The Pattern Pieces

Folder 20

The Pattern Number System

A systems engineering solution to the unification of science.

"According to Aristotle, the Pythagoreans believed numbers to be the essence of all things. Numbers were not just an abstraction of the human mind; for the Pythagoreans, numbers formed the basis, the principle, of all other things. And they came to this conclusion because they saw a variety of natural phenomena – from cosmic cycles to music scales – that could be expressed through numbers and specific ratios of numbers." Quotation from *Numbers* by Alfred S. Posamentier and Bernd Thaller.

Typical number systems, such as the decimal and binary number systems, have symbols that are used for counting and calculation, but the purpose of the Pattern number system (PNS) is to build abstract mathematical models such as the Pattern cube with a new type of unified (sum-and-shape) number. The algebraic-geometric equivalence of Pattern numbers is a key characteristic of the PNS.

Instances of the Pattern cube, called unification cubes, are used to match different natural phenomena to test the Pattern hypothesis. (The hypothesis states that natural phenomena have developed according to a universal mould.) The Pattern cube is deemed to be such a mould. The gravity cube and the atom cube are unification cubes described in this article which, when compared, reveal a new type of gravity, called chain gravity. Chain gravity corresponds with the strong force of the atom nucleus.

Pattern number blocks that are used to construct the Pattern cube are shown to exhibit quantum-like properties, such as superposition, spin and decoherence. Complex Pattern number blocks are shown to represent a unification of special relativity (in one space dimension) and quantum uncertainty.

The proposal that the PNS could be a systems engineering solution to the unification of science is based on the different sum-and-shape 'bricks' in the (dimensional) layers of the PNS and their application to the testing of the Pattern hypothesis.

The Pattern cube was also derived from the Pattern code (see Folder 18 *The Pattern Cube*). Although both the PNS and the Pattern code yield the same Pattern cube model, the PNS approach is more systematic and less intuitive than the Pattern code. The PNS approach is, however, guided by the symmetries and value pairs of the code.

Pattern numbers are the purest expression of the Pattern idea.

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Sum-and-Shape Numbers

"For the ancient Greek scholars, numbers were not just a useful tool. They regarded numbers as philosophical principles, as fundamental entities, as the essence of everything. Numbers had to be explored, as their properties would reveal the nature of all things."

Quotation from *Numbers* by Alfred S. Posamentier and Bernd Thaller.

A Basic Sum-and-Shape

A Pattern number consists of an algebraic sum and its equivalent geometric shape. The default sum is the Pattern number plus zero, e.g. 6 + 0, and the default shape is a row of cells equal to the sum (see illustration on the right). A sum is equal to its number of *a* cells plus its *b* cells. The *a* type and the *b* type cells represent the two complementary variables of the sum equation.

Complete Sum-and-Shape

A complete Pattern number consists of all the possible value combinations (in sequence) of the two variables that equal the sum.

The array of cells (on the right) shows that the number of *a* cells decreases and the number of *b* cells increases simultaneously to yield a constant sum. Pattern number 6 (Pn6) is used for illustration.

The default shape of the Pattern number 6 cell array is referred to as the 'wall' shape. Note the linear diagonal where the *a* and *b* cell-types meet.

Note also that cube cells are used as the default cell shape but other shapes, such as spheres, could also be used.

Sum Combinations

Each row of cells of a Pattern number represents a different combination of non-negative integer values that yield the default sum.

The table (on the right) lists the seven rows of values for Pattern number 6, for example, in sequence from pair (6,0) to pair (0,6).

Geometrization

Geometrization is the process whereby an algebraic expression is converted into a geometric representation by using multiple cells to represent the coefficients. The triangles and squares built from small cubes (on the right) are two examples of geometrization. These shapes, amongst others, were used in antiquity in the study of numbers by the Pythagoreans.

Unified Numbers

The numbers of the Pattern number system (PNS) are sum-and-shape combinations that yield a new type of unified number.

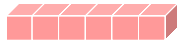
The values of the two Pattern number 6 variables (on the right) are embodied by the corresponding cells of the wall shape. The number of the cells yield the integer values (coefficients) for each one of the two variables.

The intimate relationship between number and shape is evident, for example, when children learn to count. The almost instinctive show of fingers when counting from one to five, for example, illustrates the direct relationship between number and (body) shape.

A Basic Sum-and-Shape
(Pattern Number 6)

6 + 0 = 6

Sum



Shape

a + b = c
(algebraic)

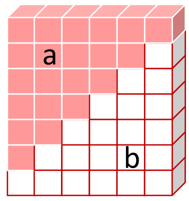
Six cells (Units)
(geometric)

Complete Sum-and-Shape
(Pn6)

a + b = 6

6 + 0 = 6
5 + 1 = 6
4 + 2 = 6
3 + 3 = 6
2 + 4 = 6
1 + 5 = 6
0 + 6 = 6

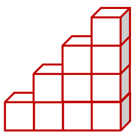
Cell Combinations



Row 1	6, 0	6 + 0 = 6
Row 2	5, 1	5 + 1 = 6
Row 3	4, 2	4 + 2 = 6
Row 4	3, 3	3 + 3 = 6
Row 5	2, 4	2 + 4 = 6
Row 6	1, 5	1 + 5 = 6
Row 7	0, 6	0 + 6 = 6

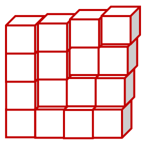
Same Sums

Triangle Numbers



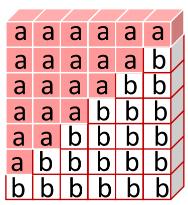
Natural Numbers

Square Numbers



Odd Numbers

Unified Pn6



6a + 0b = 6c
5a + 1b = 6c
4a + 2b = 6c
3a + 3b = 6c
2a + 4b = 6c
1a + 5b = 6c
0a + 6b = 6c

"A number is a multitude composed of units." Euclid

"One"

"Interestingly, Aristotle also states that the unit, the "One", is not itself a number; instead, it is the fundamental principle that creates number and thus plays a very special role, philosophically." Quotation from *Numbers*.

Pattern Number States

Duonity is the perfect state

Pattern numbers have two states: a duonity state and a disduonity state. The duonity state shape reflects merged rows with diagonally overlapping cells (in superposition). The overall shape of a duonity state Pattern number wall, for example, is square while the overall shape of a disduonity Pattern number wall is rectangular.

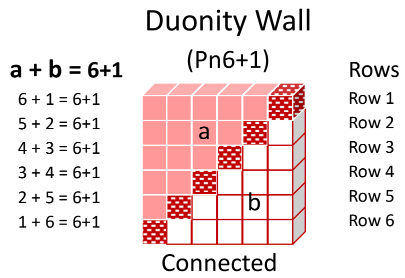
Two-State Pattern Numbers

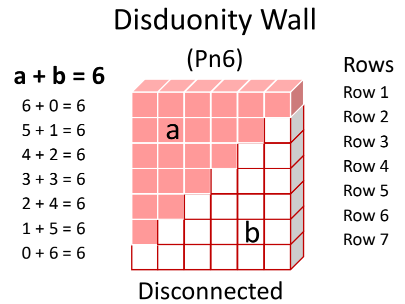
The duonity Pattern number 6 sum, for example, has six value pairs that contain no zeros. The drawing (on the right) illustrates the duonity (Pn6+1) wall with one overlapping cell in each row indicated by dotted colouring. Note that the sums (6+1) separately reflect the additional cell in each row.

The corresponding disduonity wall (on the right) is the Pn6 wall with seven value pairs (including zeros). There are no overlapping cells.

Note that the disduonity state is the default state of Pattern numbers.

Note also that a disduonity Pn6 wall shape is implied if the sum and/or the shape is not specified in the text.





Connected-ness and Disconnected-ness

Duonity is defined as the two-oneness of things and is associated with connected-ness (overlapping cells in 3D). Disduonity is defined as the two-ness of things and is associated with disconnected-ness (non-overlapping cells in 2D).

The dimensional difference between the duonity and disduonity states could be explained by an analogy with a Mobius band which is shown on page P20:9.

Pattern Number Indeterminism

The (same) sum of a Pattern number is obtained by the summation of <u>any</u> of its value pairs. This indeterminism is an innate property of Pattern numbers. Which pair will manifest at a particular instance is essentially a random choice.

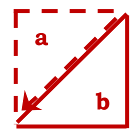
The probability of any pair to be the Pn6+1 sum, for example, is 1/6, and the probability of any one combination to be the Pn6 sum is 1/7.

<u>The following are extracts from Folder 18 *The Pattern Cube*.</u>

The Pattern Theorem

"The Pattern theorem states that *a linear inverse symmetric pair of quantities yields a conserved sum*. The Pattern theorem is symbolically represented by the module icon on the right and the equation a>+<b = [c] which symbolises that *a* is decreasing while *b* is increasing and the sum *c* stays constant. The theorem applies to any set of positive integer pairs (also called Pattern numbers) and it could be raised to any power, e.g. $(a + b)^3$."

The Pattern



a>+<b = [c]

a decreases and *b* increases to equal the conserved sum *c*

The Pattern Conservation Law

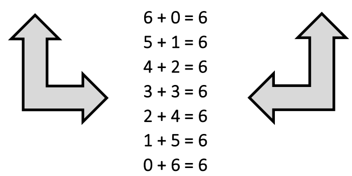
"The Pattern conservation law states that *the Pattern sum is a conserved quantity.*"

"The Pattern conservation law is similar to the energy conservation law but it is more general because any development, such as creation and construction, growing and expanding, motion and rotation, is according to the conserved Pattern sum. The Pattern theorem is also similar to, but more general than Noether's theorem."

Pattern numbers are sets of positive integer pairs with inverse symmetry.

Pattern number 1:	1,0; 0,1
Pattern number 2:	2,0; 1,1; 0,2
Pattern number 3:	3,0; 2,1; 1,2; 0,3
Pattern number 4:	4,0; 3,1; 2,2; 1,3; 0,4
Pattern number 5:	5,0; 4,1; 3,2; 2,3; 1,4; 0,5
Pattern number 6:	**6,0; 5,1; 4,2; 3,3; 2,4; 1,5; 0,6**

<u>Integer pairs</u> yield a <u>constant sum</u>.



Pattern Number Shapes

Pattern numbers profoundly enlarges the concept of number which is the most basic of tools in science.

Pattern numbers could be raised to the powers of 0, 1, 2, and 3 to form the Pattern number hierarchy. The shapes associated with these number tuples are the pillar, wall, block, and column. Duonity number shapes exhibit overlapping cells but the disduonity number shapes do not have any overlapping cells.

The Pattern Hierarchy

Pattern number 6 (and 6+1), for example, is raised to the powers of 0, 1, 2, and 3 to illustrate the hierarchy.

	$(Pn6)^0$	$(Pn6)^1$	$(Pn6)^2$	$(Pn6)^3$	Disduonity Pattern numbers
	$(Pn6{+}1)^0$	$(Pn6{+}1)^1$	$(Pn6{+}1)^2$	$(Pn6{+}1)^3$	Duonity Pattern numbers
Unit	Pillar	Wall	Block	Column	Geometrized Pattern number shapes
0D	1D	2D	3D	4D	Effective spatial dimensions
$(a + b)^0 = c^0$	$(a + b)^1 = c^1$	$(a + b)^2 = c^2$	$(a + b)^3 = c^3$	$(a + b)^4 = c^4$	The respective Pattern equations

Note the difference in powers between Pattern numbers and the Pattern equations; the Pattern number powers do not reflect the extra dimension included in the shape resulting from the geometrized values.

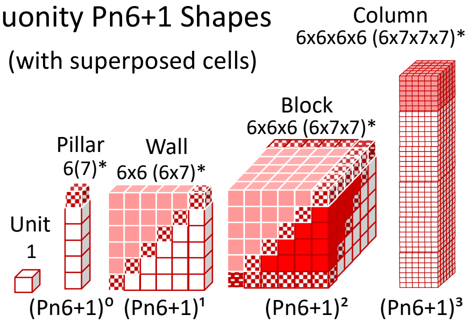
Note also that powers higher than 3 yield repeating basic shapes, e.g. $(Pn6)^4$ yield a wall like $(Pn6)^1$, but the cell density in the higher-dimensional wall is higher.

Pattern Number Shapes

The Pattern number shapes are geometrizations of the coefficients of the substituted values of the sums. The respective shapes for the duonity Pn6+1 tuple and disduonity Pn6 tuple are shown on the right. The shape sizes are indicated but, in the duonity case, the total number of cells (non-overlapping) are also given in brackets.

Duonity Pn6+1 Shapes

(with superposed cells)



*Numbers in brackets reflect total numbers of cells.

Cumulative Pattern Number Shapes

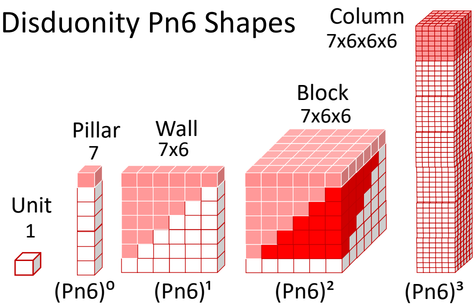
The different Pattern number shapes reflect the build-up (extension) of the shapes according to the increase in dimensions.

The 1D pillar, for example, is one slice of the 2D wall and the 2D wall is one slice (with a different composition) of the 3D block.

Invariant Shapes

Each Pattern number shape is an invariant (conserved) object according to the Pattern law. Physical (pottery) moulds are, typically, also invariant and do not form part of the finished product.

Disduonity Pn6 Shapes



Pattern Number Unit

The Pattern equation of a Pattern unit is $(a + b)^0 = c^0$. Substitution of the duonity and disduonity values in the respective variables yields the two pillar shapes (shown above, on the right). The unit itself is independent of the Pattern values. It is, therefore, a pre-value entity and, thus, not included as a shape of the PNS.

Pattern Loops

Pattern number shapes repeat at regular intervals. The pillar and the column, for example, have the same overall shape and seem to form a loop. The only difference between a pillar and a column is the cell density. Another kind of loop is evident from the similar cubical shapes of the Pattern unit and the Pattern cube (see the cube on the next page). The (virtual) unit core of the cube could, therefore, be a copy of the Pattern cube which reveals a recursive relationship.

The Pattern Identity

The Pattern identity is defined as $(a + b)^n = 6(a + b)^{n-1}$, for *n* positive integers (excluding zero).

The 6-multiplier is the same for all disduonity and duonity Pattern number shapes, except for the disduonity pillar which has a 7-multiplier, i.e. $[(a + b)^1 = 7(a + b)^0]$, owing to the seven pairs of values in $(a + b)^0$ yielding the pillar shape.

The identity could also be generalized to include the other Pattern numbers.

The sum is in the shape and the shape is in the sum.

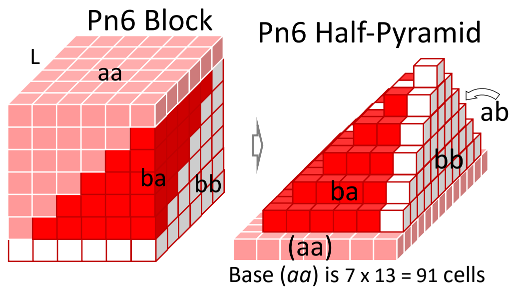
Shapes Transformed

Of all the Pattern numbers it is only Pattern number 6 (and 6+1) that makes a cube.

The transformation of Pattern number shapes yields Pattern cubes that are used as abstract (invariant) models. Transformation is achieved through a diagonalization process whereby Pn6 (and Pn6+1) block pairs become step cleft pyramids that are combined into Pn6 (and Pn6+1) cubes.

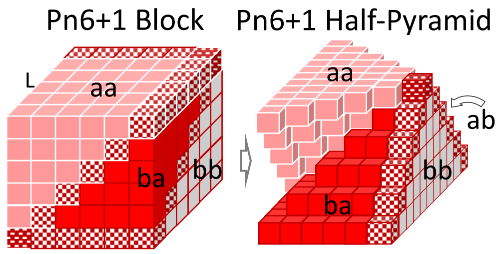
Block Transformations

A Pn6 block and an Pn6+1 block could both be transformed into half-pyramids, each with two diagonalized main parts, *aa* and *bb*, and two diagonalized fill parts, *ab* and *ba* (both diagrams on the right). The *aa* cells (1+4+9+16+25+36=91) of the Pn6 half-pyramid are compressed in one base layer of 7x13 cells. Of all Pattern numbers only Pn6 yield a perfect base.



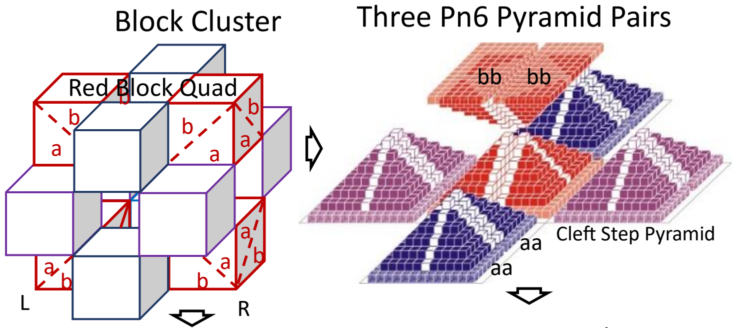
Block Cluster Formation

The twelve blocks of a Pn6+1 column pair and the fourteen blocks of a Pn6 column pair could both be rearranged into a cluster of 12 blocks (see block cluster below right). The fourteen blocks of a Pn6 column pair could be changed into twelve blocks if their 7 pairs of blocks with 6x6x6 cells in each block [7x(6x6x6)] were rearranged into 6 pairs of blocks with 7x6x6 cells in each block [(7x6x6)x6].



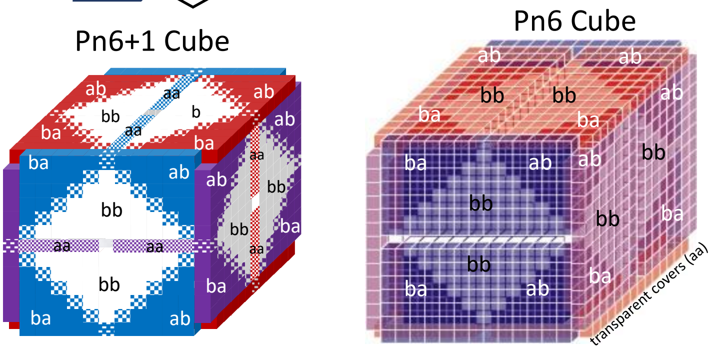
Cluster Transformation

The red quad of the cluster (on the right) consists of two block pairs. Each block pair could be transformed into a cleft step pyramid. The six Pn6 pyramids (on the far right) are in an opened cube configuration. The four side pyramids could be rotated to assemble the Pn6 cube. The Pn6+1 blocks of the cluster can, when transformed into cleft pyramids, be assembled into the Pn6+1 cube. Note that only some of the *aa* cells of the Pn6+1 cube are visible inside the clefts. Not all the overlapping cells of the cube are indicated in the diagram (on the right).



Cube Assemblies

The Pn6 cube measures 15x15x15 cells and the Pn6+1 cube 13x13x13 cells. The Pn6 cube has no overlapping cells such as those of the Pn6+1 cube because the *aa* parts were compressed into the twelve plates that form the cover of the cube.

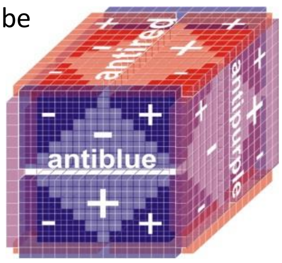


Pattern State Identity (PSI System

The PSI is an address system based on the four coordinates of each cell of the Pn6 Pattern cube. The four Pattern <u>state</u> numbers are **[c,n,s,m]** (**c** represents colour of cell, **n** represents level of cell, **s** represents spin and shape of cell, while **m** represents the cell's distance from median.) A comparison between the Pattern state numbers and the quantum numbers is given below. The cube shows the signs for the values of Pattern state numbers **s** and **m** (**m** is at the vertices).

The Pattern State Numbers		The Quantum Numbers	
Colour of pyramids	c	None	
Layers of pyramids	n	n	(energy level)
Shape and spin of cells	s	l and s	(orbital shape and spin)
Deviation (from middle)	m	m	(magnetic number)

PSI Cube



The Pattern Number System

Sums-and-shapes that shape.

The Pattern number system (PNS) consists of a positional hierarchy of unified (sum-and-shape) numbers and a series of radices. It is a system which includes other number systems, such as the decimal and binary systems.

The Pattern Number System

The PNS could be described as a type of positional unified number system.
The tuple of Pattern numbers being raised to increasing powers are:

$(Pnc)^3$ $(Pnc)^2$ $(Pnc)^1$ $(Pnc)^0$ Radix (Pnc) equals (a + b = c). The sum *c* could be any non-negative integer.
The *a,b* values are inverse symmetric combinations of non-negative integers.
All value pairs are used simultaneously in every position.

(A radix, or base, is typically the number of unique digits upon which the number system is based.)

Example 1: Pattern Number 6

$(Pn6)^3$ $(Pn6)^2$ $(Pn6)^1$ $(Pn6)^0$ Radix Pn6: a + b = 6. Disduonity value pairs: a,b: 6,0; 5,1; 4,2; 3,3; 2,4; 1,5; 0,6
Pn6+1 duonity value pairs: a,b: 6,1; 5,2; 4,3; 3,4; 2,5; 1,6

Example 2: Pattern Number 1

$(Pn1)^3$ $(Pn1)^2$ $(Pn1)^1$ $(Pn1)^0$ Radix Pn1: a + b = 1 Disduonity value pairs: a,b: 1,0; 0,1.
Pn1+1 duonity value pair: a,b: 1,1

Pattern Number Shapes:

Column Block Wall Pillar The shapes of the different radices differ only in size, not in shape.

Note that the increase in powers should be to the right to follow the Pattern convention, but they are shown here increasing to the left to be comparable with the positional numeral systems described below.
Note also that squared Pn6+1 represents Pattern qubits with six layers of cells while a quantum qubit has only one layer of cells (see Page P19:13). Pattern computing could, therefore, be an interesting alternative to quantum computing.

Positional Numeral Systems

Typical number systems are subsystems of the PNS because they use only the *b* values of the pair (a + b) as symbols. The decimal system, for example, uses only the 0,1,2,3,4,5,6,7,8,9 values as digits (symbols), and then only one at a time in each position (1's, 10's, 100's, etc.) for counting.

Example 1: Decimal Numeral System

$n \times (10)^3$ $n \times (10)^2$ $n \times (10)^1$ $n \times (10)^0$ Radix: 10. Multiplier *n* is any digit (symbol) from 0,1,2,3,4,5,6,7,8,9 range.

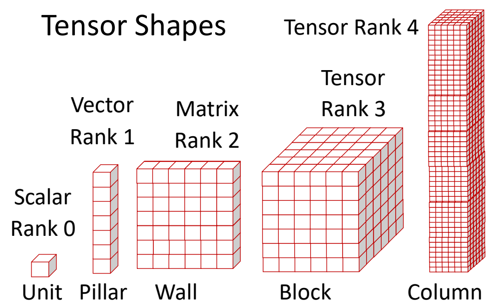
Example 2: Binary Numeral System

$n \times (2)^3$ $n \times (2)^2$ $n \times (2)^1$ $n \times (2)^0$ Radix: 2. Multiplier *n* is any digit (symbol) from 0,1 range.

Note that the radix of a binary system is 2, but the comparable Pattern number system's radix is Pn1. This difference is due to the typical radix as the number of digits and the Pattern number radix as the highest value of the range.
Note also that the expressions above do not necessarily include all possible ranges of the radices and the values.

The Pattern Number System and Tensors

Tensors are mathematical objects that are typically used to describe physical properties (Source: DoITPoMS). At first glance the similarities between Pattern number shapes and tensor shapes (on the right) are striking. The ranks of tensors (vector - rank 1, matrix - rank 2, tensor - rank 3 and, tensor - rank 4) are like the pillar, wall, block, and column shapes of Pattern numbers. (Note that the scalar is excluded.)
The main differences are the homogeneity of the tensor's single cell-type compared to the two cell-types (*a,b*) of the Pattern number system. In addition, Pattern number shapes are determined by the powers of the radices and are not variable as are the shapes of tensors.



Pattern numbers and tensors are both mathematical objects that can be used to describe properties of natural phenomena.

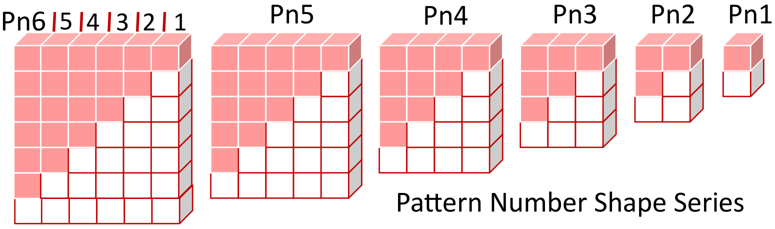
Pattern Number Series and Symmetries

A Pattern number series consists of the Pattern number itself and its lower Pattern numbers. The lower shapes are included in the Pattern number shape, but they could also be stacked step-wise onto the largest shape. Symmetries of a Pattern number shape yield pairs, quads, and clusters (consisting of three orthogonal quads).

The Pattern Number Shape Series

The series of walls (on the right), for example, are included in the Pn6 wall. The series of walls could also the added (stacked) onto the biggest shape. (See Example below.)

Other shapes, e.g. blocks, also include their smaller versions.

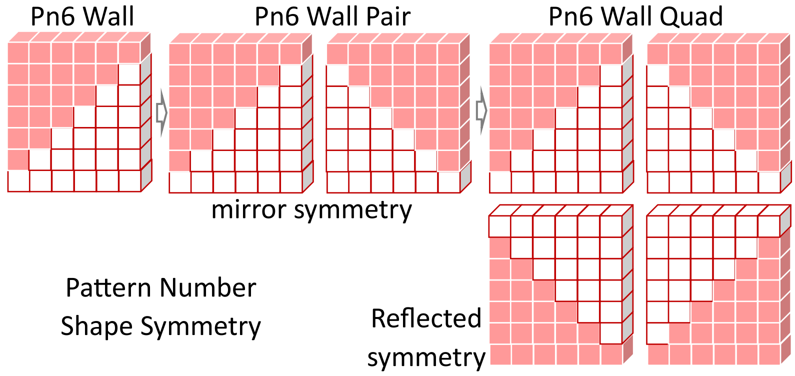


Pattern Number Shape Series

Pattern Number Shape Symmetry

A Pn6 wall pair, for example, is a mirror symmetric image of the wall (on the right). The Pn6 wall quad (on the far right) has an (added) inverse image (reflection) below the wall pair.

A Pattern cluster (not shown here) consists of orthogonal red, purple, and blue block quads. The opened (disduonity) Pattern cube (see below) that is derived from the cluster consists of orthogonal red, purple, and blue cleft pyramid pairs.



Pattern Number Shape Symmetry

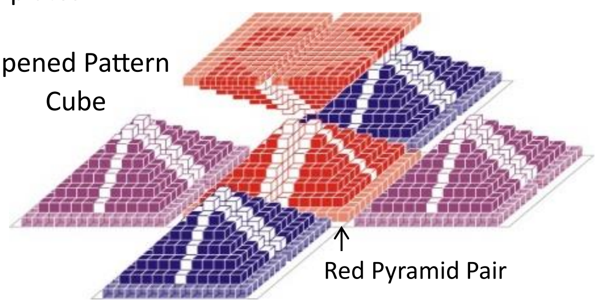
Example: Pattern Number Series and Symmetries

The Pattern Cube Pyramids

The cleft pyramids of the Pattern cube illustrate both the Pattern series and the Pattern symmetries. The red, cleft pyramid pair of the cube is in the centre (vertical) of the opened Pattern cube below. The spread-out plates of the lower cleft pyramid are shown on the right. Each plate pair resemble a wall quad (without the horizontal cleft).

The Pattern numbers of the stacked plates, together with the values for the upper half of each plate, are listed next to the plates.

Opened Pattern Cube

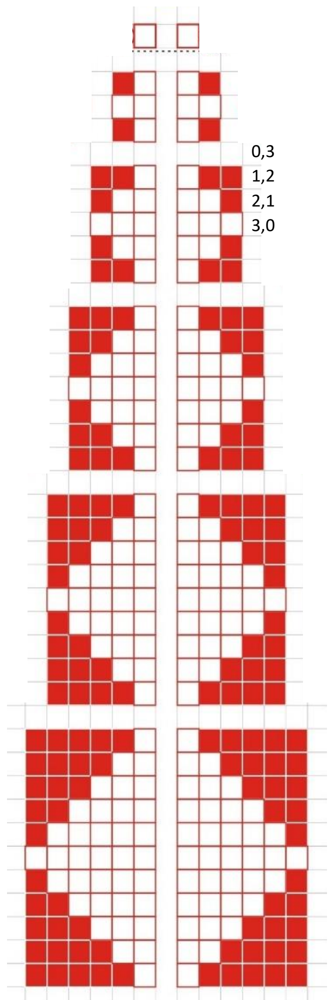


Observations

Each plate pair of the cleft pyramid (on the right) represents a wall quad of increasing size according to the Pattern series. Note that the bottom row and top row of every two wall pairs of the quads overlap.

The white cells of the plates represent the *bb* parts of the Pattern cube. Each white cell represents one chemical element of the Standard (Symmetric) Periodic Table (SPT) described in *The Pattern of All Things* (see the website).

Red Cleft Pyramid Plates



Pattern Number Quad Series

	a,b	b,a
Pn1 plate pair	1,0	0,1
	0,1	1,0
Pn2 plate pair	2,0	0,2
	1,1	1,1
	0,2	2,0
Pn3 plate pair	3,0	0,3
	2,1	1,2
	1,2	2,1
	0,3	3,0
Pn4 plate pair	4,0	0,4
	3,1	1,3
	2,2	2,2
	1,3	3,1
	0,4	4,0
Pn5 plate pair	5.0	0,5
	4,1	1,4
	3,2	2,3
	2,3	3,2
	1,4	4,1
	0,5	5,0
Pn6 plate pair	6,0	0,6
	5,1	1,5
	4,2	2,4
	3,3	3,3
	2,4	4,2
	1,5	5,1
	0,6	6,0

The six concentric cubes of the Pattern cube are a series of cubes.

Pattern Number Spins

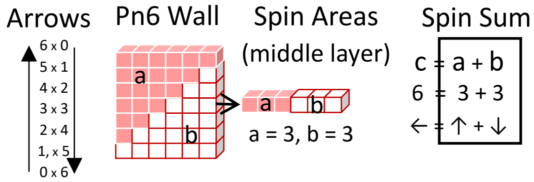
Intrinsic spin is a property of elementary particles that is related to the phenomenon of magnetism.

In the Pattern context the values of Pattern numbers seem to represent spin. The values and geometry (shapes) of Pattern numbers of different powers are shown below to match to the spin property of particles.

Pn6 Wall Spins

Pattern number spins of a (Pn6) wall are indicated (on the right) by vertical arrows, either pointing upward or downward. The arrows point according to the increase of the values. The middle layer of the wall shows the spin geometry of one specific value pair (3,3).

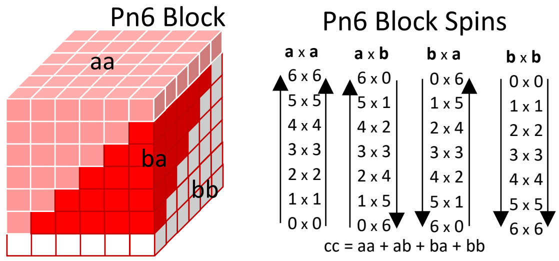
The spin sum (on the far right) reflects the algebraic representation of the middle layer with its values and spin arrows.

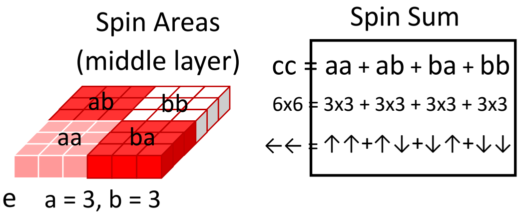


Pn6 Block Spins

A Pn6 block and its four sets of spin arrows are depicted on the right. The middle layer is shown separately below the block. The four spin areas (*aa, ab, ba, bb*) for the middle values (3,3) are indicated.

The spin sum (on far right) depicts the algebraic representation of the block's middle layer with its values and arrows. The spin sum (for two particles) is indicated by the double horizontal (west pointing) arrows. (The Pn6 block depicted here is the left block of a pair and it is also the bottom, left block of the block quad that is shown below, right.)





Block Quad Entanglement

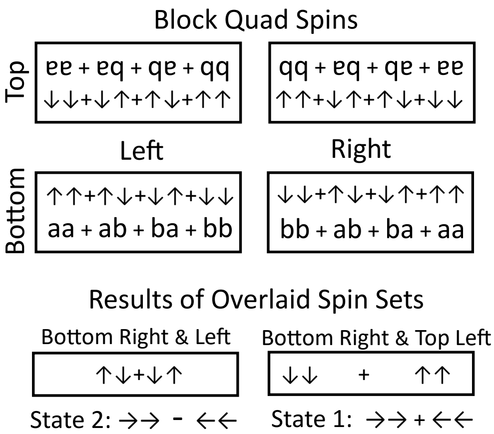
The spins of a block quad are shown in the block drawing on the right. The inversion of the bottom block pair's spin arrows in the top block pair is due to the reflected (vertical) symmetry of a quad.

(Note that the dimensionality of a quad is higher than that of a block.)

The overlaying of two spin sets, one horizontally and one vertically accross, and the elimination of non-matching spins, yield the entanglement conditions (State 1 and State 2) that are shown below the quad.

Frank Wilczek describes the quantum entanglement phenomenon by means of two similar spin conditions (states) in more detail in his book *The Lightness of Being*, published by Allen Lane. Wilczek's 'toy model' beautifully illustrates the entanglement conditions that are replicated here in a simplified form (without showing the probability amplitudes).

It is interesting to note that the two states distinguish between the real and imaginary parts of the complex unification block shown on page P20:13.



Wall Spin Probabilities

The calculation of spin probabilities follows from the spin examples above. The probability of finding spin-up and spin-down for the middle layer of the Pn6 wall is 3/6, or ½, for each. The combined, normalized probabilities (on the right) equal 1, which is certainty.

The spin probabilities of the other value pairs (layers) could be calculated similarly to yield their specific ratios.

<u>Example</u>: Normalized Pn6 Wall Probabilities

Value Pair a = 3, b = 3 (Only terms for one pair of values.)

a + b = c

3/6 + 3/6 = 6/6 (Divide each term by 6.)

½ + ½ = 1

The probabilities of each term are:

½ + ½ = 1

Note that the wall cross-section has two halves.

Block Spin Probabilities

The normalized probabilities of the terms of the middle layer of Pn6 block are depicted on the right. The multiplication of the probabilities in each term yield ¼ and the sum equals 1, which is certainty.

The two examples above show that spin probabilities are directly related to the geometric composition of the Pattern number shapes.

<u>Example</u>: Normalized Pn6 Block Probabilities

Value Pair a = 3, b = 3 (Only terms for one pair of values.)

a x a + a x b + b x a + b x b = c x c

3/6x3/6 + 3/6x3/6 + 3/6x3/6 + 3/6x3/6 = 6/6x6/6

½ x ½ + ½ x ½ + ½ x ½ + ½ x ½ = 1 x 1

The probabilities of each term are:

¼ + ¼ + ¼ + ¼ = 1

Note that the block cross-section has four quarters.

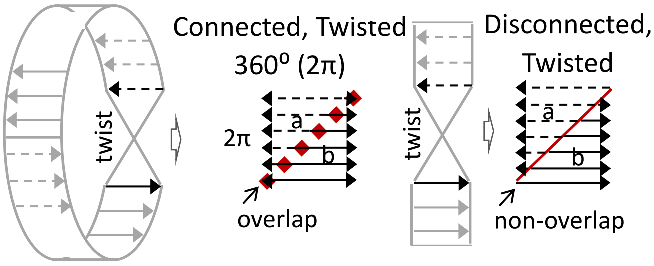
Pattern Number Twists

Pattern number shapes embody twists analogously to the twist of a Mobius band. A twisted and connected band displays a one-sidedness that is different from the two-sidedness of a disconnected, but still twisted, band. The Pattern cube, which is the final Pattern number shape, seems to twist in three orthogonal directions.

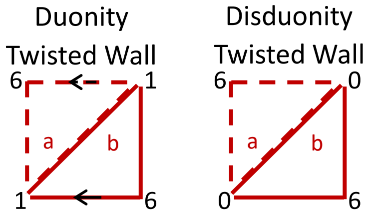
Connected, Twisted and Disconnected, Twisted

The Mobius band with vectors (on the right) is used to derive compact representations of both a connected, twisted band and a disconnected, twisted band.

A twist happens over 360⁰ (2π) and represents a synchronous decrease and increase (SDI) of two quantities, i.e. quantity *a* decreases while quantity *b* increases.

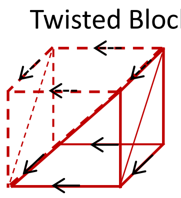


> **Antics** A fictitious ant could traverse both sides (*a* and *b*) of a (connected) Mobius band without crossing a boundary. On a disconnected, but still twisted, band the ant is stuck on one side or on the other side.



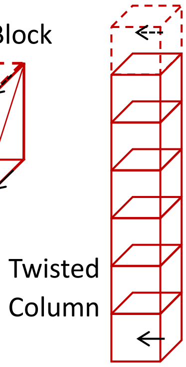
Twisted Wall

The Pattern number shape associated with the two compact band renditions above is the wall shape. The two icons (on the right) depict the duonity and the disduonity states of a wall. (Note the different numbers at the corners.) The twist lines stretch diagonally across the icons. Two horizontal arrows (not part of the icon) have been added to the duonity wall icon to depict its connected-ness.



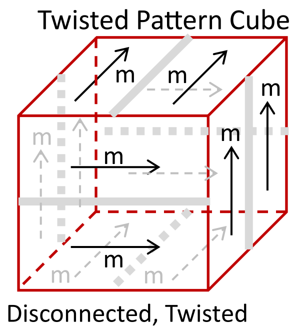
Twisted Block

The connectedness of a block is indicated by the arrows at the top and at the bottom of the block icon (on the right). The twist plane inside the block stretches diagonally across the block but it is difficult to distinguish owing to the angles involved.



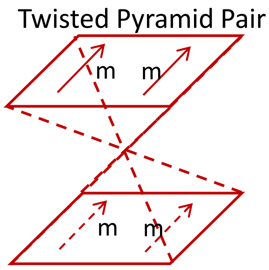
Twisted Column

The connectedness of a column is indicated by the arrows of the top and the bottom blocks of the drawing (on the right). No twist 'line' (actually a solid) is indicated owing to the scale of the drawing.



Twisted Cube

The blocks of a (twisted) column pair (c^3 & c^3) transform into the twisted Pattern cube ($6c^2$ & $6c^2$) according to the Pattern identity and the transformation (diagonalization) process. The arrows show the connectedness of the cover plate pairs of the twisted Pattern cube (on the right). The arrows follow the directions of increase (according to the signs) of the Pattern state number ***m*** of the PSI system (explained on page P20:5).



Twisted Cones

The Pattern cube consists internally of three orthogonal 'clefted' light-cones and four skew 'cored' life-cones (see page P20:12). The red vertical twisted pyramid pair of the cube, which includes parts of both types of cones, is shown schematically on the right.

The light-cone parts of the pyramids could, perhaps, be comparable to the 'twistors' that are described by Roger Penrose in his book *The Road to Reality*, published by Vintage Books.

Pattern Number Spinors

The compact wall icons (at the top of the page) could be representations of (duonity and disduonity) spinors. See '*What is a Spinor?*' on the right.

The linear twisting is represented by the (diagonal) overlap/non-overlap lines of the icons, where *a* becomes *b* in one cycle. Cycles are explained on the next page.

What is a Spinor?

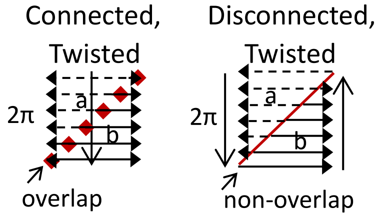
A spinor is a type of vector that transforms linearly when the Euclidean space is subjected to a slight rotation (Source: Wikipedia). A spinor could be visualized as a vector pointing along a Mobius band exhibiting a sign inversion (arrows pointing in opposite directions) when the vector is rotated through the 360⁰ (2π) of the band.

Pattern Number Cycles

A synchronous decrease and increase (SDI) of a pair of quantities is illustrated by the looping of a Mobius band (see the previous page). Repeated SDI cycles yield intrinsic 'waves' that could be plotted on timelines. The different types of cycling are uni-directional (uni-SDI), bi-directional (bi-SDI) and orthogonal (ortho-SDI).

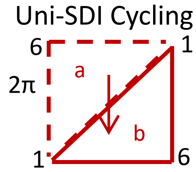
Synchronous Decrease and Increase (SDI)

The synchronously decreasing and increasing (SDI) vector diagrams (on the right) are derived from a Mobius band (see compact diagrams derived on the previous page). The single vertical arrow in the connected, twisted vector diagram depicts a uni-directional (uni-SDI) cycling because the top and bottom edges are connected. The two vertical arrows of the disconnected, twisted vector diagram depict a bi-directional (bi-SDI) cycling because the top and bottom edges are not connected.



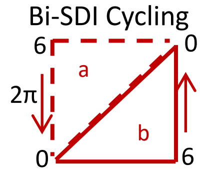
Uni-SDI Cycling

The arrow in the middle of the wall icon (on the right) represents uni-SDI in six steps. (The steps are not shown.) The numbers on the sides reflect the connected (duonity) Pattern number state (the value pairs contain no zeros). The cycling converts the *a* quantity into the *b* quantity. The last (bottom) step is followed by the first (top) step repeatedly.



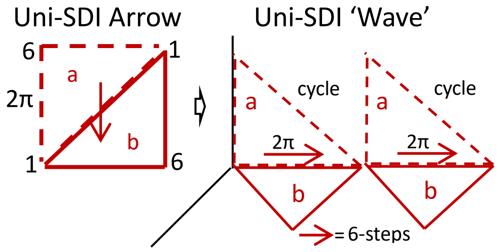
Bi-SDI Cycling

The two arrows on the sides of the wall icon (on the right) indicates the bi-SDI of the disconnected (disduonity) wall. The value pairs on the sides, that include zeros, reflect the disduonity state and there are, therefore, seven steps in each direction.



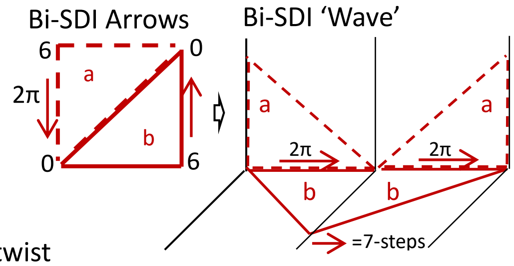
Uni-SDI 'Wave'

The drawing on the right illustrates two cycles of the intrinsic 'wave' that are caused by the uni-SDI cycling. The orthogonal sawtooth-type 'wave' repeats with wavelengths of 2π (six steps each), and it is a standing 'wave'. If *a* is an imaginary variable (see page P20:12 for complex Pattern numbers) then the orthogonal type of 'wave' that is illustrated results.



Bi-SDI 'Wave'

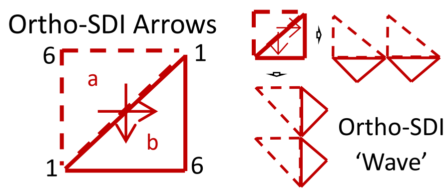
The drawing on the right illustrates the intrinsic 'wave' that is caused by the bi-SDI (down-up) cycling. The (orthogonal) triangular 'wave' has wavelengths of 4π (14 steps). Note that each cycle represents a time unit and the bi-SDI 'wave', therefore, repeats every two time units.



Ortho-SDI 'Waves'

The twist diagonal of a duonity wall (vertical uni-SDI) could also be the twist diagonal of a horizontal uni-SDI. The resulting orthogonal SDI (ortho-SDI) cycling is represented by a vertical and a horizontal arrow in the icon on the right.

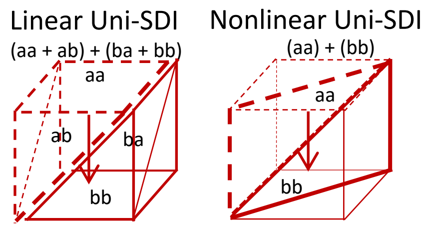
A miniature version, with no detail, of an intrinsic ortho-SDI 'wave' is illustrated next to the icon on the right. Use the horizontal uni-SDI 'wave' that is shown above for reference.



Block SDI

The two halves of the block (on the right) would yield linear SDI cycling, like the wall above. The two halves are linear and shown slightly separated.

The uni-SDI 'wave' (note the arrow) consists of four parts [(*aa* + *ab*) + (*ba* + *bb*)]. If only the *aa* and *bb* parts of the block are included, which is the often the case in physics, then the uni-SDI cycling (see arrow in diagram on the far right) would be nonlinear and the 'wave' would be sinusoidal. Bi-SDI and ortho-SDI cycling also apply to both the linear and the nonlinear intrinsic 'waves' of a block.



Linear SDI: (aa + ab) + (ba + bb)

Diagonal cross-section: (aa) + (bb)

Nonlinear SDI: $a^2 + b^2$

Extrinsic Waves

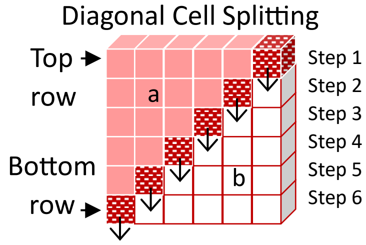
Intrinsic Pattern number 'waves' such as spin and charge could cause extrinsic waves analogously to oscillating charges in an antenna that induces electromagnetic waves in the air. Upcoming Folder 22 *The Charge Cube* describes a particle pair's electric charges as an example of intrinsic 'waves' while upcoming Folder 24 *The Wave Cube* describes extrinsic kinds of waves.

Pattern Number Splits

The split process of a duonity Pattern number into a disduonity Pattern number is called disduonification. The splitting could happen gradually in steps or all at once. Temporary unsplitting (duonification) is also possible. The phased disduonification process could be likened to a decoherence process in a quantum context.

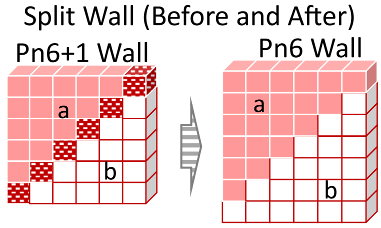
Splitting Process

The dotted cells on the diagonal of a duonity wall (on the right) represents *a* and *b* cells in superposition. The splitting (disduonification) process of the duonity wall is indicated by the six steps and six arrows. Each arrow indicates a split of a super-positioned (higher-dimensional) cell into two non-overlapping (disduonity) cells. The cells could split in sequence or all cells could split simultaneously.



Wall Split

The duonity (Pn6+1) wall, with dotted (overlapping) diagonal cells before splitting, and the disduonity (Pn6) wall after splitting are shown on the right. The six row duonity wall becomes a disduonity wall with seven rows. The dotted cells have disappeared and only evenly coloured cells are evident in the split wall.



Disduonification

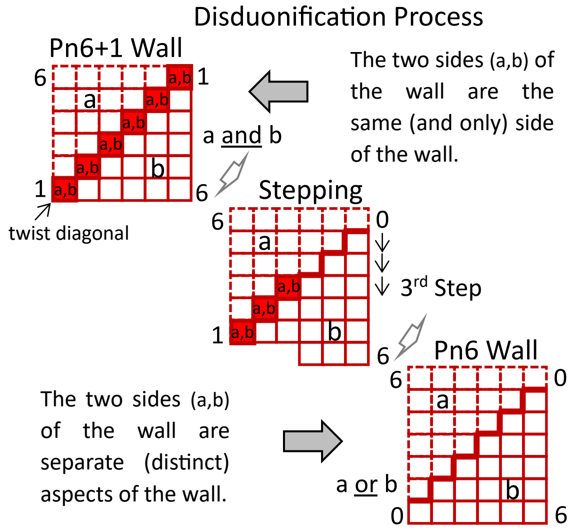
The top diagram (on the right) shows the duonity Pn6+1 (tile) wall with overlapping diagonal cells (type *a* and type *b*) as a first phase.

The middle diagram shows the tile wall after three split steps, still with three overlapping cells, as a second phase. The overlapping cells of the first three rows have each split into non-overlapping cells.

The bottom diagram shows the disduonified Pn6 wall with no overlapping cells (type *a* or type *b*). It is the last phase of the split process that took place in six steps.

In the final (disduonity) state the *a* and the *b* 'sides' of the wall are effectively opposite sides of a disconnected Mobius band and a fictitious ant (see *Antics* on page P20:9) would not be able to access the opposite side without crossing an edge. The ant would, likely, not be aware of the other side although it exists.

The phased splitting process is known as decoherence (see bottom). Note that duonification (unsplitting) is also possible and such instances could temporarily reverse the disduonification process.

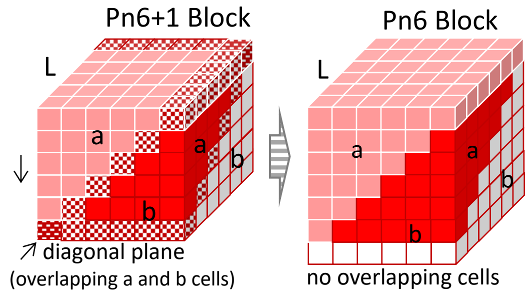


Block Split

A (duonity) Pn6+1 block with overlapping cells and the disduonity Pn6 block with no overlapping cells are shown on the right.

Unlike the wall split there is a loss of cells (and energy) if a duonity block splits into a disduonity block. Each cell represents an amount of energy, E_1. (See Folder 2 *The Pattern Energy* for more.) The duonity block has 294 cells and the disduonity block has 252; the difference (lost energy) is 42 cells, i.e. 42 x E_1.)

The reason for the energy difference could be related to the false vacuum decay hypothesis (on the right).



The False Vacuum Decay Hypothesis

The hypothesis states that an unstable false vacuum could decay into a true vacuum accompanied by the loss of energy.

Pattern Number Disduonification and Quantum Decoherence

Decoherence could be described as a process in which a system's behaviour changes from the quantum to the classical. A duonity Pattern number (sum-and-shape) could be compared to a wavefunction that is in a quantum coherent state (a superposition state) of two variables *a* and *b*. A decohered wavefunction compares with a disduonity Pattern number where both variables remain, but in a disconnected state and therefore no longer in a superposition.

The trigger for the disduonification process is uncertain, but is typically ascribed to the 'environment'. There had to be, however, an initial trigger for the original (1ststep) split. Any subsequent splitting would simply be a continuation (re-enactment) of the original split.

Complex Pattern Numbers

A Pattern number could be complexified (made into a complex number) by changing one variable, say *a*, into an imaginary quantity. The change yields complex Pattern number shapes with real and imaginary parts.

Pn6 Block

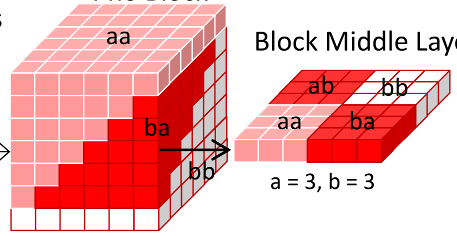
The terms of the squared Pn6 equation and their rows of coefficients are shown (on the right) together with the block geometrization. The middle layer of the block is shown separately to reveal its composition. The other layers are also structured according to their coefficients.

Pn6² Coefficients

a x a +	a x b +	b x a +	b x b
6 x 6	6 x 0	0 x 6	0 x 0
5 x 5	5 x 1	1 x 5	1 x 1
4 x 4	4 x 2	2 x 4	2 x 2
3 x 3	3 x 3	3 x 3	3 x 3
2 x 2	2 x 4	4 x 2	4 x 4
1 x 1	1 x 5	5 x 1	5 x 5
0 x 0	0 x 6	6 x 0	6 x 6

Pn6 Block

Block Middle Layer



a = 3, b = 3

Complex Pn6 Block

The complexification of the block (equation and shape) is depicted (on the right) by using the middle layer of the block. The complex squared equation consists of a real and an imaginary part [Re(z²) + Im(z²) = z²].

Another drawing of the middle layer is shown with real and imaginary coordinates superimposed. The typical sign convention is followed for both axes with the result that the sign of the *ba* term becomes '-' while it was a '+' in the algebraic expression.

Real and Imaginary Parts

$(iaia + iab + bia + bb) = zz$

$-aa + i(ab + ba) + bb = zz$

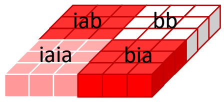
$(-a^2 + b^2) + i(ab + ba) = z^2$

$Re (z^2) + Im (z^2) = z^2$

Middle Layer of Pn6 Block

$(ia + b)^2 = z^2 = Im(z^2) + Re(z^2)$

Middle Layer



Geometry Derived Signs

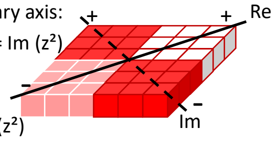
$Re (z^2) + Im (z^2) = z^2$

$(-a^2 + b^2) + i(ab - ba) = z^2$

Note the minus in 'i(ab - ba)'.

Real and Imaginary Axes

Imaginary axis: $i(ab - ba) = Im (z^2)$



Real axis: $(-a^2 + b^2) = Re (z^2)$

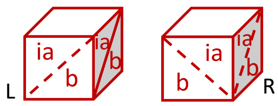
Complex Pn6 Block Cluster

The complex Pn6 block pair is shown on the right. The same pair is also the bottom part of the red quad of the block cluster. (Note the vertically reflected (inverted) symmetry of the top pair.)

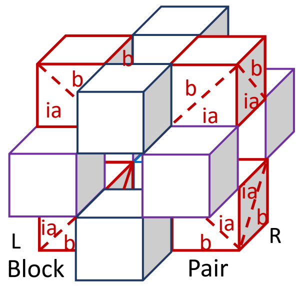
The complex block cluster consists of three orthogonal quads (only red quad has detail of quantities *ia* and *b*). The block cluster is an outcome of the rearranged complex column pair (z³ & z³).

Complex Column Pair:
z^3 & $z^3 = 6z^2$ & $6z^2$
Cluster: $6z^2$ & $6z^2$)

Complex Pn6 Block Pair



Complex Pn6 Block Cluster



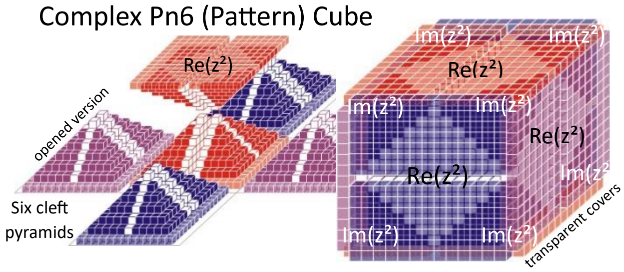
Block Pair

Complex Pn6 (Pattern) Cube

The transformation and subsequent assembly of the twelve complex blocks of the cluster yields the complex Pattern cube (on the far right).

The opened version of the Pattern cube (on the right) reveals the six cleft pyramids of the cube. (The transformation of block pairs into cleft pyramids is illustrated on page P20:5.) The three pairs of cleft pyramids (when closed) form the cube with its real and imaginary parts indicated. The cover of the (disduonity) cube is composed of the compressed *aa* (real) parts of the cube.

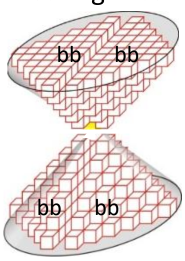
Complex Pn6 (Pattern) Cube



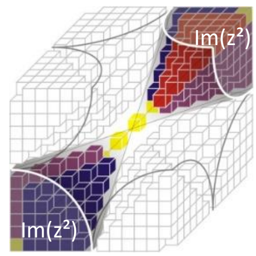
Real Light-cones and Imaginary Life-cones

The *bb* (real) parts of the Pattern cube (on the right) are shaped like (clefted) light-cones of spacetime. The *i*(*ab* + *ba*) (imaginary) parts of the blocks form into skew cones, called life-cones (on the far right). The (disduonity) Pattern cube is, therefore, composed of three real light-cones with clefts, four imaginary life-cones with cores and twelve real plates that form the covers.

Real Light-cone



Imaginary Life-cone



Overlapping Real and Imaginary Shapes

The Pattern cube seems to be a cube in 3D that represents two 'intersecting' objects, possibly a real cube and an imaginary sphere, that originate from two separate spaces; a real (3D) space and an imaginary (3D) space. The overlapping objects manifest (in compressed form) as one complex cube in 3D space. Its non-complex (real) version is generally referred to as a hypercube. The real cones of the Pattern cube seem to represent real reality and imaginary cones seem to represent imaginary reality.

The real Pattern light-cones compare roughly with actual spacetime light-cones.

The imaginary Pattern life-cones seem to embody potential (reality) by means of their codon (triplet) structure. The geometric genetic code structure of the life-cones is described in Folder 5 *The Pattern Cell*.

Unification Blocks and Cubes

A combination of the expressions for special relativity (one space dimension) and quantum uncertainty yields a complex squared equation and a matching Pattern block. Twelve (transformed) blocks build a unification cube. Unification cubes, like the atom cube and the gravity cube, are shown to match natural phenomena.

Unification Equation

The variables of the complex squared Pattern equation (on the right) are replaced by their typical relativity ($-t^2 + x^2$) and quantum uncertainty i(qp - pq) expressions (*t* is for time, *x* is for space, *p* is for momentum and *q* is for position). The squared sum (z^2) represents conserved energy.

The complex axes that are superimposed on the middle layer of a Pn6 block (on the right) yield a geometric representation of the (complex) unification equation.

Pattern Number Relativity

The two halves of the complex Pn6+1 (duonity) block (on the right) represent a linear synchronous decrease and increase (SDI) relationship.

The relativity doublet (on the far right) represents a (nonlinear) SDI expression of the special relativity expression for one space dimension, i.e. ($-t^2 + x^2$). Note the constant acceleration sequence, i.e. 1,4,9,16,25,36, that represent the number of cells in the layers of the respective shapes.

Pattern Number Quantum

The uncertainty doublet (on the far right) matches the quantum condition terms (iqp-piq). The minus in the expression is a geometric imperative (see previous page.) Note the opposing spin sequences, that could be related to magnetic phenomena, of the value pairs shown below the diagrams.

Uncertainty Shapes

The relationship between position and momentum could be expressed in terms of the Heisenberg uncertainty relation: $\Delta q \, \Delta p \geq h/2\pi$ (*h* is Planck's constant and *Δ* represents the range of measurements of *q* and *p*.)

The i*ab* and *bia* parts of a complex Pn6+1 block are shown as uncertainty shapes (on the right). The (imaginary) uncertainty relations are iab ≥ 6/2π and bia ≥ 6/2π (6 is the smallest product of the value pairs, 2π is the range.)

The uncertainty shapes represent Pattern qubits with binary 1 equal to i*a* values and binary 0 equal to *b* values, or *vice versa*. The six-layer shape compares with the one layer of a quantum qubit (see paragraph below).

Quantum Qubit

The Pn1+1 block (on the right) represents the combination of the pair of (imaginary) uncertainty shapes, i1 and 1i, that represent quantum qubits. The squared Pn1 block with the two binary number symbols is also shown.

Unification Cubes

The Pn6 (Pattern) cube is derived from twelve transformed blocks of a Pn6 block cluster. Unification cubes are specific instances of the generic Pattern cube (model). Diagrams of two disduonity Pn6 unification cubes (with covers), the atom cube, and the gravity cube, are shown on the right. Detailed descriptions of these two (non-complexified) cubes, plus five more, are provided in Folder 18 *The Pattern Cube.*

The individual parts of the atom cube represent all the elementary particles of the Standard Model which is described in Folder 4 *The Geometric Standard Model.*

The gravity cube consists of anti-gravity, gravity, and chain gravity parts. These compare, respectively, with the *aa, bb,* and *ab/ba* parts of the Pattern cube. Chain gravity acts like a rubber band that exhibits low resistance with small displacement and high resistance with large displacement (see Folder 18). The corresponding parts of the atom cube embodies the neutron/proton particles with the strong force which has the same elastic-type property called 'asymptotic freedom'.

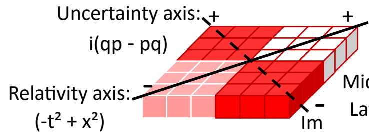
Unification Equation

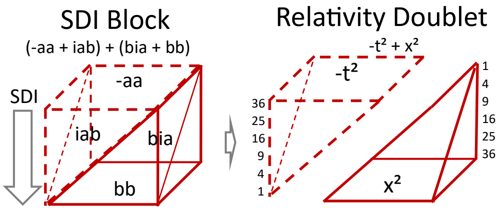
$$\mathrm{Re}\,(z^2) + \mathrm{Im}\,(z^2) = z^2$$

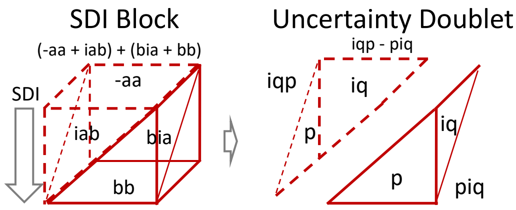
$$(-t^2 + x^2) + i(qp - pq) = z^2$$

Relativity + Uncertainty = Constant Sum

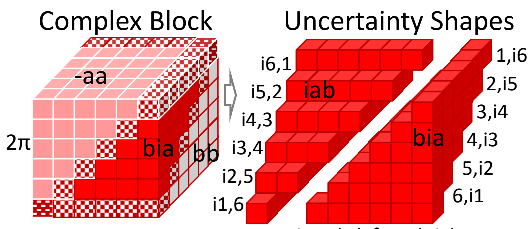
Relativity and Uncertainty Axes





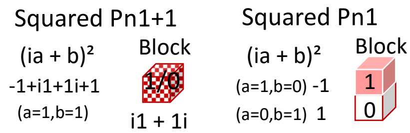


iq,p: 6,1;5,2;4,3;3,4;2,5;1,6 & p,iq:1,6;2,5;3,4;4,3;5,2;6,1

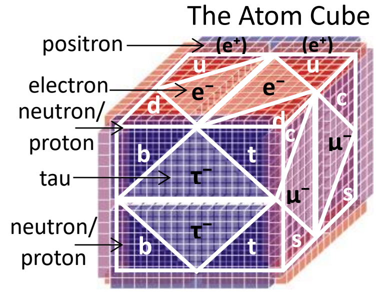


a turns into *b*, left and right.

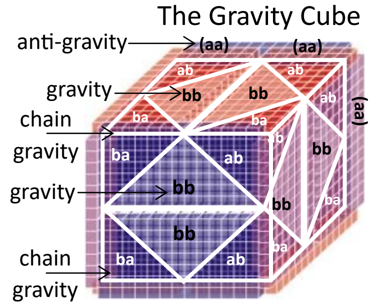
Quantum Qubit



The Atom Cube



The Gravity Cube



Unification System

A systems engineering solution.

The Pattern Hypothesis

The Pattern hypothesis states that natural phenomena developed according to a universal mould (pattern).
If the generic Pattern cube is deemed to be the mould, then specific Pattern cubes (unification cubes) that serve as models of natural phenomena could be used to test the hypothesis.

The Pattern Conservation Law

The Pattern law states that the Pattern sum is conserved.
Owing to the algebraic-geometric (sum-and-shape) equivalence of Pattern numbers, the shape of a sum, such as the generic Pattern cube, is then also conserved or invariant.

Unification Schema

The hierarchy (on the right) shows the Pattern number system as represented by a Pattern cube that consists of blocks with quantum-like properties and block parts that represent relativity.

The sum-and-shape of $(ia + b)^4$ includes the sum-and-shape of $(ia + b)^3$ that includes the sum-and-shape of $(-a^2 + b^2)$.

The Pattern cube is the main shape of the Pattern number system and is composed of twelve (transformed) Pattern blocks. Unification cubes are instances of the generic Pattern cube that are used to model natural phenomena. A prime example of the use of unification cubes is the observation that the strong force of the neutrons/protons of the atom cube corresponds to the chain gravity of the gravity cube. This correspondence could, perhaps, explain some properties of dark matter.

A complex Pattern block is shown to exhibit quantum-like characteristics, e.g. superposition, spin, uncertainty, and split (decoherence). The pair of uncertainty shapes (i*ab* and *bia*) of a (complex) duonity block is a discovery that explains not only uncertainty in a geometrical fashion, but also the structures of qubits.

The two main parts (iaia + bb) of a (complex) Pattern block embody the special relativity expression for one space dimension which is $(-t^2 + x^2)$.

The Pattern
$(ia + b)^4$
Cube

Quantum
$(ia + b)^3$
Block

Relativity
$(-a^2 + b^2)$

Unification System

The Pattern number system is a system of invariant unified (sum-and-shape) numbers that could be used to build abstract mathematical models. Unification cubes and unification blocks are instances of generic models that match key characteristics of different types of natural phenomena.

The Pattern number system had been shown to be a unification system for physics phenomena, such as relativity and the quantum, but it could facilitate unification in a wider context such as the life sciences.

The Pattern number system is an example of systems engineering which is defined by Simon Ramo as: *"…a branch of engineering which concentrates on the design and application of the whole as distinct from the parts, looking at a problem in its entirety, taking account of all the facets and all variables and linking the social to the technological."*

Conquering Complexity, 2005.

Toy Model

The potential of the Pattern number system to be a unification system is considerable but, at this stage, it could be described only as a toy model of a systems engineering solution to the unification of science.

"A good toy model captures some sense of the real thing but is small enough that we can wrap our minds around it."

Frank Wilczek

The Pattern number system has the potential of realising the unification dream. To begin unifying science by unifying the concept of number is a truly unique approach.