CARTESIANISM AND VECTOR TOPOLOGY IN ECOLOGICAL ELECTROMAGNETISM: NODES, EDGES AND THE DIRECTION OF LINEAR FEATURES AS A MEANS OF CHANGE DETECTION

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ABSTRACT: A*symmetry in nature is produced through the linear direction of displacement events and excess temporality within the ecology. In this way, nature as a set of forces prevents non-linearity from producing symmetry which enables a continuous function. In order to produce cartographic science, topology is used to understand this as a dynamic through which change may be detected. Displacement in time may be measured in ecological electromagnetism through use of the movement in linear features. Thus, moment methods in ecology are studies of movement in spatial features and temporal functions. This paper examines the way in which this new methodology may be utilized as a means of change detection. Nodes, edges and the direction of linear features were prepared topologically as vectors within a GIS program and cross tabulated. The results indicate displacement within the ecological electromagnetism that may be attributed to the contradiction between aspect and density.*

The difference between aspect and density becomes apparent when using direction as a means to distinguish between them. This critical difference also demonstrates that 'direction' may be deconstructed as a term into two categories based upon the displacement variable. Charging and discharging is a useful heuristic to describe direction as it applies to electromagnetism as well as aspect and density. The problem with this approach occurs while appropriating topological and Cartesian coordinate systems within one methodology. Nodes, edges and linear features become skewed as topological and Cartesian coordinate systems are based on different reference points. This form of datum shift also defines the gap between ecological and technological systems that may be corrected by geodesy through differentiation. In this case, topology may not be used to inform the cartesianism because ordinary differential equations (ODE) are not intended to solve geodetic shift but rather shift space. This presents a problem but also raises a fascinating question regarding the contradiction between geodetic shift and shift space. Solving for asymmetric derivatives in different geometries presents the opportunity to construct a non-ordinary differential equation (NODE). In this way, derivatives remain normal while the local tangent (geodetic benchmark) is given a degree of freedom. This enables the cartesianism and vector topology to integrate which gives a degree of freedom to the derivative while normalizing the local tangent. The result is accurate although the resolution is inefficient thus it may be used as a means of change detection through use of movement and displacement.

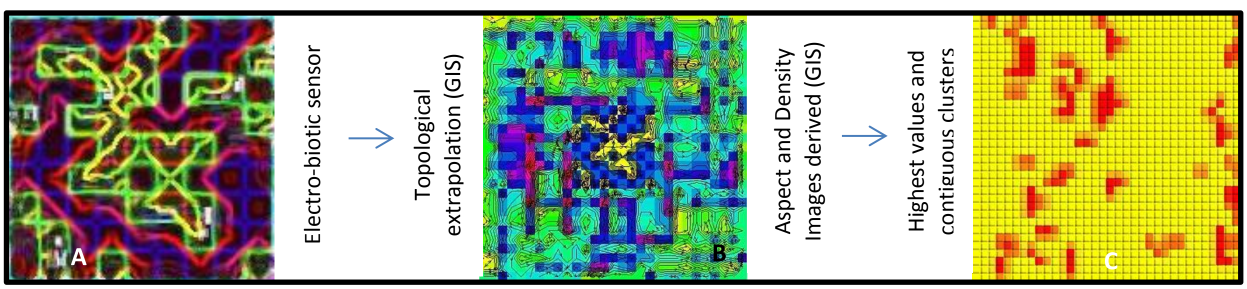

Figure 1. (A) Ecological electromagnetic field image produced with electro-biotic sensor, (B) Topographical extrapolation from original field image demonstrating linear displacement, (C) Clusters with highest density and aspect values with counter-clockwise topological movement and a southerly Cartesian direction in the field.

Often Weierstrass and Banach (1) are used to demonstrate that continuous functions are non-differentiable although as figure 1 indicates this is untrue. Adjointness is used so that every value of x and y has a function that is a function of a real value which is a function of the derivative of x and y. This enables linearity within the process and enables continuity by preventing non-linearity from producing symmetry. This is not deterministic, in order to prevent symmetry, but rather in order to prevent the local tangent from being positioned within a shift space. NODE is used so that geodetic shift may be accounted for based upon the asymmetry in nature (2) which in part argues that non-linearity is non-existent in nature. Vector topology was used to derive azimuth coordinates from an image of an ecological electromagnetic field and digitized using a GIS computer program (GRASS 6.4). The image (figure 1a) was recorded with use of an electro-biotic sensor developed by the author and registered to a plane coordinate system. The topological data was extrapolated spatially based on nodes and edges and a new feature definition image was derived (figure 1b). This feature definition image is topographical and demonstrates that ecological electromagnetism is linear based upon patterns of displacement found within. Aspect and density images were derived from the feature definition image as a means to describe spatial-temporal texture. This enabled a better understanding of directional movement within the ecological electromagnetic field. Density mapping is a difficult process due to the dependence of density upon the direction of linear features and thresholds of continuity. A qualitative image (values 0-2) was produced from the aspect and density images and the most contiguous clusters with the highest value identified. These clusters represent regions of extreme change in the ecological electromagnetic field which were compared to the aspect and density images to produce figure 1c.

Non-conformities in ecological electromagnetism (figure 1c) may be identified through either differential or algebraic topology. Generating surfaces based upon aspect and density within the ecological electromagnetic field requires both active and passive calculations. Algebra is very deterministic while differential equations offer more degrees of freedom although the linearity of algebra offers a freedom while differential non-order grants control. Algebraic forms in differential topology and differential forms in algebraic topology are two completely contradictory processes. Surfaces generated through differential forms in algebraic topology tend to be deterministic and reactionary while the risk accrued is uncertain (3). This presents a problem because it hides the underlying displacement in the structural surface. Differential topology is different than Cartesian topography because their orders are different. In order to uncover the underlying displacements within the structural framework, topographic order must be determined as topological. The topographic reaction may be handled differentially in a number of ways including ODE and NODE. NODE is perhaps preferential because the inherent lack of order (emptiness set) enables the algebraic form to emerge. Linear transformation in NODE occurs through adjointness so that every derivative of x and y, or functor, preserves its algebraic form. Thus, the adjointness in NODE conforms well to The Gap-Burden Method® because it recognizes displacement as a necessary contingent in topological relations. Geodetic shift and shift space contradict as concepts but are resolved through adjointness between space and time. Resolving transformation problems in geodesy may be accomplished by differentialism to the concept functor, or shift space, because the functor may be adjoined (adjunct) to geodetic shift. Image transformation through NODE is accomplished by identification of the vector topology in the base image and direction of linear features [1].

[1] With $(x,y) \in \Theta \times \Theta$
With $(x,y,z) \in \Theta \times \Theta \times \Theta$
$Fn = F \longrightarrow (x,y)$; $fn = G \longrightarrow (x, y), z$
$Z^{(n)} = F(x^2y^2, x^{(n)2}y^{(n)2}, x^{(n+1)2}y^{(n+1)2}, \ldots x'y''), G(z, z^{(n)}, z^{(n+1)2}, z^{(n+2)3} \ldots z')$

This is different than principal components analysis (PCA) which is a very robust transformation in image processing. The Gap-Burden Method® is intended to start with one variable and derives multiple variables rather than the opposite, begin with multiple variables and derive one variable, such as in PCA. Image transformation with NODE is exciting because the shape of the topological map is also different than the shape of the topographic map. In other words, topology and topography are different geometric languages but share similar spatial logic that may be translatable. Geometric heterogeneity becomes secondary to spatial homogeneity under the ecological pressure but parts of the geometric heterogeneity reemerge carrying a part of the spatial homogeneity. This nexus between structure and state expose a hypocrisy that NODE is intended to resolve. The structure of electromagnetism and the electromagnetic state occur in a terrain which is illuminated through their relationship. The structure and the state of the electromagnetism are most akin to a roller and coaster travelling through the field (terrain). This is a continuous and asymmetric process (4) in which the roller and coaster are not permanent fixtures but there is dominant structure and state. Displacement is discovered through this iterative rectification between topology and topography as is evident in figure 2. Displacement is registered in the root mean square error (RMSE) which indicates the gap between transformations and burden of rectification. The topological gap and the topographic burden are recalculated according to The Gap-Burden Method® and a Gap-Burden Index® value produced (figure 2). Linear transformations are not considered rubber-sheeting which requires a more robust differential equation. But, NODE is intended to algebraically stretch the topography across the topology in order to identify gap and burden. The iterative formula helps to adjoin the geodetic shift and shift space into a new feature definition image. Movement in the time series, produced through NODE, is recorded and change detected according to field flow. This approach is different than existing methods for pair approximations in different spatial geometries (5) which are still theoretical. The conclusions of this study on NODE are developed from field data and exceed expectations from other theoretical works. Results demonstrate that the direction of linear features is a good indicator of general change although the topological information, such as nodes and edges, still provides the necessary accuracy.

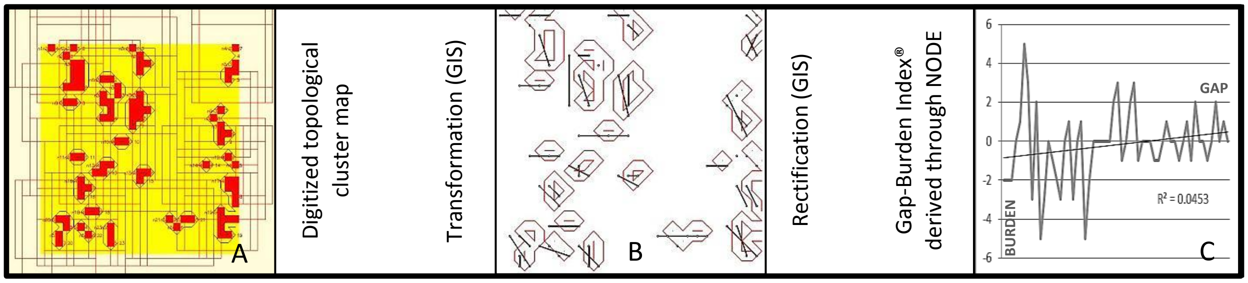

Figure 2. (A) Topological cluster map with highest density and aspect field values, (B) Displacement in the ecological electromagnetic field discovered during the transformation / rectification, (C) Chart that demonstrates a Gap-Burden Index® of the ecological electromagnetic field through non-order differential equation (NODE).

This research raises questions regarding the role of drift in physics and its treatment with regard to processes of ecological electromagnetism. Drift in physics and shift in electromagnetic geodesy (geodetic shift and shift space) are essentially the same and must be examined as such. The result of the collaboration between the two terms is significant because the normative contribution of their separation is contradictory and damaging to science. If asymmetry and non-order are inherent to nature, ecology and electromagnetism than stochasticity may be conserved. The conservation of stochasticity is important because it is an environmental variable that is difficult to identify corporeally. Other approaches of analysis, such as co-inertia, partial triadic and redundancy (6), may be classified as Wiener processes and disregarded. The line between variability and stochasticity is very fine and any simultaneous analysis demonstrates that stochasticity remains a more dominant variable in the electromagnetic structure while variability rules the electromagnetic state. As table 1 indicates, the structure-state debate may be demonstrated statistically as a lag between geometric heterogeneity and spatial homogeneity.

	STRUCTURE-STATE 1	STRUCTURE-STATE 2	STRUCTURE-STATE 3
ODE (x'y')	**10,15 or 15,15**	**9,11 or 11,12**	**14,17 or 15,21**
NODE (x'y''z)	**10,15,5**	**9,12,3**	**14,21,7**
GAP-BURDEN INDEX®	**5/0**	**3/2**	**7/3**
RESULT (out of 10)	***0***	***1.5***	***2.3***

Table 1. Comparison of Ordered Differential Equations (ODE), Non-Order Differential Equations (NODE) and Gap-Burden Index® for three structure-state relationships in the ecological electromagnetic field (see figure 2b).

The tendency in statistics and mathematics to fill the gap between structure and state with an average has presented a dilemma for disciplines such as ecology and geography. The dilemma is in the fact that structure and state cannot be mediated directly unless through a contextual variable such as the ecology or landscape (7). The use of the Z variable in NODE, as derived from the Gap-Burden Index®, indicates that displacement is the keystone.

References

1. Eves, H. 1990. *An Introduction to the History of Mathematics* (6th ed.). Brooks Cole, New York.
2. Manspeizer, N. 2011. *The Topography of Terra-Incognita: Machine, Nature and The Gap-Burden Method®*. Charleston, NC: Create Space Publishing.
3. Manspeizer, N. 2007. Modeling the Hyperreal Dimension with The Gap-Burden Method™: Social-Ecological Change in the Laramie Range, Wyoming and the Asymmetry of Time. *The Middle States Geograph*. 40: 88-95.
4. Bott, R. and L.W. Tu. 1982. *Differential Forms in Algebraic Topology*. Springer-Verlag, New York.
5. Van Baalen, M. 2005. Pair Approximations for Different Spatial Geometries. In *The Geometry of Ecological Interactions: Simplifying Spatial Complexity*, U. Dieckmann, R. Law and J.A.J. Metz (eds). Cambridge University Press, Cambridge. Pp. 359-387.
6. Thioulouse, J,. M. Simier and D. Chessel. 2004. Simultaneous Analysis of a Sequence of Paired Ecological Tables. *Ecology* 85(1): 272-283.
7. Manspeizer, N. 2006. The Mediation of a Functional-Aesthetic Landscape in New England: New Braintree, Massachusetts and the Identity of Place. *The Middle States Geography* 39: 84-92.