**FOUNDATIONAL ORIGINS OF CHANGE IN THE UNIVERSE**

**Abstract**

The universe is continuously new due to the roles of seven omnipresent sources of change. These foundational sources of change are here identified and described. While each source of change is unique, they each initiate change in the form of noncoexistent-sequential-difference, which is the core characteristic of change. The occurrence of noncoexistent-sequential-difference, the occurrence of change, initiates the existence of something new. Each unique source of change initiates a unique form of newness. These sources of change, and the different manners in which their change occurs as noncoexistent-sequential-difference, and the forms of newness they initiate, are interrelated due to existential-context, existential-dependency, factor development, and deep-structure. Complex forms of change, such as plate tectonics, biological evolution, the development of culture, and stellar evolution, are based on the seven foundational forms of change together interrelating with diverse other factors.

**Keywords**: change, time, motion, cause, emergence, universe.

**1. INTRODUCTION**

Change is evident throughout the universe from the large scale to the small scale.

1. The rotation of spiral galaxies.
2. Supernovas.
3. Burning stars.
4. Orbiting planets.
5. Planetary geology—volcanoes and plate tectonics.
6. Ecological succession.
7. Biological evolution.
8. Animals moving about.
9. Growth of plants and animals.
10. Molecular dynamics in living cells.
11. Growth of crystals in geodes.
12. Motion of magnets when close together.

Why does all this change occur?

Where does it come from?

What is the source of change in the universe?

This paper identifies seven foundational sources of change.

1. The continuing-existence of space—time.
2. The continuing-existence of matter.
3. Motion.
4. The continuing-existence of motion.
5. The process of emergence.
6. Push.
7. Change due to material interaction.

All other more complex forms of change exist as combinations of these foundational forms.

Real, actual, existing change has two intrinsic qualities by which it can be recognized—noncoexistent-sequential-difference and newness. Newness is the coming into existence of something new that was not there just previously. That is, something new intrinsically to the situation that is changing—not just the appearance of change due to a different or a changing viewpoint, which is a factor extrinsic to the situation that is changing.

Noncoexistent-sequential-difference is change. Walking is an example. When a person is walking along a road, there is continuous change occurring. The process of walking is itself an ongoing continuous change. When walking along a road, a person is continuously passing by different sections of the road.

During the first part of the walk the person is passing by one section of the road. During the middle part of the walk the person is passing by a different section of the road. And during the last part of the walk the person is passing by a third section of the road.

During the first part of the walk, the middle and last parts of the walk are not occurring. During the middle part of the walk, the first and last parts are not occurring. During the last part of the walk, the first and middle parts are not occurring.

The three different parts of the walk did not occur simultaneously. They were not coexistent, but rather occurred sequentially, one after another along a sequence of sections of the road. They occurred in a pattern of noncoexistent-sequential-difference.

Noncoexistent-sequential-difference is the intrinsic basis of change. All forms of actual change in the universe occur in the pattern of noncoexistent-sequential-difference with the occurrence of something new. With noncoexistent-sequential-difference, when the current part is occurring the other parts are not there, they are not occurring. When the part that follows directly after the current part does occur, it is new, newly occurring. Noncoexistent-sequential-difference, change, always results in the occurrence of something new.

The change that happens with each of the seven sources of change occurs in the pattern of noncoexistent-sequential-difference. Each of these seven foundational forms of change is creative, bringing something new into existence. Due to the roles of these essentially omnipresent forms of change, the universe is continuously new.

So, why and how do each of these basic forms of change occur as noncoexistent-sequential-difference and result in the coming into of existence of something new? And what is it that each different source of change brings newly into existence?

**1.1. The continuing-existence of space—time**

While all these seven sources of change are foundational in the universe, there is a pattern of dependency that exists between them. Some of them cannot occur without the concurrent underlying occurrence of another more fundamental form of change. Others are emergent from the occurrence of prior forms. And the seventh, change due to material interaction, is composed of all the other six together.

The continuing-existence of space is the ultimate foundational source of change, the only form of change that is independent of all the other sources of change, but which also enables all those other sources. The continuing-existence of space makes it possible for the other forms of change to occur.

This ultimate foundational source of change enables other forms of change because it is the continuing-existence of space, because it is the continuing-existence of the place where all the other forms of change occur. Each form of change occurs during and concurrent with the continuing-existence of the spatial-place where the change is occurring. Without that place *in which* to occur the other forms of change could not exist, and without the continuing-existence of that place *during which* to occur the other forms could not happen.

Space exists. Space is there, and it continues to be there—space exists, and it continues to exist. Space has continuing-existence. In reality it is not only that space has continuing-existence—space has to have continuing-existence. Space could not exist without continuing-existence.

There are three existence-factors the roles of which are required for there to be existence—any existence at all. These factors are existential-quantity, three-dimensionality, and continuing-existence.

In order for something to exist, in order for something to be there, there must be some quantity of that something, some amount of it. If there is no existing quantity of it, no existential-quantity, then it is not there, it does not exist.

Likewise, for something to exist, for something to be there, it must be three-dimensional. Its existential-quantity must occupy a three-dimensional area of spatial-place. If one of the dimensions of something’s existential-quantity were reduced till there was no longer any existential-quantity in that dimension, there would not be any existential-quantity left to have extension in the other two dimensions. It is impossible for existential-quantity to exist with less than three-dimensions.

And again, for something to exist, for something to be there, it must continue to be there. There must occur some amount, some quantity, of continuing-existence. If something has no continuing-existence, then it is not there, it does not exist.

Actually, if something exists there will be continuing-existence because existence initiates continuing-existence.

Continuing-existence is a consequence of existence. This is a case of consequent-existence. Consequent-existence is the existence of something as a consequence of the mere existence of something else.

That which is there continues to be there simply because it is there. That which exists continues to exist simply because it exists. Existence initiates continuing-existence. If there is existence, there will be continuing-existence. This is the first stage of the development of consequent-existence, a factor that greatly influences the nature of the universe.

With consequent-existence what goes before determines what follows. What goes before determines what follows by way of structural-logic. Structural-logic is the manner in which the intrinsic qualities of something that exists determine what kind of relations that something can have with other things that exist. Structural-logic determines what follows because the existence and intrinsic qualities of what goes before determine the existence and intrinsic qualities of what follows. This occurs either simply by way of the continuing-existence of what has gone before, or by way of what has gone before as modified during its continuing-existence by various foundational sources of change—motion, emergence, caused change, and change due to material interaction.

Realistically, intrinsically, space exists as the infinite, three-dimensional, extension of immaterial place. As such it constitutes the limitless, all encompassing, foundational component of the universe. It provides an existential-context, a place in which to exist, for all else that exists. All forms of change occur in spatial-place during and concurrently with the continuing-existence of space.

The continuing-existence of space occurs as noncoexistent-sequential-difference. Only the current part of that continuously ongoing change is occurring. Previous part of the ongoing change ceases to exist as the current part occurs. And the future part does not exist because it has not yet occurred.

The parts of the continuous change—what has gone before, what is occurring now, and what will occur—are not coexistent. When one part is occurring, is existing, the other parts are not occurring, are not existing. The parts are noncoexistent.

Because the parts are noncoexistent, they are distinct, different from one another—each, when it is occurring, has its own intrinsic existence. The parts of the continuing-existence of space occur in sequence—first the previous part, then the current part, and eventually the future part. The change of the continuing-existence of space occurs as noncoexistent-sequential-difference. Intrinsic noncoexistent-sequential-difference is change.

When the previous part of the continuing-existence of space was occurring, the current part was not there, was not occurring, did not exist. When the current part does occur, it is newly occurring, newly existing—new part of spatial-continuing-existence.

Because space is the foundational component of the universe, providing an existential-context, a place in which to exist for all else that exists, the continuing-existence of space is the foundational form of continuing-existence. New part of spatial-continuing-existence is, then, the foundational form of newness in the universe. This universal foundational continuously ongoing change during which all other forms of change occur has traditionally been called time.

**1.2. The continuing-existence of matter**

The following six sources of change all involve matter in one way or another—the continuing-existence of matter, the motion of matter, or some form of material interaction.

The forms of change that occur with motion, emergence, caused change, and change due to material interaction, take place during the continuing-existence of whatever is undergoing change. And the continuing-existence of what is undergoing those forms of change occurs during the continuing-existence of space, during time. All forms of change involving matter take time to occur.

Matter exists, and it continues to exist. Matter has continuing-existence. The continuing-existence of matter, because it is a form of continuing-existence, occurs as noncoexistent-sequential-difference. When the previous part of the continuing-existence of matter was occurring, the current part was not there, was not occurring, did not exist. When the current part of material-continuing-existence does occur, it is newly occurring, newly existing—new part of material-continuing-existence.

**1.3. Motion**

Motion is the passage of matter through space. Motion has two different intrinsic forms of noncoexistent-sequential-difference. The first form is motion itself through space, as measured by a ruler of some sort. The second form is the continuing-existence of that motion, how long the motion continues to occur as measured by a clock.

Because space is immaterial and cannot interact with matter in any way, the motion of matter in relation to space itself is unincumbered, smoothly continuous. Motion is intrinsically smoothly continuous.

When motion is passing through one part of space, it is no longer passing through the part of space it just previously passed through, and it has not yet passed through the part of space that it will pass through. Motion passes through different parts of space sequentially during different parts of the ongoing motion. The parts of motion as it passes through different parts of space are distinct, different—not coexistent. Motion occurs as noncoexistent-sequential-difference.

When the prior part of an ongoing motion was passing through a part of space, the current part of that continuous motion which is passing through a different part of space did not then exist, was not then occurring. As the current part occurs now, it is newly occurring—new part of ongoing motion.

**1.4. The continuing-existence of motion**

Motion exists, and it continues to exist. Motion occurs, and as long as it is occurring it is continuing to exist. Motion has continuing-existence. The continuing-existence of motion, because it is continuing-existence, occurs as noncoexistent-sequential-difference.

When the ongoing continuing-existence of motion was occurring as the motion was passing through a part of space, the current part of the continuing-existence of that motion was not there, it was not occurring, it did not yet exist. When the current motion is passing through a different part of space, the current part of the continuing-existence of the motion is newly occurring—new part of the continuing-existence of the motion.

With motion there are two kinds of change occurring simultaneously, two kinds of noncoexistent-sequential-difference. The one, motion itself, occurs in relation to space. The quantity of motion is measured by how far it has progressed through space using some form of distance measurement. The other, the continuing-existence of motion, occurs in relation to time. The quantity of the continuing-existence of motion is measured by how long it continues to occur using some form of temporal measurement, some form of clock.

**1.5. The process of emergence**

Every group of material objects has an intrinsic pattern-of-organization based on the distance and direction relations between the objects in the group. Emergence is the coming into existence of a newly occurring pattern-of-organization as a consequence of the motion of one or more objects in the group. Motion of the members of the group changes the distance and/or direction relations resulting in a different pattern of relations—a new pattern-of-organization of the group.

Prior to the occurrence of motion there is a specific pattern-of-organization. After the motion there is a different pattern-of-organization. Then, following further motion, there will be yet another pattern, also different. These patterns occur sequentially, one after another. The patterns do not occur simultaneously—they are not coexistent. The occurrence of the patterns-of-organization of the group is a case of noncoexistent-sequential-difference.

**1.6. Push**

When one object collides with a second object perpendicular to the direction of motion of the second object, the one object will push against the second object. The push forces a change in the direction of motion of the second object. The push makes the change happen—the push causes the change. The push is cause.

Before the collision, the direction of motion of the second object was unaffected. The changed direction of motion of that object was not there. When the collision occurred, and the one object pushed on the second object, and the change in direction occurred, the prior unaffected direction of motion was not there—it no longer existed. The two different directions of motion were not coexistent, occurring sequentially, one after the other—noncoexistent-sequential-difference.

When the change in direction of motion of the second object occurs after the collision, it is newly occurring—new caused change.

**1.7. Change due to material interaction**

When change occurs due to collision and push, the contribution of matter to that situation is nothing more than the substantiality of the matter. The substantiality of the one object pushes against the substantiality of the other object. No other quality of matter is necessary.

A collision is a form of interaction between matter one part with another.

The substantiality that plays a role in collision is a basic quality of matter. Matter has many other qualities that enable a great diversity of other more complex forms of material interaction.

Coherence, matter binding one part with another, is an example of material interaction based on qualities of matter other than substantiality. Coherence is one of the foundational forms of material interaction. There are several ways in which matter can bind together. With each type of binding, each type of coherence, the result is the emergence of some form of material structure. Everything that a human can see is basically a form of material structure. Coherence, matter combining with matter, is one of the most significant sources of change in the universe.

The situation prior to current coherence, in which there is no material structure due to current combining, and the situation following current coherence, in which there is now emergent material structure, are different, distinct, in that they are not simultaneous, not coexistent. The two different situations occur sequentially one after the other—noncoexistent-sequential-difference.

In a specific situation, before units of matter combine coherently, there is no material structure due to current coherence. After coherence occurs, there is emergent material structure—new material structure.

All these seven sources of foundational change occur as noncoexistent-sequential-difference, which is the core nature of change. They each result in the coming into existence of something new that was not there just prior.

**2. DISCUSSION**

**2.1. Forms of newness with the foundational sources of change**

There are five general forms of change—(1) continuing-existence, three types, (2) motion, (3) the process of emergence, (4) push, (5) change due to material interaction. Each has a unique form of newness.

1. Continuing-existence.
	1. The continuing-existence of space—new part of spatial-continuing-existence.
	2. The continuing-existence of matter—new part of material-continuing-existence.
	3. The continuing-existence of motion—new part of motion continuing-existence.
2. Motion—new part of ongoing motion.
3. The process of emergence—new pattern-of-material-organization.
4. Push—newly existing effect, newly existing caused change.
5. Change due to material interaction—newly existing bonding and altering relations.

**2.2. Existential-context relation for the foundational sources of change**

The infinite, three-dimensional, extension of immaterial spatial-place provides an existential-context, a place in which to exist, for all else that exists.

The continuously ongoing change of the continuing-existence of spatial-place provides a changing existential-context, a place in which to occur, for all other forms of change. The noncoexistent-sequential-difference of spatial-continuing-existence provides a changing existential-context for the noncoexistent-sequential-difference of all other forms of change.

The continuing-existence of space, the continuing-existence of the place where other forms of change occur, provides a temporal-context during which all other forms of change can occur.

**2.3. Existential-dependency relations between the foundational sources of change**

***2.3.1. Existential-context dependency***

Everything that exists other than space does so in the place provided by space. The infinite, three-dimensional, extension of spatial-place is all the place there is. To not exist in spatial-place is to not exist. Everything that exists in space is existentially-dependent on space for a place in which to exist.

Likewise, all forms of change other than spatial-continuing-existence take place during the continuing-existence of the spatial-place where those changes are occurring. The continuing-existence of space is the only infinite, universally omnipresent changing existential-context for the occurrence of change. To not occur during the continuing-existence of space is to not occur. All real change is existentially-dependent on spatial-continuing-existence for a changing context in which to occur.

***2.3.2. Continuing-existence existential-dependency relations***

The continuing-existence of matter occurs during, concurrently, with the continuing-existence of the space the matter occupies, and thereby simultaneously with the omnipresent continuing-existence of infinite space. This is the specific existential-context dependency of material-continuing-existence on spatial-continuing-existence.

The continuing-existence of motion occurs during, concurrently, with the continuing-existence of the matter that is moving. By occurring concurrently with the continuing-existence of the matter that is moving, which is occurring currently with the continuing-existence of infinite space, the continuing-existence of the motion is also occurring concurrently with the continuing-existence of infinite space.

With the existence of matter there are two forms of simultaneous continuing-existence, the continuing-existence of the matter and the continuing-existence of space. With the existence of motion there are three forms of simultaneous continuing-existence, that of the moving matter, that of space, plus the continuing-existence of the motion.

The continuing-existence of the matter, and the continuing-existence of the motion are concurrent with and existentially-dependent on the continuing-existence of space in the existential-context relation. The continuing-existence of the motion is existentially-dependent on the continuing-existence of the matter because it is the matter that is moving.

The existential-dependency relation of the continuing-existence of the motion to the continuing-existence of the matter is different from the dependency relations of the continuing-existence of the matter and the motion to the continuing-existence of space, which is an existential-context relation.

Because space is immaterial, it does not have any form of relation to anything else that exists other than providing the existential-context. Space and matter are two entirely different forms of existence—the one immaterial, the other substantial. The existential-context / existential-dependency relation between them is between two different things that exist—the relationship is extrinsic in nature.

The existential-dependency relation between the continuing-existence of motion and the continuing-existence of the matter that is moving is between the matter and what the matter is doing—both based on the matter only. The relationship is intrinsic in nature.

***2.3.3. Motion existential-dependency relations***

Motion has an existential-dependency relation with material-continuing-existence because motion occurs during and concurrent with the continuing-existence of the moving matter. Motion also has an existential-context existential-dependency relation with spatial-continuing-existence because motion occurs during the continuing-existence of the space through which it passes.

***2.3.4. Existential-dependency relations that occur with the process of emergence***

Emergence is based on the motion of matter so all the existential-dependency relations that occur with motion and with the continuing-existence of matter also occur with the process of emergence.

The process of emergence has an existential-context existential-dependency relation with the continuing-existence of space because the process of emergence takes place during the continuing-existence of the spatial-place where the process occurs, and thereby with the continuing-existence of all infinite space, the temporal relation.

***2.3.5. Push existential-dependency relations***

Push is an emergent factor. The occurrence, the existence, of push is existentially-dependent on the process of emergence. All the prior forms of existential-dependency that occur with the process of emergence also occur with push.

***2.3.6. Existential-dependency relations that occur with change due to material interaction.***

The situation is essentially the same with this source of change as it is with push. Change due to material interaction is a consequence of push and is thereby existentially-dependent on push. Thus, all the prior forms of existential-dependency that occur with push also occur with change due to material interaction.

**2.4. The developmental and deep-structure relations of the foundational sources of change.**

Development is sequential-difference through space and structure, through time and change. Sequential-difference is a universal—omnipresent throughout space, time, matter, and change. There is an immense variety of different forms of sequential-difference.

With the development of change, the transition from existence to continuing-existence is a case of sequential-difference by way of consequent-existence. The sequential-difference, the development, from existence to continuing-existence occurs by way of existential-pathway-development. Existential-pathway-development is the continuously ongoing sequentially connected development of a situation through space, time, and process interrelations.

The development from existence to continuing-existence is a simple example. A more complex example occurs with a group of horses racing around a track. The progress of the group around the track and the changing positions of the horses relative to one another are examples of sequentially connected change, sequentially connected development—existential-pathway-development.

Factor-development is a different kind of development, a different kind of sequential-difference. A factor is something that exists and plays a role in the situation in which it exists. Factors develop, occurring in simple form in simple situations where few other factors are playing roles, and occurring in more complex forms, more developed forms, in situations where more other factors are playing roles.

The foundational sources of change develop, occurring in simpler forms with the three types of continuing-existence, and then occurring in complex forms with change due to material interaction. There is a developmental sequence with the three forms of continuing-existence based on what it is that is continuing to exist—space, matter, or motion.

The continuing-existence of space is the simplest because of the immaterial nature of space. The continuing-existence of matter is more complex because substantiality is quite complex compared to immateriality. The continuing-existence of motion is more complex yet because it involves the complexities of substantiality, since it is matter that moves, to which are added the intrinsic qualities of motion.

What is continuing to exist with substantial matter is more complex than what is continuing to exist with immaterial space. And what is continuing to exist with motion is more complex than what is continuing to exist with just matter itself because the qualities of motion are continuing to exist additionally to the qualities of the matter that is moving.

Due to the existential-dependency relations among the foundational sources of change, at each stage of their development all the prior stages are still there, and still playing their roles in the intrinsic nature of each stage. All the prior stages that are still there together at each stage constitute the deep-structure of each stage. The deep structure of a stage of the development of change is composed of prior simpler stages of change.

As a factor, deep-structure is one of the universals, omnipresent throughout the material component of the universe. It is evident in the hierarchical organization of that material component. Quarks are present as deep structure in protons and neutrons. Quarks, protons, and neutrons are present as deep structure of atomic nuclei. Quarks, protons, neutrons, atomic nuclei, and electrons are present as deep structure of atoms. Quarks, protons, neutrons, atomic nuclei, electrons, and atoms are present as the deep structure of molecules. Quarks, protons, neutrons, atomic nuclei, electrons, atoms, and molecules are present as the deep structure of essentially everything humans can see or touch. All objects and systems have component and subcomponent deep structure in multiple levels of organization all the way down to quarks.

The components of deep structure are there, they are present, in both the hierarchical organization of material reality and as the bases of developed forms of change.

**3. CONCLUSION**

Seven unique foundational sources of change are identified. Each is described as occurring in the form of noncoexistent-sequential-difference with an accompanying creation of something new, the two intrinsic hallmarks of change.

Each different source of change creates a unique form of newness.

1. New part of continuing-existence.
	1. New part of spatial-continuing-existence.
	2. New part of material-continuing-existence.
	3. New part of motion continuing-existence.
2. New part of ongoing motion.
3. New pattern-of-material-organization.
4. New effect.
5. New bonding and altering relations.

The seven foundational sources of change are closely interrelated through existential-context, existential-dependency, factor development, and deep-structure.

Space constitutes an existential-context, a place in which to exist for all else that exists. The continuing-existence of space provides a changing existential-context, a place in which to occur, for all other forms of change, thus playing the role of time during which change can occur.

Everything that exists in space is existentially-dependent on space for a place in which to exist. All forms of change, other than the continuing-existence of space, are existentially-dependent on spatial-continuing-existence for a context during which those forms of change can occur.

Each succeeding source of change is existentially-dependent on the prior simpler sources of change. Succeeding sources of change occur during, currently, simultaneously with prior sources. Prior sources of change play roles in the intrinsic natures of succeeding sources.

The nature of change undergoes factor development with each additional source. Each succeeding source is more complex than the prior form, beginning with the simplicity of the continuing-existence of immaterial space and progressing to the complexity of matter’s capacity for material interaction.

Because prior sources of change are still present and playing roles in the nature of succeeding sources, at this foundational level each succeeding source of change has all the prior sources as its intrinsic deep structure.