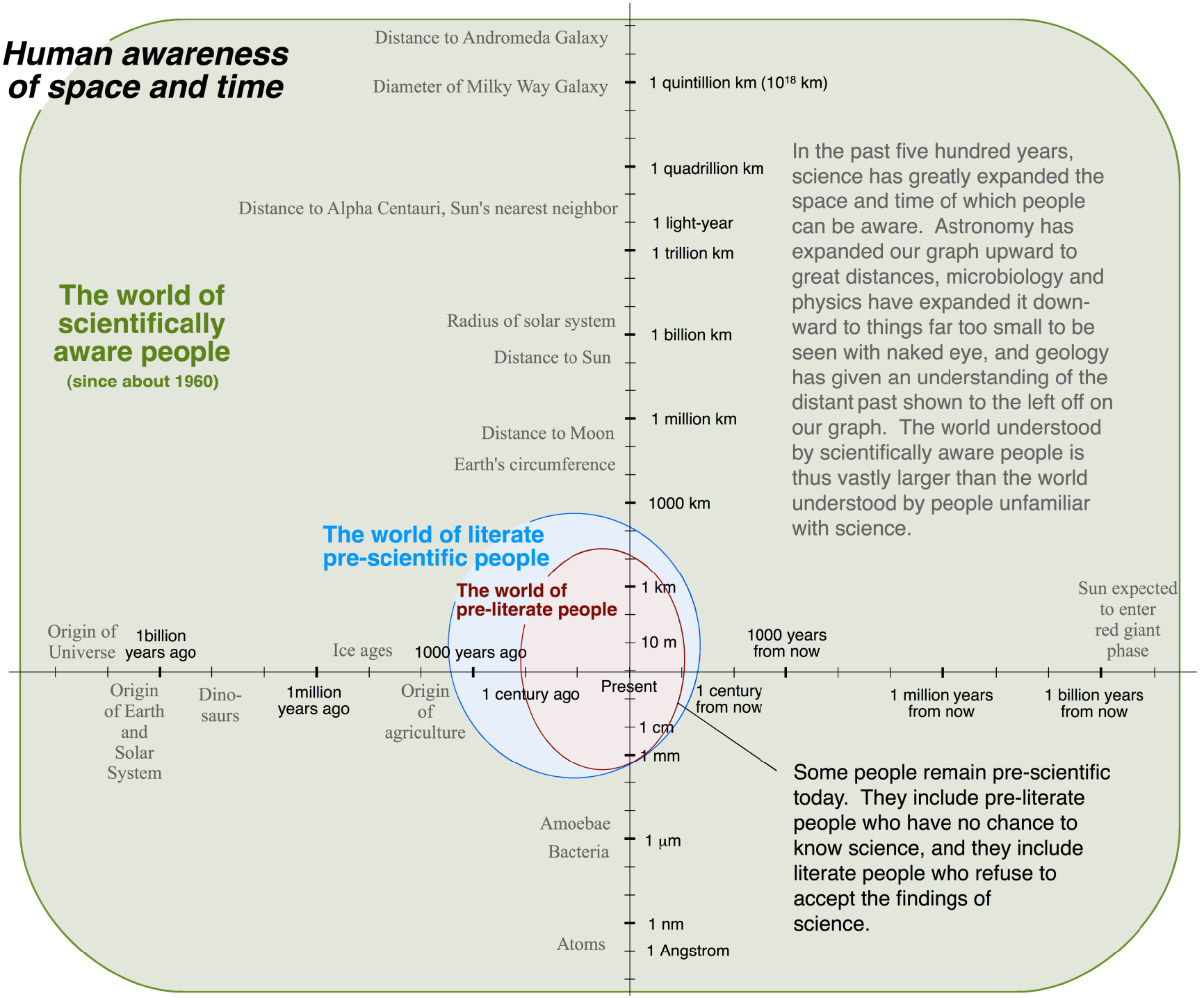


Human awareness of space and time



In the past five hundred years, science has greatly expanded the space and time of which people can be aware. Astronomy has expanded our graph upward to great distances, microbiology and physics have expanded it downward to things far too small to be seen with naked eye, and geology has given an understanding of the distant past shown to the left off on our graph. The world understood by scientifically aware people is thus vastly larger than the world understood by people unfamiliar with science.

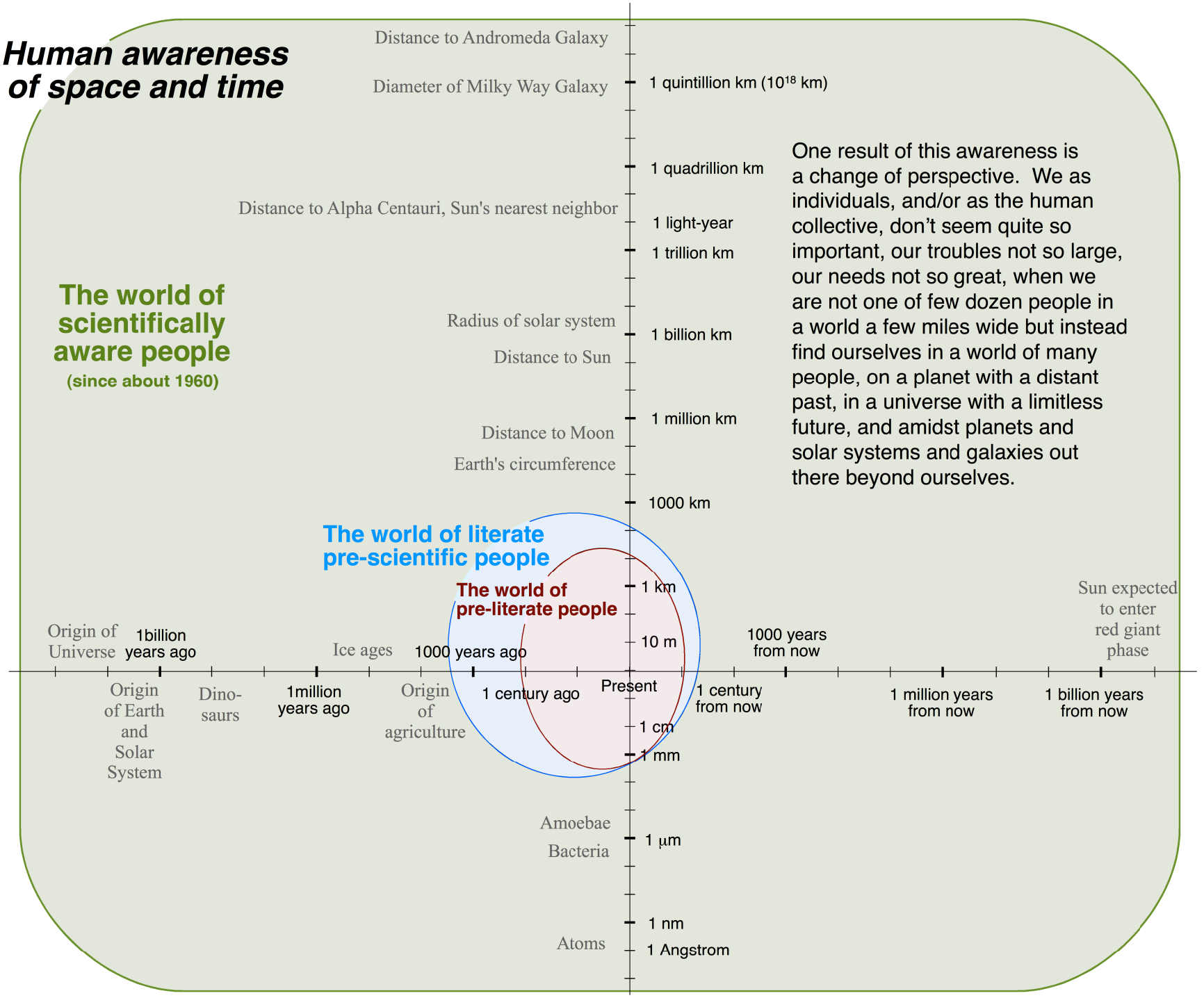
Human awareness of space and time



In the past five hundred years, science has greatly expanded the space and time of which people can be aware. Astronomy has expanded our graph upward to great distances, microbiology and physics have expanded it downward to things far too small to be seen with naked eye, and geology has given an understanding of the distant past shown to the left off on our graph. The world understood by scientifically aware people is thus vastly larger than the world understood by people unfamiliar with science.

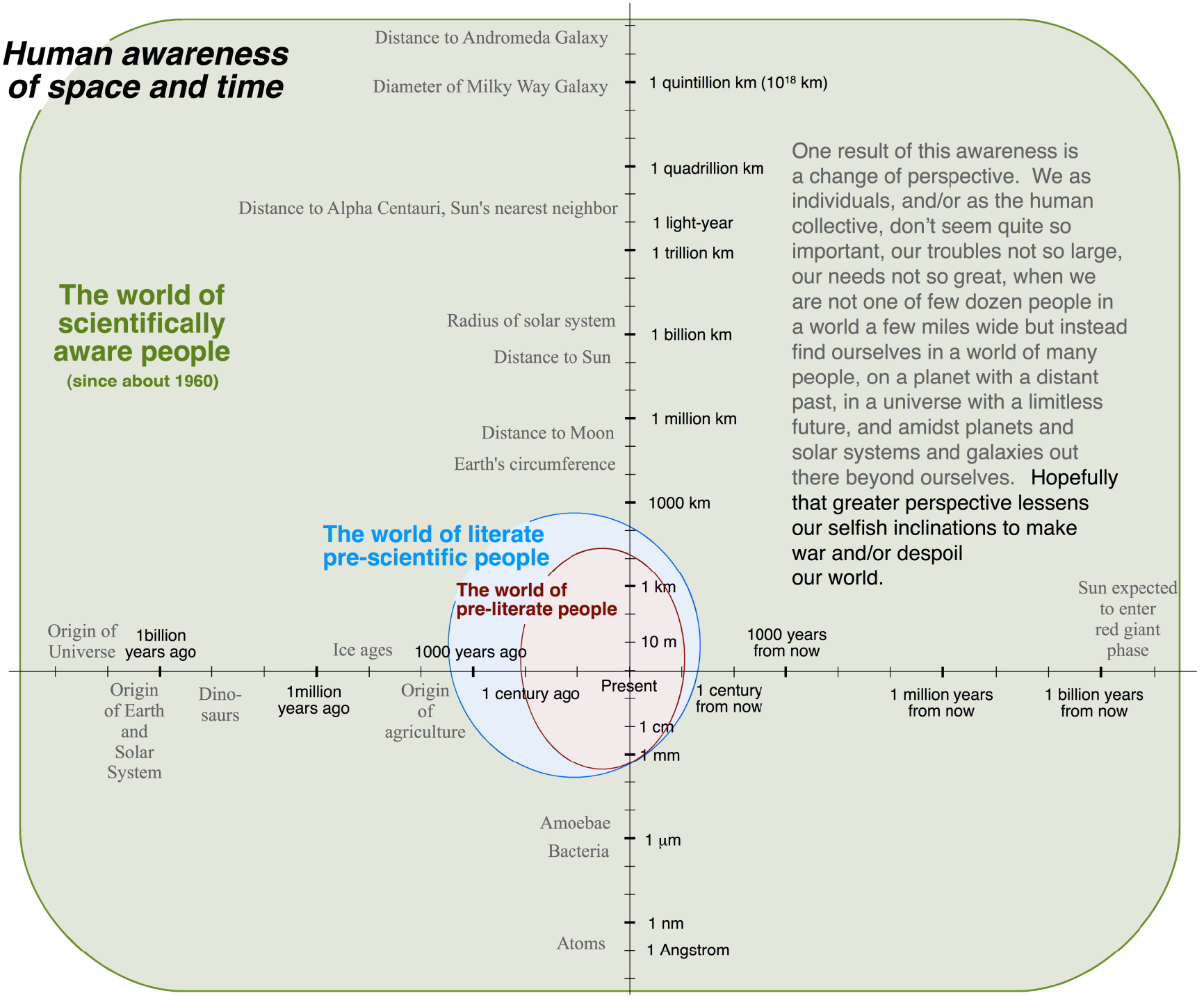
Some people remain pre-scientific today. They include pre-literate people who have no chance to know science, and they include literate people who refuse to accept the findings of science.

Human awareness of space and time



One result of this awareness is a change of perspective. We as individuals, and/or as the human collective, don't seem quite so important, our troubles not so large, our needs not so great, when we are not one of few dozen people in a world a few miles wide but instead find ourselves in a world of many people, on a planet with a distant past, in a universe with a limitless future, and amidst planets and solar systems and galaxies out there beyond ourselves.

Human awareness of space and time



One result of this awareness is a change of perspective. We as individuals, and/or as the human collective, don't seem quite so important, our troubles not so large, our needs not so great, when we are not one of few dozen people in a world a few miles wide but instead find ourselves in a world of many people, on a planet with a distant past, in a universe with a limitless future, and amidst planets and solar systems and galaxies out there beyond ourselves. Hopefully that greater perspective lessens our selfish inclinations to make war and/or despoil our world.

Human awareness of space and time, and more

Railsback's *SFMG*

Distance

Distance to Andromeda Galaxy

Diameter of Milky Way Galaxy — 1 quintillion km (10^{18} km)

1 quadrillion km

Distance to Alpha Centauri, Sun's nearest neighbor — 1 light-year

1 trillion km

Radius of solar system — 1 billion km

Distance to Sun

1 million km

Distance to Moon

Earth's circumference

1000 km

1 km

1 mm

Amoebae

Bacteria — 1 μm

1 nm

Atoms — 1 Angstrom

The world of scientifically aware people

(since about 1960)

We again clean up our slide to move onward with the next slide, which will again take things a bit further.

Time

Origin of Universe — 1billion years ago

Origin of Earth and Solar System

Dino-saurs

1million years ago

Ice ages — 1000 years ago

Origin of agriculture

1000 years from now

1 million years from now

1 billion years from now

Sun expected to enter red giant phase

LBR AwarenessDimensions01.odg 12/2012

Human awareness of space and time, and more

Railsback's *SFMG*

Distance

Distance to Andromeda Galaxy

Diameter of Milky Way Galaxy — 1 quintillion km (10^{18} km)

1 quadrillion km

Distance to Alpha Centauri, Sun's nearest neighbor — 1 light-year

1 trillion km

Radius of solar system — 1 billion km

Distance to Sun

1 million km

Distance to Moon

Earth's circumference

1000 km

1 km

1 mm

Amoebae

Bacteria — 1 μm

1 nm

Atoms — 1 Angstrom

The world of scientifically aware people

(since about 1960)

One additional way that science has changed our view of the world around us is that matter exists both in ways that seem particle-like (as most of us know matter) and in ways that seem wave-like. Experiments have now demonstrated the wave properties of matter not only with regard to sub-atomic particles and atoms, but also with regard to molecules consisting of dozens of atoms.* Those experiments suggest that only the limitations of our laboratory equipment keep us from demonstrating the wave-particle duality of much larger entities.

*Markus Arndt , Olaf Nairz, Julian Voss-Andreae, Claudia Keller, Gerbrand van der Zouw, and Anton Zeilinger, 1999, Wave-particle duality of C_{60}: Nature 401, 680-682.

Particle

Wave

Origin of Universe — 1billion years ago

Origin of Earth and Solar System

Dino-saurs

1million years ago

Ice ages — 1000 years ago

Origin of agriculture

1000 years from now

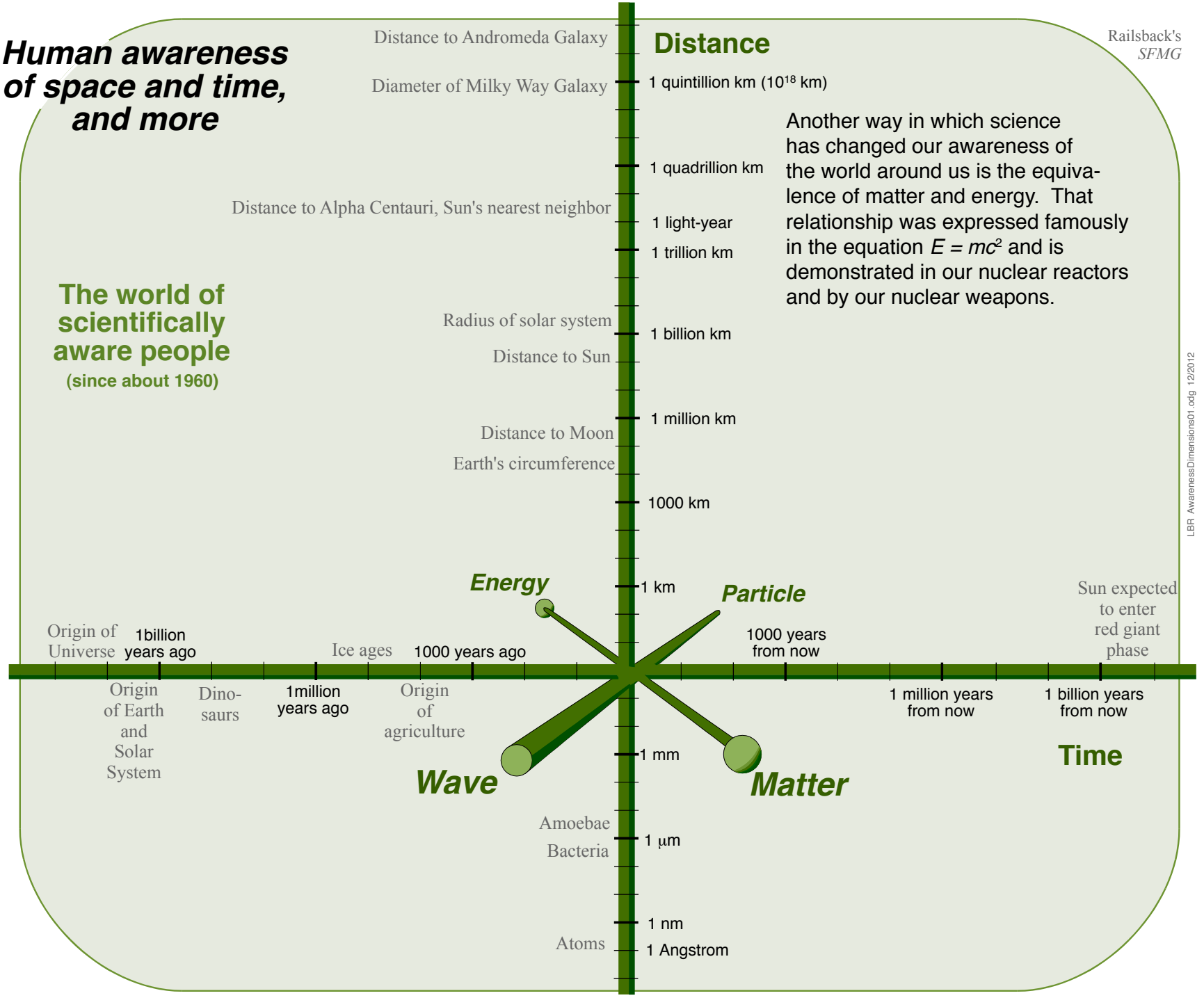
1 million years from now

1 billion years from now

Sun expected to enter red giant phase

Time

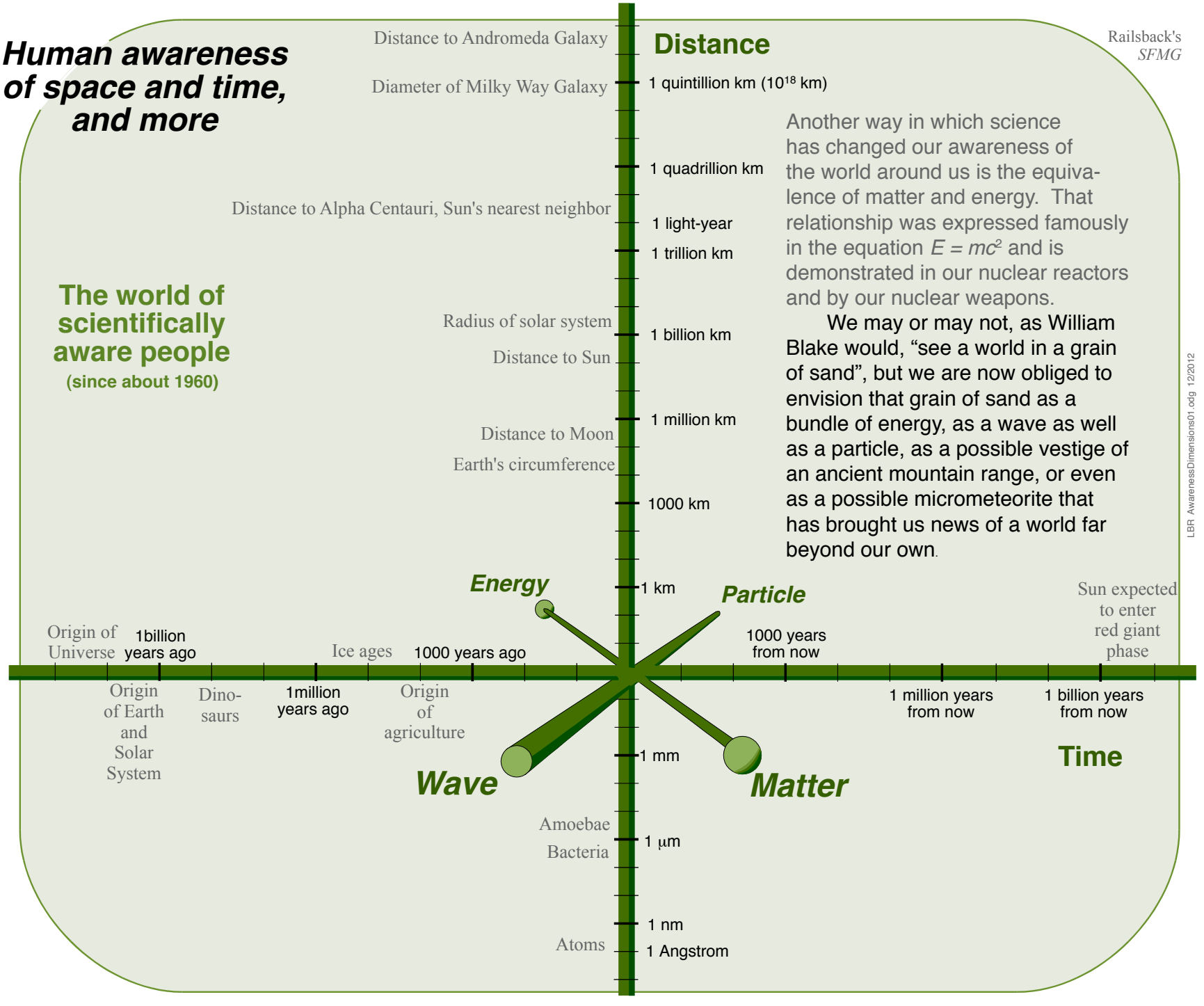
LBR AwarenessDimensions01.odg 12/2012


Human awareness of space and time, and more
Distance
Railsback's SFMG
Distance to Andromeda Galaxy
Diameter of Milky Way Galaxy
1 quintillion km (10^{18} km)
1 quadrillion km
Distance to Alpha Centauri, Sun's nearest neighbor
1 light-year
1 trillion km
Another way in which science has changed our awareness of the world around us is the equivalence of matter and energy. That relationship was expressed famously in the equation $E = mc^2$ and is demonstrated in our nuclear reactors and by our nuclear weapons.
The world of scientifically aware people
(since about 1960)
Radius of solar system
1 billion km
Distance to Sun
1 million km
Distance to Moon
Earth's circumference
1000 km
Energy
1 km
Particle
Sun expected to enter red giant phase
Origin of Universe
1billion years ago
Ice ages
1000 years ago
1000 years from now
Origin of Earth and Solar System
Dino-saurs
1million years ago
Origin of agriculture
1 million years from now
1 billion years from now
Time
1 mm
Wave
Matter
Amoebae
Bacteria
1 μm
1 nm
Atoms
1 Angstrom
LBR AwarenessDimensions01.odg 12/2012

Human awareness of space and time, and more

Railsback's *SFMG*

The world of scientifically aware people
(since about 1960)



Another way in which science has changed our awareness of the world around us is the equivalence of matter and energy. That relationship was expressed famously in the equation $E = mc^2$ and is demonstrated in our nuclear reactors and by our nuclear weapons.

We may or may not, as William Blake would, "see a world in a grain of sand", but we are now obliged to envision that grain of sand as a bundle of energy, as a wave as well as a particle, as a possible vestige of an ancient mountain range, or even as a possible micrometeorite that has brought us news of a world far beyond our own.

LBR AwarenessDimensions01.odg 12/2012