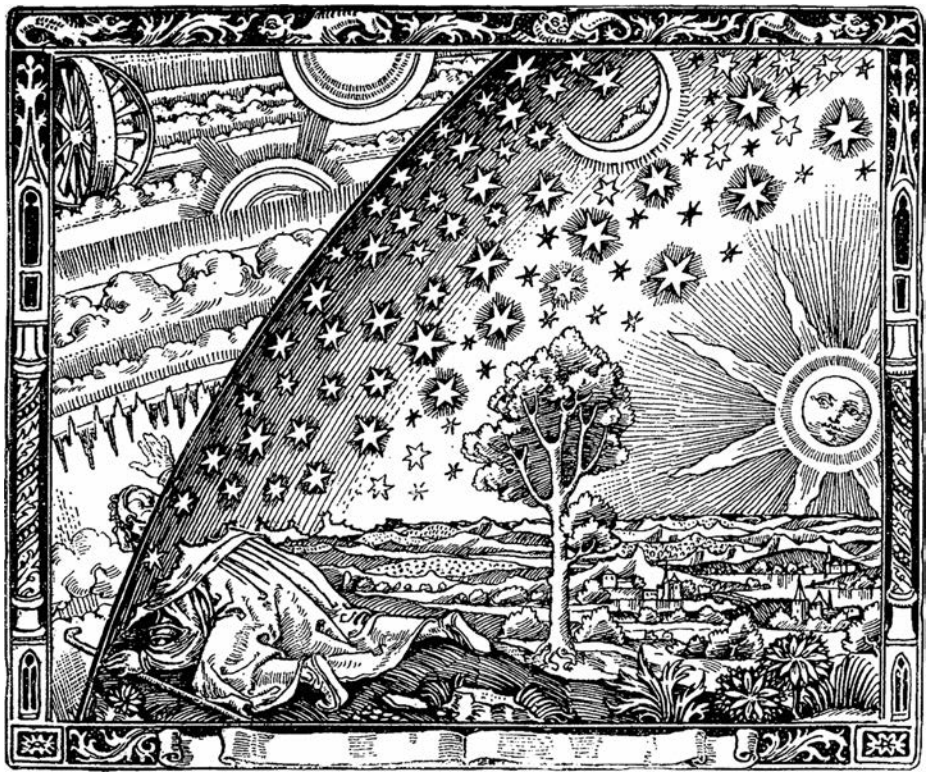
A Better History of Time



Flammarion, Camille. *L'atmosphère: Météorologie Populaire* (1888).

Part One: Causality—What Makes Things Happen?

Science as a world belief which is still incomplete

It has certainly been true in the past that what we call intelligence and scientific discovery have conveyed a survival advantage. It is not so clear that this is still the case: our scientific discoveries may well destroy us all…

—Stephen Hawking,
A Brief History of Time

Where do things come from?

Quantum mechanics vs. the general theory of relativity:
That is, the truth of where universes come from must be equally true for the smallest atomic particles.

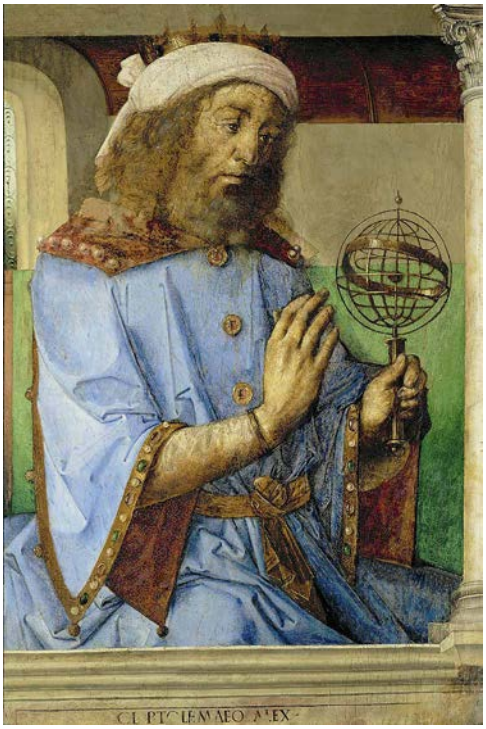
If I understand where the universe comes from, I should be able to understand why my partner criticized me today. And I should be able to stop them from criticizing me in the future.

Models evolve

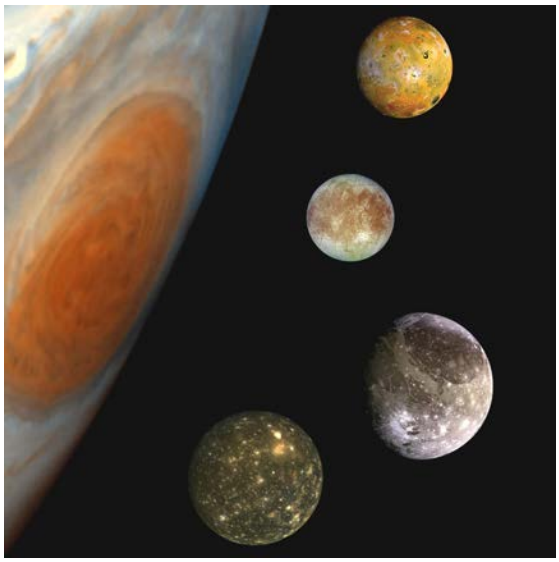
Until about 300BC, worldwide
The world is flat, and the center of the universe

Around 350BC, in Greece
Aristotle:
The world is round, and the center of the universe.

Around 100AD, Egypt
Ptolemy:
The world is round, and the center of the universe; the sun & planets & stars move around it on spheres.



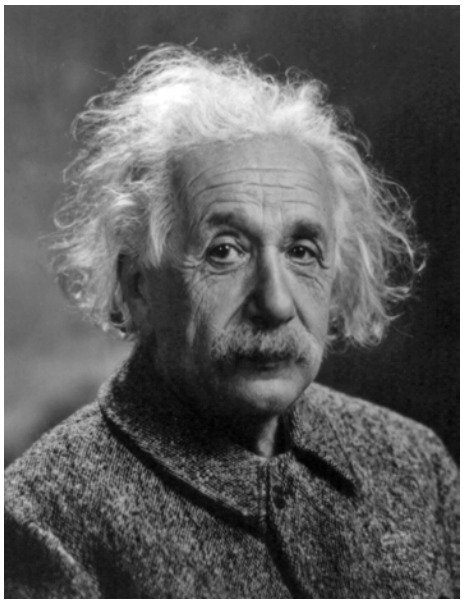
1514, Poland
Copernicus:
The sun is the center of the universe; it is stationary, and the Earth & other planets orbit it in circular orbits.



1609, Italy
Galileo:
There are moons orbiting Jupiter, so Copernicus must be right, and not everything revolves around the Earth! Rather, the sun is the stationary center.

1605, Germany
Johannes Kepler:
We can only explain the path of the planets if they are moving in ellipses (stretched circles) rather than circles.

1687, England
Isaac Newton:
The attractive forces of gravity keep planets and stars in their positions, in a static universe.



1916, Germany

Albert Einstein:

Space and time are bent, or curved, by the presence of matter and radiation. This General Theory of Relativity accounts for inconsistencies in Newtonian explanations of the movement, for example, of the planet Mercury.

1929, America

Edwin Hubble:

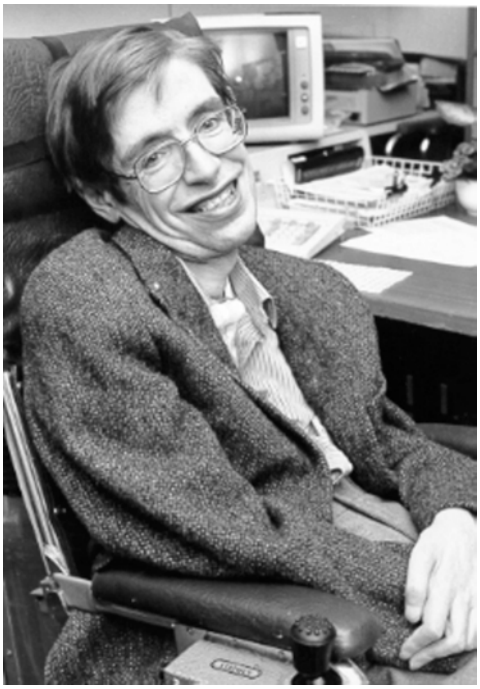
Galaxies that are farther away are receding faster; therefore, the universe is not static, but rather it is expanding. Nothing is stationary, not even the sun around which the planets revolve. Hubble further works out the existence and distances of other galaxies; meaning ours is not even the center of the universe!

1927, Belgium

Fr. Georges Lemaitre:

Working backwards from an expanding universe, we can posit an Hypothesis of the

Primeval Atom, or the Cosmic Egg. This later became known as the Big Bang: a single point that once contained all of space, and then exploded, 13.8 billion years ago.



1974, England

Stephen Hawking (and others): As the heat of the original explosion of the universe is gradually dissipated, the universe reaches maximum entropy and thus "heat death" which precludes information processing, and therefore life itself. Black holes slowly dominate the universe and then disappear themselves, as they leak tiny amounts of Hawking radiation.

1988, England

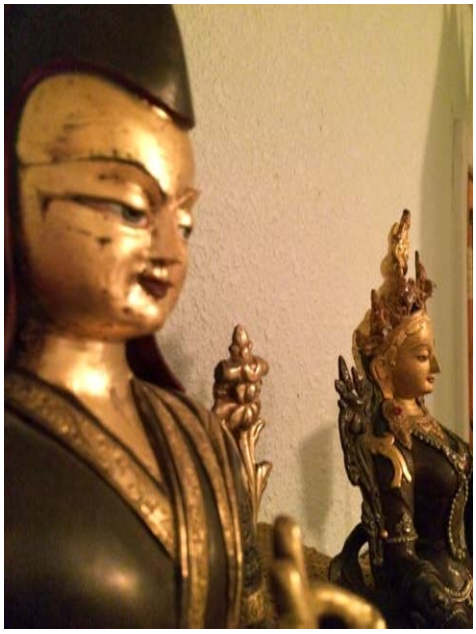
Stephen Hawking, *A Brief History of Time:*

Recent breakthroughs in physics, made possible in part by fantastic new technologies, suggest answers to some of these longstanding questions. Someday these answers may seem as obvious to us as the earth orbiting the sun—or perhaps as ridiculous as [perceiving the shape of the earth as] a tower of tortoises. Only time (whatever that may be) will tell.

Causality

Question: Why does my partner criticize me?

Aristotle's 4 Causes



1) Material cause

The thing which turns into the result: the silver for a cup, or the bronze for a statue. My husband doesn't respect me, and this is just the latest expression of that disrespect.

2) Formal cause

Meaning form-al cause: the archetype determines the details. By having a human body I have four limbs and a head. Men in a relationship are disrespectful; my husband is just doing what men do.

3) Efficient cause

That which triggers or moves an event into action: A person lifts a rock. My husband had a bad night and didn't get enough sleep, so he is criticizing me today.

4) Final cause

The end or goal of an action, which inspired or motivated it: Socrates takes a walk after dinner to improve his health. My husband really wants a divorce, and so he's criticizing me as just one more step to get there.

The 6 Causes in the Abhidharma

1) Creation cause

Everything in the universe that didn't prevent my husband from criticizing me today. Two types: things that could have and things that couldn't have. The entire universe is conspiring to have my husband criticize me.

2) Mutual cause

For example, parts of the mind that reinforce each other in the same moment. My husband's critical attitude of me is reinforced by his jealousy over me, and vice versa.

3) Homogeneous cause

Things with a nature that is the same as what they cause, especially ethically. My husband's critical attitude is a result of the general negativity that has been flowing through his life for some time now.

4) Mentally linked cause

Main mind and emotions within this mind are linked in five ways, supporting each other in five ways. The fact that my husband is aware (not asleep or knocked out, for example) is making it possible for him to have critical thoughts of me. His awareness is linked to his critical attitude by (1) looking out through the same visual consciousness; (2) focusing on the same face (mine); (3) sharing the same aspect (physicality of my face); (4) going on at the same time; and (5) consisting of the same "stuff" (mind).

5) Ubiquitous cause

Any of the five mental functions which accompany all states of consciousness; and in this case, specifically those which involve negative thoughts. For example the fact that my husband can focus upon anything at all and feel negatively about it allows him to have critical thoughts towards me. The fact that his mind possesses basic functions at all allows his criticism. Here is the list of all five of these functions of the mind: (1) the capacity to feel things; (2) the capacity to distinguish between things; (3) the capacity to think; (4) contact between the mind at the outside world; and (5) the ability to focus the mind on an object.

6) Karmic cause

Actions, words, or thoughts which are good or harmful, and create pleasure or pain after a period of ripening. I have to see my husband criticize me because I unfairly criticized our children last week.

The four causes of Master Dharmakirti

The Buddhist master Dharmakirti (c. 650AD):

The definition of a cause is "Anything which gives birth to something else." The definition of a result is "Anything which something else gives birth to."

Causes can be divided into:

(1) Immediate cause

Anything which gives birth to something else directly.

Example: Fire for smoke.

Example: My comment about the garbage after dinner, for my husband's attack on me this evening.

(2) Indirect cause

Anything which gives birth to something else indirectly.

Example: Firewood for smoke.
Example: My thinking this morning about how my
husband never takes out the garbage,
for my husband's attack on me this evening.

Or, causes can be divided into:

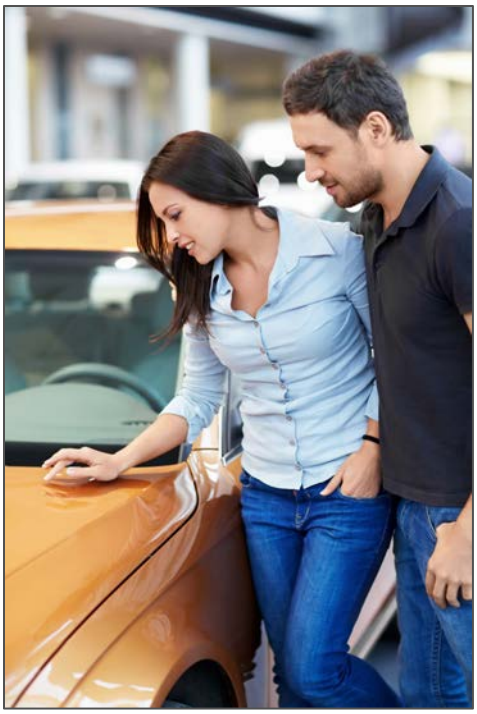
(1) Substantial cause
That which acts mainly as a cause which gives birth to something else, as a continuation of its flow as a substance (cf. Aristotle's material cause.)

Example: A seed, for a sprout.
Example: My husband's sense
of frustration, just before
he decided to criticize me.

(2) Contributing cause
That which acts mainly as a cause which gives birth to something else, but not as a continuation of its flow as a substance.
Example: Water, fertilizer, or conditions of warmth
and wetness, for a sprout.
Example: My husband's insufficient understanding
of my needs; his upbringing without empathy;
the pressure he's having at work.

The V cause of the Mind-Only School

When I look at a car, my awareness of the car is coming out of the same karmic seed as the apparently indivisible atoms of the car itself.



It's as though I'm making a peace-sign V with my first two fingers: ultimately, the source for both of them is my one hand, although they look as though they are separate, and can interact with one another. This idea of causality is attractive to the highest schools of Buddhism, so long as we can leave out the part about indivisible atoms.

And so, in this view, I see my partner criticizing me because I criticized somebody else, earlier (let's say my kids, last week, when they wouldn't get ready for school).

This seed created me with my eyes and my mind, to see my partner open their mouth to say something negative about me. And it seems that this partner consists of tiny, indivisible atoms of stuff.

This is true whether we are talking about the six causes from the Abhidharma; the four causes of Master Dharmakirti; the V cause of the Mind-Only School; or the causes of matter and energy recognized by modern science. And so it's important to look into what atoms are, and how they might work.

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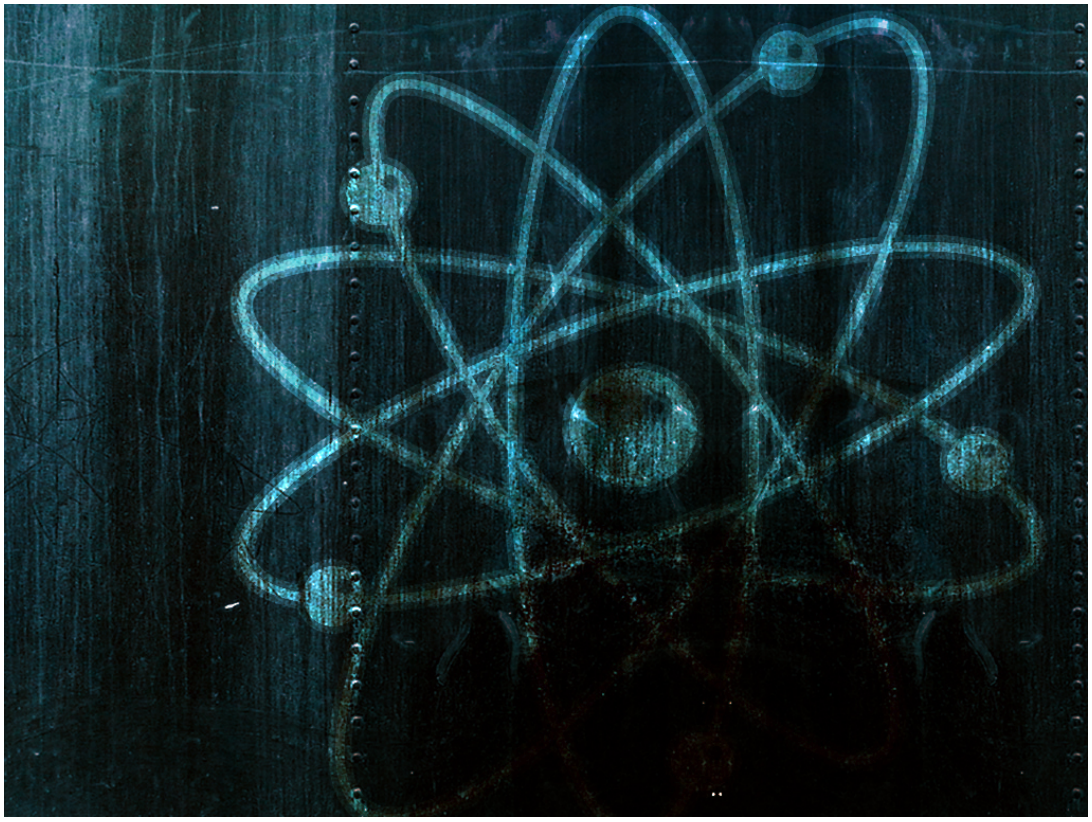


Part Two: The Problem with Atoms

Atoms, East & West

The size of an atom

From the
Treasure House
of Higher Knowledge
(Abdhidharma Kosha)
by the Indian Buddhist master Vasubandhu (350AD):

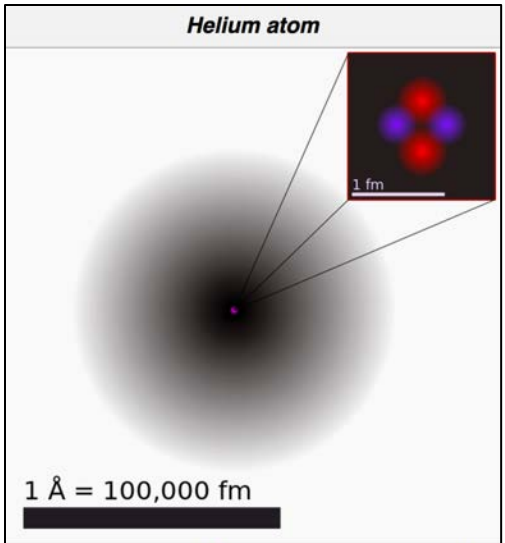
The smallest thing is an atom.
Something seven atoms wide is big enough
to be a molecule.
Something seven molecules wide is big enough
to be an ironicle.
Something seven ironicles wide is big enough
to be a watericle.
Something seven watericles wide is big enough
to be a rabbiticle.
Something seven rabbiticles wide is big enough
to be a sheepicle.
Something seven sheepicles wide is big enough
to be a bullicle.
Something seven bullicles wide is big enough
to be a dust mote in the sunlight.
Something seven dust motes wide is big enough
to be a flea egg.
Something seven flea eggs wide is big enough
to be a flea.
Something seven fleas wide is big enough

to be a barley grain.
Something seven barley grains wide is big enough
to be a fingerwidth.
Something 24 fingerwidths wide is big enough
to be a cubit [a forearm's length].
Something 4 cubits wide is big enough
to be an armspan.
Something 500 armspans wide is big enough
to be a *yojana* [about half a mile].

Working backwards from an armspan of 6 feet (a typical person's armspan is equal to their height), we can say that the Buddhist atom (inseparable particle) is about 9 picometers (trillionths of a meter) wide; this is not far off the currently accepted width of a helium atom (considering the entire distributed electron cloud), which is about one angstrom (.1nm, or 100 picometers, equal to one ten-billionth of a meter); the nucleus of the helium atom, considered alone, is one hundred thousandth of an angstrom.

The shape of an atom

From The Sun that Illuminates the True Thought, *a commentary to Master Vasubandhu by Choney Lama Drakpa Shedrup (1675-1748), textbook writer for the incomparable Sera Mey Monastery:*



An illustration of the helium atom, depicting the nucleus (pink) and the electron cloud distribution (black). The nucleus (upper right) in helium-4 is in reality spherically symmetric and closely resembles the electron cloud, although for more complicated nuclei this is not always the case. The black bar is one angstrom (10^{-10} m or 100 pm).

Some claim, as the Sutrists do, that atoms have no shape. This is incorrect, because they are said to be spherical. If it were not the case that atoms had some shape, then we

would have to accept the idea that an atom could have no parts.

How does all this relate to my husband yelling at me? When I look at him while he's yelling, I have a deep-seated, instinctual belief that his whole body and everything around him is made up of tiny bits of stuff, and that these bits have their own qualities, that help make him who he is—and this belief determines how I deal with his criticism, using my own "atoms"!

"Atom": the word & the idea

The word "atom" means "indivisible," or "irreducible," and thus refers to the smallest, indivisible part of physical matter. The term can be traced back to the Sanskrit, which consists of two components.

The initial *a-* prefix means *not,* as we see in the English cognates *apolitical* (not political) or *apathetic* (not passionate) or *atheist* (not believing in God).

The second half of the word traces back to an Indo-European root √ *tem,* which means *to cut.* It is the source of the word *temple* (a place which was reserved or *cut off* from the rest of the village) and from there, *to contemplate.* Other cognates are *tome* (a piece of papyrus *cut off* to make a scroll for a book); *anatomy* (to *cut up*); *dichotomy; epitome* (a *cut* above, with the *epi-* coming in fact from the Sanskrit *abhi-,* or *higher,* as we've seen in the "Higher Knowledge" of Master Vasubandhu's *Abhidharma*).

The idea then is the same as that found in the Wikipedia article for "atom" (as of 11/14/14), which defines the word as "the smallest recognized division of a chemical element." If you cut the particle into a smaller piece (which you can), it will lose its chemical qualities. And then an atom of iron stops acting like iron, and the same for copper or helium and all the rest.

What you get when you divide the "indivisible"

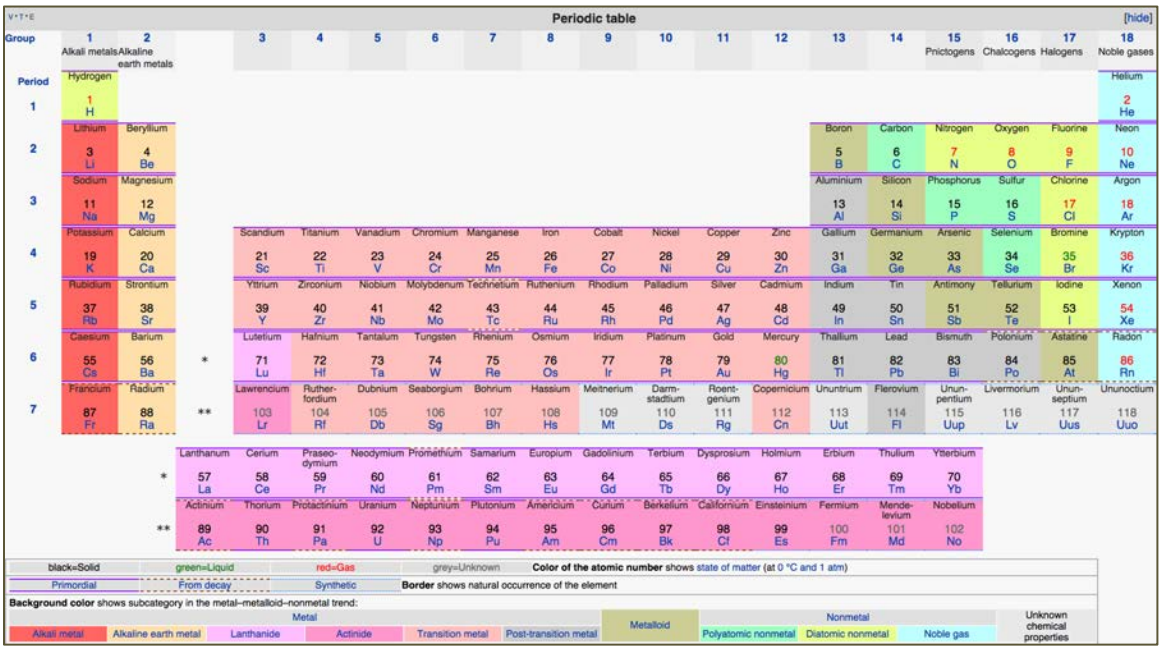
Scienceclarified.com ***website as of November 14, 2014:***

"Truly elementary particles" (an "elementary" particle is considered "a subatomic particle which cannot be broken down into any simpler particle") have been given the names *quarks* and *leptons.* Each group of particles consists of six different types of particles. "The six quarks, for example, were given the rather fanciful names of up, down, charm, strange, top (or truth), and bottom (or beauty)." [Not that different from Master Vasubandhu's "bullicle" and "rabbiticle."]

These six can be combined to give particles such as protons or neutrons. Those are two of the five most important subatomic particles, the others being the electron, neutrino, and positron.

The number of protons in the nucleus of an atom of a chemical element determines its atomic number, as shown in the periodic table. The number and position of the electrons in the atom of a chemical element determine its position within the rows and columns of the table.

Periodic Table of the Elements



This is a famous summary of the 118 "irreducible" chemical elements recognized so far. "Irreducible" means that they lose their unique characteristic or identity if you break them down past the size of a single atom of them.

The rows here are called "periods" (thus the *periodic* table) and the columns are called "groups." A new row is started when a new electron shell has its first electron. All the elements in the same column have the same number of electrons in a particular subshell. Elements in the same group or column generally have similar chemical properties: for example, the noble gases (such as helium, neon, and argon—all odorless, colorless, and monatomic gases with low chemical reactivity); or the alkaline earth metals (such as magnesium, calcium, or radium—all silver-colored, soft, with a low melting point).

The first 98 elements exist naturally; the rest are products of artificial synthesis.

Subatomics ala the Buddha

According to Master Vasubandhu and his commentarial tradition; the elements presented here are very similar to those accepted by Aristotle, although he would not have agreed to describing them within tiny atoms, which he did not accept:

The very tiniest aggregate of physical matter, or atom, must still contain eight different subatomic particles: the particles of the four elements or fundamental forces of earth, water, fire, and wind; and the particles that make something visible, smellable, tasteable, and touchable. [Sounds are considered so fleeting that they are not in this presentation considered subatomic particles.]

The elements are four basic forces contained in all physical matter. These are called “earth” (the force which retains things); “water” (the force which gathers things); “fire” (the force which ripens things); and “wind” (the force which spreads things).

“Earth” is defined as the element which gives things solidity. “Water” is defined as the element which allows things to flow. “Fire” is defined as the element which gives things heat.

"Wind" is defined as the element which gives things mobility.

In Sanskrit, these elements have two names. One is *bhuta,* which literally means "that which is happening." The elements are said to be given this name because they are what make other things—like cars or songs—happen. The other name is *dhatu,* which comes from the root √*dha,* meaning *to put.*

This etymology of this word is sometimes explained in the literature as relating to the similar root √*dhir,* meaning *to hold;* and so an "element" is "something which holds its own definitive characteristics." In this sense, an element is similar to a Western atom, meaning the smallest piece of something which retains its own unique qualities or identity.

The four elements are sometimes called "great elements" (*mahabhuta*), especially when they are mentioned as components of the massive sum of all resulting physical objects. The four are classically considered objects of the tactile sense, so that these objects (some of which are felt "inside") are traditionally divided into eleven: the four great elements of earth, water, fire, and wind; and the tactile objects of softness; roughness; heaviness; lightness (of weight); hunger; thirst; and cold.

In general though, all four elements are considered to be contained within every physical object. Thus, nothing is perfectly cold, but has some degree of heat within it; nothing is completely solid, but is flowing to some degree, however tiny, and so on. The water of a river, for example, does contain some solidity, which is why it hurts when you jump into it from a substantial; and steel has some flow or "give," if only when penetrated by a diamond.

Some later presentations of the elements add two others: space and consciousness. The addition of wood seems to belong only to non-Buddhist presentations, in Chinese philosophy for example—although it is found in the five elements used for naming years in later Tibetan Buddhist histories, for example.

Buddhist philosophy is careful to distinguish the *elements* (*bhuta*) from their *derivatives* (*bhautika*): the things they create, the things they are parts of. And so elements are the energies behind things, but not to be confused with those things themselves: the earth element is not a brown thing below us, nor is the element of fire something red at the tip of a cigarette; nor even is water something wet and flowing, nor wind something which is light in weight and blowing—rather, these elements are the forces (similar to gravitational or electromagnetic forces) which underlie those physical phenomena.

The Problem with Atoms

Whether we consider the atom or one of its component particles something which is "indivisible," higher schools of Buddhism have a problem with the idea of any kind "tiniest" or "irreducible" particle. The classical expression of these problems exists in the writings of the Indian Buddhist sage Nagarjuna and his disciple Aryadeva, from around 200AD.

At some point, as we have seen, when we drop down in size to the component subatomic particles of a chemical element such as iron, we reach particles that no longer individually display the unique qualities of iron. This is why for example atomic numbers are given to the elements; they convey the number of protons in the nucleus of the particular element, and if we change the atomic number—that is, change the number of protons—then the atom doesn't behave the same way any more.

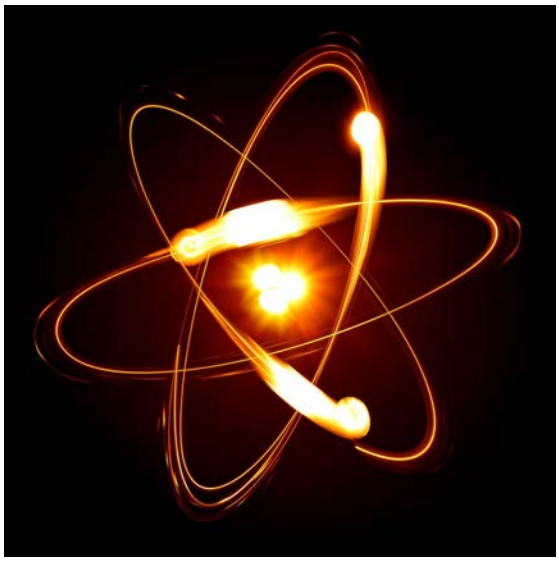
When we say it doesn't "behave" the same way, what we mean for example is that a substance composed of iron atoms normally interacts with other things—like the skin of my finger—as relatively "hard" or unyielding. The particular combination of electrons and protons and other components of the iron atom give it this behavior in its interactions.

We can call this interaction, simply, *causality*—which we've already covered, from Western and Eastern schools of thought which are essentially similar in their view of the world. The iron *causes* the tip of my finger to smush.

This implies that *all* of the subatomic particles contained in the iron are making contact with the tip of my finger, since individually—or in groups less than their total number of protons, for example, as we have seen—the *subatomic* pieces of iron will not act like iron.

If though the subatomic particles have any discrete spatial existence from each other—that is, if they are not each one taking up the very same spot, overlapping 100% with each other—then by definition it is only the particles on one side of the atom which are making contact with the atoms that make up my finger.

This by the way is because each subatomic particle, regardless of how small it is, must have *some* width. If it has *some* width, then this implies by the way that it is not the smallest piece of a substance that can be, because it can then be divided in measure.



Even if the width of a particle is a trillionth of an angstrom, for example, the fact that this width can be measured implies that the particle could be further divided. That is, if something is an inch long, we can always divide it into two pieces of half an inch—if only mentally.

In fact, one school of Buddhism, by the way, in fact defines the "ultimate" or "true" reality of a thing as the point at which—if we divide down past that, even mentally—we lose the thing. Sort of like going to protons and then down to quarks, and thereby losing the iron. This makes the *atom* of iron then the "real" thing in iron, that makes it behave the way it does. This idea is shared by both these

lower Buddhist schools and by Science, and by our gut feeling that there must be some "essence" inside the smallest atom that gives the iron its unique qualities.

If something were so small as to have no width, then it would have no sides—no left or right sides, no east or west sides. This is because, for example, the left side would overlap the right side. And then the only thing that could be between them is—nothing.

So let's go back to the finger touching the piece of iron. At the very first moment of contact, only a single particle within the atoms of the iron can be touching a single particle of the atoms of the skin. As we've seen, the hardness can't be "in" the iron until all particles are acting together; until the skin touches all the particles.

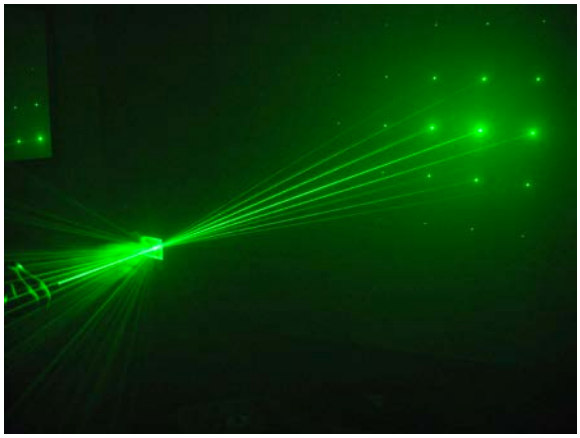
But the skin never can, because each particle has width, and occupies its own unique position, either on the "touchy" side of the atom or on the opposite side. We cannot be touching a piece of iron, not in the way we think we do. Nor can we be seeing our partner, or hearing their criticism of us, in the way we always thought we were.

Wave-particle duality:
The contradiction of the passage of light

A similar contradiction is described in science, with the passage of light. In essence it reflects the same problem; that is, we still don't really understand how light passes from the sun and comes to touch our eye, so that we can see everything around us. It's not clear whether light moves in particles or in waves.

Here's how the relevant Wikipedia article describes it:

> **Wave–particle duality** is the concept that every elementary particle or quantic entity exhibits the properties of not only particles, but also waves. It



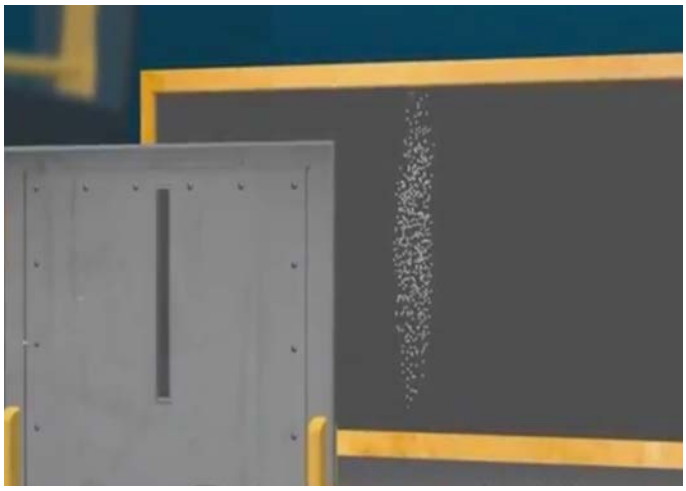
> addresses the inability of the classical concepts "particle" or "wave" to fully describe the behavior of quantum-scale objects. As Einstein wrote: "*It seems as though we must use sometimes the one theory and sometimes the other, while at times we may use either. We are faced with a new kind of difficulty. We have two contradictory pictures of reality; separately neither of them fully explains the phenomena of light, but together they do.*"

And, in the Wiki article for *photon,* or an elementary particle of light*:*

> A single photon may be refracted by a lens or exhibit wave interference with itself, but also act as a particle giving a definite result when its position is measured.

Here is how we observe this contradiction, in actual practice. There is an instrument called a "diffraction grating," made of slits cut into a substance such as fused silica. These slits allow light to be split into its component parts, much like a prism—often creating a rainbow effect as waves of the light collide with each other and cancel out selected wavelengths.

With a very tiny grating, single electrons can be "shot" through the slit. A screen is placed behind the grating, which allows us to observe the pattern that the electrons make as they pass through the slits.



If we cut only a single slit in the grating, then electrons fired at the grating pass straight through, like bullets. If enough electrons are fired, then the pattern left on the screen behind will have the same outline as the slit, indicating that the electrons behave like particles.

Now if we cut a second slit in the grating and fire electrons towards the two slits as we did at the single slit, we would expect the resulting pattern on the screen to resemble the two slits. But something strange happens. When we shoot the electrons through two parallel slits, the resulting pattern is exactly the one we get when two waves collide.

In some spots as they travel past the slit, the waves build on each other and create a bright vertical line on the screen behind. In other places, the waves interfere with each other, leaving blank black vertical areas on the screen. The resulting pattern is a series of separate, bright vertical lines across the screen, tapering off in brightness towards the two sides of the screen.

This is a very typical pattern for wave interference, and strongly implies that light moves in waves, and not in particles. Thus we have light behaving in two contradictory ways.

But that's not all! If we place an instrument at the single slit to observe the passage of the electrons and determine their behavior, we do confirm that they pass through behaving like particles. But if we place the observation instrument at one of the slits of a two-slit grating where the particles were acting like waves, *the electron stops acting like a wave and goes back to acting like a particle.*

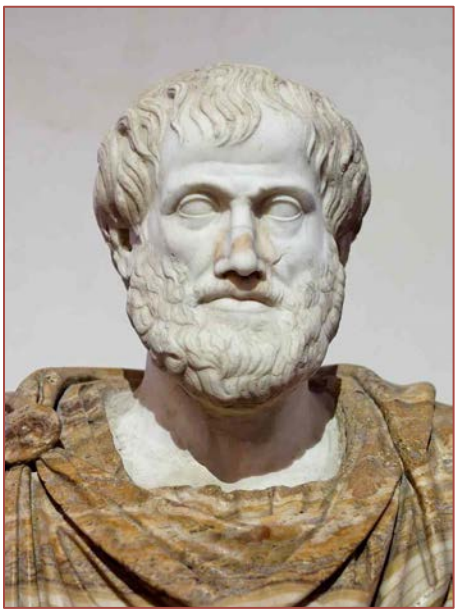
Researchers often remark that it is almost as if the particle were reacting to the presence of an observer. And that brings us to presentations from the higher schools of ancient Buddhism which just might resolve these paradoxes of Science, and make it complete—in more ways than one.

A Better History of Time

Part Three: The Scientific Method

Going at questions with the jewel of science: the Scientific Method

We can say now that we have two problems to solve.



One is: Why did my partner criticize me today? How can I stop it in the future?

The other is: Can we find a better way to explain why objects have the qualities they do, and how objects interact with other objects?

We are asking this question because the atomic theory which is the basis of all the physical sciences has at least two contradictions: (1) we cannot explain how an atomic particle possesses a unique characteristic which interacts with other objects; and (2) all matter appears to behave in contradictory ways, both as a particle and as a wave.

As we've noted above, the answer to these two questions should be related: If we really discover the key to the universe, it should apply as well to our interactions with our partner: It should apply to our real life.

Stephen Hawking states the grander paradox of physics as follows, in his *Brief History of Time:*

> Today scientists describe the universe in terms of two basic partial theories—the general theory of relativity and quantum

mechanics. They are the great intellectual achievements of the first half of this century.

The general theory of relativity describes the force of gravity and the large-scale structure of the universe, that is, the structure on scales from only a few miles to as large as a million million million million (1 with twenty-four zeros after it) miles, the size of the observable universe.

Quantum mechanics, on the other hand, deals with phenomena on extremely small scales, such as a millionth of a millionth of an inch.

Unfortunately, however, these two theories are known to be inconsistent with each other—they cannot both be correct. One of the major endeavors in physics today, and the major theme of this book, is the search for a new theory that will incorporate them both—a quantum theory of gravity.

Later we will add yet a more important, general question: Is there any necessary relationship between how matter behaves, and the welfare of living beings on this planet? Or is it true that, as Hawking says elsewhere in his *Brief History,* "The discovery of a complete unified theory, therefore, may not aid the survival of our species. It may not even affect our life-style."

One of the greatest achievements of science is the Scientific Method, which as the Oxford English Dictionary defines as "a method or procedure that has characterized natural science since the 17th

century, consisting in systematic observation, measurement, and experiment, and the formulation, testing, and modification of hypotheses."

Here are the steps of the Scientific Method that we should use, if we are going to try to posit a new, unified theory of how things work in the universe: How things interact with each other.

It took humanity a very long time to develop all the details of this method—most people attribute its roots to Aristotle, 17 centuries ago— and deep at heart most of us in the modern world accept it as valid: it has become perhaps the closest thing to a universal religious belief in this world. These in essence are the rules that decide whether or not we believe anything.

A summary of 18 steps of the Scientific Method

1) Formulation of a question through observation and reflection
2) An hypothesis of how we might answer the question
3) A prediction of what should happen if our hypothesis is true
4) An experiment to test our hypothesis
5) Documentation: a careful account of the steps of the process of the experiment, and the data recorded
6) Watchfulness against bias such as expectations,

previously held beliefs, and a desire for novelty or peer recognition; use for example double-blind tests, avoid hindsight bias

7) Openness to new possibilities & discoveries; including a recognition of the role of chance or serendipity in discovery—refer to the Wikipedia article on "Scientific Method":

Somewhere between 33% and 50% of all scientific discoveries are estimated to have been *stumbled upon,* rather than sought out. This may explain why scientists so often express that they were lucky. Louis Pasteur is credited with the famous saying that "Luck favours the prepared mind."

8) Recognition of the limitations of the equipment, staff, and process
9) Operational definitions of relevant quantities
10) Analysis of results of experiment; the drawing of conclusions
11) An estimate of the degree of uncertainty in the results
12) Publication of these results
13) Archiving of data and conclusions for the future
14) Sharing of data
15) An external review of experiment & conclusions by peers
16) Replication of experiments by others, preferably neutral parties not related to the original researchers
17) Increasingly sophisticated characterizations (explanations) of the ideas involved, as time goes by

18) Confirmation and utilization of conclusions
by community

Nine classical preconceptions from the great schools of Buddhism

The sixth of the 18 steps outlined above for the wonderful Scientific Method Watchfulness advises us that we must "watch against bias, such as expectations or previously held beliefs." In point of fact, it may be very strong preconceptions—so strong that we possess them even from birth—which prevent us from even considering a truly unique solution to the (now) three inconsistencies of Science as it stands today.

Classical Buddhism describes nine of these possible preconceptions that are especially useful in our current study (there are many more). Let's cover them one by one; they are increasingly more subtle errors, which once we overcome them allow us to come at our new Unified Theory with a fresh, unbiased state of mind—entirely necessary if we are really to follow Scientific Method.

1) རྟག་པ།

Takpa

Things will stay this way (my partner will always be critical like this)

2) གཅིག

Chik

Objects must be grouped the way I see them (my partner as critical, isolated from their own pressures)

3) རང་དབང་ཅན།

Rang wang chen

Operating on its own steam (my partner wills to be critical)

4) རང་རྐྱ་ཐུབ་པའི་ཇུས་ཡོད།

Rang-kya tuppay dzeyu

Substantial, in the sense of being able to direct things (my partner could make me feel un-criticized if they chose to)

5) གཟུགས་དང་གཟུགས་འཛིན་པ་ཇུས་གཞན།

Suk dang suk dzinpa dze shen

I have come to any particular instance of criticism, to this kitchen, along my own event-trail; and so has my partner—they could not be flowing from a single previous event which was ethically charged

6) རྟུལ་ཕྲན་བསགས་པའི་གོང་བུ།

Dultren sakpay gongbu

The physical manifestations of my partner—things like the redness of their face as they criticize me, and the sound of the words they use to criticize me—exist out there, as clumps of tiny atoms

7) རང་ཉིད་རང་ཉིད་ཅེས་པའི་ཐ་སྙད་འཇུག་པའི་འཇུག་གཞིར་ཡིན་པ་

རང་གི་མཚན་ཉིད་ཀྱིས་གྲུབ་པ།

Rang-nyi rang-nyi chepay ta-nye jukpay jukshir yinpa
rang gi tsennyi kyi druppa

The way I feel about my partner's criticism this evening—the way I choose to name it, or interpret it—is the only way it could be

8) བློ་གནོད་མེད་ལ་སྣང་བའི་དབང་གིས་བཞག་ཙམ་མ་ཡིན་པར་

ཡུལ་རང་གི་ཐུན་མོང་མ་ཡིན་པའི་བསྡུད་ལུགས་སུ་གྲུབ་པ།

Lo nu-me la nangway wang gi shak tsam mayinpar yul
rang gi tunmong mayinpay duluk su druppa

The way I see my partner acting is in fact coming completely from them; it is not as though it is a creation of my mind based on indications or signs coming from them.

9) མིང་བརྡས་བཞག་ཙམ་མ་ཡིན་པར། ཡུལ་རང་གི་བསྡུད་ལུགས་ཀྱི་ངོས་ནས་གྲུབ་པ།

Ming de shak tsam mayinpar, yul rang-gi duluk kyi ngu ne druppa

My unhappy partner sad face and gestures could not be a product of names and mental images popping out of karmic

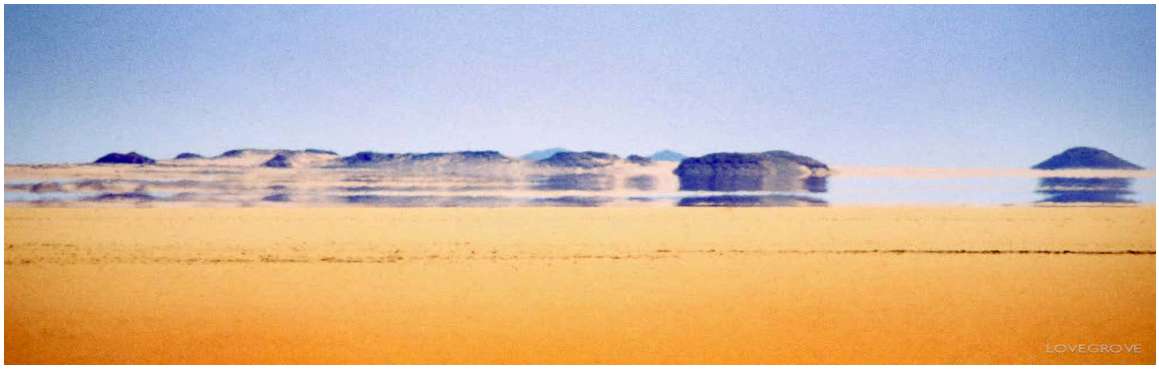
seeds which I planted through my behavior towards others last week.

Out of the realm of outer objects

Working up through these nine more and more subtle inconsistencies—where by the end of #6 we have encountered and overcome our inborn bias for believing that the people and objects that I observe around me in my world are made of tiny particles of matter with their own unique identity—brings us to an important threshold in classical Buddhist thought: the need to go beyond the idea that objects exist "out there," independent of my own mind.

By the end of the experiment with the slits of the diffraction grating, we have reason to suspect that it's not the case that particles are behaving in two contradictory ways; that, rather, there may be something going on with the person conducting the experiment themselves.

That is, could it be the case that the very instrument of the perceiver—their eyes and mind—are somehow skewing the results of our experiment? And if so, then how would we know, with that same mind, that we *are* skewing the experiment? If my mind is like a telescope with a dust spot on the inside of the lens that makes me see something which was never there, how can I ever *know,* with that same mind, that the dust spot is there?



The answer is **reason:** the capacity for example to deduce that what we see with our senses may be wrong. On a drive across the Arizona desert, my eyes may report to me that a large body of water is lying across the road on a day in the middle of a long rainless summer; but my mind—considering the unlikelihood of the water—can reason out that I must be seeing a mirage.

In our case, someone has alerted us to the possibility that our tendency to perceive the objects in our world as being made of atomsfull of stuff may simply be the result of a preconception so deeply rooted that we have in fact carried it from birth. We further gradually develop a mistrust for this perception once we detect "cracks" or inconsistencies in this view of the world, raised by the very people—scientists—who have proposed that this perception is correct.

That is, we have those two inconsistencies we've already described in detail: the fact that atoms broken down to the point required to facilitate causality can no longer exhibit any ability to cause; and the fact that we can verify that particles act in two contradictory ways: as particles, and as waves.

Having examined and removed the nine classical preconceptions that might be skewing our perception, we are

ready to carry out an experiment free of these pre-existing biases. We shall proceed using the 18 steps of Scientific Method described above.

Nagarjuna's Hypothesis

1) Formulation of a question

Our question is threefold:

- Is there a more accurate way to describe what gives substances their unique qualities, such as the hardness in iron?

- Is there, as a result, a more accurate way to describe how substances interact? That is, can we describe causality in a way which doesn't run into the problems we've already seen?

- Finally, and most importantly, is it necessarily the case that—if we do uncover a more accurate way of describing natures and interactions—it would be of unequivocal benefit to livingkind? That is, *is it possible that a complete understanding of substances and their interactions would necessarily lead to the construction, for example, of automobiles which could never get in accidents; and airplanes which could never crash?*

2) An hypothesis of how we might answer the question

Master Nagarjuna, an eminent Buddhist thinker from the 3rd Century, proposes a seemingly enigmatic answer to our questions, in his landmark work, *Foundational Verses entitled "Wisdom"*. The lines here constitute the first verse in the first chapter of that work, itself entitled "An Examination of How One Thing Causes Another."

> Things don't come from themselves,
> Nor do they come from other things.
> Neither do they come from both,
> And neither do they happen without a cause.
> In fact there is no object at all
> Which ever comes from anything.

Nagarjuna's hypothesis then is that nothing is caused by anything else in any of the ways we ever thought things could be. What he's saying is that things *do* cause other things, but not at all in the way we always thought they did. Let's get some specifics on how he thinks things *can* be caused, and then wrap up by applying the other steps of the Scientific Method to his full hypothesis.

The Pen Thing:
it's all a matter of perception

Master Nagarjuna begins acquainting us with his hypothesis by holding a pen up in front of us.

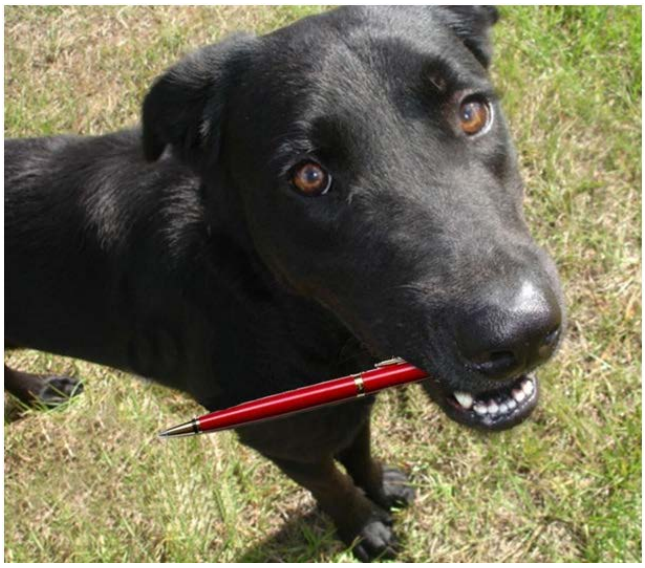
"What is this thing?" he says.

"A pen," we reply.

"And if a puppy dog came into the room, and I stooped down and waved this thing in front of the puppy, what would they do with it?"

"Well, they might very well bite it."

"So does the dog see this thing as a pen?"



"No, he sees it as a chewtoy."

"Well then, who's right—the dog or the human? Is this thing a pen, or a chewtoy?"

We think about it for a moment and shrug and say, "Well, I guess it can be both, at the same time. It just depends on who's looking at it."

And that's right, because the human can correctly use the pen to write something, and the dog can just as correctly enjoy chewing on it.

Master Nagarjuna then lays the pen down on a desk and asks us, "Suppose now I set this down here, and all the dogs go out of the room, and all the humans go out of the room too. At that moment, which one is it—a pen or a chewtoy?"

We think for a moment more and give another good shrug and say, "Well, at that moment it's not really either one. It's just sort of available to be one of those things."

"And what does it become, if the dog walks back in?"

"If the dog walks back in, it becomes a chewtoy."

"And if the human walks back in?"

"If the human walks back in, then it becomes a pen."

"So now let me ask you another question. If that's the case, then is the pen coming from the pen's side, or is the pen coming from the human's mind? Which one?"

"Well if it becomes a pen when the human walks back in, then I think we'd have to say that it's coming from the human's mind."

But how does that work? Let's go further in our observations.

The role of free will

At this point, says Master Nagarjuna, a question arises. Given that the pen seems to be coming from my mind, can I just close my eyes and engage in some really positive thinking—can I *wish* really hard that the pen was a large diamond, and it would become one?

Try. It doesn't work.

The pen may be coming from my mind, but it's not something happening because I *wished* it to. There must be some other explanation of how the pen comes from my mind. In fact, my mind must somehow be *forced* to see a pen. How does that work?

How seeds are planted

Master Nagarjuna hypothesizes that there are seeds or potentials in my mind which—when they open up—force me to see a pen, rather than the chewtoy which the dog is forced to see.

These seeds are planted by three different steps, as outlined in the fourth chapter of the famed *Treasure House of Wisdom*, from which we got our 6 types of causes, earlier on.

Step #1

To plant a mental seed, I must first decide what I would like to achieve. In our example so far, we can say "I would like to see a day when my partner never criticizes me again."

Step #2
To plant this seed—the seed to reach a point where I never see my partner criticize me again—I must choose another person who is having some kind of problem with their partner, and make some kind of plan for how I could help them. This intention itself already begins the process of planting seeds to see my partner change.

Step #3
Do actually help this other person with the problem they are having with their partner. This completes the seed planting.

In the case of a pen, Step #1 would be wanting to have a steady supply of pens, far into the future. Step #2 would be choosing someone who needs pens, and deciding how to help them get the pens. Step #3 would be actually carrying out the plan I made, to help them. These three steps, says Master Nagarjuna, would plant the seed for future pens.

The same three types of steps, for helping someone who is having trouble with their partner, would plant the seed for me to see my own partner stop criticizing me.

How seeds ripen

If you want a watermelon, says Master Nagarjuna, it's not enough to plant a watermelon seed. You have to take proper care of the seed, or else maybe it will just sit there underground, forever! You need to *water* the seed.

To water a mental seed, we just have to focus on it. Turning our attention to a mental seed sets in motion the forces needed for it to open quickly.

For example, if I planted seeds by helping someone else who has a similar problem with their own partner, then I can add a Step #4 to the three that went into planting the seed.

We call this step "Coffee Meditation," and we do it as we are going to bed. We just lay back and think in great detail about the person we tried to help—the person who was having a problem with their partner. Being happy about good things we have done for other people is the water that makes these seeds grow and open fast.

And just how does the seed open?

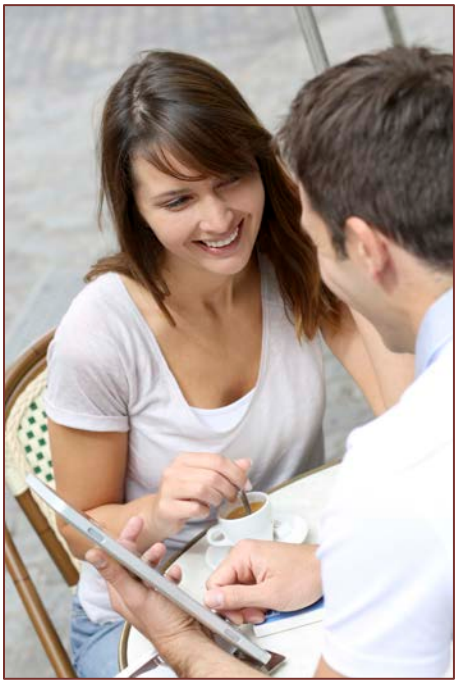
Suppose I am looking a black stick—the same stick that, when the dog looks at it, they see a chewtoy. If I have correctly planted, in my own mind, a seed for a pen (basically, by providing someone else with a pen), then when that well-watered seed cracks open, out pops a tiny, silverish, luminous image of a pen. My mind overlays this image, which is something like a hologram, on the pen—and this is why I see a pen.

The same happens with the two arms and two legs and head that presents itself in front of me in the kitchen. If I have planted a negative seed by yelling at the kids last week, then the tiny mental image of a partner who criticizes me will flow out of that seed and overlay these parts or indicators of a person. And then I will see my partner criticize me.

It is crucial to note, right here, that we have now reached a point where WE CAN NO LONGER SAY that my partner consists of external atoms. They consist of the indications of a possible partner "glued together" into a critical partner by mental images dictated to me by seeds that I planted last week, by being critical of our children, for example.

Starting our experiment

Now we're ready for the next three steps of the Scientific Method.



3) A prediction of what should happen if our hypothesis is true

If Nagarjuna's Hypothesis is true, then we would expect our partner's critical attitude towards us to gradually get less, every week, so long as we continue to help that other person with their partner problem. That is, if we were careful to help this person on a regular basis (say, once a week, every Friday afternoon for example, for an hour starting at 3pm), and if we were careful to *water* the seed properly as we go to bed, then we could predict that within a month we would see some noticeable change in our partner's critical attitudes.

4) An experiment to test our hypothesis

We test Nagarjuna's Hypothesis by following the Four Steps for mental seed planting. As with all gardening, we must follow these steps *correctly,* and on a regular basis (3pm every Friday, for an hour).

5) Documentation: a careful account of the steps of the process of the experiment, and the data recorded

The ancient Buddhist thinkers recommend keeping a small journal and making entries on a regular basis (say, every time we sit down to eat a meal) to track a personal experiment like this, where we try to change our critical partner. Part of the reason to keep a journal is that sometimes the Seed Technique works so well that we can't ever *recall* that we used to have a problem with our partner criticizing us!

Watching for weeds in the garden

6) Watchfulness against bias such as expectations, previously held beliefs, and a desire for novelty or peer recognition; use for example double-blind tests, avoid hindsight bias

Having already weeded some 9 different preconceptions out of our mind, we would want to be very watchful that they and other, similar forms of bias did not skew our results!

The rest of the steps, in brief

7) Openness to new possibilities & discoveries.

We have to remain completely open to the possibility that this combination of ancient wisdom and modern scientific knowledge accumulated to date may be creating new and extraordinary changes in our life. We may have a tendency to

try to explain positive results with our old models, just because we are so used to them.

8) Recognition of the limitations of the equipment, staff, and process

We have to remain cognizant especially of the fact that our personal perceptual apparatus may very possibly have been "infected" with very strong biases, even from our birth. Also that we possibly have had many years of collecting many thousands of seeds before we undertook the experiment, and these may affect how the new ones ripen. It is said, for example, that mental seeds double in power every 24 hours that passes before they ripen.

9) Operational definitions of relevant quantities

We have to be careful not to get stuck in misunderstood or unclear terms; a prime example would be all the confused ideas about the term "karma." We should try very hard to keep our experiment clear of biases and expectations in favor for example of Buddhism in general. We have to be very clear in defining the meaning of every concept we use; and be careful to avoid unclear or "loaded" terms.

10) Analysis of results of experiment; the drawing of conclusions

If we do gain success from an experiment, we cannot forget that it *was* an experiment; and that we have to be willing to adjust our view of the explanations offered by science, in light of the results of our experiment.

11) An estimate of the degree of uncertainty in the results

We have to be willing to admit other possible causes of the success of our experiment, and continue with increasingly more sophisticated experiments until we gain enough data to be relatively certain that Nagarjuna's Hypothesis is accurate in actual practice.

12) Publication of these results

If we find a new system for gaining the things that we want for a happy life, and we find that it works successfully, then we would be negligent if we didn't share this system with others who we feel fairly sure would want to know about it, so that they could use it themselves.

13) Archiving of data and conclusions for the future

This would basically mean keeping the journals and other notes that we made as we did our first personal experiments to confirm this new concept, so that others could share them as they began their own personal experiments.

14) Sharing of data

Real wisdom which is left unshared with others because of our own selfishness or sloth can only be described as a tragedy.

15) An external review of experiment & conclusions by peers

Talk about your self-experiment with friends, to see if they can see any "holes" in what you think has happened to you. Be open to other ideas; this is the quicker way to truth.

16) Replication of experiments by others, preferably neutral parties not related to the original researchers

Help others to repeat your experiment, and see if they get the same results. This will reinforce our own efforts. Seek out especially intelligent people who are willing to follow Scientific Method to confirm these ideas, even if originally they may be critical of your ideas and methods. Use their criticism to sharpen your ideas.

17) Increasingly sophisticated characterizations (explanations) of the ideas involved, as time goes by

Help the world work towards a perfection of these methods and explanations. Be willing to give freely of your resources—both time and finances, for example.

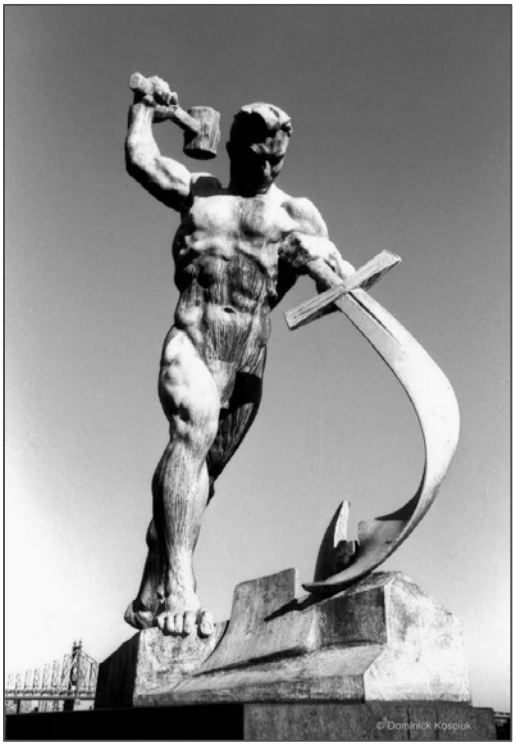
18) Confirmation and utilization of conclusions by community

Hold in your mind a vision of a world which has reviewed your experiments and come to accept them, and put them into practice in their own lives. Here is what it will look like:

The bigger happy ending—

A science which cannot hurt livingkind

This is a bigger subject than we can cover here in detail, and perhaps that should be saved for some future, more expanded teaching.



Suffice to say that let's remember that we were talking about what gives iron its hardness. If it's a particular number and arrangement of electrons and neutrons and other particles which does so, then it would still be possible to use this iron for purposes which hurt livingkind; for example, in guns that shoot or in cars that crash.

Iron which is made without a full understanding of what gives iron its hardness *can,* in fact, hurt others.

But suppose that we finally understand that what gives iron its hardness is the fact that—for example—I take some of my own personal time to build shelter for the needy. The more I consciously build these structures in a sturdy way, then the more seeds I plant in my mind to see substances—such as iron—be strong and hard when I need them to be: for example, in the safe construction of my own home.

If a person producing the steel for an automobile for their use were to do so while helping others to get places safely, then they would be avoiding the seeds to see themselves ever be in

an accident. A vehicle produced under these conscious conditions could never crash or hurt a person.

And in this case we would have disproved, finally, the statement found in Stephen Hawking's *Brief History of Time* which says,

> The discovery of a complete unified theory,
> therefore, may not aid the survival of our species.
> It may not even affect our life-style.

Because a truly unified theory would *assure* our survival, and our happiness. We could then say that we had discovered *A Better History of Time.* More on that later!