Information Is Immanent Incongruence

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Abstract

Two combinatorial functions cross twice in the region *1..n..140.* Their slight deviations relative to each other is taken as the skeleton of an elaborate explanation model which assumes the world to be of a basic duality. The two functions are put into a context of similarity and diversity. We observe that humans' neurology splits neuronal impulses based on the background being similar or diverse. On a similar background, we perceive ranks and sequences based on diverse properties of objects; on a background of diversity, we perceive groups of similar objects. The maximal number of diversity statements about *n* elements of a collection deviates slightly to the maximal number of similarity statements about the same assembly. Both upper limits refer in their f^{-1} form to identical *n*, albeit with a slight mutual dis-calibration, up to *n ~ {136, 137}.*

We introduce a measurement dimension: diversity/similarity. The numeric facts show that an assembly of *6 * 11* sequenced objects has ~ *9* times as much possible spatial variants as an assembly of *66* objects, which facts allow for the concept of condensing information.

Cycles that constitute the procedure of a reorder connect the two differing viewpoints. We introduce and tabulate the most elementary reorders and their constituent cycles and find geometric representations of different readings of *a+b=c,* which appear to picture concepts known from genetics and theoretical physics.

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1. On Counting

1.1. Exactitude and Counting

The ideas of ‘exactitude’ and ‘counting’ are closely related. In some cases, one can interchange their meaning. It is axiomatic, and culturally agreed, that if one counts, one counts exactly. Otherwise, it is not counting but guessing. Our whole system of mathematics is based on the idea of exactitude and seamless integration of parts into a whole.

We offer the idea that exactitude and counting are two different subjects. Methods of counting should be distinguished, because we arrive at different results, while counting correctly, when we count differing properties of objects. The slack is quite small, but it is significant and influences our way of looking at the world; how we determine what to measure and how we interpret the results received. We suggest that the inner, immanent incongruencies that come from employing two different, equally legitimate methods of counting, be recognized as the material that gives rise to the concept of information.

1.2. Basic Duality

We propose a world view, in which a basic duality exists. Allowing for a basic duality enables us to deal with logical conflicts within a system rooted in logic. Traditionally, specifically in light of Wittgenstein’s research [1], it is assumed that within a logical system, no contradictions can exist. Allowing for *two* fundamental ordering principles, it is possible to visualize a world, in which the existence of logical conflicts is acknowledged, and methods of compromise-finding among logical conflicts can be hypothesized. We build the case for duality by progressing from incongruences apparent in the *linear* arrangement of objects, to planar, and in the sequel to spatial – temporal consequences that are implications of the compromises bridging over the mutual linear deviations arising from using *two* enumerations of the same state of the world. We assume the existence of a basic relative dis-calibration between the results coming from *two* methods of counting properties of assemblies.

Everyday observations show, that Nature uses a conflict management system. The Gay-Lussac law[2] is a perfect example of Nature adapting to changes, maintaining and regulating an equilibrium. The method evidently works. We want to find its most basic, elementary, fundamental form. We search for a controversy, which then can be observed to be subject to regulations. The more archaic the inner discrepancy, the better it is suited to be a fundamental truth in an edifice of explanation.

Information is the extent of deviation of the observed value to the expected value. In order to have a pair of mutually *{expected, observed}* values which can then be in disagreement, yielding the extent of information, we have to conceptualize a duality of aspects of descriptions of the state of the world, which both are correct, but can be in deviation to each other. We have found the duality to be a feature of our neurology, namely the distinction between foreground and background.

1.3. Similarity and Diversity

Ordering and grouping are both pre-mathematical techniques of counting. By sequencing, we observe the diversity of the objects, contrasted against the background of the similarity of the places; by grouping, we observe the similarity of the objects against the background of their being diverse among each other. By observing or creating groups among the members of a collection, we use the similarity within the groups in the foreground, against the background of the other, remaining elements' diversities.

Example: As we rank a few of our objects, say dolls, we assign places based on properties that the object has in comparison to other members of its cohort. If we rank on *prettiness,* the prettiest doll comes to the 1st place, the 2nd prettiest on the 2nd place and so forth. The comparison happens in the foreground, the background is similar. All the places are equal until we declare one specific place to be the 1st. We sequence before a background of similarities, where we assign the property of a place to the place, based on the properties of the object we compare with its peers. As we build sequences, we have: foreground diversity, background similarity.

As we build groups among a few of our objects, we have the similarity in the foreground and the diversity constitutes the background. We create one mental space in the foreground (we grab the dolls with red), in which we place similar objects. This similarity is in the foreground, contrasting to the diversity of all the other objects that are diverse, relative to the similarity we observe in the foreground. As we build groups, we have foreground: similarity, background: diversity.

1.4. Upper Limits

In the following, we shall make use of some concepts of Test Theory[3], [4]. We state that about a collection consisting of a limited number of members, only a limited number of distinct sentences can be said.

The descriptive sentences state the existence of relations among members of the collection. A descriptive sentence segments the collection into those about which the sentence speaks and into those about which the sentence does not speak. If the number of members of the collection n is limited, there will exist only a limited number of distinct logical sentences, because the number of segmentations of n is limited. After k distinct sentences, one will start repeating oneself, pointing out such a relation between two (groups of) members which relation has already been pointed out.

Example: Among n students, we point out that *(A, B, C)* are good in *French.* If, at a later time, we point out that *(A, B, C)* are good in *History,* then one of the two assignments of properties to elements is redundant. Similarly, if we point out that $A < B$ in *Sports,* a sentence which states that $A < B$ in *Mathematics,* both sentences refer to the same relation among the same objects, therefore one of the sentences is redundant.

It is theoretically possible to evaluate each and all relations among members of a collection. The resulting test system would be quite elaborate, but it would have a limited size, if only the underlying collection is of a limited size.

There exists an upper limit for the number of logical sentences stating the existence of logical relations among n members of a collection, if n is limited. It is irrelevant, whether the sentence states the existence of similarities among the members that are the subject of the sentence, or whether the sentence states the existence of differences among the members that are the subject of the sentence. Describing a state of the world by means of sentences of the form $a = b$, a

≠ *b* both are equally admissible.

Diversities before a background of similarities become visible as we generate *sequences.* The distinction based on places goes back to a previous distinction based on properties of elements compared. The place of *A* is the result of a comparison of *A* with *B*. Based on the results of a comparison of objects, we assign a name to a place. Before we have decided which of the objects comes to which of the places, the places had no individuality: all the places were alike. It is our arbitrary decision, whether we understand *better – worse* to be pictured as positions *left – right* or *right – left.* The place itself is nondescript.

The upper limit for the number of distinct sentences that state the existence of ≠ before a background of = agrees to the number of possible distinct linear sequences into which the members of the collection can be brought. It is but a detail, whether we think the collection of possible linear sequences to be realized as *1* number line, or a plane with *2* axes or a space with *3 or more* axes. The main point is that all: the one-dimensional, linear, and the two-, three- or more-dimensional sequences use *similar, identical* units. The statement about diversities among members implicates a grid of similarity, relative to which the objects subject to the comparison are different. There is a common context, a common measurement dimension, on which the difference can be established. The common context behind sequences is that the rank difference of *1* is of unit nature, and that a grid based on linear distances – which reflect the differences among the objects compared – can be established. The numeric extent of the relevant function is *n!,* defined in *oeis.org/A000142* [5]

Similarities before a background of diversities have also a maximal extent which relates to the number of members of the collection that can be similar to each other. If the number of members *n* of a collection is limited, then the number of distinct sentences that state a similarity relation among members is also limited. We use the concept of *partitions of n* [6] to discuss the number of ways groups of similar objects can be stated to exist, and the upper limit to distinct, nonredundant sentences that state the existence of a relation of = among some members of the collection. (We simplify the statements "k_1 dolls have something *red* in their clothes" and "k_2 dolls are *< 20 cm"* into *n:* $\{(k_1),(k_2), \dots (k_i)\}$ and assume the existence of a relation = among the members being included in groups k_1, k_2, k_i.)

The upper limit for the number of commutative structures on a collection of *n* members of a collection is related to the number *p* of *partitions of n*, [6] namely as the (exponent of the) square of the logarithm of *p(n).* In its logarithmic form, the formula *ln(p(n))^2* makes it easily comparable to the other upper limit *n!,* which is the *exp(sum(1, n, ln (n))).* We propose to use the **notation *n?* for the numerical value of** $\boldsymbol{exp(p(n)^{ln(p(n))})}$**.**

Explanations for the concept n? come from test theoretical considerations:

1. We can validate a test with *max_f(n)* items on a population of *n* probands. If the probands can build groups in *q* ways, *max_f(n)* must necessarily agree to *q,* otherwise we either had a constellation among probands which is not foreseen by the test design, or we had test results that are a replica of test results that had already been achieved, or they describe group structures which do not exist. The number of sub-segmentations among objects can be neither more nor less than the number of sub-segmentations among symbols. If all possible pictures of all possible states of the world have been made, the number of pictures that depict a distinct state of the world will agree to the number of

distinct states of the world that have been depicted. The overall result is necessarily of a quadratic form.

2. With the brute force method, one will create a fictitious collection that evidently overstates the extent of the upper limit, by creating the collection p^p, that is, the number of partitions of *n* to the power of the number of partitions of *n.* By this technique, we assume that every new aspect of description subsegments the collection completely anew, and that there exist as many aspects as there are partitions to *n*. We then start crossing off such subsegmentations which have already been enumerated. (The partitional states *(n)* and *(1,1,1,…,1)* come to mind, which get crossed off first.) It is easy to see that as many results of distinguishing aspects shall remain as there shall remain objects' constellations that have been distinguished. Again, the overall result is of a quadratic form.
3. The sequence *n?* can have no standalone deictic definition entry into the Online Encyclopedia of Integer Sequences, because the combinatorics of partitions is discounted by the probability of the present statement being a redundant replica of a statement that has already been enumerated. An integer, expressing the number of possible variants is multiplied by a series of quotients which correct double counting: therefore, the combinatorial results yield no integers. The *sequence* of describing aspects is not a given (presently), therefore one does not know whether a sentence that states the existence of an element which is a member of groups of k_1, k_2, *etc.* elements, had already been catalogued in the list of states of the world under the aspect of groups with k_i members. The first test one conducts on a population has the maximal discrimination power. Subsequent tests are necessarily of less efficient discriminatory characteristics, because they cannot avoid retrieving such groups that had already been delineated. Not knowing, which of the aspects of a description of the world is the primary aspect, one has to accept decreasing discriminatory power and increasing proportion of redundancy on repeated testing of the same population of probands, as a general principle.

1.5. Upper Limits: Numeric Relations

The two functions *n!, n?* follow each other *f(n),* extremely closely, up to a limit. In absolute numbers, we are, in the region of the most pronounced deviation, in the order of magnitude of *EE+92*. A Figure depicting the factorial of *n* together with the structural of *n* would bring no didactic advantages, because the two functions deviate relative to each other in such a small measure which cannot be detected by the human eye. The relative bias is the most pronounced near *n = 66*, where the respective values are *5,4EE+92, 1,8EE+93*.

Yet, the overall interdependence between similarities and differences makes this very slight relative bias play an extraordinary role in epistemology. It is not the *extent* of a relative inexactitude of two interdependent ways of describing the world, but the very *existence* of such an inner difference which is remarkable.

We happen to count occurrences differently, in dependence of the background of the occurrence. If the background is made up of identical units, we establish, how diverse the foreground is by comparing and keeping track of distances among elements. (A permutation is understood to be a collection of statements about distances between elements.) The distances are measured in identical units. The extent of maximal diversity is given by the sum of the logarithms of all possible group sizes. The concept is that of a *linear* addition of logarithms. The background of similarities assigns ranks along a linear order.

If the background is made up of units that are by their nature maximally diverse, the groups that consist of elements that are similar to each other, are in the foreground. Addition is of no use here, because we cannot know whether an element which is a member of diverse groups, had already been counted, based on a different one of its properties. The algorithm, using the square of the logarithm of a property of the biggest of the elements, shows a path towards a *planar* understanding of similarity. We have a plane of which the axes are the logarithms of the number of ways pictures and objects can be subsegmented. Both of the axes are in themselves one-dimensional. The background of diversities assigns places on a plane.

Mutual deviations

OEIS/A242615 shows *n?* contrasted to *n!.*

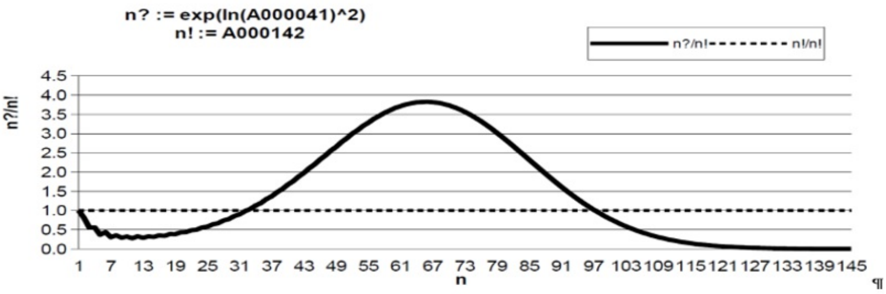


Fig. 1. Oeis.org/A2424615: n? normed on n!

For comparison, we show also *n!* normed on *n?*

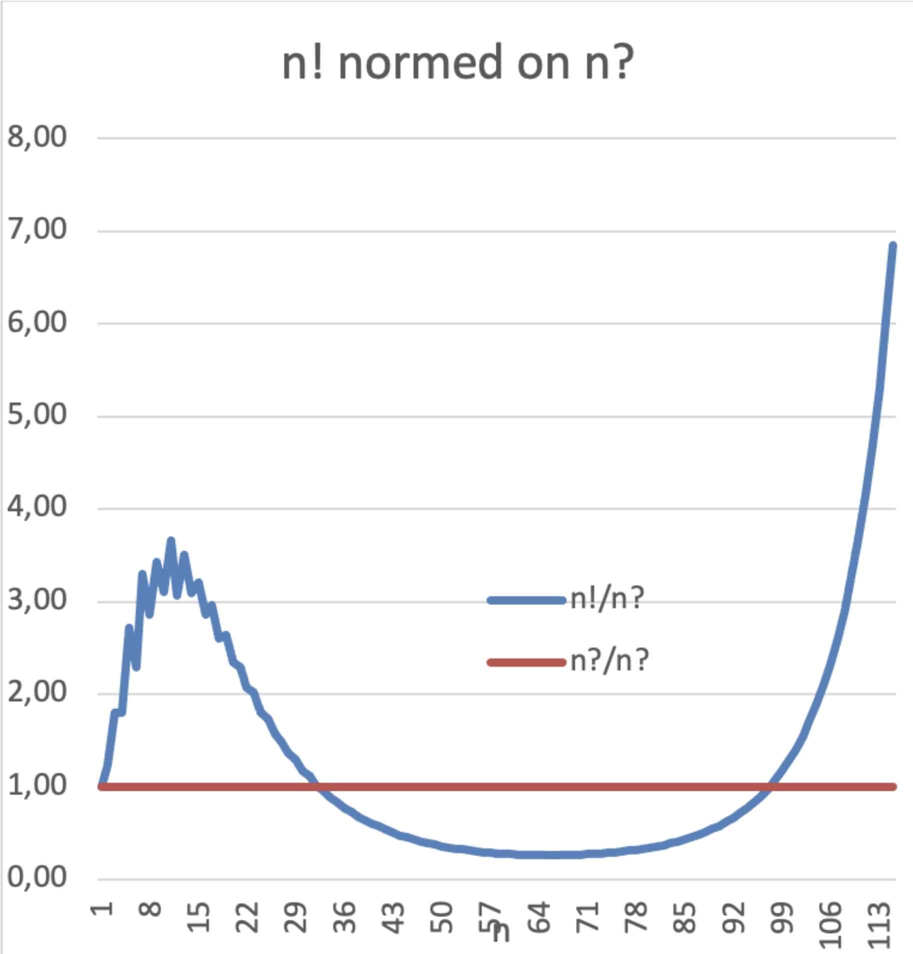


Fig. 2. Number of sequences per number of groups

Numeric relations between *n!* and *n?* allow conceptualizing an overall picture of an assembly which can be read in several, different ways. It appears that Nature makes use of some creative accounting techniques.

There are *3* equivalence points for *n!, n?*, at *n = 1, 32, 97.* Collections consisting of *32, 97* can be described equally consistently. We call those sentences among a description of a state of the world *consistent*, which refer to the same subcollection of elements among the elements of the collection in such a way that the sentences that state diversities and the sentences that state similarities are *both* true.

There are local maxima, near *n ~ 11, n ~ 66.* We may suggest the idea that of the collection of *n!* sentences, each refers to a *spatial* feature of the assembly, as the sentences point out a state of diversity relative to a background made up of identical units. (The millimeter-paper serves as a grid in the background: this grid can be used for constructing the concept of space.) Contrasting to this, the collection of *n?* sentences is understood to picture *material* aspects of the collection: the sentences pointing out *similarities* before a background made up of diversities, have a background of many shapes and forms. All these diverse *particularities* have one *generality* common: here we see it in the form of a numeric extent; as a picture of the world, the concept of *mass* comes to mind.

Hypothesis: Nature makes use of accounting procedures that treat logical relations to be translatable into fragments of objects. We use the *two* measurement rods, which are in a slight dis-calibration relative to each other, and read off the *n* values corresponding to *f(n)* logical relations. If we have *q* logical relations, we build *two* functions of the form $f^{-1}(n)$, namely $f^{-1}(n)$_n!, $f^{-1}(n)$_n?. But for the regions *n ~ (1, 32, 97),* the $f^{-1}(n)$ will point out slightly different *n* values as the minimal number of carriers of symbols that are necessary to generate *q* logical relations.

Condensation: The relative inexactitude is actually quite small. The over- resp. undercounting has *2* maxima, near *n ~ 11, 66.* Even in the regions with maximal deviance, the relative difference, expressed as a quotient, does not reach *¼ resp 4,* but is near ~ *3.5.* An accounting opportunity opens, where one can exchange superfluous relations of a spatial nature, which are generated by reading the assembly as *6 * 11,* against an overcrowded collection of *66* elements, read under the aspect of their similarities. We have argued for the definition: information is the extent of being otherwise. *6 * 11* elements have *r* possible variants of spatial arrangements, unused, while *66* elements have *s* possible variants of material composition, unused. In the sequenced maximum, *r* spatial arrangements can alternatively be made (the stuff could be in *r* places), in the material maximum, *s* kinds of materials can be alternatively on the restricted number of places. **The non-realized possibilities are subject to rules of accounting.** In their extent, they fulfil the requirements of the definition of information; it even appears that there are additivity relations among kinds of information. As a technical procedure, the accounting of matching possible places to possible kinds of matter is quite a task of combinatorics, challenging our intellectual dexterity. Of a viewpoint of grammar of logical sentences, it appears that the required overall tautology of a logical system can be maintained. It is theoretically possible to tell a story by enumerating, which alternatives had not been realized. The mechanism apparently works, because we observe the DNA to transmit by positional means material selection criteria. Now the linkage to traditional methods of creating enumerations has been found.

Thresholds are an inbuilt feature of using *two* measurement systems. The relative deviation *Δn* in the number of objects minimally needed to accommodate *q* logical relations remains, for a while, rather small in the region above the upper equivalence point, *97.* The *Δn* is twice *Δn' = n | (? → n) – (! → n). Δf = f(n+1) – f(n). If Δn ~ Δf,* it is undecidable, whether the extent of error comes from using two counting systems or from counting one object more. There is a threshold to which *two* values of *n* refer: *136, 137.* In that region, the inexactitude in calculating back, to the number of objects that accommodate *q* logical relations, yields the first time an extent that reaches the extent of one additional unit. Above this *n,* it is impossible to exactly establish the number of objects interacting in a system, because in one reading, one needs *137* objects to accommodate *q* logical relations, while in the other reading, *136* objects are sufficient to be hosts to *q* logical relations. The numeric facts rehabilitate Eddington. [7]

2. Consolidating Logical Conflicts

We have outlined a world which is fundamentally of a dual nature. Of this world we speak in sentences that include such which state something that *can be the case.* (In continuation to Wittgenstein, who has discussed sentences that describe what *is the case.*) Having found *two* interrelated aspects of all things that make up the world, we enter a field of language logic, which has been treated with great circumspection and reserve, the field of logical contradictions.

It is clear that a logical system must *globally* remain tautologic and free of inner contradictions. The task is, then to integrate *local* information content and contradictions, into a system that is such that we can reasonably speak about. Having introduced *two* interrelated languages, we can show differing surface structures relating to identical deep structures (like *chair, chaise* referring to the same kind of objects).

In the present Chapter, a model is presented which is very much suited to be the origin of deictic definitions of relations. Expressed in the context of psychology, we conduct an experiment. We generate a cohort of logical individuals and subject them to periodic changes. We wish to observe how periodic changes affect a collection of logical symbols. That what can be adapted to, or learnt, appears repeatedly. We wish to extract which logical relations are germane to periodic changes, specifically, which recurrent occurrences can serve as bases of predictions, their grammar having been learnt, understood.

2.1. The Cohort

The logical symbols we exercise with (the probands of the experiment) are pairs of natural numbers *(a, b),* where $a \le b$. They come in cohorts. For deictic reason, we show the first 4 cohorts.

The Table of Cohorts

Table 2.

No of distinct properties *d*	No of distinct elements in the cohort n_d	Elements of the cohort
1	1	*(1,1)*
2	3	*(1,1), (1,2), (2,2)*
3	6	*(1,1), (1,2), (1,3), (2,2), (2,3), (3,3)*
4	10	*(1,1), (1,2), (1,3), (1,4), (2,2), (2,3), (2,4)(3,3), (3,4), (4,4)*

Semantic interpretation: With regard to their number, members of the cohort are generated by creating each and all of tuplets consisting of *(a, b)*. The number of members is driven by *d,* the number of diverse variants of *(a, b):* this agrees to the triangular numbers *oeis.org/A000217*. [8]

Names and mnemonics: The name *logical primitives* for the collection comes from a suggestion by Marcus Abundis. [9] They represent semantically anything that is being made up of *two* parts. Our probands in the experiment can also be visualized as a pair, like a married couple or like centaurs. The restriction $a \le b$ refers to a concept, where girls are not bigger than boys in a couple, and the human part of a centaur is not bigger than the horse part of it.

Size of the cohort chosen: Due to some epistemological considerations, we state that the movement patterns of the probands cannot be interpreted consistently, if there are less than *6* different variants of *a, b,* yielding a cohort size of *21.*

Taking into account the relations shown in *oeis.org/A242615,* we have decided to discuss here the observations registered by watching a cohort of diversity category $d = 16$, yielding $n = 136$ different logical primitives. A cohort of this size can utilize the changing of the proportion *diverse/similar,* which is $f(n)$, to the maximal extent, with the highest efficiency.

Diversity and similarity of the members of the cohort among each other: while each of the logical primitives is an individual, each of them is also similar by its own right to d_a elements, and by its partner to d_b elements, where $d_a + d_b = d+1$; and this for both *a, b.*

Example: element *(3,4)* is similar by its own right to *(3,3), (3,5), (3,6),…, (3,16),* by its partner to *(1,3), (2,3), (3,3);* and is similar by its own right to *(1,4), (2,4), (3,4), (4,4),* by its partner to *(4,5), (4,6), (4,7), …, (4,16).*

2.2. Hypotheses:

We reformulate the main points that await decision, based on observations of a collection of logical symbols that are subjected to periodic changes.

1. There exist some recognizable *a-priori* logical relations in Nature, which we are able to demonstrate by using the experimental setup;
2. The relations come in *two distinct types* (= the observed relations can be classified in two grand types by a reasonable observer);
3. These are: *spatial and material*, where spatial refers to results that have been achieved by using similarity-based measurements and material refers to results that have been achieved by using diversity-based measurements;
4. The main driving principle of the experiment is that the probands are subject to several, concurrently existing *periodic changes*;
5. The concept of periodic changes implicates the concept of *cycles*: these are subgroups of probands, which periodic changes affect in a common fashion;
6. Cycles have several properties, which properties generate multiple pairwise expectations regarding the properties of probands partaking in them;
7. Some cycles have common gradations on their axes: of these cycles, planes, and of planes, spaces can be constructed by assembling two resp. three axes in a rectangular grid;
8. Both the basic duality represented by *a, b* and the basic unity (uniformity) represented by *c* can be observed during movements of the probands while subject to periodic changes;
9. The behavior of the probands is neither random nor spontaneous in the foreground: such behavior of the probands can be assumed to take place in the background;
10. The explicit, predictable behavior of the probands is a corollary to their being such as they are: The properties of the probands determine their relations to other probands, and diverse periodic changes determine their diverse *ad-hoc* confederation into members of a cycle; those probands that are in a cycle behave in a predictable fashion, which roots in the properties of the probands;

11. There exists for the observer the concept of "now": observer may call any moment during a periodic change *"now"*, both locally, where the "now" refers to one specific member of the cycle being the case, and globally, where the "now" refers to the collection of such members of cycles which are locally "now".
12. One of possible measurement units to describe what one observes is "information", which is the extent of the deviation of the observed value to the expected value; the measure always comes in two variants;
13. The system contains many saturation points and thresholds.

2.3. Periodic Changes

Our planet is subject to at least *3* different periodic changes. These are caused by the movements of the Moon (causing tides), the rotation of the Earth (causing day/night changes) and the revolution of the Earth around the Sun (causing seasons within a year). An *explanatory* system can be assumed to picture the world better, if it replicates in its basic design properties of the world depicted. Our world being subject to periodic changes, it makes sense to conduct an experiment that observes the effects periodic changes have on a collection.

Adaptation to periodic changes can be pictured by *ranking,* sequencing the elements according to some properties of the elements that reflect the degree of adaptation to the changes that come periodically.

Example: We imagine *n* very simple organisms (amoeba, protozoa, etc.) which live in a bay. In this habitat, the flow speed, light and nutrient contents vary with the periodic changes caused by Moon, Earth, Sun. There will be some of the *n* probands that adapt well to {slow, high} flows of water, caused by tides, to {high, low} sunshine, caused by day – night changes, and to {high, low} degrees of competition on food, caused by the seasonal change of co-inhabitants during the year. The periodic changes assign properties of being *first to last* in adaptation capability to each of the periodic changes.

Periodic changes are pictured by sequential orders. Each member of the cohort is assumed to be prepared for adaptation in each of the kinds of periodic changes.

2.4. Conduct of the Experiment

We draw a parallel here to the experiments Mendel[10] has conducted on yellow and green garden peas. We do away with the effective, physical plants and conduct the experiment on a mental level. We imagine *d* variants of male and female predecessors of each of our theoretical plants, and create the resulting *n* logical primitives, which are each a picture of a plant. We investigate, how much the paternal properties influence the potential of a plant, as opposed to the influence of the maternal properties. We will not see and recognize at first the *particularities* of being green or yellow in the theoretical model, but we can see the *generalities* of being diverse to all others, while being also related to groups of them, awhile also adapting to periodic changes.

The idea of the sorting experiment, namely one takes a collection of values of *(a, b)*, and subjects the collection to procedures of ordering and reordering, is in itself nothing revolutionary. One would think that this subject has already been dealt with in the fields of arithmetic, combinatorics or number theory.

What the sorting experiment gives us is a table of possible places, possible neighborhoods and possible conflicts among these.

Aspects of the members *(a, b)* we use are: *a, b, a+b, b-2a, b-a, 2b-3a, a-2b, d-(a+b), 2a – 3b*.Readers are invited to introduce different or additional aspects.

Number of aspects is derived from the exponent *ln(p(n))* which is interpreted as the maximal number of independent tests needed to describe each and every possible distinct collection of similar properties on *n* elements. In the case most interesting for us, at *n = 66,* this value is *~ 15*. This means that one needs no more than *15* consecutive or contemporary queries to be able to identify each different constellation of inclusive groups that can exist on *66* elements.

Aspects actually used: We have relied in the construction of the present model on *9* primary aspects, see above, and easily surpass the necessary maximum of *~15* by combining each of the primary *9* as the *outer, senior* with each of the *8* remaining aspects, thereby getting *72* sorting orders. Each of the sorting orders used has one of the primary aspects as first sorting criterium and a different one as *inner, second, junior* sorting criterium.

Reorderings and the patterns we observe during these are of central importance in the concepts behind the experiment. We create *72 * 71* reorders and register each step an element makes during the transition from a place *i* in any of the catalogued sorting orders to a place *j* in any of the different catalogued sorting orders. This data set is the basis for the conduct of the experiment.

2.5. Results of the Experiment

Linear sequences appear as we subject the collection to a sort. To maintain brevity, we shall discuss *pars pro toto* the sequential orders *[ab], [ba]* and ask the reader to conduct the other sorts we by implication refer to.

The $rank_{\alpha\beta}$ of an element in a linear sorting order is that natural number which refers to the place which the element is assigned to as the result of a sort on *[αβ].*

Contradictions among sorting orders appear as two differing sorting orders assign two different ranks to one and the same element.

Example: In sorting order *[ab],* element *(1,3)* is in the sequence *(1,1), (1,2), (1,3) …* on rank *3.* In sorting order *[ba],* element *(1,3)* is in the sequence *(1,1), (1,2), (2,2), (1,3)* on rank *4.*

Planar place of an element is that point on the plane which has as coordinates *x= rank([αβ]), y = rank([γδ]).* A plane of which the two axes are two sorting orders, includes one definite place for each of the elements of the cohort. (We neglect the complications coming from exchanging the names of the axes.)

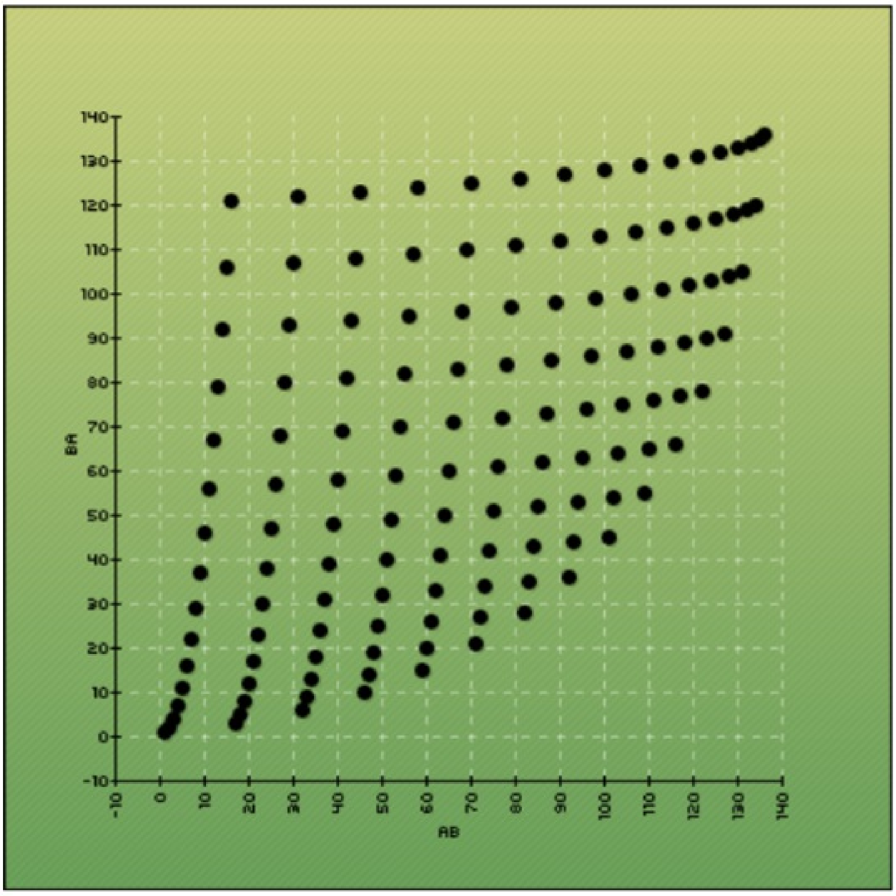


Fig. 3. Positions of logical primitives on the plane *[ab], [ba]*

Reordering is the name of a procedure by which each element finds it future place, by leaving its past place. (Similar names for the starting and ending place could be: previous and present, predecessor and existing, existing and successor, observed and expected).

Cycles are the constituents of reorderings. Allowing for a cycle of*1* member to mean that the element changes places with itself (that there is *1* element in the cycle), it is observed that a reordering consists of*k* cycles. In order to avoid any trespassing on matters that belong in the domain of mathematics, the **term cycle** as used in the context of the present treatise is that concept which is **demonstrated deictically and defined** in *oeis.org/A235647.*

Examples of cycles in everyday life are observed, if on a bus ride or in a social gathering, person A wants to sit next to a person B, but a person C already sits there. He now has to ask C to move. Quite often, this involves that C has first to ask D to vacate a place (…etc…), until the last person involved Q can occupy that place which A has left vacant at the beginning of the procedure.

The path of the cycle is the line that connects the spots representing the places of the members of the cycle. The grid of the plane being gradated *1..136,* the coordinates of the points being the result of linear evaluations, the distances of the points are additive. We shall refer to the 'run' of a cycle and mean the sum of the distances between two consecutive members of the cycle over the *i* members of the cycle.

Example: The geometrical representation of the periodic change *[ab] ↔ [ba]*

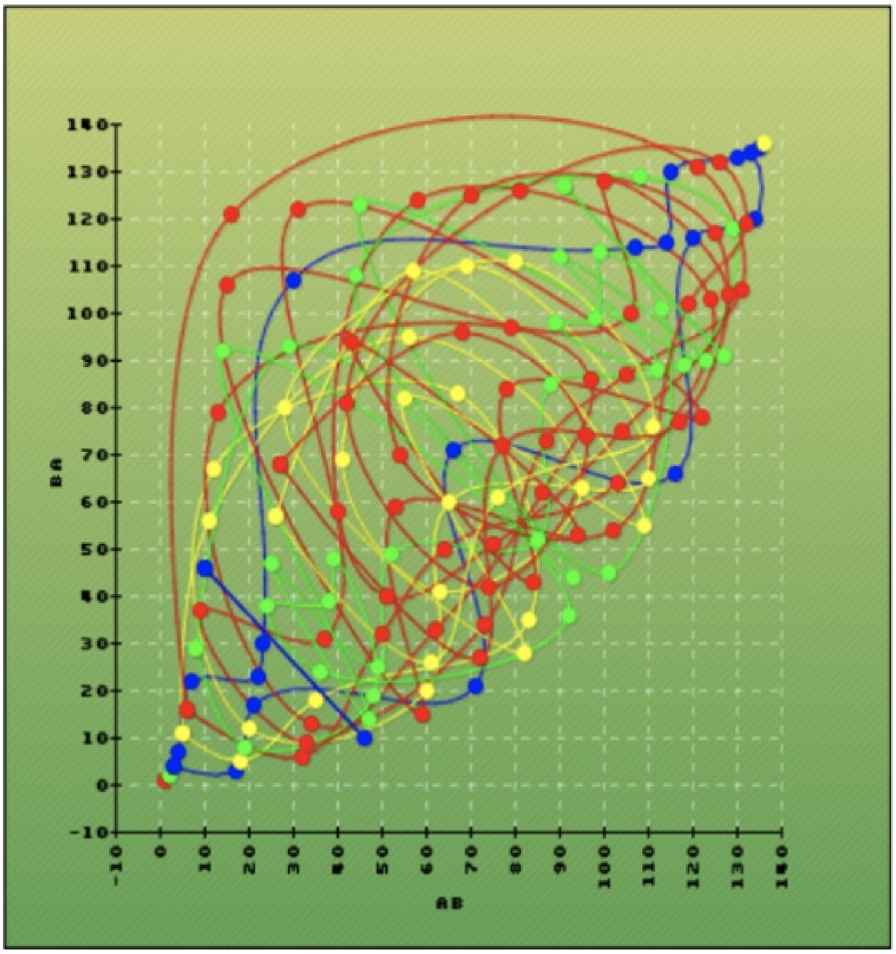


Fig. 4. The Twelve Cycles of *[ab] ↔ [ba]*

The push-away principle is an anthropomorph analogy to the mechanism assumed to the basis of the changes within cycles. Person A comes to the place person B presently occupies and says: “According to the order presently in force (the requirements of periodic changes) this place is now my right place. You go and find your own right place.” One may choose from several visualizations. If there are *i* members in the corpus of the cycle: (a) there are *i-2* spots full, *1* spot empty, *1* spot filled doubly (b) there is a continuous smear of the *i* members along the path of the cycle, (c) the smear is pulsating on the differing properties of the members of the cycle.

2.6. Implications of Results of the Experiment

Cycles are the centerpiece of any rational explanation of the workings of a system that undergoes periodic changes. Cycles direct the mechanism of place changes during a reorder. Cycles connect concepts of material mass to those of distances. They create a web of possibilities that describes and contains that what can be the case if an assembly is subjected to periodic changes.

It appears more reasonable to think that the members which constitute a cycle receive their respective individual properties by means of (inherited from) the cycles they partake in, than the opposite cause – effect consideration: that the elements' individual properties constitute in their ensemble the cycle, as was the case in the experiment.

The elements as data depositories approach credits each element with *72 * 71* data packages that detail, on which sequential position *i* in which cycle *j* the element is partaking in a reorder *[αβ] ↔ [γδ].* The contents of the data depositories are *a-priori* facts, because they are direct implications of the properties of pairs of natural numbers. This is insofar revolutionary, because it shows a transformation of a relation into a fact. Where the element will be, together with which other elements, during a reorder, is no more a Zusammenhang but a simple Sachverhalt. That the elements behave in such a way as they do during a reorder is a fact caused by their innate properties. Whatever changes take place, there are rules and laws to the changes.

Standard reorders are such reorders which have the following common properties:

- *45* cycles of *3* members + *1* central element
- *45 * (∑ a = 18, ∑ b = 33) +(6,11)*

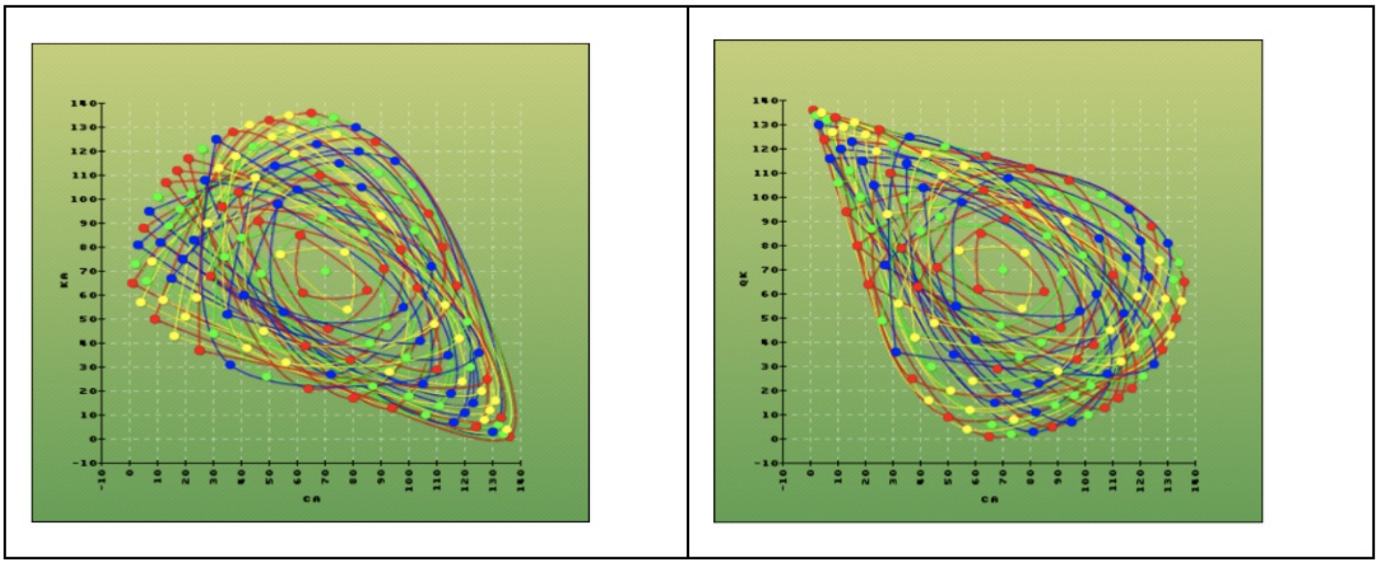


Fig. 3. Two examples of standard reorders: *a+b, a ↔ b-2a, a* and *a+b, a ↔ a-2b, b-2a*

Planes construct spaces: we use the twice three **common axes** provided by the standard reorders to create a rectangular, Carthusian space, which comes in *two* variants. The variants appear to give geometrical interpretations of the possibilities surrounding *a* resp. *b.* We see *two central elements*; their spatial position is slightly different.

Autokefal or heterokefal: the distinction refers to seats of beliefs which declare themselves the fountain of truth resp those which distribute truth the source of which is elsewhere. The two Euclid spaces frame the space for context of sentences that describe the world from the viewpoint of *a: a = c-b, resp b: b = c -a.* It is possible and legitimate to use a language that refers to the extent the glass is empty. Equally possible and legitimate is to use a reference system comparing relative to the other end of a continuum, how much the glass is full. The inner reliability of the self-references in the language may be sufficiently, even exceedingly high: Nature has introduced a cross-validation requirement, in which the two parts of the system have to show that their readings of *a+b=c,* namely *a=c-b* and *b=c-a,* refer to each other also sufficiently exactly. (There are *two* strands of the DNA.) Two ordering principles can be wildly deviating, but that which they manage to maintain as a common effort, must be in agreement to both of them. (The sentences divorced parents say in congruence relating to the future of the common child, are consistent sentences.)

2.7. Spaces and Phases

The space concept is woven together by the readings of the triads that constitute the cycles of the standard reorders. By their movement patterns, the logical primitives constitute a space concept that is rooted in planes, which planes are again rooted in linear ranks, which linear ranks are a consequence of properties of natural numbers.

Of the two Euclid type spaces one, common, partly enveloping space can be created. This space shall be named *Newton space*, as it closely resembles the usual space, we experience ourselves being alive in. This space is in the view of an accountant much more of a mental creation than an observation of facts. The two Euclid subspaces have a clean accounting genealogy. Each place on a plane there is an exact reference to one rank each in two *sequences*. The tautology is so far free of possible errors.

As we merge axes into a *Hauptachse,* we commit an inexactitude by omitting a sub-reference, the place attribute as prescribed by the *second, junior* sorting criterium. Of the two axes of the two Euclid spaces: *z = {(a+b, a),(a+b, b)}* we create the Hauptachse *z = a+b.* Similarly, for *x = {(b-2a, a),(b-2a, a-2b)}* we simplify into *x = b – 2a.* Of *y = {(a-2b, a),(a-2b, b-2a)}* we extract the Hauptachse *y = a - 2b.*

The Newton space is a mental construction, making use of predictions which are based on accounting facts. The prediction is by its nature less reliable than the statement of the accounting. In this sense, the common, usual Newton space is a compromise, in which the inexactitudes and errors of cross-reference are accepted (explained as mysteries of Nature). The argument for naming the space that is created by leaving off the second sorting arguments in the course of the sorting experiment-procedure is the existence of a directed and additive axis that can well give a picture for the observation known as **gravity.**

Gravity is emerging from reordering pairs of natural numbers. The axis of similarity is an axiomatic ordering principle which is additive and oriented. Its effects are the underlying facts and relations, of which we drew the picture of **N**. Crossing the axis *a +b* is the plane of diversities, with the axes *a-2b, b-2a.*

The tautology link is required to continuously exist, otherwise it could not be self-evident that *sequence abc* on a specific location in the DNA refers to *building block q* in the assembly of the organism. Something expressed in a 3D language must mean the same as the same thing expressed by *6* statements in a 2D language, below which one cannot go because the number of 1D statements referring to the same thing cannot be determined by the present method, which uses *6* as its smallest interpretable unit.

The sequence of the turns of the phases appears to allow suggesting that they follow the same clock-wise turn, like a screwdriver driving in.

The gather – scatter principle builds the basic tautology by describing a *succession of 3 phases,* that happens in three *turns,* stating:

Rank(e)_X & Rank(e)_Y → Place(e)_XY → Rank(e)_Y & Rank(e)_Z → Place(e)_YZ →Rank(e)_Z & Rank(e)_X → Place(e)_ZX → etc.   (1)

The wanderings of the logical primitives show that they *scatter – gather – scatter – gather – etc.* during the elementary moment which consists of three turns. They scatter into the plane, gather on the next axis, scatter into that plane and gather into the other axis and then once more. The sentence, which the grammatical tautology requires, runs: *it is true that rank(a) & rank(b) → place(plane ab) and that place(plane ab) → rank(a) & rank(b).*

The footnote to the tautology is, that it is irrelevant, whether the next phase begins with the same constellation as was the case previously. The **development of variants** is allowed for within the tautology.

For each variant that will develop, it holds true that:

- the sequential ranking of elements on their properties will assign a place to an element on a plane;
- the elements congregate into cycles;
- there exist readings of properties of elements which show their place in a grid made up of similar units;
- members of cycles move along definite paths during periodic reorders;
- the grid made up of similar units keeps being a background to whatever periodic changes take place.

For each of the variants it will hold as a tautology that the element's place on a plane is reflected / mirrored / pictured as two linear distances. The translation into the language of the DNA must work also in cases in which such an organism could never come into existence, let alone live. The *position* part of the message being not up for negotiation, there remains as a medium to carry information the *relative oddity* of element *e* being on that place, *considering the circumstances.*

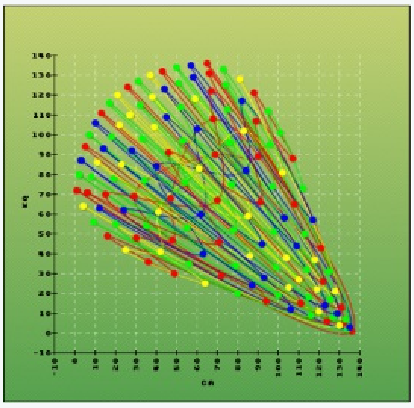
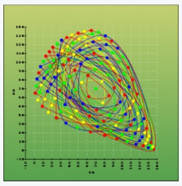
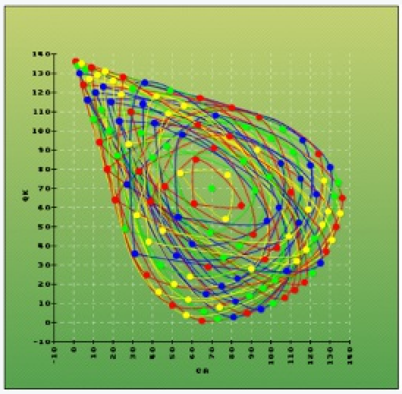
Change in the background

The accounting exactitude can be maintained if one registers *which* of the subsegments are meant when issuing a statement regarding a state of the world in the 3D, Newton world. Knowing that an elementary moment consists of *3 phases,* one can maintain exactitude by giving notice, *which* of the two variants of the Hauptachse is currently referred to, in each of the *3 turns*. The genetic information transmits, which of the *backgrounds* to use to position such a something in, that fits well.

The syntax of genetic information transfer uses *4* logical tokens on *3 places in succession* to point out, properties of *which* of the two Euclid subspaces are presently valid, of which the unified Newton space creates one axis. The turns of the *3* Hauptachsen *up/down, left/right, front/back* create planes: *vertical, horizontal, sagittal,* which together are constituting space (the accountant remarks: they create the appearance of space by establishing planes). A concurrent description can register which of the two sub-axes are relevant at each turn, and this is what the DNA does.

*The properties of the planes on levels a, b*are slightly different and either the elements are slightly different that fit in well in such a space as made up by the specified combination of planes, or the elements retain their properties, but the position into which they fit best will be different. For maintaining the required tautology, it appears easier to adjust the properties of the elements than to modify the spatial grid. (The suggestion is that the geometric constraints are a given, and everything else is but a corollary on the possible alternatives.)

There is an additional restriction on the properties of elements that can be on places (turns) 1,2,3 of a word. On the example above: *(a+b)* axis of agglomerative Space C can be on any of the places (turns), originating from either*(a+b, a)* or *(a+b, b).* It is open, whether the message refers to the left or the right subspace. The axis which creates plane: *up/down-left/right* cannot be any, because only *(2b-a, a)* fits to *(a+b, a),* and only *(2b-a,2a-b)* fits to *(a+b, b).* Therefore, although at first glance, on any of the three parts of the logical word, any of *4* symbols can sit, because of the restrictions, that the logical sentence must provide coordinates, only *2* of the arguments can appear together, namely such that belong to the same, left or right subspaces.

	This vertical plane *z:a+b, a ↔ x: b-2a, a*	
cannot attach to this horizontal plane *x: b-2a, a-2b ↔ a+b, a*		**can** attach to this horizontal plane *x: b-2a, a ↔ a+b, a*
		

The syntax *{word1[{p, q, r, s}, {p, q, r, s}, {p, q, r, s}], word2[{p, q, r, s}, {p, q, r, s}, {p, q, r, s}],…, etc}*has great similarities to the syntax assumed to be used by Nature when registering into and reading out from the DNA. In case the hypothesis is correct, that the message within the DNA refers to properties of subspaces, the syntax would be restricted into *{word1[{{p, q}, {r, s}}, {{p, q}, {r, s}}, {{p, q}, {r, s}}], word2[{{p, q}, {r, s}}, {{p, q}, {r, s}}, {{p, q}, {r, s}}],…, etc.}*which syntax appears to be observed in Nature.

De motu is relevant in two ways:

1. In reading the cycle in words of *3,* one follows the turns of the phases. A cycle of *k* members *(k > 6)* will be read *ABC DEF GHI … etc.* How closely the diverse contents of the words will fit into the space grid, is determined by how close the *∑ a, b* of the words *ABC, DEF, etc.* words come to *18, 33,* which is the standard value for space;
2. In reading the cycle in words of *2,* one makes use of the tautology that the 3rd element of a triad is known, once *2* members of the triad are known. This because the cycles of standard reorders are each a partition of *18, 33* into *3,* respectively.

There are *two* space concepts concurrently in existence.

1. In the material-based one, the *cycle* has an *a-priori* existence, and the statement about the state of the world is complete with references to the *three* planes delineating space; the spatial arrangements are the consequence of the data read out of the depository with regard to the standard reorders, even if the cycle is a part of a non-standard reorder;
2. In the geometric-spatial construction, there exist automatic spatial disagreements among the members of the cycle. Here, the assumed/predicted properties of every 3rd element are the consequence of the properties of its 2 immediate predecessors. One reads *AB→C' BC→D' CD→E' etc.*, where the value X' is given by *18 resp 33 – ∑ a, b (predecessor, pre-predecessor)*.

The concept of a tension between spatial properties of elements coming from reading the assembly once in *twos* and once in *threes* could explain the observations that periods alternate, in which an inner tension in a system is being built up, respective in which an inner tension is diminished. A discharge – recharge mechanism can be conceptualized, like experienced by humans in the form of periodic sleep. (One distinct order concept sees the Chess figures ideally ordered in their starting position. The procedure of reordering into the maximal order (again) is a periodic necessity.)

3. Summary

3.1. Extending the grammar

We have shown that the grammar of logical sentences allows for investigations into the relations between elements' properties and their place in a linear sequence. Distinction based on properties can only be conducted if there are different elements. We have defined cohorts of logical primitives and subjected these to periodic changes. The apparent contradiction arising from *two* different sorting orders assigning *two* different linear places to the same element, can be overcome by placing the element on a plane, using the *two* linear ranks as coordinates.

Periodic changes exert their effects by assigning linear ranks, which change due to the external periodic change. Having *two or more* periodic changes at work, we switch the perspective to that of reorders. In order to have an instrument at hand, of which deictic definitions can be read off, we have catalogued the *72 * 71* most basic reorders that can be conducted on a cohort of logical symbols, which are numeric realizations of the first few elements of **N.** The entries of the catalogue correspond to logical sentences that describe a state of the world. Every step of the argumentation has been a statement relating to facts. The model is logically sound and grammatically correct. Sentences that refer to places of elements within a cycle and within a spatial grid during a reorder are grammatically correct.

3.2. Naming and measuring the bias

Human neurology processes occurrences that happen before a background of similarity differently to occurrences that happen before a background of diversity. There are differently many similar and different backgrounds, due to restrictions posed by Mathematics. The elementary occurrence is understood to be one state of the world before a background. This is a logical sentence, a logical relation.

A collection of *n* elements can accommodate *f(n)* distinct patterns of logical relations. The two describing viewpoints, based on their opposite backgrounds, diversity and similarity, allow for slight differences regarding the number of elements minimally needed to accommodate a given number of logical relations. The two functions depicting the upper limits for distinct sentences stating the existence of similarities vs the number of distinct sentences stating the existence of similarities, *n?, n!* are in a slight deviation relative to each other. $\Delta f_?(n), f_!(n)$ is near *Zero for n = 1, 32, 97.* The most pointed is the over- resp. undercounting near *n ~ 11, n ~ 66.* Above *n ~ 136,* the bias reaches the threshold of *1* unit. The two functions diverge strongly *n ≥ 140.*

The extent of the relative bias is exactly known at all instances and circumstances. The bias is an immanent feature of the numbering system. The proposal is to use the fact that an inner deviation exists within one counting system with two reference backgrounds, to give the name *information* to the interference caused by the bias, as a name for a general principle.

3.3. Spatial grids made up of identical units

The paths that appear during reorders can be bisected into *mass-related, distance-related* ones. We have found among the reorders such, which allow for the construction of geometric variants of space. We find *two Euclid type,* and *one Newton type* spaces. These are transcended by further *two* planes.

3.4. Syntax of the DNA

Inheritance by genomes is comparable to a cross-validation of two systems of statements: *a = c – b, b = c – a.* These are both suitable ways to describe states of the world. In both of the Euclid subspaces, all possible states of the world can be depicted that root in the concept that a place on a plane is the same as two ranks on the axes that generate the plane.

The *3rd* axis is, what regards its geometrical properties, a consequence of the two other axes. Based on *two* elements of a triad, one can *predict the properties* of the *third* element, as expected from the background created by the *two* previous.

This principle works well in the Euclid spaces, but leads to variants in the common Newton space.

During construction of the common Newton space, one neglects the *junior argument* of a sorting order as one assembles *one* Hauptachse based on the first sorting criterium of *two* constituent spaces' axes: an element of incertitude exists, whether a rank on a Hauptachse refers to the *left* or the *right* variant of the Euclid spaces. A common axis connecting two planes, the incertitude appears to be in the existence of *4* possible variants that follow each other as three statements of a logical sentence, as three turns of plane – axe or as three phases of one moment.

The syntax of a language that states tautologies between linear positions and material selection criteria in a 3+D space is generated by properties of space itself. Space consists of *3 phases,* each a *turn* of axes *z, x, y* in common Newton space. The exact bookkeeping registers, *which* of the Euclid subspaces is meant as these merge into the Newton space. This brings forth a *logical word of 3 phonemes that are sequenced.* Each of the phonemes can be any of *4 logical tokens.* The idea has great similarities to the syntax assumed to be used by Nature when registering into and reading out from the DNA. In case the hypothesis is correct, that the message within the DNA refers to properties of subspaces, the syntax would be restricted into a form, in which the *4 logical tokens* are split up into *two pairs,* which syntax appears to be observed in Nature.

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