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Produced Consciousness Shapes of the Machiavellian Snake

Bernhard Bierschenk¹

Abstract Consciousness, in the beginning of its scientific use, was considered to be material, i.e., to represent an attribute of substance or matter. During later periods, it was associated with learning processes. Based on questionnaires and interviews, a number of different definitions have made its learned content dependent on statistical measures of what people consciously know. However, statically and without a proper time-scale, it is impossible to identify causal links to the biological mechanisms, responsible for consciousness. Despite the fact that no satisfactory explanation exists at the morphogenetic level, speculations continue about what consciousness actually is about. As a first measure, it has been important to establish the quality (q) function of consciousness. Empirically, it is demonstrated that the (q) function, together with the developed Agent-action-Objective (AaO) formalism has the capacity to connect spinning strings to flowing consciousness. It will also be demonstrated that a biologically important link exists between changes in the flow and the production of various shapes of consciousness. By referring to the balanced states of Orientation that involve (1) Heretic for the original Italian text and (2) Proof for its English translation, the latter signals an important deviation due to the ethical conduct of the translator. Moreover, the Intention in the original is emerging as (1) Warning, while the English translation is resulting in (2) Confession, which again is markedly different from the original Italian import. A full description will be based on the established functional text geometry. This includes both potential and free energy surfaces. The calculation of their dynamic (flow) and thermodynamic (fusion) properties are derived directly from real time imaging procedures.

Evolutionary Dynamics

In departing from the fundamental hypothesis that Nature is the producer of language, this hypothesis requires that the steering and control mechanism, responsible for proper language production, becomes recognisable. In a most fundamental sense, the scientific study of this steering and control mechanism must begin with the observation of discontinuity in natural language expressions. Thus, over and above all analytical approaches to text production, its study must begin with an investigation into the phenomena of stability and loss of stability, which is emphasized by Arthur T. Winfree in *The Geometry of Biological Time* (Winfree, 1980). Making time a key concept in studies based on language means taking into account that text produces itself rhythmically, that it leaves “holes” in the formed spaces, and that these are “mended” in an irregular fashion as the production goes on.

Already around the turn of the last century, Karl Ernst von Baer (1792-1876) proposed the concept of *Bauplan* which allowed him to discuss the deep commonalty that biological mechanisms show in their evolution of patterns of behaviour. Based on this conception, Rudolf A. Raff in his book *The Shape of Life* is discussing the biological meaning of the concept from an evolutionary point of view. He refers to the fact that von Baer could show that not even at the genetic level there is any strict or uniform reproduction. Instead, the genetic mechanism is steadily producing new forms of expression (Raff, 1996). Likewise, in

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conceiving language expressions as part of biology its open-endedness is asserted, which among other things implies that a schema is at work and not a frame (see paragraph on *Schema* below).

A key-concept of the Bauplan relates to Ernst Hackel (1834-1919), who introduced the concept of *heterochrony* among others and proposed the hypothesis of character displacement. Through the dislocation of characters in the order of succession, every new form of any biological expression is establishing itself as a result of novel terminal states, according to a discussion in *Shapes of Time* (McNamara, 1997). This observation has not only continuous value but also far-reaching consequences for the study of text production. In a study on *Heterogeneity in Achievement* it is shown that individuals produce text in accordance with their own biological system (I. Bierschenk & B. Bierschenk, 2004).

From a strictly scientific point of view it is not enough to take one's point of departure in Nature as the architect of an underlying plan and to suggest fundamental strategies. Methodological considerations need to be based on a-priori assumptions. In the present context, natural refers to that what nature generates. The introduced Agent-action-Objective (AaO)-axiom (B. Bierschenk, 1984, 1991; I. Bierschenk, 1984) is the assumed basic natural principle. In accepting the hypothesis of a self-contained description, the scientific standpoint must be to explore the mechanism responsible for proper production. The Vertex system (I. Bierschenk & B. Bierschenk, 2011) has been developed for efficient processing of the involved complexities. The approach must therefore be conceived of as a strategy, which provides the ethical foundation for the scientific study of shapes of consciousness, that is, what is created through language (I. Bierschenk, 1989). Because, speaking of a plan makes no sense in the absence of the autonomous and responsible *Agent*.

Agent as Function

Agent stands for an individual, autonomous way of governing a process. Depending on what the process concerns or where in the flow the government becomes evident, the source emerges in the shape that is the most feasible for the moment. In this way a subcomponent may stand for a unity, which has as consequence that the unity is not known in all its parts during processing, not until the text production has come to an end. An important consequence of this appears in the agent function, which is bound to the first position in a so-called functional schema. The schema is the very mechanism that puts the AaO model into operation on text. Except for certain formal words (conjunctions, prepositions) any piece of text can hold the agent function. By this it is possible to control the cooperation between the material and immaterial, that is, between texture and structure (I. Bierschenk, 1999).

The notion function in this context shall be conceived as biological and not mathematical. Because, function is here seen as empirical, something that operates on something final. The elements are showing up, maybe only two or three times. If one will test something quantitatively, the analytical function should be used, for which a formula can be given. But this only concerns the structural stability of a process, as Rene Thom (1975) expresses it. Then we have to do with a structurally defined function, which operates on local relations.

Schema in Function

The notion schema may cause confusion, because it is used by representatives of various scientific fields with the unambiguous sense of frame. It can be seen applied within computer science and linguistics, for example, in the notion sentence schema, which means something constructed to make visible syntactic patterns. Their schema concept is a data holding device and builds on semantic decisions of which words take which positions. The present conception is that a schema is axiomatic, something a priori, which cannot be

constructed. As such it is structurally bound. The functional positions are only two, either before the verb, the A-place, or after the verb, the O-place. The two positions form the widest possible openings for the revolving process to come about. In this way the schema is put into function by the model but is not the model (I. Bierschenk, 2011).

Rotating Movement

One promise of Vertex is the thermodynamic way of operating to form the language spaces called shapes of consciousness. Of course there may be readers who react emotionally when confronted with such a statement on language. Human language is namely one of the most fostered objects of discussion and opinion among laymen as well as academics and professionals. So, a conservative conduct vis-à-vis a phenomenon that concerns us deeply is nothing but natural. History is full of similar situations.

For example, once upon a time it was inconceivable that Earth could have a geometric sphere. But Nicolaus Copernicus insisted that the Earth rotates on its axis and with other planets in the solar system it revolves around the sun. He established the theory of the universe, which forever changed our world view. Tycho Brahe contributed with precise observations of the stars and planets, and Johannes Kepler formulated the law of motion in the orbit. Further, when the geoscientist Alfred Wegner in 1915 suggested the theory of continental drift, his colleagues laughed. However, in 1950 indisputable facts emerged, which showed that Wegner was right (Malakoff, 2001).

Another example is the invention of the lens, which has been regarded as a fortunate milestone for science. As an optical device for making observations on the motion of planets in the macro-world as well as particles in the micro-world it made it possible for scientists to establish the laws of matter. They succeeded in applying the rules of mathematics to their observations and so the laws of motion could be scientifically established. But the more complex phenomena of living systems such as *Fließgleichgewicht* (the term was introduced by Bertalanffy, 1950, pp. 23-29) have until recently remained outside the scope of science. Observations of true rotation in living systems had been absent.

Nonetheless, the scientific community has now become aware that bacteria accelerate forward through the clockwise rotation of their flagellar filaments and change direction through counter-clockwise rotations (Vogel, 2003). This fact was established in 1973. In 1981 it was proposed that a single molecule may possess a rotary motor, which suggests that one or more subunits rotate against the others. At that time few scientists believed in this theory. Nevertheless, the theory of rotation in molecules became a reality in 1993, as discussed in Kinoshita (1999). Again, it is not difficult to imagine that the pretention of a theory of rotational movement in a language space may cause conservative reactions.

However, the assumption that the AaO-axiom is biologically rooted is made against the background that all living systems depend on a rotary motor (Hernández, Kay & Leigh, 2004), which is establishing synthesis and consequently life, i.e. meaning. Though, without the determination of a proper time-scale (Foster & Kreitzman, 2004) in biologically important kinetic and kinematic processes and an operational definition, it is impossible to identify causal links to the biological mechanisms, which are responsible for changes “that produce and shape consciousness” (Koehler, 2011).

Flowing Consciousness

Empirically, it will be demonstrated that the developed Agent-action-Objective (AaO) formalism has the capacity to connect spinning strings to emerging consciousness. It will also be demonstrated that a biologically important link exists between the changes in kinetic and kinematic processes that produce and shape consciousness. This biologically rooted mechanism is the AaO-mechanism which works in a rhythmic and clock-like manner. At first,

the mechanism seems to produce a simple “ring” structure. The ring must be conceived as the most fundamental unit which is producing compounds and is stringing together graphemes. The processing begins with the conversion of kinetic energy into writing activities. Second order patterns are governing the development of dynamic string relations and are important in the evolutionary development of the waves in flowing textures. A full description of the AaO-ring suggests that its effect is attainable through a transformation of invested energy into an AaO-system. Thus, binding an α -string of the A-component and a β -string of the O-component involutes both viewpoints and a perspective.

The meaningfulness of this process relates to the fact that *free* parameters are not needed, since it is not required that the present approach fits one or the other empirical context. In particular, its biological energy landscapes, obtained from dynamic and thermodynamic properties, allow a global view on the notion structure.

Involution and evolution, taking part in writing consciousness into text cycles, are producing open AaO-systems. A cycle in its most primitive form of expression contains a string which is curling and gaining in complexity as the writing activity goes on. Complexity implies that the (a) of the AaO-system is reaching a phase where strings of graphemes develop into a layered composite. Sufficient absorption implies that the “character” or “style” of its producer becomes embodied textually. Thus, involution is the precondition for this state and necessary for the textual evolution of consciousness.

The most primitive form of an emerging string becomes approachable through an AaO-ring, which contains a verb (‘verto’), referring to (‘verti versum’). It implies growth and means a systemic involution or in-folding of “en-ergon” (Feeke, 1976) in the form of an energetic potential or rotational energy. But equally important is the nonlinear dynamics of the verb-function, which is noted in the German verb (‘werden’) and the Swedish verb (‘varda’). Since the growth of text presupposes that its body must revolve in AaO-rings, the verb is manifesting a whirl in an otherwise flowing consciousness. This means simultaneously flowing texture in which strings of graphemes are twisting and twining. Thereby, the vortices of the textual flows can specify their energetic properties. Unwrapping an energetic potential means unfolding their surfing and rolling waves.

Based on the mode in which AaO-rings are linking together their encompassed A’s and O’s, it becomes feasible to make apparent phase-dependent cascades in textual flows. However, an AaO-ring cannot exist independent of the forces inherent in the flow. For this reason, the flow is carrying the text producer’s intention and orientation deeper and deeper into the ongoing involution until the lowest point in the textual embodiment is reached. From that point on “attractions” begin to ascend and are thereby producing abstract spaces.

To be able to identify the energetic attractiveness of a text presupposes that the Agent becomes identified and that its identity becomes discoverable. This is, however, only possible under the condition that the Agent is writing something. Getting to know the Agent by the way of writing implies that the individual writer is the token of a biological type, which has this capacity (Kugler & Turvey, 1987, p. 213). The individual text producer provides a unique physical context and the AaO-approach implies a transformation of coordinated ring structures according to natural law. On the other hand, it is also crucial to be able to catch the corresponding progress at the textual level, which cannot be done without some suitable tool.

In previous studies, it has been shown that this tool exists in a number of identification and bookkeeping procedures which are manifesting textual movement patterns (I. Bierschenk & B. Bierschenk, 2011). Their development has been based on an a priori assumption, namely that the AaO-principle is reflecting lawful relations which may be symbolised as copies (B. Bierschenk, 2011). Hence, the principle becomes functional, in the moment when a copy of its components is being realised. By functional it is meant that a “standard copy” (Hardison, 1999, p. 126) is produced. This process is going on irrespective of its meaning. In strictly

mechanical terms duplications take place and the copies of copies are ordered strictly through interacting sequences. Copying requires that some AaO-rings are incomplete. Incompleteness is to hand when either the A- or the O-component or both are missing at the textual level. This situation has been symbolised with $(\emptyset_{Aa\emptyset_O})$. Thus cooperative interaction between different AaO-rings become possible through the placeholders (\emptyset) , which are influencing both the involution of a string and the channelling through regulating the textual flows.

As a first measure, it is important to establish the quality (q) function of consciousness by developing the formation space of a text. Figure 1 illustrates the connecting channel formation for an incomplete AaO-ring containing one placeholder.

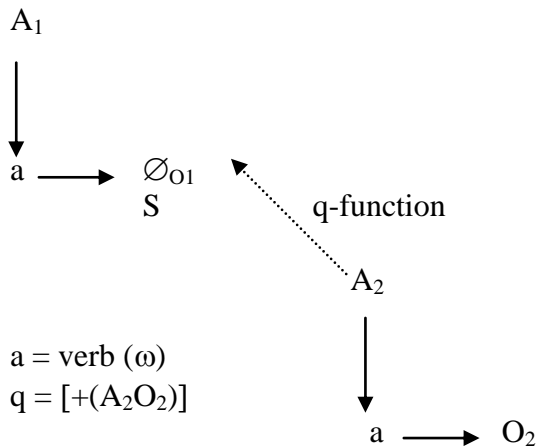


Figure 1 Vertical Coupling in an AaO-configuration

It follows that an open sequencing space always is open for attractive forces to enter the ring. When an active “spring” is indicating the elasticity in an AaO-configuration, it is symbolised with the dummy for the corresponding component. The springs are used to trace the cascades in a textual flow. As to the channelling, springs may be used to decide upon the quality of the flows.

By straightforward calculation it is easily verified that the involution in Figure 1 rests on five slants. Since there is a slant missing, the q-function has to be calculated by simple counting. The (\emptyset_{O1}) notation has been chosen to mark the coupling on the vertical axis. Since vertical pairing is constitutional, (\emptyset_{O1}) marks involution through winding. Hence, evidence for the existence of the q-function is obtainable through the processing itself. However a proof can be performed only under the hypothesis that there is a “red thread” or a “virtual string” to work with for the AaO-system, conceived as the “reversible synthetic rotary motor” (Hernández, Kay & Leigh, 2004).

In addition, the existence of a rotation mechanism implies that a textual expression is suitable for proofing its quality, provided that it contains cues to its capacity of stretching and straining, and of curling and bending. So, at the material level a composition of strings has to respond in an elastic way to the evolving flow dynamics of textual patterns. It is therefore not a coincidence to suggest that a text material must be described by its flow properties and that these are decisive for the rotation dynamics, and consequently for the realisation of the Potential Energy Surface (PES) of a textual space. In demonstrating empirically the existence of PES for a particular text space, the followed strategy is based on a few important steps.

- (1) The first step consists of the observation that neither perspective nor viewpoints can exist in latent form in the brain. Both must be built up during text production.

(2) A second step is related to the establishment of the bookkeeping procedures, which can capture dynamic changes, flows and rhythms of strings in the foundation of a space and the development of its morphogenesis.

(3) The third step concerns the complexity of the produced dependency relations. It is this complexity and its overwhelming capacity to reflect synthesis that is experimentally challenging.

What is in focus is the empirical demonstration of the existence of a “real physical geometry” (Hestenes, 1986/1993, p. 583) and a powerful mathematical system called “geometric algebra” (Hestenes, 1994a, p. 65), which has the capacity to “reproduce” the space of a particular text even though the text has been translated into different languages. Based on the AaO-rings, this means at the kinetic level that graphemes must be regarded as the result of a “microscopic synthesis”. The two waves in the A-component of Figure 2 relate the original Italian formulation as well as to its English translation.

Translations, independent of their quality, can only give an approximate idea about the original. This is especially true when the original has been produced in historical time. Moreover, if the author is as sophisticated as Niccolò Machiavelli, comprehending or translating his thoughts can only become a proposal of what he is consciously knowing and recommending. Since his text appears to be simple and easy to appreciate, it has been a source for attempts to reveal the kind of knowledge that has been the background to his strategies and aims. The kind of text that Machiavelli has produced is illustrated with the following example:

“Perché io credo che questo sarebbe il vero modo ad andare in paradiso: imparare la via dello inferno per fuggirla” (Niccolò Machiavelli, lettera a Francesco Guicciardini del 17 maggio 1521).

The example shows that this text requires the concept of “involution”. Thus, to write one’s knowing as in Machiavelli’s case into text must result in interplay between intention and orientation. When the generation of graphemes and grapheme strings is being composed to sequences, their degree of rotation creates a space in itself and develops simultaneously their interplay on the textual surface. Particularly for the selected text is its lack of restrictions for interpretation and an exercise in making a distinction between medieval visions and reality. The following translation into English has been used:

“I believe that the following would be the true way to go to Paradise: learn the way to Hell in order to steer clear of it.” (Letter 270 in Machiavelli (1996))

Control of the English translation means a two-fold description of non-verbal behaviour, i.e., the English text material. Accordingly, text is an expression of an Agent’s (A) interaction (a) with some given Objective (O). On the other hand, when somebody else is learning or translating text, its function is shifting from being an “expression of experience” to being the “context of experience”. On one hand, it can be assumed that certain viewpoints are chosen, when the text producer is communicating his particular outlook. On the other hand, viewpoints are intentionally reproduced, when a translator is communicating the outlook of a particular text.

Since the rings operate on graphemes and grapheme strings regardless of language, the original Italian text, translated into English must reflect the intertwined functions of text and context and thus cope with their organisational specifications at the textual level.

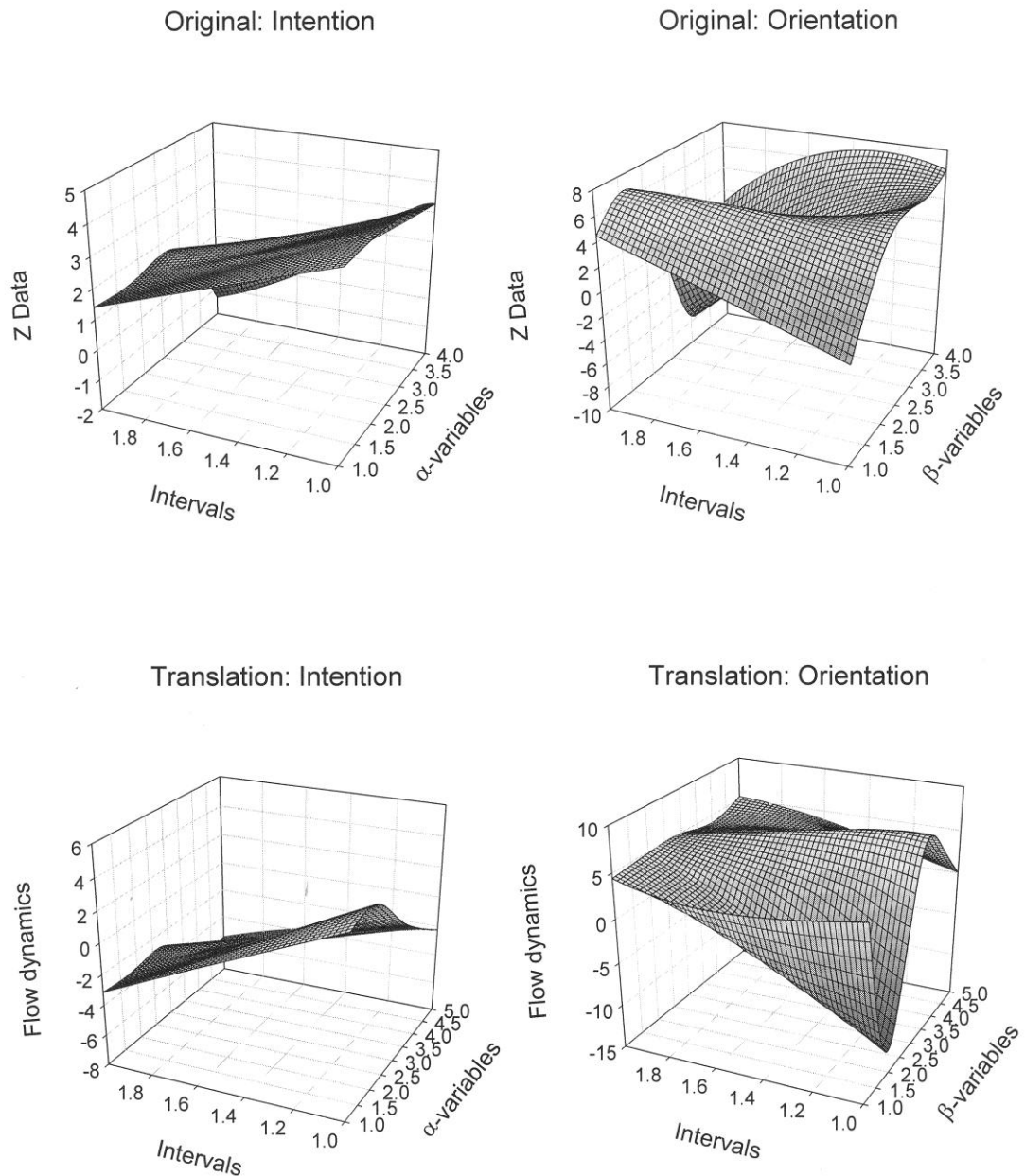


Figure 2 *The Potential Energy Surfaces (PES) of the Unfolded spaces*

The hypothesis is that the English syllables indeed vibrate and oscillate but never in exactly the same fashion, although variations can occur. In contrast to the original Italian formulation, the translator appears to have chosen a slightly more active attitude. As a result, shades in meaning may have influenced the involution, as well as a temporary induction in its energy investment. But seen over the entire range of the text, such variations are normal, since text production is always a result of breaking the influence of spatial and temporal order parameters or at least reducing them.

At first, it would seem unlikely, that a separation of the A- from the O-function would lead to comprehensible results. However, testing the effects of separation will be studied with the following strategy:

- (1) In a first step the space belonging to the O-component is developed.
- (2) In a second step follows the space of the A-component.

At a first glance, this strategy may seem to destroy the strict dependency of the two components. If the separation would lead to the establishment of a bi-componential disparity of intention and orientation, this would be seen to be a very radical test on the validity of the AaO-approach.

For this reason, it is quite natural that the materialisation of a textual space must take into account the way in which the variables of the components are sliding over the intervals. Related to the relative changes in acceleration are the processes of advancing from one state to another. This perspective opens up a discussion of the extent to which a textual space may express explicit as well as implicit relations. In this respect, the acceleration in the rotation is a measure on the equally fundamental properties of materialisation and shading.

In particular, the English translation shows, compared to the original Italian text, a very similar development. At the end of the process, the order parameters are in both cases trapped by the “shadows” of preceding attractions. For example, the effects of a change from one system state (fixed point) into another (copy of a fixed point) are determining how the control parameters are governing rotation. A stretching operation is obviously accelerating the governing rotation. Thus, the effect of doubling an α -variable in the Italian text has changed the direction of the developing wave.

In contrast, the curve of the English translation is exhibiting a larger increase in distance, which means that it is primarily a function of extensive copying of the α -variable and hence, the redundancies in this component are influencing speed and acceleration in the trajectory. Uniformity is broken in the second part of the Intervals. The resulting wave shows a higher degree of acceleration. Moreover its trajectory is extended and has generated differences in depth. This means that every step in the copying process leaves behind a mark of itself that has an effect on the rise and fall as well as the overall dynamics in pattern formation. However, since the trajectories of the A-clocks in the Italian and English text reveal nevertheless a remarkable similar course most of the time, a certain degree of symmetry is observable.

The reason for testing the A-component has been to get hold of a perspective change. The shadings in Figure 2 around some preferred phase relations have been determined in order to demonstrate the kind of change that can be accounted for within and between the periods and the fractions of a period that are critical in the production of a particular text. In comparison it becomes evident that the clocks of the A-component have their own subtle ways of striking, which has produced distinguishing properties in each single case.

In the English text, a somewhat deeper slope has developed, which is a result of the coordinative operations of the two control parameters. Both work toward a successive augmentation in the limitation of the possibilities of the A-component to fluctuate. This successive limitation does not leave until the process transits to its final phase. Further, the steep of the slope depicts some shading, which is not to the same degree present in the space of the Italian text. In the English case, a slightly winded formation is to hand. The critical moment that has caused this winding is a disposition toward delay in the second part. Hence the governing deviations in displacement produce partial differences in the geometry of the English space. So far, a very high degree of similarity in the geometric form can be verified. However, each A-clock seems to prefer to stay at its own tempo.

A more pronounced divergence appears in the spaces of the O-component. What is particular in the original Italian text can be extracted easily from the “drifting” over a particular number of β -variables. The steps in the Orientation graphs show that a shift has

occurred which has influenced the shapes of the spaces differently. When determined from the displacements of the β -variables in the Italian case, drifting over the Intervals is changing the fundamental phase relation in the second part. This situation is reversed in the English Orientation space. The steep appears at the right-hand side and implies acceleration in the process of involution. However, relative phase stability remains and the cyclic clock-like function is revealing the existence of an asymmetric symmetry in the sliding over the Intervals.

Ostensive space similarity implies exactness in the coordinative movements of the textual elements on the translation level, which, in itself, is a transition from one state to another. The remarkable symmetry in the sliding of the variables is verification, that multiple rhythms and various delays at the phase transitions are demanding a continued and refined analysis. This kind of processing requires that the manifested sliding is further determined in relation to the intervals characterising the period. This determination is presented in the Orientation spaces. Obviously, unfolding operations entail the concept of time and its expression through successively increasing and decreasing shades in articulation.

The larger the increase is in the distance, the longer is the time it takes the process to relax from the critical speed in phase transition and to slow down to the speed of the initial phase. Thus, whenever a depicted process is advancing from one state to the next, the established distance is a measure on the degree of “directness”, which is driving the system toward the intended pattern.

It follows that distance below zero corresponds operationally to a certain degree of “in-directness”. Independent of the kind of distance, as expressed by negative or non-negative magnitudes, it means that the shading is an ingrained space property. A comparison of the orientation in the reproduced textual spaces leave no room for doubt that the geometric shape reflects an overwhelmingly and convincing overall similarity. What may be considered dissimilar is related to greater depth in translation, which was caused by a greater stretching effect. The additional β -variables have contributed with an expansion of depth in the space at the transition marked by the second part of the Intervals.

Especially the development in the Orientation makes evident that the biologically coordinated string movements are absolute and established on the basis of a process that is independent of the material and thus language-specific grapheme composition. In comparing the established spaces, it becomes evident that biological coordination must be conceived of as the outcome of a synthesising process.

Synthesis proceeds according to the way in which the text producer is coupling the components and how the coupling of single textual elements is performed. Different and language-specific functional requirements seem to have had no substantial influence on the operations that have generated the shapes. But the flow dynamics in the developed spaces has changed in subtle ways. That subtle differences in displaced textual elements can have profound effects on the acceleration of the involved clocks will be emphasised in comparing the coupling of (α) and (β) pair-wise and within a particular translation. It becomes evident that a synthesising process must be conceived of as the outcome of biological coordination. It follows that rotational difference can be analysed effectively with reference to the complementary running of the clocks. It is impressive how Italian and English clocks have adapted their running to comparable speed. In contrast, the complementary running of the English clock has produced a pronounced shading operation, which has developed on the basis of a higher degree of acceleration. The latter has been made evident through a longer duration in phase drifting. Nevertheless, relative coordination of the complementary clocks has in each and every case generated an “over-all clocking symmetry”. To repeat, this means the coupling of strands with an observable tendency towards synchronisation.

The Products of Conscious Performance

Understanding the evolution of a landscape depends on the knowledge of the “Snake” that is developing (B. Bierschenk, 1993). Its movements, development and growth are producing the kind of escapements that is illustrated in Figure 3.

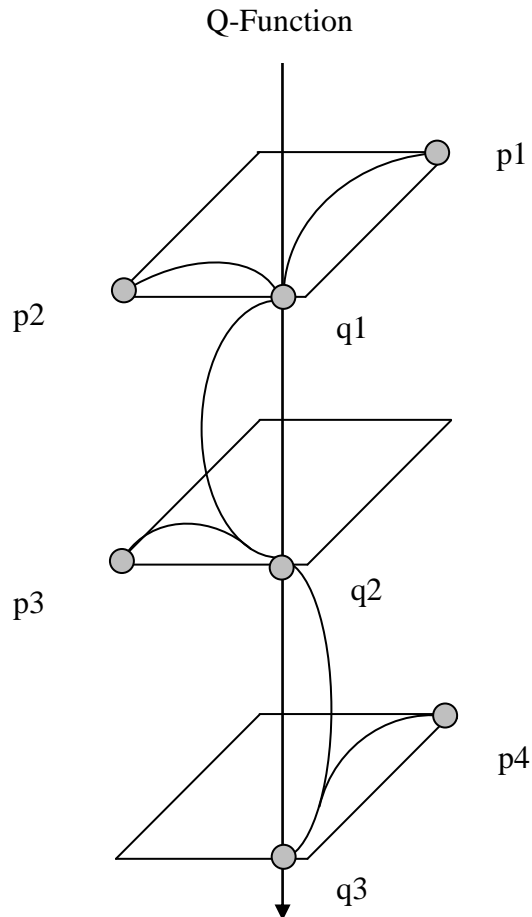
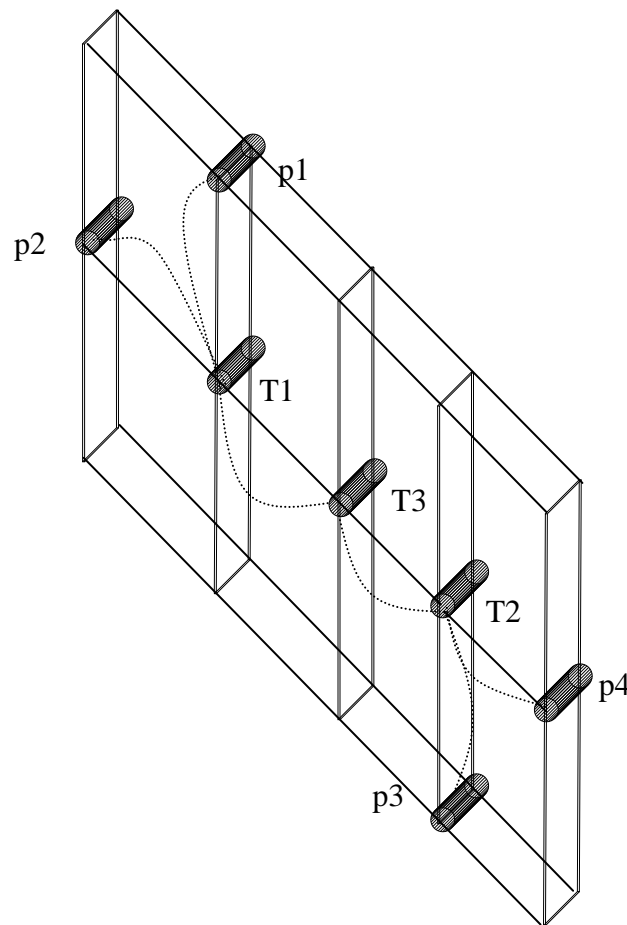


Figure 3 *Escapement*

Catching the Snake with a Mesh

Information on the way in which the quantities of (p) and (q) increase or decrease will not be sufficient to understand the global dynamics unless the underlying PES helps to define the minima which actually separate the evolving planes. Moreover, in terms of the FES, local minima, underlying evolutionary growth, can be extracted from the Q-function. This function is forming a spiralling line of growth, which is self-indicative. Moreover, the spiral reflects discontinuities and represents a lasting record of successive stages. In conclusion, the convolutions of the Snake refer to manifested barrier-heights or depths, which is a function of local minima and equilibration. If a counting of the nodes of Figure 4 is regarded as expression of topological distance, then equidistance becomes visible as length of the trajectory, which has empirical implications. The size of a holotop can be determined on the basis of the following observation:

The representation of one singularity in a topological space requires four coordinates. The number of singularities (T_n) is one less the number of point attractors (p_n), which have attracted the composites, making up the α - and β -strands.



Note: A singularity exists independent of the kind or degree of deformation of the curve. This defines topologically the existence of invariance.

Figure 4 *Holotopic Evolution: Manifested Barrier Heights*

It follows that the needed states of the grid can be approximated with the relationship

$$\text{Required States} = [(4 \otimes T_n) - 4 = (\text{Propagating Cells} - 1)] .$$

As to the establishment of the needed states in the evolving holotop, subtraction ($-T_n$) relates the number of degrees of freedom. By averaging over all other degrees of freedom, a holotopic system is generated that is invariant over languages. Furthermore, it is worth noting that the states at the boundaries of the present system represent the point attractors (p_i) as well as a new kind of Dummy (D_i). Every point attractor or Dummy is acting on the transformations that take place in a holotopic space description. In focusing on the specification of the planes in Figure 4 where the point attractors (p_1, p_2, p_3, p_4) have been attracted by the state attractors ($T_1, T_2, \text{ and } T_3$), space and time can be formalised on the basis of the distance between levels.

By localising transformations in a holotopic space, it becomes possible to determine length topologically. Hence its singularities can be used in the specification and description of evolving micro-structures, simply by counting the number of neighbouring nodes. If a trajectory is of one-step length, at least nine nodes would become involved. On the other

hand, if a path consists of two singularities, then at least 12 nodes must have been involved. A transition from one path into another implies a transition between two “regimes” (Hayes, 1997, p. 508) which, however, requires at least 24 nodes.

As an intermediate step, catching the transformations of the Snake with a holotop is giving expression to the involved number of degrees of freedom. Determining size and growth in complexity is recognising evolving dependency relations. Hence, a holotop is transforming processes on the kinematic level, which become meaningful first through an approach that describes the relationship among various parts of the Snake. In addition, it can be demonstrated that the helical configuration of the Snake always appears as unity in a plane. “Changing its skin” means that the Snake maintains the holotopic coherence between various parts of the resulting “micro-structures”. Thereby, the nature of the Snake is manifesting the way in which information, carried by the stages, becomes transformed and conserved or stored in a changing path.

If the changes, instantiated by the point attractors, are small, they will produce a *homorhetic* path. However, any time the transition from one state to the next following is producing a sudden and unexpected or exceptional jump, this is resulting in a *hysteresis*, and a new path comes into existence (B. Bierschenk, 1993). Further, any application of a minimally sufficient system will have the capacity to catch the manifestation of the Snake’s sliding and turning on the path. Thereby, self-indication forms the basis for “self-reference”, which consists of a number of qualitatively distinct phases.

After a holotop has been established, the processes involved have to be explained and discussed with reference to the impact of rotational dynamics on attitude change. Hestenes, (1994b, p. 72) provides a unique relationship, which constitutes the foundation for the *attitude spinor* and consequently a distinction between direction and orientation as a function of states. With the point of departure in the “binary operator function” suggested by Connes (1994), phase-dependent transitions can be detected and made manifest. Connes’ function leads to remarkably simple measurements of the transitions and takes into consideration the coordinative interaction of the transitions so that even small changes can contribute to a determination of appearing landscapes. Since the generation of a landscape presupposes topological stability, the concept of “landscape” provides the key to the manifestation of adaptive structures. Understanding how a language system can relax efficiently to a particular structure, such as a tree structure or a substructure of a tree, requires a global view on the landscape.

The Zipper Function

The application of Connes’ (1994) fusion operator ($\Delta/2$) to the transformation processes makes the magnitudes of certain composites become united. Connes is using the two-fold matrix and inserts the operator value in the upper left cell, while the contrasting reference value is found in the bottom right cell. He fills the remaining cells with zeros. In this way, Connes identifies these cells with “identity” copies. Thus, generating pairs implies that the values are enveloped by operations that are closing all open “sets”. Hence, an attractor space must develop on two simple connection (C) matrices, which is resulting in $[T=C\otimes C]$.

It follows that a connection matrix is based on the association of two discrete points, which has the obvious power of changing either point into the other. Because Connes’ space consists of only two points and their “alter-egos”, he is, according to Mackenzie (1997, pp. 32-37), “doing something extraordinary”. Since the space can be represented as a pair of numbers, classical arithmetic operations can be performed despite the fact that “every point” is twinned with an indistinguishable “alter-ego” (Mackenzie, 1997, p. 36). It follows that progressive processing of (T) is definable and illustrates an efficient processing of

complicated AaO-configurations. The relation expressed is the natural foundation of functional identity as discussed by Connes (1994, p. 7).

How differences in angular articulation will constrain individual composites in the folding process will be demonstrated in the following. The folding makes the coupling process visible and gives its outcome direct physical meaning. Finally, it can be concluded that the breaking of symmetry must appear in pairs both within and between components. Whenever the deviation in a particular pair exceeds the critical value ($\omega=1.00$), the actual system begins to respond in discontinuous manner. Hence, when length no longer is connected arc-wise, a hyperbolic curved space becomes available as the result of convolution processes. But the developing configurations require a processing technique, which can pick up and communicate the meaning of the fusion dynamics. Thus, inherent in the process of forming state attractors of growing degrees of complexity is the process of naming.

Naming Procedure The procedure to be presented for the generation of names will be shown to produce asymmetric tree-structures. At the terminological level it will be made evident that the produced conservations are the result of a bi-componential disparity which will be studied and discussed in the context of the translation of a paragraph from the Italian into the English language. Besides enabling an invariant formulation of the involved A-O-kinematics, naming procedures have been shown to facilitate an efficient communication of alternative holotopic systems. Coupling and naming alternative kinematic constraints has effectively contributed to the generation of a stable theoretical basis for tacitness (B. Bierschenk, 2012). This must be regarded as a developmental twist in the study of consciousness.

Generation of Folds

In addition, to the concept of “holotop”, the concept of “holophor” is introduced with the purpose to make evident that structure requires the concepts of wholeness and evolution as well as the concept of control variables. The holophor builds on a small number of order parameters. The typical order parameters include two stress functions, namely the X-function, which is manifesting the “strain”, and the Y-function, which is representing the “shear”, while the Z-function is reflecting the fusion of invested “rotational energy”. Based on the thermodynamic trajectories of Intention and Orientation, fusion is shown to emerge as convoluted attractor spaces. The underlying biological mechanism accounts for their deep holophoric commonalty. Moreover, it will be shown that the invariants are pointing toward the presence of a biologically determined interplay between the state attractors of the holophors of Intention and Orientation.

Since the dynamics of the resonating landscapes is manifested in continuous and discontinuous trajectories, both have constraining effects. The latter indicated that an evolving helical curve is winding itself around the corresponding component so that the defining thermodynamic path develops towards the point of destination. Based on the holophor concept, it becomes possible to capture the point of destination through the final or global state attractor. When related to the distance in a folded space, the fusion dynamics gives expression to distinctive mountains and valleys. Any resulting tree-configuration, reflected in the holophor, is an expression of completeness.

Illustration of Completeness

The grid of Figure 4 above has a further function, namely to show that the elasticity in the A- and O-component of the [AaO] system is not constant but increasing with increasing degrees of deformation. When a holophor of Figure 5 is considered as context, the cooperation between Intention and Orientation is no longer the objective of the physical

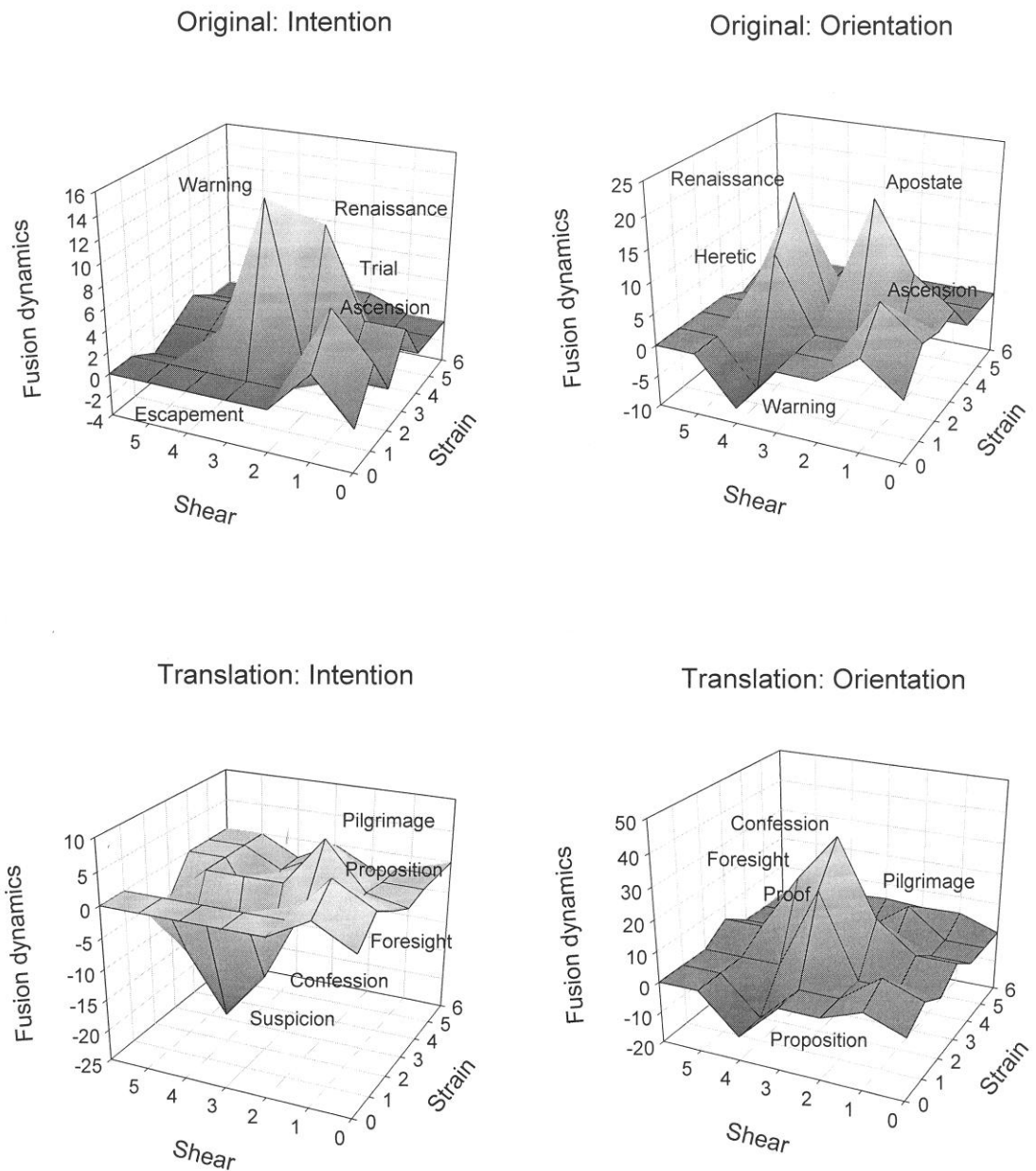


Figure 5 *Holophoric Stability in the Folded Spaces*

conditions of making experience. Instead, it is the hyperbolic determination of the global state attractors that comes into focus. Thereby, new constraints are produced, which pass beyond the limit of reality. As a consequence of transcending physical reality, completeness is evolving, which has the hyperbolic property of intrinsic curvature. Coherence in the structures of the resulting folds provides for the incorporation of Intention and Orientation into the single harmonious framework of Figure 5. Since the dynamics in the folding is manifested in continuous and discontinuous trajectories, both have constraining effects. Based on the established macro-level, it becomes possible to capture the point of destination through the final state attractor. Thus time-directed processing is generating structurally integrated composites. However, since incorporation is the result of gentle changes in the fusion

dynamics, any faithful integration must correct itself during the folding operations. Hence, the function of the point attractors at the terminals of Figure 4 is to control the evolution of a convergent pathway. The aim with the holophors in Figure 5 is to embed the global attractors of Intention and Orientation.

Crucial for the processing of the magnitudes in the determination of the “shape of a holophor” is speed and acceleration as well as the observations on “entangled components” (B. Bierschenk, 2002). Entanglement is the result of intermittent phase transitions. This means that entanglement is determinable through the function of elapsed time. Further, it concerns the expression of thermodynamic flow processes, which are generating structural properties. With growing winding numbers the course of a path is generating increasing rotational distances. Hence, instead of trying to obtain crystallised arrangements of components, the focus is on individual specificity of the holophors.

The Landscapes

At a first glance, there is nothing but geometric patterns of mountains and valleys, which however constitute the abstract configurations of the final singularities. As shown, the final state attractor *Suspicion* is emerging in the English holophor of Intention and only deeply below sea level. The final state attractors are in all cases the result of elaborated courses, which represent substantial bending towards the final outcome. Below or above sea level, integrated in their growing complexity is growing distinctness.

For assessing the meaning of the emergent state attractors, it is essential to conceive the development of their psychological import as result of changes in their degree of complexity. Thus, coupling configurations, related to neighbourhood, prevent ambiguity, because time-dependent coupling, speed, and reversible covalent interface smoothness are generating novel fitness conditions. This novelty is the result of the described fusion dynamics, which is superior when compared with the functional architecture of the classical clustering algorithms.

Orientation

To begin with the graph in the upper right corner, the two highest mountain tops are carrying *Renaissance* (rinascimento) at the left-hand side and *Apostate* (apostate) at the right-hand side. Both are separated by a deep valley and a low barrier. They are the result of considerable substantiation. Baker-Smith (1996, p. 2) writes:

“From such a perspective virtue, whether political or moral, does not come from cloistered innocence or pious idealism but from frank knowledge of the devices that evil may adopt so that they can be countered. At least that is the theory; there remains still the uneasy suspicion that familiarity with the ways of evil will poison the moral imagination.”

The emphasis on *Renaissance* is establishing a need for re-vitalisation. When a situation is observed to be in need of a change, a value is placed on what is observed and requires a modification in orientation. In the foothills appears *Ascension* (ascensio), which implies that the doctrinaire’s devotion to faith is based on the absence of any doubt. It underlines the absurdities one should notify. The believer is not in the position to be concerned with knowledge, nor is he concerned with the individual’s amount of control over the outcomes in a given state of action.

Therefore the *Apostate* makes obvious, that the absurdities of “faith” should be circumvented since it is a strong conviction in something that cannot be proven. The individual gains maximum control to the degree that he can bring about success by any functionalistic means he has to his disposition to control the course of action.

It is interesting to note that the terminus *Heretic* (eretico) marks the final as well as the balancing attractor state, appearing left-hand side at medium height. Hence, the first obligation of a non-believer is to seek knowledge and opt for control of superstition. Furthermore, this term is directing focus towards the contextualisation of wariness and a situation, which also implies a sense of being out of event control. Therefore, it is only natural to expect *Heretic* as the balancing state.

Warning (attenzione) for weird and wonderful experiences, appearing below sea-level, is emphasising a need for matter-of-factness. The implied *Warning* for strange experiences is emphasising a need for realism instead of idealism. Thus, it would be better to deal with “the bad reality” than to turn to “the good divinity” as a way out of quandaries.

Consequently, resistance towards the priestly opinion to leave things to fortune is implied by warning. It points toward those factors which in fact provide the most efficient instruments possible for a re-vitalisation. The reference to *Renaissance* clearly contains a politic-economic indication related to its orientation towards utility. It involves withdrawing from religious canon.

The holophor in the lower right corner is a further expression of componential disparity within and between the pairs of components. For example, the geometric pattern is more compact and carries *Confession* as well as *Foresight* and *Proof* as substantial state attractors. In contrast, *Proposition* appears below sea-level which now marks the indirectness, and consequently the implicitness of a plan or idea. Appearing in the foothills of the background is *Pilgrimage*, which is a reminder on the conviction to base behaviour on faith. However, from the realistic point of view, it is only logical to require a *Proof* to its validity. The eminent dividing line between the intellectuals of Italy and Medieval theology was the exercise of control contra causes which are beyond rational control. Finally, through prescience one can make preparations for minimising the effects of confession.

Intention

The configuration of Machiavelli’s intention is shown in the left-hand graph. Through a reconfiguration and cyclic extraction of the information invariants out of the Objective component, it is demonstrated that the Agent component is causing an important redistribution concerning the articulation of Intention.

The difference between the Orientation and Intention concerns the reappearance of *Renaissance* (rinascimento), however now as part of perspective differentiations. This may be seen as an indication of sensitivity towards the articulation of a need for renovation. However, as the left-hand side shows, *Warning* (attenzione) is the attractor which is directing attention towards the necessity to guard for subsistence. The steep is determining the distance to *Escapement* (fuggire= *Run away*). The dependency relation between both concerns a divergence between run away and concern.

The right-hand side is manifesting structurally the articulation of the condition of *Ascension* (ascensio) which can hardly exist in reality. It must be a matter of faith. On the other hand, the attractor state *Trial* (processo) is marking a need for examination. The aim to gain knowledge, which is a more reliable way of life than worship, implies preparing for *Escapement*.

The holophor in the lower left-hand corner contains information of dissimilar kind. For example, there appears in the foothills the terminus *Pilgrimage*, which means to gain knowledge of the irrational and in tandem with the *Proposition* that knowledge is more reliable than worship. Against this background, *Foresight* just below sea-level is indicating the necessity to guard for subsistence.

The deep seated motifs are *Confession* and *Suspicion*. Evidently, in the perspective of *Foresight* one should keep a watching eye on *Confession* and faith. Moreover, gaining

knowledge of foolish beliefs will prepare for an efficient and rational control of existence. Thus *Suspicion* is a prerequisite for sustaining existence.

Controlling Limits

As a consequence of the processed A-O-disparities, global singularities are supporting the differentiation of the dynamical states of evolution. Changes in the working of the involved A-O-functions have provided the ground for four convoluted Holophors which are carrying fitness landscapes, separated by certain distances in space and time. As shown in Table 1, the global attractor of a holophor is thereby manifesting the all-inclusive particularity embedded in the holophor.

Table 1

Final Attractor States of Intention and Orientation

<i>Language</i>	<i>Global</i>	<i>Intention</i>	<i>Name</i>	<i>Global</i>	<i>Orientation</i>	<i>Name</i>
Italian	T _{A9}	14.8051348	Warning	T _{O9}	11.78984	Heretic
English	T _{A9}	-12.727603	Confession	T _{O11}	26.3266	Proof

Table 1 is reflecting componential “disparity”, which is the necessary condition for the emergence of novel super-symmetries. When measured against the bi-componential disparities, the energy manifested through the global state attractors of intention differs with respect to the fused energy. As proposed, the established fusion mechanism requires a structured task environment. Differences in invested energy are apparently resulting from differences in produced asymmetries. Through this double asymmetry each component in a pair keeps a certain complementary control over the other. As demonstrated, the winding paths have produced novel differences in the patterning of their final singularities. However, in response to the requirements of internal adjustments to the task environment, asymmetric symmetry can also be observed through the balance in the naming relation, e.g. Warning – Heretic.

Maintenance of the non-equilibrium properties through symmetry-breaking operations allows the English system to reflect its own internal dynamics together with the structure of its particular context (its translator). Context-embedded structures are producing constraints, which are influencing perspectivation and consequently, the origination of alternative energy landscapes.

Changes in growth require a linkage to the task of translation, but the translator operates differently on the growth curve. In evolutionary retrospect, it can be concluded that a task forms and reforms one’s manifestation of intention as well as one’s orientation. The energy invested in the A-component of the A-O-pair is demonstrated at the left-hand side of Table 1. Their right-hand side reflects the energy, invested in the O-component.

An overall impression is that the asymmetry in the named relation (Confession – Proof) primarily is the result of the individual writing style, which is controlling the growth rates in the structure. Furthermore, the mechanism for elevating the global singularities of the produced structures seems to be an excellent tool for extracting the energy, invested in the growth curve. Both systemic dependencies and discontinuous local growth factors are evidently responsible for the emerging disparity in perspective and objective.

Since “consciousness” appears through processing and within the limits of the single individual’s ability to express it through writing, reading and rewriting, singularity constitutes the biologically founded frame of reference. A precondition for the study has been that structure cannot be imposed a priori, but it can be discovered and give an answer to the question of what the single individual has been conscious of. Thus, the observed limits are

addressing the kind of structure that has been established during text production. The structurally significant aspects of consciousness have been captured conceptually in the naming of the kinematic states.

Hence, what consciousness exactly is has been established and made visible through the convolutions on the obtained trajectories. To paraphrase Mackenzie (1998), the validity of its computational solution comes from the processing itself, but requires always the presence of a structured context. Besides their capacity to contribute to unification, they converge on the global state attractors.

Discussion

The text materials used can be characterised partly with the absence of “frame factors”, partly with a pronounced degree of softness in the moulding of particular points of view as well as points of observation. The experimental significance of this particular style of writing relates to timing and spacing. Moreover, their relational processing reflects a high degree of implicitness or depth in the development of their kinetic trajectories. But it has also been shown that prismatic variations in the surface of a textual segment is effecting and governing the acceleration and the resulting space properties.

On the kinetic level of text production, it means that increasing depth implies increasing implicitness and consequently enlargement in the fading of textual agents as well as the sinking of textual objectives. However, progress in understanding the biological nature and evolution of trajectories has been shown to depend mainly on the q-function, performed by the dummies, which constitute the evolving channels. As demonstrated, accessing their scope and import is approachable only through a study of the links, illustrated in Figure 1 above, and the observation of intermittent phase transitions.

In particular, the presented results give weight to the hypothesis that rotational dynamics is basic to the effects that selective string movements have on the formation of patterns in the evolving spaces. In adapting some basic concepts of Hestenes (1984a, b) theory of “invariant body kinematics”, nonlinear dynamic movement patterns have been studied on the basis of a scalar component, which has been utilised in the form of radians. These are corresponding to the rotations in the α - as well as in the β -domain of the established flow-fields. It has also been shown that direction and the rotational angle carry ecological validity. Finally it has been made evident that single composites are organising themselves in hyperbolic spaces which are negatively curved. By definition, negatively curved spaces are hyperbolic at any level and require that ordinary geometry is replaced with what has become known as non-commutative geometry.

The study has demonstrated that natural language must be treated as bio-kinematic system, which develops evolutionary and obeys natural law. Through text translation, the processing of asymmetries, and phase transitions, it has been shown that the translator meets the same functional requirements, however, in different ways. The studied texts have made evident that they are producing proliferated and stable trajectories, however, of different kind.

In discussing Machiavelli’s original text, the established global invariants give evidence for empowerment. To clarify this property, it is informative to look at the holophors of the English translation. Contextual differences have produced variations in speed and rotational variability. The manifested effects of expanding and straining operations have remoulded the boundaries of the substructures. Thus changes in articulation of the textual movements have generated shifts in attention, which have become manifest in the folding lines of the trajectories.

In focussing on the global state attractors of the English translation, they reveal obvious differences. For example, the difference in shading is drastic. The captured

theoretical implication gives expression to the idling of the individual. With reference to the produced intentional inclination, the thematic course is manifesting the expression of probing (proofing) in order to provide a possible clarification. At a minimum, this pair of global state attractors serves as the basis for diagnosing knowing through a rational (i.e., experimental) processing of possible mental disorder (i.e., the unreasonable). Therefore, it is instructive to ponder on the following quote of Roger Nett in *Conformity-Deviation and the Social Control Concept*. *Ethics*, 1953, 64, 38-45.

His (Macciavelli), in the large, was a science of rational control through knowledge of irrationsals (Reprinted in W. Buckley (Ed.) (1968) *Modern systems research for the behavioral scientist*, p. 414, Note 4)

In contrasting the produced results, it is obvious that the translation is the source of error in the sense, that the invariants have neither captured the fundamental theme nor the fundamental motif, but have produced differently convoluted landscapes. Since the steep of a mountain corresponds operationally to the degree of realised articulation, depth or height reflects sensibility to a different discourse.

As a rule, it is always possible to associate a word with fused strings, but it has meaning only in the configuration context of a particular space. In this sense, a word communicates the state that a system has reached in the realisation of a certain action. The closeness of a particular name to some other in space and time makes the fusion possible and transforms the entrenched attractors into a unified attractor space representation. Once a new term has come into existence, its transformation through successive states in this space imposes rigour on the process of naming and generates the information specificity of the evolving state attractors. The causal relationships between the underlying morphological configuration of a particular text and the resulting invariants make evident the specificity of the pathways. Alternative termini have emerged concerning motif (Confession), and theme (Proof), which specify a “new“ relation.

References

- Baker-Smith, D. (1996). The serpent and the dove: Political council in Machiavelli and Erasmus. In Leerssen, J. Th., & Spiering, M. (Eds.). *Yearbook of European Studies*. 8. *Machiavelli: Figure-Reputation* (pp. 1-26). Amsterdam and Atlanta (GA): Edition Rodopi, B.A. The Netherlands
- Bertalanffy, L., von (1950/1969). The theory of open systems in physics and biology. In F. E. Emery (Ed.) (1969), *Systems thinking* (pp. 70-85). Harmondsworth, Middlesex: Penguin Books.
- Bierschenk, B. (1984). Steering mechanisms for knowability. *Cognitive Science Research*, 1. Lund University. (ERIC, ED 264 246)
- Bierschenk, B. (1991). The schema axiom as foundation of a theory for measurement and representation of consciousness. *Cognitive Science Research*, 38. Lund University. (ERIC, ED 338 650)
- Bierschenk, B. (1993). The fundamentals of perspective text analysis. *Cognitive Science Research*, 45. Lund University.
- Bierschenk, B. (2002). Real time imaging of the rotation mechanism producing interview-based language spaces. *Cognitive Science Research*, 83. Copenhagen University & Lund University. (ERIC, ED 465 812)
- Bierschenk, B. (2011). Functional text geometry: The essentials of Perspective Text Analysis. *Cognitive Science Research*, 101. Copenhagen University & Lund University. (Lund University: Open Access).

- Bierschenk, B. (Ed.). (2012). Consciousness in Historical Time: Tacitus on the Suiones. *Cognitive Science Research*, 103. Copenhagen University & Lund University. (Lund University: Open Access).
- Bierschenk, I. (1984). The schematism of natural language. *Cognitive Science Research*, 2. Lund University.
- Bierschenk, I. (1989). Language as carrier of consciousness. *Cognitive Science Research*, 30. Lund University. (ERIC, ED 312645)
- Bierschenk, I. (1999). The essence of text: A dialogue on Perspective Text Analysis. *Cognitive Science Research*, 70. Copenhagen University & Lund University. (ERIC, ED 430053)
- Bierschenk, I. (2011). Ett ekologiskt perspektiv på språk och textanalys [An ecological perspective on language and text analysis]. *Cognitive Science Research*, 98. Copenhagen University & Lund University. (In Swedish) (Lund University: Open Access).
- Bierschenk, I., & Bierschenk, B. (2004). Diagnose der Leistungsheterogenität durch die Perspektivische Textanalyse: VERTEX [Diagnosing heterogeneity in achievement through the Perspective Text Analysis: VERTEX]. In W. Bos, Lankes, E.-M., Plaßmeier, N., & Schwippert, K. (Eds.), *Heterogenität: Eine Herausforderung an die empirische Bildungsforschung [Heterogeneity: A Challenge to the empirical Research in Education]* (pp. 16-28). Münster: Waxmann.
- Bierschenk, I., & Bierschenk, B. (2011). Perspective Text Analysis: Tutorial to Vertex. *Cognitive Science Research*, 100. Copenhagen University & Lund University. (Lund University: Open Access).
- Connes, A. (1994). *Noncommutative geometry*. New York: Academic Press.
- Feekes, G. B. (1976). Periodical system of energies. *General Systems*, 21, 155-167.
- Foster, R. G., & Kreitzman, L. (2004). *Rhythms of life. The biological clocks that control the daily lives of every living thing*. New Haven, CT: Yale University Press.
- Greene, B. (1999). *The elegant universe. Superstrings, hidden dimensions, and the quest for the ultimate theory*. New York: Norton.
- Hardison, R. (1999). The evolution of hemoglobin. Studies of the very ancient protein suggests that changes in gene regulation are an important part of the evolutionary story. *American Scientist*, 87, 126-137.
- Hayes, B. (1997). Square knots. *American Scientist*, 85, 506-510.
- Hernández, J. V., Kay, E. R., & Leigh, D. A. (2004). A reversible synthetic rotary molecular motor. *Science*, 306(5701), 1532-1537.
- Hestenes, D. (1986/1993). *New foundations for classical mechanics*. Dordrecht: Kluwer Academic.
- Hestenes, D. (1994a). Invariant body kinematics: I. Saccadic and compensatory eye movements. *Neural Networks*, 7, 79-88.
- Hestenes, D. (1994b). Invariant body kinematics: II. Reaching and neurogeometry. *Neural Networks*, 7, 65-77.
- Kinosita, K. Jr. (1999). Real time imaging of rotating molecular machines. *The FASEB Journal*, 13 (Suppl.), S201-S208.
- Koehler, G. (2011). Q-consciousness: where is the flow? *Nonlinear Dynamics, Psychology and Life Sciences*, 15 (3), 335-357.
- Kugler, P. N., & Turvey, M. T. (1987). *Information, natural law and the self-assembly of rhythmic movement*. Hillsdale, NJ: Erlbaum.
- Machiavelli, N. (1996). *Machiavelli and his friends: Their personal correspondence* (J. B. Atkinson & D. Sices (Eds. and Trans.)). Northern Illinois University Press.
- Mackenzie, D. (1997). Through the looking glass. In arithmetic 5 and 7 can be added in any order to yield 12. When order does matter, you have entered the strange, disorientating

- world of noncommutativity. *The Sciences*, 37(3), 32-37.
- Mackenzie, D. (1998). The proof is in the packing. *American Scientist*, 86 (6), 524-525.
- Malakoff, D. (2001). Prizewinners, no – But not losers. *Science*, 294(5541), 292-293.
- McNamara, K. J. (1997). *Shapes of time. The evolution of growth and development*. Baltimore: The Johns Hopkins University Press.
- Raff, R. A. (1996). *The shape of life. Genes, development, and the evolution of animal form*. Chicago: The University of Chicago Press.
- Thom, R. (1975). *Structural stability and morphogenesis: An outline of a general theory of models*. Reading, MA: Benjamin.
- Vogel, S. (2003). *Comparative biomechanics. Life's physical world*. Princeton, NJ: Princeton University Press.
- Winfree, A. T. (1980). *The geometry of biological time*. Berlin: Springer Verlag.

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