Pico-Mathematics
(Infinite Mathematics)

Contents

Summary

In PicoPhysics the record of observation is important. The quantitative expressions in the record of observation consist of a number along with unit. It is important to study the linkage between units and number used

in record of observation. This discussion is about concept of numbers and there manipulation using arithmetic operations.

Besides numbers representing quantity, we find other numbers in pure mathematics. These are Infinite, Zero and Negative numbers. Negative numbers represent transactions abstracted thru use of arithmetic operators. It is seen that the result of Mathematical abstraction can only be selectively applied to physical Reality.

A Reality can not be measured in-absentia. The binary Zero has no place in record of observation. A record of observation, without mathematical processing (except scaling) will have numbers represented by square of Real Number. To address in-absentia condition, the observed Reality can be conceptualized to be composed (minimum) two mutually independent parameters, each represented by mutually exclusive Real Number. The exclusiveness together with two parameters is enough to exclude the in-absentia results.

The usable number concept in Pico-Physics is derived from Set theory. Set theory extends the range of numbers to set of transfinite numbers. Real Numbers express the observed Reality. The Real Number it-self is obtained by transforming a Transfinite Number 'representing the object' using a transformation number representing unit Reality. The set of usable numbers are subset of Transfinite Number set.

The available series of transfinite numbers is an intrinsic characteristic of object and units of observation. The Reality can be represented by a minimized set of constituents, parameters or properties. The cardinality of representative set of numbers represents dimensions of Reality. It also determines the Infinite Order of Transfinite Number representing the observed object. The Infinite Order is dimensions of the Reality.

The Infinite Order of the Transfinite Number in observation record can be computed by subtracting the Infinite Order of unit of measurement from Reality. The Infinite Order is generally Zero as observation unit and measurement unit represent objects of same type. Reality, set theory and Pico-Math all provide set of finite Real Numbers to record Reality.

To measure identity in an object using a unit, a conformal mapping between object's identity and unit's identify shall be possible. The maximum difference between Infinite Order of two identities is less than 2. The Infinite Order of usable unit is same or one less than that of object.

Mathematics in Observations

A recorded experience is an observation. The minimum required step in observation are experiencing the object and recording it. Subject selection, object identification, translation, communication and other steps can be executed on the record of experience itself. The concept of numbers and there manipulation using arithmetic operations to represent physical quantities is important in PicoPhysics.

Number is an abstraction – the result of operations that combine unit objects into observed Reality. By separating magnitude from the object, it becomes possible to learn rules to manipulate quantity independent of object itself. The observers, who understand this manipulation, can interpret un-ambiguously, communicated record of observation, for magnitude vis-à-vis unit object.

Quantitative observations are recorded using two symbols. One represents 'Unit Object' understood by all prospective partners in communications. Second symbol 'Number' represents the quantitative relationship between the Object and 'Unit Object'. The expression for physical quantity has two components.

- Unit - component represents all physical properties of the object together with magnitude known across all interested observers
- Number – A symbol for collection of unit objects that equals in magnitude to the object

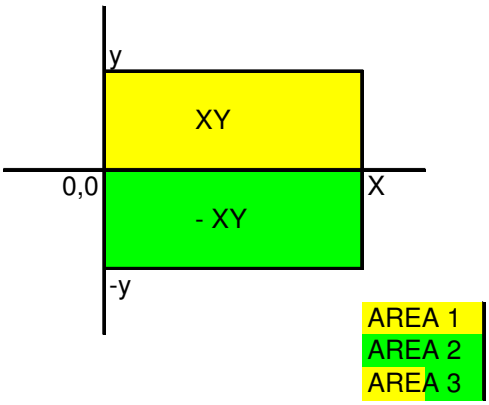
With comparison of two objects as the driving force, Numbers developed in association with discrete transactional objects. To the extent feasible, line segments in number-symbols can be representative of unit objects. Composite symbols 'Roman Numerals' evolved for ease of use before full abstraction was applied to numbers 'Hindu-Arabic Numerals'.

Revisiting concept of numbers in above light and their use in study of nature forms one of the building blocks of Pico-physics. Specially the concepts of;

1. Negative Numbers
2. Infinity
3. Zero
4. Dimensions

3.1 Abstraction in Mathematics

Use of mathematics in quantitative record increases precision.
This may also compromise represented physical Reality. 'Area' a surface, is a 2-D identity. It has two degrees (Say X & Y) of freedom. With an object, measured by area it covers, we can visualize two physical areas (mirror image of each other) to measure as below;



Area 1 = X * Y (vector +Z direction)
Area 2 = X * (-Y) (vector -Z direction)
Area 3 = X*Y + X*(-Y) (Sum of two areas)
= X Y – X Y
= 0 (Vector Addition)
= 2(X.Y) (Physical addition)

(Value '–Y' needs to exist, as the combined length 'difference in end position' is 2Y).

Even though real-estate occupied by composite object is 2XY, mathematically it occupies none in some cases. Impact of application of mathematical logic is "Area has to be defined as a vector quantity at least in some cases". Without Z axis, we don't have a vector to represent the area. Due to application of mathematical logic, it appears that 2-D area is defined only in 3-D space.

Mathematical abstraction and results can only be selectively applied to physical Reality.

In contemporary physics, many times we tend to use mathematical manipulation to arrive at a result. By combining different experiences of nature (through different set of equations and values), we arrive at a mathematical statement that represent richer experience than each individual statement. We relate the resulting statement with physical objects to understand nature. Based on this approach, we have been able to make many discoveries. We can say, mathematical abstraction continues to imbibe Reality to a large extent with caveat of limitation on scope.

PicoMaths allow Arithmetic Manipulations based on represented Reality. In case above, since Area is defined in terms of 2-D Reality, it can not be represented by a normal vector. If the object itself is 3-D and area represents cross-section transacted across by the object, it can be represented by a vector.

The difference between computational math and Pico-Math is the continued presence of goods (as Units).

3.2 Negative Numbers

As soon as man was able to think more than singular and plural, numbers were born. The object name itself, identifying the object transformed into unit.

The numbers developed in association with discrete transactions with comparison of objects as the driving force. To the extent feasible, line segments in number-symbols were representative of unit objects. Composite symbols used in 'Roman Numerals' represent it clearly. More than one 'Roman Numeral' can be used to represent given physical quantity. (Example number 8 is VIII as well as IIX). The symbols represent different sets of transactions of unit objects to arrive at object quantity. This can be seen in the successive Roman Numerals for 4, 5, 6 being IV, V, VI. The benefit of representing quantity using symbols, gave –ive numbers a directional significance (Adding to left reduce the number in composite 'Roman Numeral').

Rational numbers evolved out of need to use the collection of objects as unit. Application of mathematical concepts developed for discrete objects on fluids resulted into evolution of Real Number range. Science used mathematics to convert pure observation to precise records for communication using units.

Observations don't result into a Negative number. Negativity is the result of interpretation of the observation (Like set of three balls is two balls less than set of 5 balls). Negative numbers are used to represent loss or missed object - example, a debt that is owed may be thought of as a Negative asset, or a decrease in some quantity may be thought of as a Negative increase. The transactional aspects of accounting, made numbers acquire dimension characteristics. The concept of Negative number can be a result of need to express the result of mathematical operations of addition & subtraction. The set of possible results is a discrete number range (-Infinity, 0, + infinity).

Concept of Negative quantities is tied to transactions of goods (Credit & Debit) or neutralization of effect (Example: charge) on environments.

After discovery of electrostatics by Thales, the directional significance to Negative number became independent of transaction. Now Negative numbers exist in there own right. An object can measure itself to be +ive

or –ive. This makes mathematics treat positive and Negative numbers alike. Now numbers can themselves be considered as objects.

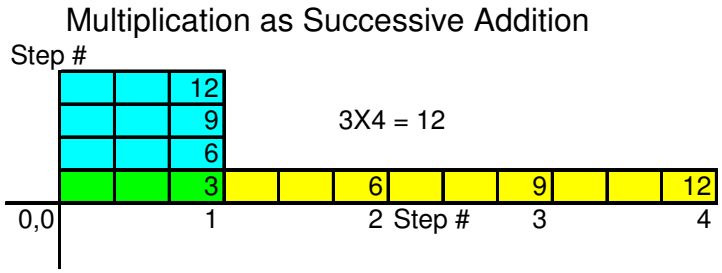
Mathematics as a science is born with focus on numbers and computations dropping the transacted goods from the picture. Now numbers (numerals) can by themselves be taken as objects.

We have elementary particles with all three flavors, neutral, positively as well as negatively charged. With contemporary knowledge, the charge is not a measure of object, but a parameter or characteristic. Even charge on collection of electrons can not be said to be due to electrons only without a presumption that no other particle is present in collection. In certain identified cases, charge can be used as a measure of object subject to certain assumptions and/or factors.

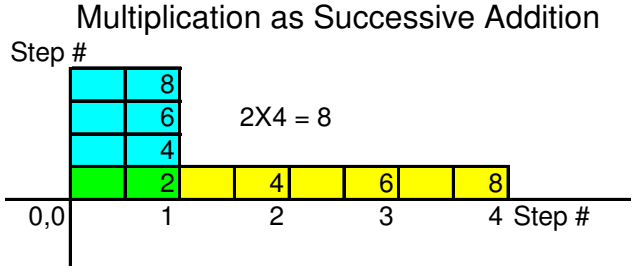
Some Arithmetic Operators

Mathematical concept of multiplication as successive addition is depicted in picture below.

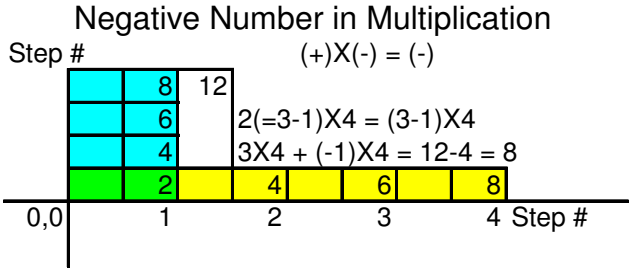
Picture 1 shows result of adding quantity '3' four times, result is 12. Same result is obtained on multiplication (Stacked Hipe).



When original quantity is 2 instead of 3, we get the result 8.



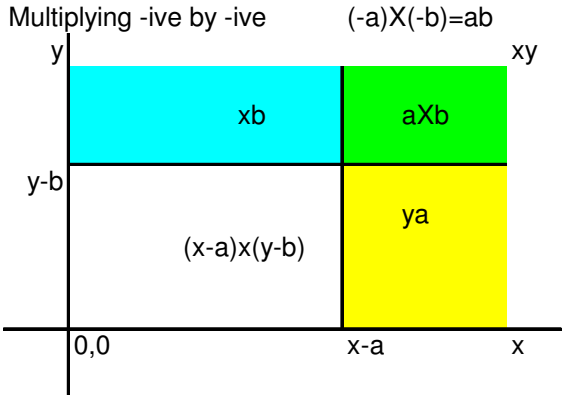
The concept of multiplication by a Negative number is found in establishing relation ship (Comparison) between two quantities.



On reduction of original quantity by 1 the result is changed by (-1)x4=-4.

Multiplication of a +ive number by -ive number results in –ive number.

Multiplication of –ive number by itself, or another Negative number result in a positive number is shown below;



The positive result signifies that value aXb is reduced twice from original value xy by applying result of independent subtraction of 'a' from 'x' and 'b' from 'y' simultaneously. To match with Reality of the object (surface) the sign of term 'AB' in the equation below is +ive. This is +ive in transactional sense as is (-AX) & (-BX) Negative in transactional sense.

(X-A) x (X-B) = X x X –AX –BX +AB.

3.3 Number Infinite

Number along with Unit represents recorded quantity. The number representing quantity increases as unit of measure reduces.

Consider an observed parameter of an object be n units. An observer is queried on the measure of Object in different sub units. Starting with current unit, and progressively dividing the unit by n (Natural Number,

progressively increased from 1 to n). All such results can be expressed by question and reply set as below;

Question with Unit = {1, 1/2, 1/3 ..... (1/Infinity = Zero)}
Measurement Reply = {n, 2n, 3n, 4n ..... }
= n X {1,2,3,4, ... Infinity}

We can express the observed parameter using a solution set. The solution set can be written as $\{(\text{unit, value::}1/N, Nxn)\}_{n=1 \text{to} \omega}$
Where n varies from $1 \text{to} \omega$, ω is the number Infinite.

Measurement = $nx\omega$-units (Lowest Observer Units)
= $n\omega$ Units
= n units (Original Unit = ω New Units)

The measurement can be communicated in terms of a finite number n or infinite number $n\omega$. Here the number infinite is subject to multiplication operators as any other number.

For general observer that can define unit of observation for the measurements it can perform on the object, even a finite quantity can be represented by infinite number.

The number Infinite can represent even finite quantity when the unit is reduced to infinitely small value.

In this case, the mathematical proportionality operations are applicable to number infinite as they are to finite numbers.

3.4 Number Zero

Both unit object and the observed object are objects under observation. Either of the objects can be used as a Unit of measure for other. Unit can be arrived at as a difference of quantity in two objects as well. When the smaller object is used as a unit of measurement, the other object can measure to infinite, depending on the magnitude of smaller object. Using the larger object as the unit provides the magnitude of smaller objects as a fraction, which can reduce to Zero.

For general observer a Zero measurement on an object may mean magnitude beyond measurement, less than what can be measured. This object if identifiable, itself can be considered a Unit Object. Now the value measured of unit object is a Real Number. In case, unit object has to be retained, the measured value is Inverse of Real Number. For an

observer that can use any object as unit, Zero means absence of object (**Binary Zero**).

*Mathematically, Binary Zero is obtained by subtracting natural number from itself (**Binary Zero**).*

Thick Zero, a different type, can also be obtained by dividing Real Number by Infinity. In this case, the object is not identifiable by observer. Zero may represents insignificant amounts in units of observation. Significance is determined by object or the observer. Zero resulting from original quantity distributed to infinite landscape, is thick-Zero, with thickness represented by quantity distributed, retaining quantitative conservation. **Thick-Zero** thus retains the characteristics of normal Real Numbers. Addition or subtraction of Zero to Real Number results in same Real Number. Multiplication by Real Number results in a different **thick Zero** than the original.

> *In general observation, the operation of multiplication and division are applicable at Infinity and Thick-Zero.*

Thickness of Zero

Let us consider observed parameter of an object be r units. An observer is queried on the measure of Object in different derived units - Starting with current unit, and progressively addition to the unit.
(Result is a Rational Number, progressively decreasing from r to r/n). All such results can be expressed by question and reply set as below;

Question with Unit = {1, 2, 3 ..... }(upto Infinity)
Measurement Reply = {r, r/2, r/3, r/4 ..... }
= r X {1,1/2,1/3,....1/n, ... TZ=1/Infinity}

Observed Quantity represented by any member belongs to the set {(1, N), (1/2,2r), (1/3, 3r) ... (1/ω, rω) } is same.

The members of two sets are related to each other as below;

> Measurement = r/N where N is the Natural Number indicating the position of member in the set of measurements.

If role is reversed between the object and unit object, we can see Zero is represented by $r\omega^{-1}$. Where r is thickness of Zero, representing the original quantity divided into infinite segments.

Infinite Order

Set theory is applied to mathematical objects - Numbers. A **Set** is a collection of well defined and distinct objects. Set is considered as an object in its own right. The cardinality – the number of elements in the set is a natural number or counting number.

Georg Cantor in his set theory extended the normally understood set of natural numbers beyond finite numbers, by introducing cardinal numbers. They are deviced to count the size of Sets.

The size of set is increased by including 'A set with binary Zero' as a member mathematical object. Using a recurssive logic, now cardinal number extends beyond infinity (example ω+1, ω+2, ω+3, and so on). Cardinal Numbers extend the set of natural numbers beyond infinity. These numbers "ℵ" are called transfinite numbers.

$$0,1,2,3,.....,n,..;\aleph_0,\aleph_1,\aleph_2,\aleph_3,.....\aleph_n,.....$$

It defines numbers as ordinals, examples of ordinal ranges are;

0, 1, 2, 3, ...
ω, ω+1, ω+2, ω+3, ...
2ω, 2ω+1, 2ω+2, 2ω+3, ...
3ω, 3ω+1, 3ω+2, 3ω+3, ...
$\omega^2, \omega^2+1, \omega^2+2, \omega^2+3,$. . . . . .
$\omega^2+\omega, \omega^2+\omega+1, \omega^2+\omega+2, \omega^2+\omega+3,$. . . .
$\omega^3, \omega^3+1, \omega^3+2, \omega^3+3,$. . . . . .
$\omega^\omega+\omega, \omega^\omega+\omega+1, \omega^\omega+\omega+2, \omega^\omega+\omega+3,$ . . .
. . . . . .
. . . . . .
. . . . . ε_0

Set theory brings to forefront the concept of Transfinite Number as above. The smallest Transfinite Number $\aleph_0$, is order type of set of natural ordinal numbers. After *all* natural numbers comes the first infinite ordinal, ω, and after that come ω+1, ω+2, ω+3, and so on. Further on, there will be ω^3, then ω^4, and so on, and ω^ω, then ω^{ω^2}, and much later on ε_0 (epsilon nought).

Pico-Physics does not recognize '0' (read binary Zero) as natural counting number that represents quantity of an object to an observer. Thus the two sets below represent the same set;

- Set Theory Set {ω+1, ω+2, ω+3, ω+4, ω+5, ω+6} of cardinality 6
- Infinte Math Set {ω, ω, ω, ω, ω, ω} of cardinality 6

While set belonging to set theory has six different transfinite numbers, Infinite maths set has the same number repeated six times.

Among numbers representing a physical identity the following holds true;

$$\omega + n = \omega = n + \omega$$

$$\omega - n = \omega = -n + \omega \text{.....(5)}$$

Where ω is number infinite, and n counting number

Since multiplication and division are applicable to Infinity, Pico-Physics recongnises only a sub set of transfinite numbers.

Valid Ordinals in PicoMaths

Valid Set of Ordinals in PicoMaths

$1, 2, 3 \ldots\ldots\ldots\ldots\ldots\ldots \omega$

$2, 4, 6 \ldots\ldots\ldots\ldots\ldots\ldots 2\omega$

$3, 6, 9 \ldots\ldots\ldots\ldots\ldots\ldots 3\omega$

$\omega, 2\omega, 3\omega \ldots\ldots\ldots\ldots\ldots\ldots \omega^2$

$\omega^2, 2\omega^2, 3\omega^2 \ldots\ldots\ldots\ldots\ldots\ldots \omega^3$

$2\omega^2, 4\omega^2, 6\omega^2 \ldots\ldots\ldots\ldots\ldots\ldots 2\omega^3$

$\omega^3, 2\omega^3, 3\omega^3 \ldots\ldots\ldots\ldots\ldots\ldots \omega^4$

$\omega^4, 2\omega^4, 3\omega^4 \ldots\ldots\ldots\ldots\ldots\ldots$

$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \omega^{\omega} = \varepsilon_0$

The set of numbers valid for quantitative expressions representing an Aspect of nature in general can be expressed as a set of numbers below;

$$\{l\omega^r, 2l\omega^r, 3l\omega^r, 4l\omega^r, 5l\omega^r, 6l\omega^r, \ldots\ldots\ldots\ldots\}$$

Here l is the level of number range and r the infinite order. All numbers are counting numbers. In individual number can be expressed as v $l\omega^r$

Compared with set theory $(a\omega^r + b\omega^{r-1} + c\omega^{r-2} \ldots\ldots)$.

In PicoMaths, the number $(a\omega^r + b\omega^{r-1} + c\omega^{r-2} \ldots\ldots)$, signifies multiple units of measure are used to measure an object or the measured in a lower order unit and communicated in higher infinite order.

Measurements

At maximum, in a single observation there is possibility to use three units of measure, one each for observation, measurement and communications. If these units belong to different infinite order, by successive unit conversions the remainders can be kept along with

measure at higher order unit value to have final result expressed by expression with three terms

$$O + M\omega^{m} + C\omega^{c}$$

Where O is remainder on conversion to measurement units of order 'm'. M is remainder when converting to communication units of Infinite Order 'c' and C is the magnitude communicated.

Consider an object taken as unit object by the observer to measure to

$$Ul'\omega^{r'}$$

Where l' is unit object level and r' its infinite order. In terms of unit object, the quantity representation is;

$$(Nl/Ul')\ \omega^{r\ -r'}$$

Nl/UI can be expressed as a rational number R, r-r' is an Integer 'i' with value range –r' to r. The number expression for quantity of object in terms of the unit is

$$R\ \omega^{i}$$

Let us evaluate above expression in different cases;

Case 1, Infinite order of object and the unit is same. Then r=r', and expression reduces to a rational number.

Measure of Object = R , Rational Number

Case 2, Infinite order of Object is greater than the unit object by n.

Measure of Object = $R\ \omega^{n}$,

n is an integer with value range 1 to ω
R is a rational number Rational Number

If one or more unit objects can be added to the object to represent a greater object, the expression below represents the measure.

Measure of Object = $(N/\ \omega^{n-r} + R)\ \omega^{n}$
$= R\ \omega^{n}$
Where R is a Real Number and n is a counting number.

In this case, since the object is observable with a unit of lower infinite order, it can always be measured to an infinite number. Addition or removal of finite multiple of unit quantity will remain the amount unaltered. However addition and removal at Infinite Order of object will affect the amount.

Case 3, Infinite order of Object is less than unit object by n

Measure of Object = R ω^{-n} ,
n is an integer with value range 1 to ω
R is a rational number Rational Number

If unit is the unit of observation, the object is identified. The measurement does not materialize. Mathematically the measure represents a Zero(or Suksham number) of thickness R

.

Compared with set theory ($a\omega^r + b\omega^{r-1} + c\omega^{r-2}$. . . . . .), amount in pico physics is represented by single expression $R\,\omega^n$.

Transfinite number set (PicoMath)

When observations are recorded with a given unit, the number is a finite number which is counting number, rational number or Real Number. In this case, the number range from set theory is congruent to number range in PicoMath.

However, when observer has multiple units of measure on different aspects of object, like point, length, area or volume, only one number can belong to Real Number. Others belong to transfinite numbers. In this case, the number set available to express the quantity in record of measurement is a subset of Transfinite Number set of Set Theory. The subset is shown in picture below.

Ordinals for Record of Observation

PICO MATHS										SET THEORY									
1	2	3	4	5	6	7	8	9	w	1	2	3	4	5	6	7	8	9	w
2	4	6	8	10	12	14	16	18	2w	w+1	w+2	w+3	w+4	w+5	w+6	w+7	w+8	w+9	2w
3	6	9	12	15	18	21	24	27	3w	2w+1	2w+2	2w+3	2w+4	2w+5	2w+6	2w+7	2w+8	2w+9	3w
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.	.	.	.	.	.	.	.	.	(w-1)w	.	.	.	.	.	.	.	.	.	(w-1)w
w	2w	3w	4w	5w	6w	7w	8w	9w	w2	(w-1)w+1	(w-1)w+2	(w-1)w+3	(w-1)w+4	(w-1)w+5	(w-1)w+6	(w-1)w+7	(w-1)w+8	(w-1)w+9	w2
^	^	^	^	^	^	^	^	^	^	w2+1	w2+2	w2+3	w2+4	w2+5	w2+6	w2+7	w2+8	w2+9	w2+w
|	|	|	|	|	|	|	|	|	|	w2+w+1	w2+w+2	w2+w+3	w2+w+4	w2+w+5	w2+w+6	w2+w+7	w2+w+8	w2+w+9	w2+2w
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w2	2w2	3w2	4w2	5w2	6w2	7w2	8w2	9w2	w3	(w2-1)w+1	(w2-1)w+2	(w2-1)w+3	(w2-1)w+4	(w2-1)w+5	(w2-1)w+6	(w2-1)w+7	(w2-1)w+8	(w2-1)w+9	w3
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2w2	4w2	6w2	8w2	10w2	12w2	14w2	16w2	18w2	2w3	w3(w2-1)w+1	w3(w2-1)w+2	w3(w2-1)w+3	w3(w2-1)w+4	w3(w2-1)w+5	w3(w2-1)w+6	w3(w2-1)w+7	w3(w2-1)w+8	w3(w2-1)w+9	2w3
^	^	^	^	^	^	^	^	^	^	2w3+1	2w3+2	2w3+3	2w3+4	2w3+5	2w3+6	2w3+7	2w3+8	2w3+9	w2+w
|	|	|	|	|	|	|	|	|	|	w2+w+1	w2+w+2	w2+w+3	w2+w+4	w2+w+5	w2+w+6	w2+w+7	w2+w+8	w2+w+9	w2+2w
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w3	2w3	3w3	4w3	5w3	6w3	7w3	8w3	9w3	w4	(w3-1)w+1	(w3-1)w+2	(w3-1)w+3	(w3-1)w+4	(w3-1)w+5	(w3-1)w+6	(w3-1)w+7	(w3-1)w+8	(w3-1)w+9	w4

	Numbers available for use in Record of Observation
	Number not available for use in Record of Observation
XXX	Infinite Number beyond measurement with units of observations

The red background number is not available to represent the quantity in record of observation. In both cases, the number belongs to a set of numbers represented by expression

$$R\,\omega^N$$

R – Real Number represents the magnitude
ω^N represents the unit
N is Infinite Order of Reality (Object observed)

Number 'N' in the expression may have an order from – ω to ω. The lower limit is determined by unit as –u. Where u is Infinite Order of the unit. Infinite order can also be expressed relative to unit. In this case, N is a Integer number –u to 0. At Infinite Order 0, value for R, is restricted to belong to Rational number, Infinite Number or Suksham number (Thick Zero series).

Infinite order of Exression
= Infinte order of object
– Infinite order of Observation Unit

When the Infinite Order = 0, R is a rational number.
If finite order <> 0, it is transfinite number
If finite order > 0, it is an infinite number
If finite order < 0, it is a suksham number (belong to set of numbers that are Realised to Zero)

Maximum Infinite-order is an intrinsic characteristic of natural identity of object.

Numbers for Record of Observation

(Complex Numbers)

If observer is restricted in measuring individual identity by comparison with similar quantity, we will always have a number with 0 Infinite Order to represent the quantity. This is normal situation in most measurements.

Object Area = $A\omega^2$ Points
Unit Area = $U\omega^2$ Points

Number representing object area $A\omega^2$ Points in units $U\omega^2$ Points is Rational number A/U. The numbers A & U are never recorded by the observer with unit area as unit.

In Pico-Math, number Zero is excluded from set of Natural Numbers that can represent magnitude of an observed object. Since, if subject of observation is missing, no observation is made. The magnitude can not be measured. The physical characteristics of the subject can not be applied to missing object.

In this respect, mathematical numbers can be analyzed to there ability to represent a transaction or existence of an object. The number that can represent existence can certainly represent a transaction. However the reverse is not true. The number Zero is a unique example, where in one case it can represent an observation of two complementary transactions. But can not be result of an observation to measure and identify the object "Reality".

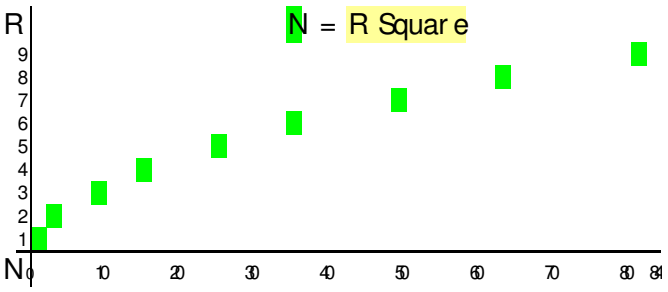
When no object is identified, it can not be ascertained from observation, what was supposed to exist. Thus number Zero can not be associated with any unit to represent magnitude of an object out of an observation.

If 'R' belongs to Real Number, and N represents a measure on physical Reality, we have;

$$N = R^2 = R_1^2 + R_2^2 ....with...R_1 \neq R_2 ...and..R \geq R_x .....(1)$$

Ordinals & $N = R^2$

1	2	3	4	5	6	7	8	9	.	w
2	4	6	8	10	12	14	16	18	.	2w
3	6	9	12	15	18	21	24	27	.	3w
4	8	12	16	20	24	28	32	36	.	4w
5	10	15	20	25	30	35	40	45	.	5w
6	12	18	24	30	36	42	48	54	.	6w
7	14	21	28	35	42	49	56	63	.	7w
8	16	24	32	40	48	56	64	72	.	8w
9	18	27	36	45	54	63	72	81	.	9w
.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	w2



Where N (Positive, A Non-Zero Real Number) represents quantity of transacted identity and R (A complex number) is computed quantity from N as measured Identity. In this equation 'R' represents magnitude of a complex number.

$$R = I_1 + iI_2 .....(2)....where..i..is..imaginary..unit$$

A number used in Quantitative observation for object parameters can be expressed by magnitude of a complex number of pure mathematics.

A measurable Reality can be conceived to be composed of two hypothetical identities. Magnitude of these conceived identities can be expressed by Real Number of pure mathematics.

Let us use normal symbols from contemporary physics. The number $\Psi\Psi^*$ represents magnitude 'N' of Reality. It is related to mathematical numbers as below;

Ψ^* = A + iB .....(3)

In equation 3 above, The unequal numbers A & B belong to set of Real Numbers of pure mathematics. A is Real part and B the imaginary part of the complex number Ψ^*. For simple observation, B can be assumed to be Zero. This excludes the possiblity of A being Zero.

$\Psi, \Psi^* = Q \in R$.....*set..rational..numbers*.....(4)

Here A & B are Real Numbers and represents the measure of hypothesized identities that co-exist (or compose, represents an aspect) with measured Reality. Two are minimum terms required on the right hand side of equation 3 to incorporate Reality of object being observed, and hence exclude value 0 from the range of values to represent Reality.

Infinity in Pico-Physics

Consider the equation
$\omega = \omega + r$
$\omega = \omega - r$ . . . . . (5)
(Depending on nature of object, the number r is rational or Real)

Where ω & r represent the quantity in two objects 'A' and 'B'. The values ω and r represent there respective magnitude.

The set of (5) equations represent creation or collapse of object B, in presence of Object 'A'. These equations represent creation & annihilation of object B.

Intuitive Infinity & Dimensions

The number infinity has been internalized in geometrical concepts of point, line, area and volume. Example: Line two centimeter long has twice as many points as one centimeter line. While both have infinite points, Infinity of two centimeter is twice as much as that of one centimeter. This enables a distinction be made between two lines of varying lengths, still constituted by infinite set of points. The difference is attributed to the number infinite (1 ω) in say line one (Unit length) being n times or (n ω), the length of second line.

An area can be said to be an infinite set of lines, and volume an infinite set of areas. We can also say directly that Volume is an Infinite set of

points. These infinities are different. It is possible here to use Infinite Order to express number of points in respective objects. We can say measurement of points on a line is first order of infinite, area second and volume third.

So we can say while addition/ subtraction operators on infinity result in same infinite number (belonging to same order) operators such as multiplication, division, exponent etc. Operate normally on infinity and thick-Zero. The Infinite Order of finite Real Number being Zero, multiplication by these numbers (when used as counting numbers) do not result in increase in infinite order.

Infinity ω^2 , will be the infinite number of points on the unit area of which each side is a unit length. This internalization give a meaning to infinity which defines infinity as a number 'ω' such that;

$\omega = \omega - R$; $\omega = \omega + R$ (where R is any rational number)

Unit length = ω , Length of Object = L Units = L ω Points
Unit Area = ω^2 , Area of Object = A Units = A ω^2 Points
Unit Volume = ω^3 , Volume of Object = V Units = V ω^3 Points

To express a quantity the infinite number needs a Real Number and an integer to be associated with it. Infinity is a conversion factor for communicating magnitude of Reality between observers with differing limitations on observable dimensions.

If observer limitations are defined (Observation by comparison of similar objects, Example when length is observed, points cease to be observable) we have the finite Real Number to represent the magnitude in all cases. This limitation on observation gives finiteness to observation of length, area and volume. This limitation is included in the units we use to measure.

A physical Quantity (Example Volume – Object occupied space) can in general be expressed in Quantitative terms to be of Magnitude;

Measure of Reality (Volume) = $abc\omega^3$

Where a, b & c are the magnitudes in respective dimensions and 3 represents number of dimensions.

The Infinite Order of a physical identity also identify the dimensions of the Reality and maximum cardinality of set of Real Numbers that represents the magnitude of the Reality.

Measure of Reality (Volume)

= $abc\omega^3$ Point Units

= $v_l\omega^2$ Length units (U ω Points)

= $v_a\omega$ Area – units (U ω^2 Points)

= v Volume-units (U ω^3 Points)

The Transfinite Number representing the Reality is the maximum number a general observer (observer who is free to choose unit of measure) will use to measure the Reality. It is related to Transfinite Number representing the unit Reality.

Dimensions of Reality

= Infinite Order of Unit quantity
+ Infinite order number on observation record

In case of volume (occupied space) with length 'Infinite order 1' as unit of measure, at minimum three Real Numbers are required to represent the volume without mathematical manipulation except scaling. The cardinality of set of Real Numbers representing Reality (dimensions of Reality). It determines '2' the Infinite Order of Transfinite Number representing the measure of observed Reality. The Infinite Order is dimensions of the Reality. The order of Transfinite Number is an intrinsic characteristic of the Reality.

In case volume is measured as a ratio of displaced volume of standard object being unity, we have Infinite Order of unit object itself as '3' and the Infinite order of Reality as '0'. The dimension of Reality 'volume' is still '3' A characteristic of volume.

Mapping quantities with different dimensions

Mapping is conceptualization of the association between two quantities without relevance to limitations imposed by nature on quantitative observations. Mapping two partner identities (A & B) with quantity a & b respectively, means 'a' part quantity of A, and 'b' part quantity of B, are visualized to be associated with each other.

Repeat the mapping processes till either of the two quantities are exhausted leaving other remainder quantity without partner quantity.

Conformal Mapping

The partnership without a remainder is said to be conformal (a<>b).

The absolute quantities of A & B participating in the partnership are not important, as these are different entities, and quantitative conversion relationship between two units does not exist.

If a & b represent all the quantity of identities that exist in nature, we can define relationship between identities as conformal or non-conformal. This definition is inherent relative characteristic of two identities.

The partner identities are said to be non-conformal if no conformal mapping is possible between them.

Mapping identities (Same dimensions)

Let us consider two identities (A & B) belonging to same infinite order. Irrespective of number of sets created out of A, we can always distribute B so that all sets have a fraction of B quantity available i.e. B->A mapping is conformal.

Mapping identities (dimensions difference = 1)

When identity A belongs to Infinite Order n while B belongs to Infinite Order n-1. Sets of infinite ordinals of identity A can be created, with a counted position replaced by identity B. The number representing count of such sets is one Infinite Order lower than number representing magnitude of A. Now with a limited amount of B is assigned to each of these sets, there exists no set, which is exclusive to A. The mapping between B->A (B into A) is still conformal. However mapping A into B is non-conformal (Leaves sets with A without B).

Mapping identities (dimensions difference > 1)

These mapping are non-conformal, since there is no possibility to map A into B or B into A, which will not leave a set exclusively populated by A or B.

- ***The identities are conformal; with measure of same order***
- ***The identities are conformal; with maximum Infinite Order difference one.***

- ***The identities are non-conformal; if Infinite Order difference is greater than one.***

In uniform conformal mapping, the ratio of numbers representing the total quantities mapped is the mapping density or density. Density can also be defined in conformal but non-uniform distribution, with a subset of mapped space.

- *In general, we can say, for a mapping to be non-conformal, the difference in dimensions (exponent) shall be >= 2.*

There exist a natural difference between substances differing in dimensions by more than 1 (=>2), that can not be abridged by the power of observer to observe the two quantities. Dimensional difference (>1) in quantities cannot be swamped by observation power, it is inherent to the objects under observation.

Thus even the general observer, will not be able to create conformal map with physical quantities that differ in dimensions =>2.

Mapping is a means of comparing identities belonging to different infinite orders. Like measurement, it enables comparing the quantities. No conversion is valid between the two identities. With-in same identity, we measure by comparison. Across infinite orders, the comparison has only two results. Conformal or Non-Conformal mapping between identities. Conformal means equal, non-conformal mapping A in B means A > B, non conformal mapping B in A means B>A.

Mapping & Measurement

Mapping

One of the limitations of an observer is the “infinite order” of number range available to measure the object. This in turns depends on Infinite Order of the unit of observation. The set of numbers to represent the quantity along with a unit is no longer object neutral. It is object neutral only with a condition that observation unit and measurement unit represent objects of same type.

The ‘number set’ can be treated as object neutral by incorporating in units the distinction arising out of dimensions of object. In this case, the number belongs to Real Number set.

In general, the number set belongs to Transfinite Number set.

Measurement can also be viewed as mapping between two numbers belonging to two different identities. The measurement, mathematically is mapping between two number sets which may belong to different infinite order. The mapping is conformal, if for each element of object a corresponding element of observer exists. This provides the observer means to measure full extent of object's existence.

A conformal mapping 'B in A', between unknown identity 'A' and known identity quantity 'B', is a requirement to measure 'A' using 'B'.

Density

Density is expression of simultaneous measurement of two identities 'A&B' in an object expressed as a ratio. Since it is a ratio, it is invariant with respect to sectioning of the object. If the two parameters are independent, the minimum object that can be subject of measurement is defined by the quantity of object for which either parameter 'Say A' has a magnitude of one observable unit. For density (<1 from knowledge repository) the magnitude of second identity 'B' is less than unity.

If two identities are conformal, density represents the magnitude with a suitable unit representing identities of both object and the unit.

Binding

If a limitation exits, (minimum observable quantity = unit object 'B') then the minimum composite object shall contain greater than one unit of 'A' so that a unit quantity of 'B' is associable with the object. Observable unit definition for 'B' imposes a condition on minimum size of composite object 'AB' being (A, B:: B x density: 1) where density 'A with respect to B' is expressed as a rational number. The minimum observable quantity of identity 'B' determines the minimum observable quantity of composite object. 'B' acts as a binder to 'A'.

As density of B in A decreases, the minimum observable object size increases. (We will return to this discussion after introducing Knergy).

Observing power can bind two identities in a variable ratio (rational number) so that both identities in a minimal object are integral multiple of unit object.

Density defines the minimal size of composite object.

Measurement (Different identities)

Consider a case when two identities apples and oranges are available. There are more apples than oranges. Oranges have a label with a unique symbol (say numeral). The objective is to count apples.

1	2	3	4	5	6	7	8	9	.	w
2	4	6	8	10	12	14	16	18	.	2w
3	6	9	12	15	18	21	24	27	.	3w
4	8	12	16	20	24	28	32	36	.	4w
5	10	15	20	25	30	35	40	45	.	5w
6	12	18	24	30	36	42	48	54	.	6w
7	14	21	28	35	42	49	56	63	.	7w
8	16	24	32	40	48	56	64	72	.	8w
9	18	27	36	45	54	63	72	81	.	9w
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.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	w2

Use set of numbers in the row 1 on the left by creating sets each consisting one orange and one apple. If apples count less than oranges we stop the mapping process as soon as the event occurs. Now the set of mapped apples and oranges is a conformal 1:1 set. The measure of apple and oranges are equal.

The 1:1 conformal mapping makes both identities measure to same number. The mapping density is unit.

If we exhaust oranges first, begin adding an apple to each set of one orange and one apple, making it a set of one orange and two apples. If apples are now exhausted, we have two conformal mappings. The first with two apples extends to orange count say M_1, and second with orange count M_2. The count of used oranges now is sum of set count at different levels.

Measure of apples = $\sum_{1}^{l} d_l M_l$

Where l is the level of the conformal set (Orange in Apple) and d is first member of set at this level (mapping density), M is number of sets at this level or oranges used at this level. With number of sets limited to infinity, we are able to measure magnitudes to multiple of infinity.

For 1:1 conformal mapping we have, we have l=1, we have

Measure of apples = $\sum_{1}^{l} d_l M_l$ **= M oranges**

= Measure of Oranges

Thus for conformal 1:1 mapping, measure of apples and oranges is same. Apples and Oranges are two different identities.

Measure of two identities is same, when mapped in conformal 1:1 mapping.

Measurement (Unit of measure – single identity)

Let us now consider instead of apples, we had unmarked oranges. We want to count how many dozen oranges are unmarked. We do the same iteration as above, but instead of starting with level 1, we start with dozen level. So we have collection of unmarked oranges as an object to be measured using dozen as unit of measure, while unit of observation is an orange. We begin to collect 12 orange sets and put a marked orange in-front of the collection. Till we are left with less than a dozen. The count is given by;

Oranges in Dozens = $\sum_{1}^{l} 1_{12} M_{12}$ **= M oranges**

Here value of mapping density is 1 Dozen per Orange, and M is number of sets of dozen oranges. Here we were able to count oranges by dozens since unit of observation was one orange. The unit of measurement was a dozen. If leftover is observed to be less than 12, the measure of oranges can not include the left over set. (Conformal mapping at unit of observation level produces exact match. Since units of observation are finer than units of measure, the left over represent the uncertainty in measurement with is less than unit of measure). Between oranges in units of dozen and orange unit of observation, a 1:1 conformal mapping exists. Hence measure of oranges in dozens is same as number of oranges used in the measurement.

Now let us say, the oranges are shipped to market from the producer in boxes of 5 dozens. The producer can now advice the market on how much he can ship. Thus Orange Box is the unit of communication.

Measurement is a process of mapping the object and unit of measurement (set of unit object) into 1:1 conformal mapping. Fold-over or Repeats of Unit of measurement is the measure of the object in the units folded.

To execute measurement a 1:1 conformal mapping is required between object and its unit of measure.

Objects & Intervals

In a measurement, the unit provides basis to quantify the object under observation. But unit as an object two independent observers may not identical quantitatively. (Object of unit length to observers moving relative to each other). When measurements from two independent observers, referring to same identity (or object) are compared we need to identify the nature of observation;

- Observation to identify the object
- Observation for Interval

The two are related by inverse relation ship.

Let us say, the unit for second observer is reduced. Then if the observation is related to object identity, its magnitude is reduced as well. If it relates to how many objects can be created from a fixed quantity (Fit in a given interval), the measure increases.

M = NxU
- M is established Interval
- N of equivalent unit object
- U Unit Object Quantity

Here M is the interval in which N unit objects each of magnitude U fits in.
When M is proportional U, observation identifies the object. In this case N is constant.
If M is constant (Defined independent of observer) , N increases as U decreases.

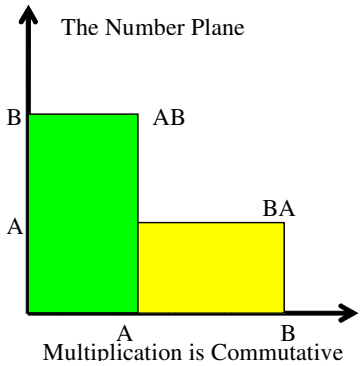
The purpose of measurement is important in understanding the conceptualization of observer as inertial frame of reference.

The number space

Measurement – As numeral lookup process

The measurement can be visualized as a process as a symbol lookup process from series of ordered sets (number series). The symbol, numeral indicates the measure of the object. The selection processes being sequential and number of lookup steps equal dimensions of object. The figure below visualizes of measurement of a 2-D object, and establishes that for numbers, multiplication is commutative. (AB = BA)

.	.	.	.	.	.	.	.	.	.	w2
.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.
9	18	27	36	45	54	63	72	81	.	9w
8	16	24	32	40	48	56	64	72	.	8w
7	14	21	28	35	42	49	56	63	.	7w
6	12	18	24	30	36	42	48	54	.	6w
5	10	15	20	25	30	35	40	45	.	5w
4	8	12	16	20	24	28	32	36	.	4w
3	6	9	12	15	18	21	24	27	.	3w
2	4	6	8	10	12	14	16	18	.	2w
1	2	3	4	5	6	7	8	9	.	w



Multiplication is Commutative

The number plane axis represents two dimensions of the object without absolute Negative values. (First Quadrant of Geometrical Plane). The processes of measurement includes alignment of object to the numbers space (and/or lookup of numbers at all (both) ends of object), The number space (in the represented case, number plane,) connects arithmetic, algebra, geometry and co-ordinate geometry together into a unified strata of knowledge. It provides for geometrical visualization of nature. For example, if a 2-D quantity is conserved, it can be stated as product of the its two dimensions is constant. It continues to enjoy two degrees of freedom, first the absolute measure, second one of its dimensions, the third is then automatically determined using commutative property of multiplication or similar characteristic (or rules of numerals lookup). We will not further expand on the number space concept here, probably it already exist in science of mathematics.

Discussion Results

- *Mathematics as a science is born with focus on numbers and computations dropping the transacted goods from the picture.*
- *The difference between computational math and Pico-Math is the continued presence of goods (as Units).*
- *Mathematical abstraction and results can only be selectively applied to physical Reality.*
- Concept of Negative quantities is tied to transactions of goods (Credit & Debit) or neutralization of effect (Example: charge) on environments.
- *The number Infinite can represent even finite quantity when the unit is reduced to infinitely small value.*
- Mathematically, Binary Zero is obtained by subtracting natural number from itself (**Binary Zero**).
- *Without object identification, it can not be ascertained from observation, what was supposed to exist. Number Zero can not be associated with any unit to represent magnitude of an object out of an observation.*
- *In general observation, the operation of multiplication and division are applicable at Infinity and Thick-Zero.*
- *Pico-Physics recongnises only a sub set of transfinite numbers.*
  Infinite order of Exression
  = Infinte order of object
  – Infinite order of Observation Unit
- *The partnership without a remainder is said to be conformal (A<>B).*
- *A conformal mapping, between unknown identity 'A' and known identity quantity 'B', is a requirement to measure 'A' using 'B'.*
- *Density defines the minimal size of composite object.*
- *In general, we can say, for a mapping to be non-conformal, the difference in dimensions (exponent) shall be >= 2.*
- *If two identities are conformal, density represents the magnitude with a suitable unit representing identities of both object and the unit.*
- *To execute measurement a 1:1 conformal mapping is required between object and its unit of measure*
- *Two identities with 1:1 conformal mapping, measure to same number.*