Resolving the Fourth Spatial Dimension via Motion in Spacetime: Toward a 5D Geometry of Force and Beyond

Abstract:

This paper re-examines the concept of the fourth dimension, proposing the natural next step beyond static three-dimensional forms to be the motion of those forms through both space and time. This reading eliminates the need for an abstract fourth orthogonal axis and unites two previously competing traditions — Charles Hinton's recursive four-dimensional geometry and the spacetime framework of Hermann Minkowski and Albert Einstein.

The mathematics and logic of Hinton's tesseract have long demanded a fourth spatial axis, while relativity established time as the fourth dimension. By regarding the "four-dimensional edges" of the tesseract (and other polytopes) not as representing an additional orthogonal direction through space but instead as displacement vectors tracing paths of change through both space and time, all currently-established representations of four-dimensional forms can be conceived as worldlines — precisely the four-dimensional histories of three-dimensional objects that Minkowski described.

Treating the fourth dimension as both the spatial and temporal capacities of motion (the animated, ever-moving world we live in) opens a natural extension: a fifth dimension of force. This geometric interpretation aligns with historical attempts in Kaluza–Klein theory and its modern successor, Space-Time-Matter theory. The five-dimensional penteract is shown to mirror the structure of particle interactions and cosmological dynamics. The framework then continues beyond physical space toward consciousness, proposing a sixth dimension of possibility (observation, knowledge, awareness) and a seventh of intelligence (reason/logic, choice/will).

Introduction

The tesseract (Hinton, 1888), or hypercube, is understood to be the four-dimensional spatial progression of a cube. It is usually represented through a three-dimensional projection as depicted below—a smaller cube nested within a larger cube, with all corners connected by new "four-dimensional edges."

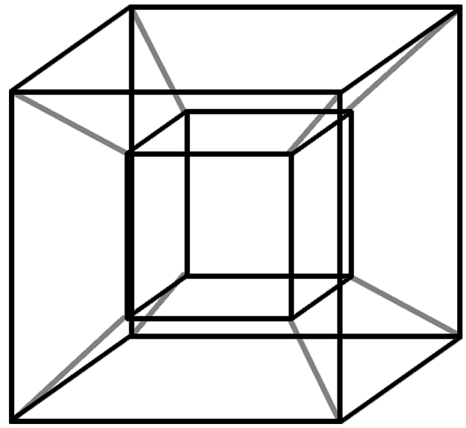

Figure 1: A 2D image of a 3D projection of Hinton’s 4D tesseract—a cube nested within a larger cube with new “4D edges” connecting them.

Hinton reasoned through a method of recursive progression that just as we can picture a square as two parallel lines joined by edges that run in a new perpendicular direction, and a cube as two parallel squares joined by edges that run in a new perpendicular direction, the progression of the cube into a tesseract is then thought of as two cubes connected by new edges that run in a hypothetical fourth direction.

This object has served as the standard representation of a spatially four-dimensional form—a shape presupposing a static fourth spatial axis, an abstract direction at a new right angle to length, width, and height, demanded by recursive mathematics and logic. This paper proposes, however, that no such additional static perpendicular axis exists beyond the familiar three spatial directions. The “four-dimensional edges” of the tesseract (along with other four-dimensional polytopes) need not depict an abstract and unreachable higher space. Instead, what they do perfectly illustrate is what is here proposed as a more complete regard of the fourth spatial dimension: the motion of three-dimensional objects as enabled by the non-spatial dimension of time within space (spacetime).

Through this lens of understanding, the tesseract can be seen as a representation of a cube’s progression from a basic static three-dimensional form into a fourth spatial capacity of motion enabled by time—specifically that of its motion of expansion or contraction. With the outer cube representing a cube at one moment in time and the inner cube as the same cube at a different moment, the “four-dimensional edges” that connect all the corresponding corners can be seen as paths of motion—represented by displacement vectors tracing the vertices' trajectories—as the cube shrinks or grows through space and time.

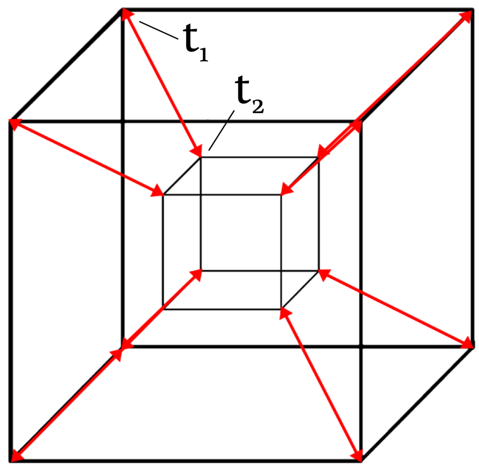

Figure2: Here the tesseract's 3D projection represents the motion of a single cube from one point in space and time to another, a four-dimensional spatial process that includes time.

This mirrors another idea from Minkowski, formalized in 1908, called the worldline (Minkowski, 1909), which is the four-dimensional history of an object as it moves through space and time. The above example shows the tesseract-projection to represent the worldline of a cube undergoing the motion of expansion or contraction. The same can be seen with other forms of four-dimensional representations, from the 4-simplex to the 3-sphere, which will be shown later.

1 - A Dynamic Visualization.

A common way to regard the recursive progression of dimensions is to imagine each higher level a replication of the lower on a new axis. The point replicated in one direction becomes a line, then the line replicated perpendicular to itself can be stretched out to become a square, and finally a square replicated perpendicular to its face can grow out to become a cube. How, then, may a cube be replicated through a fourth spatial axis? To do this, we must consider spacetime as an axis that combines space with time, so the cube can be replicated through time as it remains in space. Yet time is not spatial, so it should not be represented spatially, but what time does enable in spacetime is a new process for 3D objects—motion—and 4D geometry can be seen as a perfect representation of that capacity within spacetime.

A Time-Space Before Spacetime

Well before Minkowski's 1908 presentation of spacetime, an anonymous letter to Nature (Anonymous, 1885) attempted to present a similar idea, suggesting a 'time-space' needed to describe the fourth dimension.

> "Since this fourth dimension cannot be introduced into space, as commonly understood, we require a new kind of space for its existence, which we may call time-space." (Anonymous, 1885)

The ideas proposed by this anonymous author (widely suspected to be mathematician James Silvester), however, mostly dealt with unmoving 3D objects as they pass through time *within* space and not *through* both space and time by way of motion. It proposed a 4D object to be represented by timelines, measuring the duration of an unmoving object in space over time.

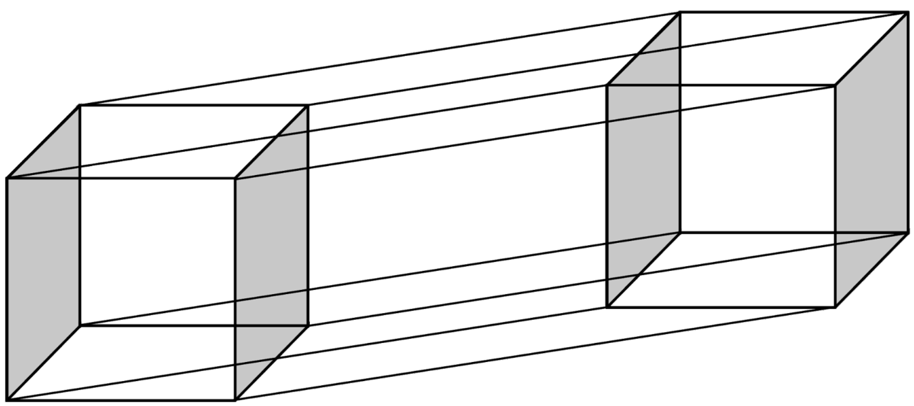

Figure 3: Another version of a 4D hypercube as two 3D cubes connected by "4D edges."

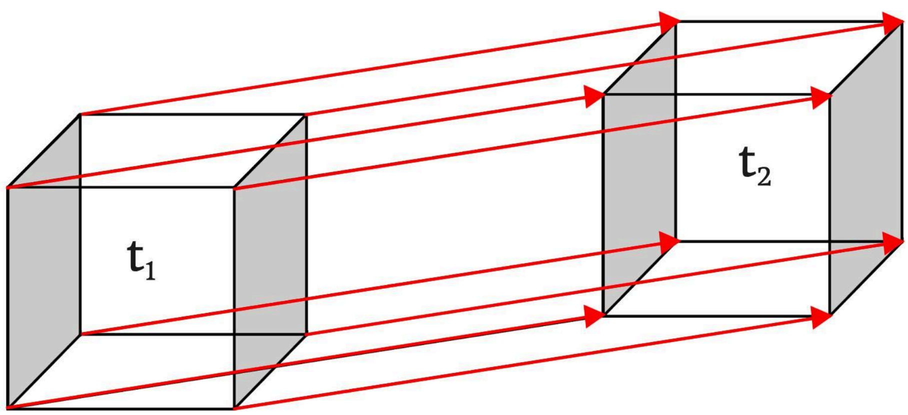

Figure 4: This hypercube can perfectly represent an unmoving cube's passage through time, with the 4D edges as time lines.

While this scenario can be accurately represented by this version of a hypercube that shows new edges as timelines, troubles arise if we use the system to represent a fuller fourth dimension, not just of the duration of time but also of motion. In some cases that can be accomplished by warping the 4D edges to show simple spatial changes, but if changes happen along the same direction that the time lines are moving, we cannot faithfully represent that scenario. To solve this issue, we must have 4D edges represented by displacement vectors instead of timelines, using them as a new expression of the spatial measurement of motion that occurs through both space and time.

With the consideration of the tesseract's cubes marking an initial and end state, the size difference between the two cubes indicates something: spatial change has occurred—the cube has undergone motion between states. The "four-dimensional edges" are then better regarded as displacement vectors indicating spatial direction, not just timelines indicating duration. To determine duration and infer the velocity of the motion, the initial and end state values of the t_1 and t_2 coordinates are observed and paired with the length in distance of the vector.

This shows how regarding the new edges as representing a spacetime axis, tracking change through both space and time is the best option for 4D geometry. Through that method, the hypercube shown above is then seen as representing a cube undergoing positional motion through space and time.

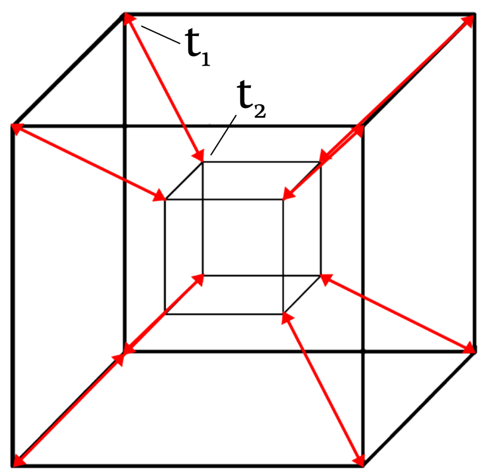

Figure 5: Interpreting the 4D edges of the tesseract here purely as timelines is impossible because spatial change has occurred between the two states. Here they more appropriately indicate paths of motion as displacement vectors.

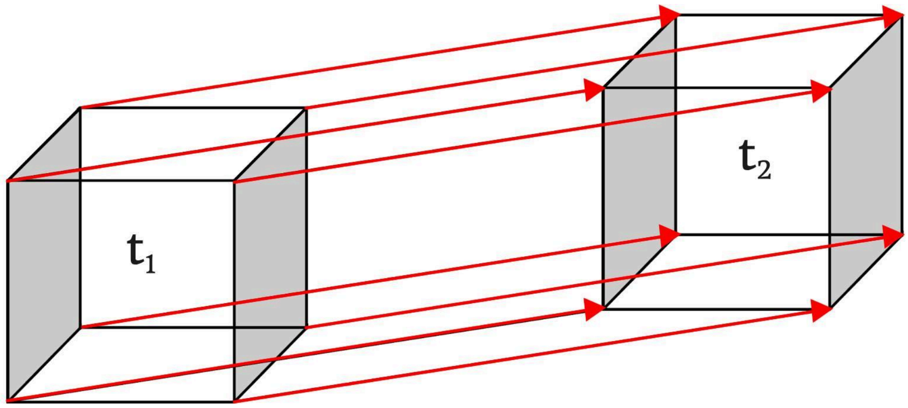

Figure 6: With the edges as displacement vectors instead of timelines, this image now represents a cube's positional motion through both space and time by way of motion.

Revisiting Flatland

Edwin Abbott's *Flatland: A Romance of Many Dimensions* (Abbott 1884) remains the most famous analogy for understanding a fourth spatial dimension. As it describes, when a 3D sphere passes through a purely 2D world, the flatlanders who live in that world see only a circle that first appears as a small dot, grows, and then finally shrinks and vanishes—a changing 2D slice of a fixed higher-spatial object.

The analogy is rightly celebrated, yet it grants the flatlanders something that must be withheld for the sake of this paper's argument: the dimension of time itself. To complete Abbott's thought experiment with that consideration, imagine 3D beings who lack the capacity for time and motion: static-landers. To them, a moving cube would appear not as the static 3D tesseract-projection, but only as a single 3D cube frozen in time—its full comprehension accessible only to higher 4D beings who live in a world of time and motion.

Yet those 4D beings could just as well present the familiar tesseract-projection (the nested cubes joined by new edges) to the 3D static-landers as a perfect representation of their own higher dimension: a static, three-dimensional time-map of a cube's motion in contraction or expansion.

Symmetry to Simplicity

Carl Sagan in *Cosmos* explained further properties of the tesseract, saying, "the real tesseract in four dimensions would have all lines of equal length and all the angles right angles" (Sagan, 1980). Imagining our example, and with a bit of a stretch in reasoning, that may be possible, as all the lengths and angles of a cube in contraction/expansion motion stay the same relative to itself in each moment of time as it changes size. The new 4D edges formed, though, representations of the trace of the cube's motion from its corners, are not the same length and at the same angle.

Can the properties of Sagan's tesseract with the added edges at right angle be shown through a different form of motion, though? What movements must a cube make to trace out all of its displacement-vector edges through space and time at equal length while also being at right angles? That situation does not seem possible within one moment in time, but if the cube is moved to the many positions that will let it meet those parameters over time, then we can frame that 4D imprint as satisfying those conditions in part of its fuller geometry of motion.

This stretch in logic raises an important consideration when reflecting on the standard interpretation of the recursive method in regard to 4D geometry, which typically begins with a line, a square, and a cube. These are not the simplest shapes for expressing dimensional progression—they may appear so because of their symmetry which eases visualizing the dimensional progression, but what qualifies as truly simple?

Even simpler than a progression from a 2D square would be a progression from a 2D triangle. From the triangle, a new 3D shape can form by pulling up another point from its face: the tetrahedron, and from there a tetrahedron can be made into what is known as a 4-simplex, its 4D counterpart.

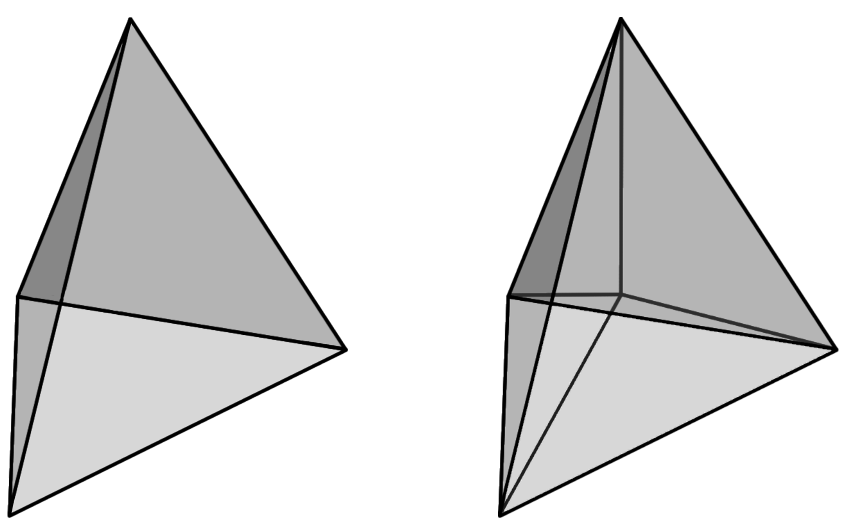

Figure 7: (Left) *A tetrahedron, the simplest 3D polygon. (Right) The 4-simplex, like the tesseract, is the 4D analogue of a tetrahedron.*

While the tesseract extends a cube's pattern of increasing *symmetry*, the 4-simplex continues a tetrahedron's path of *simplicity*, and both shapes can align naturally with the concept of motion as a fourth spatial dimension. Whereas the tesseract can model a cube in uniform expansion or contraction of all parts, the simplex offers a subtler visualization. Imagine just one corner of a tetrahedron moving inward toward its center. As this point shifts, its connected edges and faces deform accordingly, while the opposite face remains unchanged. The result is a progressively flattened tetrahedron, and the trajectory, traced through space, outlines the structure of a 4-simplex. The imprint of the moving interior edge can be represented as a displacement vector, tracing the path of change. In this sense, the 4-simplex emerges as a 4D form, represented by a 3D map of motion in the same way the tesseract is a map of a cube's uniform growth.

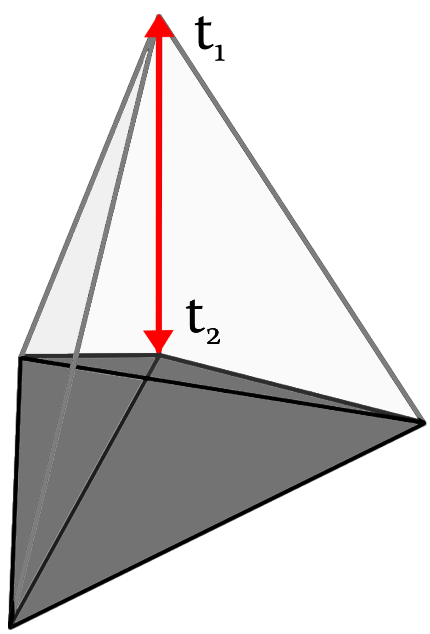

Figure 8: *Like the tesseract, the 4-simplex can be a representation of the form of a motion of its base shape.*

Corners to Curves

Consider a 3-sphere through the idea of 4D as motion through spacetime. Unlike a cube, which acquires new edges when extruded into a tesseract, a sphere has no new edges to "sprout" when it moves or transforms through the fourth dimension. Its boundary remains smooth and uniform in every direction, leaving no obvious structure to indicate its movement in the same way. So how do we describe its motion of expansion or contraction in terms of 4D geometry?

One approach is to consider the 3D solids swept out by that motion—just as a cube expanding through space forms a higher-dimensional cube, a sphere expanding from radius r_1 to r_2 carves out a shape that includes the original sphere, the expanded sphere and the new shell in between. Mathematically, this region is defined in $\mathbb{R}^4$ as all points whose distance from the origin lies between r_1 and r_2—a precise, volumetric path of transformation through the fourth dimension that meets the conditions of how a 4D sphere is described.

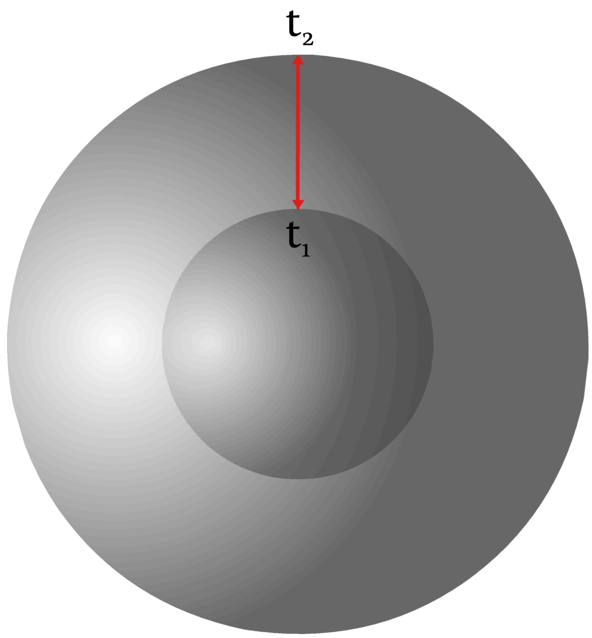

Figure 9: A 4D sphere as a smaller sphere within a larger sphere. There are no "new edges," but a displacement vector can be attached to represent its motion of expansion or contraction.

When considering rotational motion, a sphere may appear unchanged in the static 3D snapshots over time—yet over time, each point on its surface traces a unique path through space and time. These paths, along with the form of the sphere, collectively form a higher-dimensional structure. To describe how the sphere's orientation evolves, we must attach a directional reference to it which tracks the rotational behavior as the sphere moves, as in the case of Hopf fibers and fiber bundles.

2 - Modern Speculation on Four-Dimensional Theory

A recent publication in computer graphics and machine learning acknowledges the motion of 3D objects as part of 4D study, yet it also encompasses static geometry and particle dynamics within the same category:

> "Reconstruction and generation of 4D data, i.e., 3D geometry evolving over time while exhibiting motion and interaction, is becoming increasingly critical as computer graphics applications expand into domains requiring dynamic scene understanding, temporal modeling, and motion synthesis. From cinematic visual effects and immersive virtual reality to autonomous robotics, medical imaging, eCommerce and advertising, the ability to capture, represent, and manipulate 4D content has emerged as a fundamental challenge that bridges graphics, vision, and machine learning.
>
> The fourth dimension introduces complexities that extend far beyond simply concatenating spatial coordinates with temporal indices. Temporal coherence, motion continuity, topological changes, interaction dynamics, and the preservation of geometric, appearance, and physical properties across time present unique representational challenges that require careful consideration of both spatial and temporal encoding strategies. As the field matures, researchers have developed increasingly sophisticated approaches to handle these challenges, leading to a rich landscape of 4D representation schemes, each with distinct advantages and limitations." *Advances in 4D Representation: Geometry, Motion, and Interaction* (Zhao et al., 2025)

In contrast, the framework developed in this paper distinguishes these elements dimensionally: static 3D geometry remains three-dimensional, the motion of 3D objects through spacetime constitutes the fourth spatial dimension, and the interaction dynamics (forces) among moving 3D objects manifest a fifth dimension.

3 - 5D Geometry of Force

As defined in this paper, a 4D form is then any 3D form undergoing the process of motion. Now, in a purely 4D world, two objects that move into the same space would simply pass through each other, untouched by any notion of physicality. In the real world, however, when two objects converge, something different happens: force manifests—not as a new static geometric extension, but as a magnitude of energy that directly affects and is affected by the 4D spatial nature (motion) of the objects interacting.

Going back to Hinton's method of recursive progression, we can conceive a 5D progression of a cube (a penteract) as two 4D hypercubes joined by new directional edges and reinterpret this using motion and force as our new "directional edges." As the tesseract-projection was shown to represent the motion of a cube expanding or contracting, imagine a possible progression of that scenario: a smaller cube expanding within a larger cube that is contracting—a hypercube nested within a hypercube, each tracing its own 4D pathway through space and time. What exactly would new edges connecting them represent?

This paper speculates that new "5D edges" connecting two hypercubes could represent any events of force where and when the two cubes interact, places where the observance of change through cause and effect can determine a magnitude of force. In the example above, the smaller expanding cube and the larger contracting cube will eventually make contact, causing force events to happen across every corner, edge, face and volume that collide. These events of impact are new measurable happenings in space that, while they are not entirely spatial in character like new directions extending into space, they do remain connected to places where they occur as *spatially anchored* new forms of measurement.

These 5D events of force have the capacity to modulate the 4D qualities of motion for each object involved—altering their position, formation, acceleration or trajectory through space and time. Whereas motion is a 4D spatial capacity that can change the 3D form and position of objects, force is a 5D spatial capacity that can change the 4D motion of 3D objects.

Quantifying Force Through Cause and Effect

Recall that the new "4D edges" of the tesseract were interpreted to represent displacement vectors, with direction and distance associated with each of them. When temporal coordinates were given, measuring the duration between the initial and final states of the cube allowed us to infer the velocity (v = distance / time) of the cube's motion. Likewise, for the new "5D edges" that would represent force interactions, instead of velocity we can infer the magnitude of force with each instance of impact by examining the resulting change in velocity or acceleration. To do that we must measure the velocity of objects involved both before and after the interaction.

As we showed the two cubes of the 4D hypercube to represent one cube at different points in time, for a progression toward a 5D geometry of force, one hypercube could represent a causal state (the motion that led to the force interaction), and another could represent an effect state (the motion that was the result of the force interaction) for any of the objects involved in the force event. So, when two objects in motion collide, each has both a causal state and an effect state that can be expressed as 4D hypercubes (3D motion paths); the instant and location of their meeting is the “5D edge”—but here we do not need to draw new static orthogonal line to represent the 5D force events; we can simply just anchor a form of information to that place and time.

The image below shows two hypercubes colliding via positional motion, connecting at a new “5D edge” where and when they meet. Instead of just passing through each other in a world of purely 4D motion, the fifth dimension is what is experienced as the spatial effect of force. It is a capacity of effect that is spatially anchored. More than an effect, force is also a cause, and a full observance of a force event requires an observance of both cause and effect states.

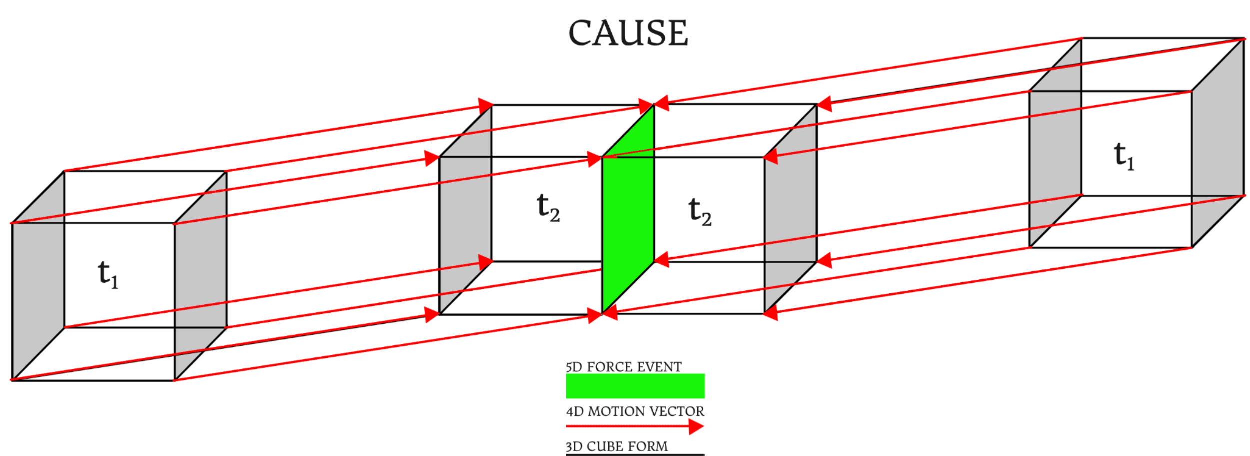

Figure 10: The initial state of the force event can be seen to have two hypercubes moving toward each other, showing what caused the event of force to happen.

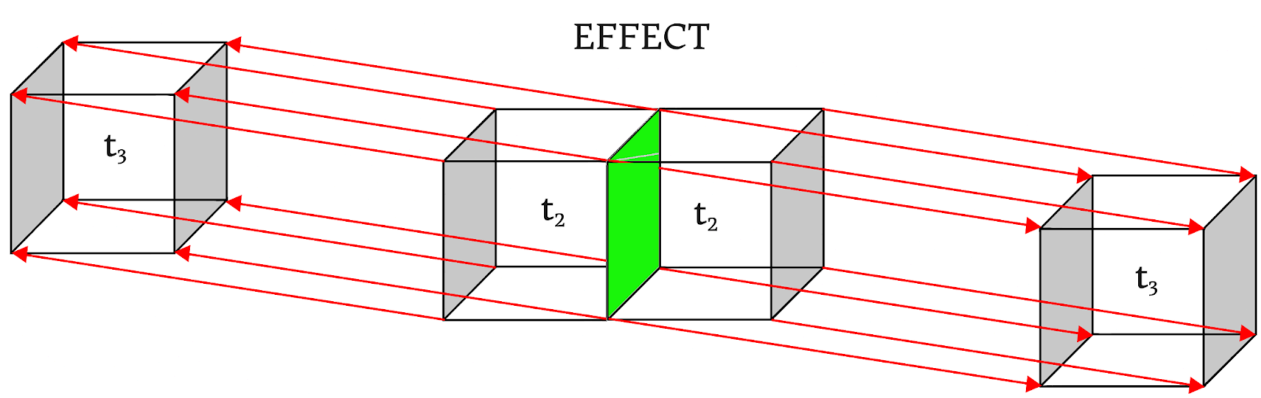

Figure 11: This image shows the state of the two hypercubes after the force event.

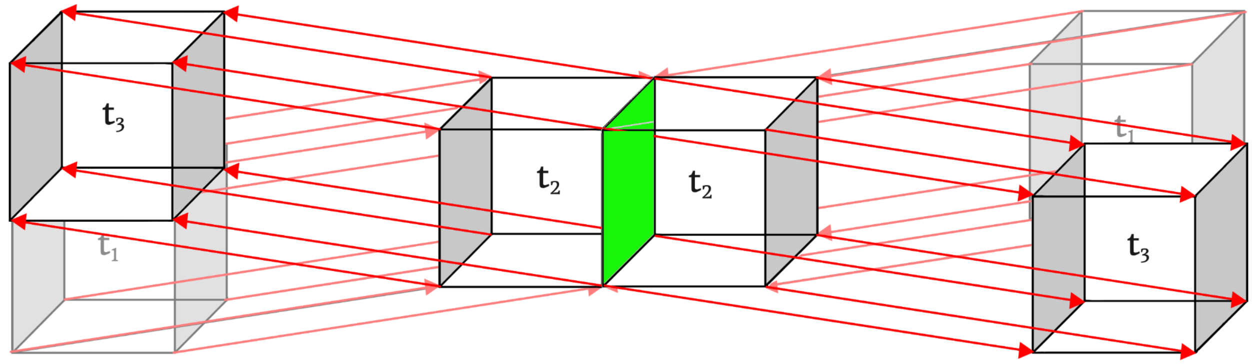

Figure 12: Both cause and effect states, showing four hypercubes in this one force interaction.

For anyone familiar with basic physics, they will know that part of the inferred magnitude of a force event comes not just from the change in velocity (acceleration) of the objects involved, but from another crucial property of the objects themselves: their mass. When we enter into the dimension of force we must now regard it as an all-pervading dimension within 3D objects. Force does not only occur at points of interaction; it is rooted in the very internal energies that compose matter, famously exemplified by Einstein's $E=mc^2$ (Einstein, 1905). Mass itself is concentrated motion and energy—bound in extraordinarily stable configurations, waiting to be released by an introduced 'unbalanced' force. In this sense, every material object is already a 5D entity: its 3D form is sustained by ceaseless 4D motion.

This is something to consider if we are to find the symmetrical progression from a 3D cube to a 4D tesseract to a 5D penteract through our idea of form, motion and force. Also, to observe a 5D element we must observe both a cause and an effect related to the force event, like in the example above, not just measuring between two points in time, but triangulating three moments to measure an initial velocity, a moment of force, and then an exit velocity.

Completing the Penteract

Geometrically, a penteract is calculated to be composed of 10 hypercubes (what this paper regards as 3D forms in motion), 40 solids, 80 squares, 80 edges and 32 vertices.

In the case of a single contracting cube, it will eventually collapse into a singularity, drawing the familiar tesseract-projection as it does, with 6 solids within the cube showing the trace of the corners as it shrinks into the smallest possible cube, all sides compacted. In the penteract, these 6 solids are conceptual forms undergoing change, accounting for 6 of the 10 hypercubes. Traditionally, the tesseract projection considers the outer cube and the inner cube as separate solids, each being translated into separate hypercubes in conceptions of the penteract, but this paper interprets them as a single cube in motion, so we will regard the two as actually just one cube in motion, accounting for one of the hypersolids.

At the point of impact at the singularity, the cube will then rebound into opposite directions of space, retracing a new hypercube representing the cube now expanding along the same 6 hypercube paths toward another point in time. The cube collapsing before the force event accounts for one hypercube, and the same cube expanding after the force event accounts for another hypercube. Along with the 6 sides, that makes 8 total.

Now, do we count 6 new hypercube sides traced by the new expanding cube? What I considered is that the 6 hypercubes are conceptual traces, and through this symmetrical event are simply reused paths, so they are not recounted.

The last thing to consider here is the mass of the cube’s entry state and the mass of the cube’s exit state. We propose these to be two hypercubes themselves, representing the internal motion states of the cube’s materiality. This completes the 10 hypercubes of the penteract. The complete cycle unfolds into ten hypersolids: the initial contracting motion hypercube and its mass hypercube of the causal event, six transitional volumes swept by the moving faces, and the final expanding motion hypercube and its mass hypercube of the effect event.

This tenfold symmetry resonates with the structure of particle physics. Every interaction is framed by an initial state, a moment of force, and a final state, with mediating propagators and conservation laws binding them together. The causal motion and effect motion hypercubes mirror the incoming and outgoing trajectories of particles, while the six transitional hypersolids echo the internal channels through which interactions unfold. The two mass hypercubes embody the conservation of energy–momentum, anchoring the system before and after the event. In this way, the penteract’s ten facets are a dimensional analogue of particle interactions: geometry, motion, and causality balanced in the same way that physics balances states, mediators, and conservation principles.

This structure also finds a natural parallel in Feynman diagrams, which depict interactions of particles through incoming and outgoing lines connected by internal propagators. Just as the diagram organizes trajectories, mediators, and conservation anchors into a coherent picture of an event, the penteract organizes motion, force, and mass into a tenfold symmetry. Both systems reveal that what appears as a single interaction is in fact a collective of varied states and mediating channels bound together by conservation laws. While this geometric mapping is interpretive rather than derivatively predictive, it offers a novel visualization of conservation laws and interaction structure complementary to standard quantum field theory descriptions.

Here the penteract serves as a minimalistic demonstration of dimensional symmetry, tracing the progression of a specific shape, a cube, through higher dimensions of motion and force. The real world is not built from cubes, however, but from spheres and fields mostly, spinning, traversing orbits and having other forces spin around them, like the electrons around an atom. We move beyond straight edges, planes and cubes into curves, fields, frequencies and irregular motions as we encounter a spectrum of forces that govern the external and internal motions of objects—gravity, electromagnetism, radioactivity, quantum behaviours, and heat. A step in this development must be considered that envisions force not merely as the outcome of two objects meeting in space, but as an effect that operates across distances as subtler forces that work between objects and also within the makeup of matter.

Past Attempts to Tie Force to 5D

The idea of force as a spatially-anchored fifth dimension echoes early 20th-century insights from Theodor Kaluza and Oskar Klein, who sought to unify gravity and electromagnetism by extending Einstein’s general relativity into a 5D model (Kaluza, 1921; Klein, 1926). In Kaluza-Klein theory, force did not arise as a separate entity, but as a geometric consequence of an additional spatial dimension beyond the four of spacetime (Duff, 1999; Overduin & Wesson, 1998). Kaluza discovered that the extended equations naturally split: one part described gravity, while the other mirrored Maxwell’s equations for electromagnetism—suggesting that electromagnetic force could be interpreted as curvature in a hidden dimension (Kaluza, 1921). Klein refined this idea by proposing that the fifth dimension is compactified—curled into a tiny, imperceptible loop at every point in space (Klein, 1926).

My approach differs: rather than imagining a compactified dimension pervading all space—akin to the historical concept of an aetheric field once thought to fill the universe—I propose that the fifth dimension manifests through matter and energy only where it already exists. In this view, space remains an empty field, and dimensional properties are not embedded in the void but anchored to objects and their forces already at play.

Kaluza-Klein theory was revived in the 1990s by Paul Wesson’s space-time-matter theory, culminating in the 2018 book *Principles of Space-Time-Matter* (completed by his collaborator James Overduin after Wesson's passing) (Wesson, 1999; Overduin, 2018). From the preface of the book:

> “The theory of Space-Time-Matter uses the geometry of the fifth dimension to explain the matter in the world. It has something in common with Einstein’s 4D theory of general relativity and its 5D extensions due to Kaluza and Klein. However, STM has an energy-momentum tensor which is derived from an extra dimension that is not rolled up or compactified to an unobservably small size. In fact, we see evidence of the fifth dimension in things from the mass of an elementary particle to the density of the cosmological fluid. In this way, STM theory fulfills Einstein’s theorem of transmuting the “base wood” of matter to the “fine marble” of algebra.” (*Principles of Space-Time-Matter: Cosmology, Particles and Waves in Five Dimensions* by Paul S. Wesson and James M. Overduin) (Wesson & Overduin, 2018).

This “energy-momentum tensor” may align with the “5D edges” in this paper’s system—the places where force occurs. Yet, they could either be “rolled up” at miniscule points as in the measure of mass, or spread out through any edges, planes and even solids/fields where forces act.

4 - Beyond Space

Here it is speculated that if the fifth dimension can be described by hypercubes interacting, describing the forces of physical reality within space and time—then the sixth dimension would replicate all the possible outcomes of those interactions themselves, stretching them into an infinite array of potential realities (Everett, 1957; Deutsch, 1997). Just as a 1D line extends with infinite parallel copies (yet constrained within a plane) to form a 2D square, and a square to a 3D cube, the sixth dimension replicates the possible states of lower-dimensional systems of 5D force under conditional constraints. This mirrors Hilbert space in quantum mechanics, a structured, high-dimensional (often infinite-dimensional) framework where every possible state of a system—each measurable result—is encoded as a vector, bound by norms and operators that tether its infinite results to the system’s rules (Dirac, 1930; Albert, 1992).

In quantum configuration space, for instance, the dimensionality grows with the number of particles (3N dimensions for N particles), encompassing all possible configurations as "parallel" possibilities within a single mathematical structure (Albert, 1992).

If we go back to considering geometry, any “new 6D edges” connecting two 5D penteracts (events of force through cause, effect and conservation of energy), could represent that constellation of events as ‘alternate realities’ connected to the boundaries of that system (cf. Everett, 1957, on branching in Hilbert space). In our earlier hypercube progression, symmetry was preserved by assuming equal forces, motions and forms, but in this sixth-dimensional field of potential, conceiving it all as a spatial geometry becomes difficult. Here we begin to systematically vary inputs—direction, velocity, acceleration, or mass—and observe the cascade of results. We explore multiple variations of a state, forming a database of if–then conditionals, as seen in computer programming:

> If the velocity of one hypercube increases, then the other deforms.
> If acceleration rises and a vertex twists, initiating rotation, then a spiral shear emerges.

Each 5D ‘slice’ of a full 6D potential system between two interaction scenarios could be a very complex outcome.

Toward Intelligence

To further dissect the intricacies behind these higher dimensional concepts that now delve into consciousness, we must begin to engage with the higher constructs of logic and reason—a vast terrain that has stirred human inquiry for millennia (Chalmers, 1995). As complexity in reality grows from simple geometric shapes to infinite arrays of conditional logic, the next step is seen to be aimed at simplifying that complexity to forms of further understanding and utilization. In the dimension of possibility, quantities of data are merely navigated by the mind, yet through the next order of consciousness they are selectively narrowed down to be considered through mental capacities of choice and then finally will. These higher functions naturally emerge from the knowledge of potential and possibility that stem from a basic awareness of the world, and are deeply integral to how conscious beings shape and react to the world they experience through the more advanced conscious abilities of reason and intelligence (cf. Tegmark, 2014, on computational emergence).

Conclusion

The reinterpretation of static 4D geometry to instead represent the motion of 3D objects through spacetime represents a pivotal shift in understanding higher dimensions. This view unifies established geometric constructs inspired by Hinton—such as the tesseract, 4-simplex, and 3-sphere—with the dynamical framework of Minkowski and Einstein's relativity, where displacement vectors in 4D polytopes trace the worldlines of moving objects.

Why does this perspective matter? For over 150 years, since Hinton's recursive logic, researchers have pursued an elusive static fourth spatial axis. This pursuit, while intellectually fruitful, has yielded no empirical evidence for such a dimension. Debates still regularly spark about the 4th dimension—whether it is a new spatial axis or simply the temporal dimension of spacetime. Instead, the fourth spatial dimension is better conceptualized as a unification of these two views by considering the motion of 3D objects through spacetime.

This paper speculates that a fourth static orthogonal axis will always remain unfound, and offers a better foundation to explore higher dimensions—one that makes much more practical sense through the geometry of motion toward the spatial dynamics of force, the structures of possibility and beyond.

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