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Alcohol abuse and dependence as a loss of the stretch-and-fold capacity

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Resumen

De acuerdo con la rigidez de los esquemas convencionales del diagnóstico psiquiátrico se diseñó y evaluó la versión no lineal (NLPDAT) de la prueba diagnóstica de alcoholismo de Taiwán (PDAT) mediante el modelo de Rössler.
Se aplicaron los 24 nodos-síntomas del NLPDAT a 407 pacientes taiwaneses.
La trayectoria mecánica del tiempo del PDAT fue transformada en el tiempo fractal. Los requerimientos de las tres variables y parámetros implícitos en las ecuaciones diferenciales de Rössler fueron satisfechos a través de las diversas expresiones numéricas de los nodos-síntomas del NLPDAT.

Se demostró empíricamente que los 288 pacientes no alcohólicos presentaron un atractor que se estiraba y plegaba, mientras que las trayectorias de los nodos-síntomas del NLPDAT de los 46 y 73 pacientes diagnosticados como abusadores y dependientes al alcohol tendieron a exhibir patrones rígidos, inactivos y auto degradados.

Concluimos que la participación de la teoría del caos en la integración diagnóstica del alcoholismo, simplemente evidenció que existen limitaciones de los aspectos lineales, determinísticos y reduccionistas para describir el abuso y la dependencia al alcohol.
Palabras clave: alcoholismo, diagnósticos, modelo de Rössler y atractor sano.

Abstract

The non-linear version of the Taiwanese Alcoholism Screening Schedule (TASS) was designed (NLTASS) and evaluated through the adaptation of the Rössler model, due to the rigidity of the usual psychiatric diagnostic schemes.

The 24 symptom-nodes of NLTASS were applied in 407 Taiwanese patients. The track of the mechanical time of the TASS was transmuted into fractal time. The requirements of the three variables and parameters implicit in the Rössler's differential equations were fulfilled through the different numerical expressions of the NLTASS-symptom-nodes.

It was empirically demonstrated that the 288 non-alcoholic Taiwanese patients showed a stretch-and-fold healthy attractor, while the trajectories of the NLTASS-symptom-nodes of the 46 alcohol abusers and 73 alcohol dependents tend to exhibit unbending, inactive and self-degraded patterns.

We concluded that the performance of the chaos theory in the diagnosis of alcoholism simply points out the limitations of the linear, determinist, reductionist approach in the attempt to describe the alcohol abuse and dependence.

Key Words: Alcoholism, Diagnoses, Rössler model, Healthy attractor.

Introduction

Health is chaotic (1-3)! Chaos provides the body with enough flexibility to respond to various stimuli (4). Since 1973, Shainberg argued that mental illness, which appears chaotic, is actually paradoxical (5). On the contrary, in 1992, Preussner and collaborators (6) asserted that alcoholism has the connotation of a strange attractor. However, none of them could empirically demonstrate the presence or absent of a strange attractor of health (1-3), mental illness (5) or alcoholism (6) respectively. Therefore, it was postulated that alcoholism -alcohol abuse and dependence- is not a dynamical illness (7, 8, 9) and that non-alcoholism is characterized by the presence of a healthy attractor. Briggs and Peat (7) encouraged this survey by replacing the

conventional track of mechanical time in the diagnostic integration with the fractal time. The design of a self-catalytic diagnostic instrument1 (10), in order to obtain diagnostic phase portraits and fractalgraphies (12), was followed by a geometric method adequately derived from dynamical systems (13).

Materials and methods

Sampling

The 407 patients explored with the Taiwanese Alcoholism Screening Schedule (TASS) in the city of Taipei, conform a more or less bias controlled sample, that has been described in detail elsewhere (14). The clinical interview, exploration and testing were done according to the ethical considerations stated in the Helsinki Declaration and with the signed consent of the patients, based on their free will to participate in this study. Before the survey began, the Local IRB -Ethics Committees- approved the undertaken explorations. The clinical diagnosis was established in accordance with the DSM-IV criteria (15). Well-trained interviewers, whom were unaware of the results of the TASS, conducted the interviews (14).

Transformation of the primary 24 linear TASS-items into a fractal symptom-nodes' distribution

In order to soften up the monotonic TASS arrangement -reported entirely somewhere else (14)-, its 24 items, following the nonhierarchical network (16) and the principles of the medical semiotic process (17), were remodeled as symptom-nodes and examined through nine clinician features: 1) Positive and negative clinician-data (+cd; -cd2); 2) Early age of the first drink data (AFDd) (23), with which the required psychopathological initial conditions (pic) (24) were fixed.

To prevent the pic's concomitantly confounding or distortion effects (25), the AFDd, related with the appearance of the initial symptom-node, was standardized equal to 0; 3) Through the ordering-data (od), the fractal sequence of the symptom-nodes was implemented, in accordance to their incidence after the AFDd (23); 4) The time-data (td), related to the dissemination velocity of the symptom-nodes, is circumscribed to the time (t = days) that any symptom-node required to appear in linkage with the AFDd (23); 5) The time-nodes (tn) comprehend the number of symptom-nodes answered positive; 6) The proximity-data (pd) engaged the number of links that separate each pair of symptom-nodes (16); 7) The saturation-data (sd) attached the number of symptom-nodes that are connected directly with each of the symptom-nodes; 8)

The relation-data (rd) concern to the distance between each pair of symptom-nodes measured by a 7-point scale (16); and 9) The steps of time-increment (sti) are related to the stepwise integration of the diagnoses.

Development of the Non-Linear Taiwanese Alcoholism Screening Schedule (NLTASS) through a stretch-and-fold diagnostic operation

Considering that the nine clinician features were developed in accordance with the three theoretical dimensions of the medical semiotic system (17), the clinician components of each of the NLTASS symptom-nodes were also tested with the four three-dimensional ordinary differential equations in the used Harold's software 3 . By comparing their respective fractal dimensions, first, through the bifurcation diagram of Sparrow (27), and second, by the partial control-phase portrait of qualitative behavior (28), the Rössler system (29) showed consistency in giving the best resolutions for the three clinician diagnostic entities.

The interaction of the defined nine clinician attributes that amalgamate each symptom-node incited to redesign the original linear structure of the TASS -depicted in its entirety elsewhere (14)- as a dynamical test material. With the target to ensure the validity and reliability of the stretching-and-folding operation of the NLTASS as the nonlinear diagnostic machine (7), the three variables and adjustable constants coefficients or parameters (10) of the Rössler model of three first-order equations (30) were adapted to operate with the clinician values of the nine clinician features.

Adaptation of variable x

It determines the trend (31) and synchronization (32) of the velocity of the 24 symptom-nodes that, by operating as diagnostic trajectories or orbits, are able to shape the three diagnostic doughes of the NLTASS (30). The velocity is proportional to the 24 NLTASS symptom-nodes dissemination speed of the diagnostic trajectories (33), which was estimated by the td distribution of the symptom-nodes (tn) (34). This first variable is also proportional to the parameter b of the third equation [z' = b + z (x - c) (3)] that is defined as the size of each of the diagnostic regions, which were estimated through the ratio of sd and cd+ indicating their relative sizes (30, 28). For example, the first NLTASS symptom-node has a correspondence with the AFD of the subjects transformed into days. Therefore, the AFDd is proportional to the intensity of the diagnostic convective motion (30). To establish the required pic, the early age was related with the appearance of the initial symptom-node.

Considering that the x-velocity of the NLTASS symptom-nodes dissemination is proportional to the distances for each pair of NLTASS symptom-nodes -b-parameter-, when x > 0 the 24 NLTASS symptom-nodes disseminate clockwise, while when x < 0 the 24 NLTASS symptom-nodes disseminate counterclockwise. Therefore, this x(t)-variable operates as a time dependent coefficient or amplitude of the symptom-nodes dissemination in accordance to the x2y-solution, which conduces the orbit spirals of the symptom-nodes around twice in the positive half space when x > 0 and one time in the negative half space when x < 0 (30).

Following the conjectures of Thompson and Stewart (28) and, Abraham and Shaw (35) to conserve the circulation principles as a time diagnostic integration and to sensitize the original velocity and distribution of the orbits to the diagnostic time and motion spreading of the symptom-nodes, the time-data of the symptom-nodes was transformed into a harmonic time mean (hm) 4 . To make fluidity the strength of the symptom-nodes td, variable x was assumed as a hm diagnostic td, which is divided by the cardinality of the conjunct (cc)5 diagnostic time integration, that is determined by the occupied tn: td-hm/cc-tn.

Adaptation of variable y

It determines the route and the managing of the oscillation of the diagnostic orbits. Therefore, y is proportional to the rd difference between the ascending and descending NLTASS symptom-nodes (34,35) in accordance to their paths as independent frequencies in the respective diagnostic dough. The oscillation component of the diagnostic integration is feasible, because y-variable, as a symptomatic oscillator -with x-variable-, has a correspondence with the first term in the Fourier series expansion (28) of the symptom-nodes rd. Therefore, the Fourier series were adapted as a diagnostic analytical theory of the distance among symptom-nodes, because the infinite series indicated the sum of the distance terms of a symptom-nodes rd vibration sequence. In the case of an infinite symptom-nodes rd wavering sequence, this diagnostic series can have an unlimited number of pounding symptom-nodes6 . The Fourier series of the symptom-nodes rd are transformed, in the analysis of a diagnostic distance-geometry, into its constituent sin distances of different frequencies of the symptom-nodes and the enlargements of the rd, with which is possible to describe a symptom-node undulation with a rd solution on one side of the respective diagnostic region7 .

Considering that y is proportional to the rd distance of the convective diagnostic motion (30), the oscillation conduces the pattern of the diagnostic trajectories around the single spiral. Consequently, there is one sheet in which the diagnostic orbits spiral towards. When the distance from the center of such a diagnostic spiral becomes larger than some particular inception, the solution is ejected from one constituent of the spiral and attracted by another fraction of the same diagnostic spiral, where it begins again to spiral the central parts and so, the game is repeated.

Following the Rössler's conjectures (36), to make equivalent the more general principle for generating a diagnostic spiral type of chaos by combining a two-variable (y and x) oscillator and determine the frequency associated with one rd-oscillation how fast the symptom-node orbits

and circles the diagnostic dough, the rd among the symptom-nodes was added and divided by the sum of the cc-rd. To preserve the required evenly balance of the variation pattern between high and low values of the symptom-nodes rd, the y-variable, operationalized as the ratio of (Srd/Scc-rd), was the suitable adaptation for using the Fourier coefficients sn(rd) n and d(sn) n 8 as the rd-short and rd-long directions through and around the diagnostic holes respectively.

Adaptation of variable z

It is a coefficient (28,30) constituted by the direction (31) of the fractal time (7,33) and the arrangement (32) of the 24 NLTASS-symptom-nodes, which integrate the three NLTASS-diagnoses through a diagnostic switching-type subsystem. Therefore, the z-variable is proportional to the distortion of the vertical NLTASS-symptom-nodes from its nonlinear diagnostic structure, which is linearly related with the rd among NLTASS-symptom-nodes. For example, through the rd-behavior the z-variable becomes large, with which the z-term in the first equation [x' = -y - z] comes into action (28,30) to integrate a diagnosis through a particular self-restoring activity of the symptom-nodes (28). Thus, by turning the diagnostic z-direction of the fractal time back on (z-ON!), the next rd that is related with the NLTASS-symptom-nodes behavior, follows the assumptions of 0 < a < 2-rd and b, c > 0 (34).

Following the conjecture of the z(t)-motion that produces a folding on the NLTASS-symptom-nodes dynamics back to the region near to the diagnostic center of the symptom-nodes' spiral motion (32), the rd-sum, that is divided by the sum of the cc-rd, was switched into the logarithmic transformation 9 with which the connotation of the z-coefficient was restored. The logarithmic rd-ratio was multiplied by the golden ratio, that ensures maximal distances among symptom-nodes' trajectories 10 , to reproduce the diagnostic switching-type subsystem of the z-variable, the original effect of the vertical distortion factor to generate the respective attributes of magnitude, distance and maximum width of the diagnostic orbits that depend on the rd of the clinician features. Therefore, the z-variable was estimated as the log (Srd/Scc-rd)*9.839.

Adaptation of parameter a or Prandtl number

It determines the merge of the diagnostic trajectories or orbits through the ratio of the viscosity of the fluid to the thermal conductivity (vf/tc) (37). The a-parameter is the diagnostic flow-course issue of the symptom-nodes boundary layer near the diagnostic separation points. It denotes the diagnostic boundary between no large-c orbits of symptom-nodes and some large-c diagnostic orbits (27). By implementing this essential constant in the integration of the NLTASS diagnostic system (37), the bifurcation fractalgraphy (12) becomes a three-dimensional diagnostic integration (27) and, assesses the divergence of the healthy or non-alcoholic attractor (38) as a turbulent object (39). Therefore, the a-parameter contributes to the dynamical diagnostic solution (28).

Following the Sparrow's conjectures (27) to preserve the dynamical essence of a as a diagnostic parameter of the flow-course of the symptom-nodes, the rd-ratio and sd-ratio transformations were implemented to the original a-ratio (37): a = rd-ratio/sd-ratio. Both, the numerator -rd- and denominator -sd- of a-parameter were assumed as positive-valued random variables: X to Y = 1n X. It was also presumed that Y has a diagnostic normal distribution of the distance between each pair of symptoms measured by the 7-point scale (16), in order to apply the ratio transformation. Consequently, it was presumed that X has also a diagnostic normal distribution of the number of symptom-nodes connected directly with each of the symptom-nodes.

To determine the distance matrix of the symptom-nodes, the numerator was assumed as a logarithmic transformation of the rd-summation, the denominator was assumed as logarithmic transformation of the sd-summation. The number of positive clinician-data (cd+) was implemented as a multiplier: [(logSrd)/(logSsd)] * (cd+) in order to prevent the implicit deactivation or slow down of the utmost diagnostic relation and saturation likelihood.

Adaptation of parameter b

It determines the stretch of the diagnostic trajectories and the size of each of the diagnostic regions (40). The length has a correspondence with the NLTASS diagnostic boundaries or cut-off points of the original TASS. The diagnostic size of non-alcoholism varies between 0 and 7, alcohol abuse between 8 and 21 and alcohol dependence between 22 and 36 -the psychometric TASS-structure has been described in detail elsewhere (14)-. The height of each diagnostic entity was operationalized as the respective number of positive clinician-data (cd+). Correspondingly, the larger the number of the symptom-nodes connected directly with each of the symptom-node -sd-, the higher the loss of the stretching activity that carries the alcohol abusers and dependents to a state of lower complexity, while non-alcoholics present unsystematic fluctuations. Complexity in the body may be a way to avoid strictly periodic behavior, which could be very destructive (3) in cases such as the intake of alcoholic beverages. Ensuing the conjectures of Sparrow (27) and, Thompson and Stewart (28), the maximal length of the diagnostic region was assumed as the hm of the sd, and the product was divided by the cd+. To obtain the maximal size of the three diagnostic regions, the maximal length was divided by maximal height (l/h) that has a correspondence with the cd+. In accordance to the substitution of both original terms -l and h- of the b-parameter, and considering the variability of those characteristics within the three diagnostic regions and the cd+, both terms suffered a logarithmic transformation: log[(sd-hm/cd+)/(cd+)].

Adaptation of parameter c or Reynolds number

It is a threshold for switching on the 24 NLTASS-symptom-nodes' nonlinear folding action (28, 31, 33, 34). It embodies also a diagnostic dimensionless flow-course parameter of the NLTASS-symptom-nodes (31,34), which is one of the major criteria for the behavior of natural free convention of the diagnostic integration. Therefore, the c-parameter represents the theoretical interpretation of the associated stability of the diagnostic fractalgraphies (12). The complexity of c is provided by a ratio that comprises the functions of driving to damping the diverse symptom-nodes (28), which are represented by five of the nine clinician aspects: cd+, od, pd, sd and rd. Hence, the c-parameter acts as a measure of the imposed symptom-nodes difference between the pd of the diagnostic solution layer and the sd. Due to this, the c-parameter also acts as the convective diagnostic motion (33).

To facilitate the adaptation to the dynamical diagnostic integration, the Rayleigh number was substituted by the conjunction of the four terms that are distributed into the numerator and denominator of the c-Reynolds number: c-Re = rVL/m. Following the essential motion aspect based on the temperature difference of the plates established in the Rayleigh-Bénard convection, which is economized by the c-Reynolds number, three (r, V and, m) of the four terms (L) of the c were estimated through the maximal ranges of the respective clinician-values of the NLTASS-symptom-nodes into each of the cc-diagnostic entities. In accordance to the original meanings of the numerator and denominator, the three numerator terms (rVL) were transformed into the diagnostic initial forces or acceleration terms, while the single denominator term (m) was changed into the diagnostic density force or density term (41) of the NLTASS-symptom-nodes.

Then, the foremost definition of each term was replaced with the clinician features counterparts.

For example, the original definition of r as the fluid density, was substituted by the saturation of the NLTASS-symptom-nodes, which was estimated by the Ssd of each cc-diagnostic entity, because the more saturation of the symptom-nodes (41), gives the minor behavioral flexibility (1-4,7). The term V has a correspondence with the rd of the 24 NLTASS symptom-nodes that was calculated by the Srd and in accordance to each cc-diagnostic entity, because the more relation between each pair of symptom-nodes, the slighter behavioral plasticity or adaptability (1-4,7). The last numerator term L was converted into the characteristic Length of the NLTASS's diagnostic scale, which is equal to the respective od of the cd+.

The implication of the density force of the single denominator term (m), which dives the convective diagnostic motion (33), was related with the specific pd of the NLTASS symptom-nodes. This distance was estimated by the potential maximum of the number of links that separate each pair of symptom-nodes and the pd of each cc-diagnostic entity, because the more number of links that separate each pair of symptom-nodes (41), the fewer diagnostic negative feedback loops (7,30) and the lessened behavioral expression of creative degrees of freedom (7).

Ensuing the conjectures of Sparrow (27), Thompson and Stewart (28), Steeb (32) and, Brown (42) to preserve the dynamical essence of c-parameter as a diagnostic threshold for switching on the 24 NLTASS-symptom-nodes' nonlinear folding action (28,31,33,34), the critical value of c = 5.7 was implemented as the diagnostic boundary assessment. Therefore, the cc of each diagnostic entity was obtained by the logarithmic transformations of their respective sums (sd, rd and pd), which made possible the reconstruction of the fractional connotation of the c-parameter. This adaptation preserves the original c-performance, where the interval between the diagnostic bifurcations increases rather rapidly as c increases.

The previously theoretical adaptations were substituted by the recommended real-world data (39,43), that are the nine clinician features enclosed in the symptom-nodes, in order to transmute the threshold for switching on the 24 NLTASS-symptom-nodes' nonlinear folding function of the c-parameter into the expected bifurcation of the periodic symptom-nodes orbits (37). For example, the numerator rVL was assumed as an expression, which was obtained by the real part, defined as the maximal sd and rd of each symptom-node. To operate with the symptoms-nodes as diagnostic initial forces or diagnostic acceleration data, the r-sd and V-rd were adjusted as the logarithms of each of the cc-diagnostic entities, and the od, as the characteristic Length of the diagnostic scale, was established by the potential maximum of cd+. Therefore, the first numerator term was estimated as r = log(cc-sd), the second term as V = log(cc-rd) and the third term is equal to L = od-cd+.

The single denominator term (m) that concerns to the density force (41) of the diagnostic integration, was assumed as the diagnostic potential maximum range of the pd or diagnostic whole part, that concerns to the real nearness of the symptom-nodes, in this way the c-parameter was accomplished. To homogenize the diagnostic density data (41) with those of the numerator, the pd was adjusted as the logarithms of each of the cc-diagnostic entities through the next expression: m = log(cc-pd), which indicates that the maximal cc-proximity of the maximal diagnostic region is determined by the number of links that separate each pair of symptom-nodes or diagnostic whole part.

The fundamental proposal of the Rayleigh-Bénard transference that was operationalized by the c-Reynolds number, conditioned the transformation process and maintained in each adapted term the primary implication as shown in the next equivalence statement.

$$c\text{-}Re = rVL/m = \log(cc\text{-}sd)\ \log(cc\text{-}rd)\ od\text{-}cd+/\log(cc\text{-}pd)$$

Adaptation of the time steps Dt

It determines the stepwise integration of the diagnoses. The time steps or time stop or logarithm (log) of the td-hm increment in days, preserve the multidimensionality of the diagnostic pattern. Through this issue the required diagnostic time-dependent plot is developed. The td is displayed on the x-axis as the number of iterations performed, which is very useful for examining intricate bursts such as those near the diagnostic interior crises (26) of the diagnostic fractalgraphies (12).

Following Harold's conjectures (26) to ensure the adequacy of plotted symptom-nodes, the number of iterations was estimated for each diagnostic entity. Therefore, the original linear diagnostic range was converted into a fractional td dimension inside the respective diagnostic region by implementing the logarithmic transformation of the hm of the time-in-days of each of the 24 NLTASS symptom-nodes (22). It was assumed that the logarithmic transformation of an

hm is the reciprocal of the td arithmetic mean of the mutual time-in-days of every symptom-node. Therefore, log(td-hm)/100 estimates the steps of the time increment (sti), where the division of the constant ensures the fractional stepwise integration of the diagnoses.

Operationalization (44) of the medical semiotic process as a stretch-and-fold diagnostic operation

Given that the diagnostic elicitation measures the relationships among a set of clinician features, the six terms of Rössler system (29) were implemented to establish the analogy with the medical semiotic, which concerns to the science of the symptoms in medicine. Since 1928, Carnap introduced the three semiotic theoretical dimensions into the diagnostic process (17).

The four clinician features of the first semantic dimension were related with the fractal-time diagnostic integration. This definitional aspect was operationalized through the second equation of the Rössler system (29). The y'-equation has, functionally, a correspondence with the stretching a-parameter. This term is linked with the improvement and modifications of the trajectories, which have repercussions on the behavior of the symptom-nodes' orbits in the diverse diagnostic regions.

Through the second or pragmatic dimension it was possible to arrange the clinician values of cd, od, sd and pd with their respective clinician consequences. The linking function of this semiotic theoretical dimension was operationalized through the particular position of the b-parameter and c-parameter in the third differential equation of the Rössler model. Therefore, the required diagnostic interpretation or meaning of the four clinician aspects of cd, od, sd and pd was obtained with the concurrence of both parameters. For example, the b-parameter extends the diagnostic sections by spreading out the clinician consequences as diagnostic orbits. Thereafter, c-parameter buttons on the symptom-nodes into a diagnostic folding attainment.

TABLE I

TAGGING OF THE NINE CLINICIAN FEATURES IN CONCURRENCE WITH THE THREE MEDICAL SEMIOTIC DIMENSIONS (17) AND THEIR SPECIFIC STATEMENT OF THE THREE-DIMENSIONAL ORDINARY DIFFERENTIAL EQUATIONS (30,31,33)

Semantics	Pragmatic	Syntactic
Development and changes of the connotations of the symptom-nodes	Value or judgment of the symptom-nodes by their clinician consequences	Assemble of the relationship among the symptom-nodes forming diagnoses
Stretching of the symptom-nodes and spiraling out from the diagnostic origin (*a*)	Size of the diagnostic regions given by the stretch of the diagnostic trajectories (*b*)	Oscillation of the symptom-nodes (*y*)
	Threshold for switching on the symptom-nodes into a diagnostic folding action (*c*)	Diagnostic switching-type subsystem of the symptom-nodes (*z*)
$y' = x+ay\ (2)$	$z' = b+z\ (x-c)\ (3)$	$x' = -\ (y+z)\ (1)$

Early age of the first drink data (*AFDd*)'
time-data (*td*)
time-nodes (*tn*)
steps-time-increment (*sti*)

clinician-data (*cd*)
ordering-data (*od*)
saturation-data (*sd*)
proximity-data (*pd*)

relation-data (*rd*)

$y' = (td\text{-}hm/cd+)+\{[[\log\Sigma rd/(\log\Sigma sd)]^{*}(cd+)]^{*}(\Sigma rd/\Sigma co\text{-}rd)\}\ (2)$

$z' = \{\log[(sd\text{-}hm/cd+)/(cd+)]\}+\{\log(\Sigma rd/\Sigma co\text{-}rd)^{*}9.8\}^{*}\{(td\text{-}hm/co\text{-}tn)-[(\log(co\text{-}sd))^{*}(\log(co\text{-}rd))^{*}(od\text{-}od+)]/(\log(co\text{-}pd))\}\ (3)$

$x' = -\{(\Sigma rd/\Sigma co\text{-}rd)+[\log(\Sigma rd/\Sigma co\text{-}rd)^{*}9.8]\}\ (1)$

$\Delta t = \log(td\text{-}hm)/100$

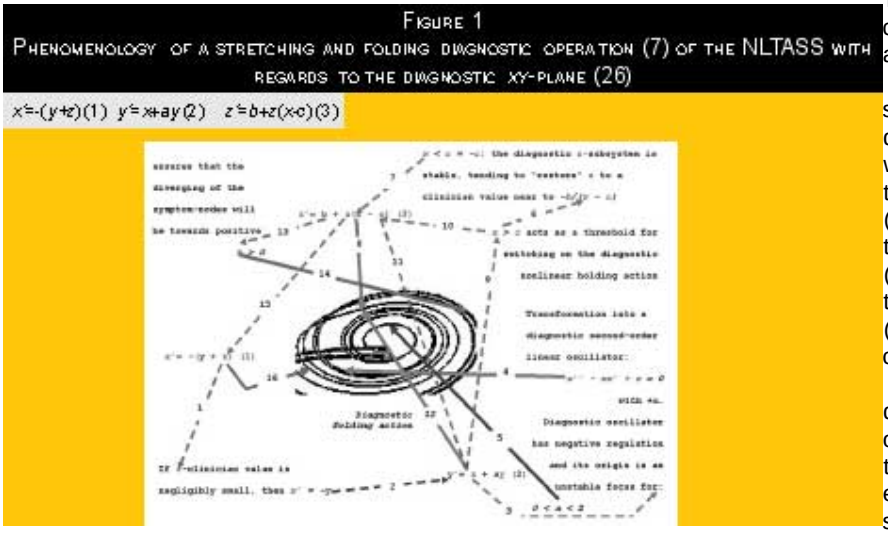
' *x* related with *AFDd* (23) which is proportional to the intensity of the diagnostic convective motion that fixed the required *psychopathological initial condition* (*pic*).

With the third or syntactic dimension, the formal diagnostic relation of the clinician features among themselves was established. The *rd*-clinician attribute was activated with the trajectories of *y*-oscillation and *z*-switching operations of the first-order equation that interlaces the connection among the symptom-nodes fusing diagnoses. Therefore, these three theoretical dimensions of the semiotic model (17) are equivalent to the equational system, defined as a collection of laws of motion for a point at coordinates *x*, *y* and *z* in three-dimensional

diagnostic space (30) (Table I).
To link the clinician network that is nested into the 24 symptom-nodes of the NLTASS with the Rössler's *model of a model* (36), the respective components were conducted to a reciprocal dynamical system (13). It gives a functional explanation of the solution of the adapted mathematical model (45) through the description of the diagnostic system disposed (Figure 1) by combining the nine clinician components that are enclosed in each symptom-node. Therefore, the nine clinician attributes and the mathematical properties of the three variables and the three parameters of the Rössler's model were incorporated in the dynamics of the three theoretical dimensions of the medical semiotic system (17).

The original nonhierarchical network (16) properties are related to the cognitive connectionism model, which concerns to the relationships between the number of nodes with the respective exclusion of the description and analysis of the dynamics (46). To impregnate with dynamics, the 24 nodes were coupled into an interactive network (46) through the used sets of self-catalytic differential equations 11 (10). By amalgamating both assets, the nodes were loaded up with the three dimensions of the medical semiotic network. These dimensions were motioned with the six mathematical terms of the third-order system of equations (33) that contain only a single nonlinear term -of second order, zx- with which the flow of a single spiral is generated. The outer portion returns, after an appropriate twist -formation of a Möbius band 12 - towards the side of the same spiral, with the outermost parts facing again the more central parts (36). The primary semantic fractal time stretching and spiraling out from the diagnostic origin, that was operationalized through AFD, AFDd, td, tn and sti, was conduced to a singular diagnostic region conformed by stretching the sd and cd+ clinician features. This region was sustained by the folding of the rd, td, sd, od, cd and pd clinician features through a pragmatic threshold for switching on the single rd-medical-syntactic-attribute that produced the oscillation of the symptom-nodes' trajectories with the support of diagnostic switching-type subsystem. The original phenomenology of the simple autonomous diagnostic system (28) was adapted by using the clinician features provided by a non-alcoholic Taiwanese patient. Thus, to demonstrate empirically the interaction of those data with the respective mathematical components, what makes evident the configuration of a healthy attractor (Figure 1).

FIGURE 1
PHENOMENOLOGY OF A STRETCHING AND FOLDING DIAGNOSTIC OPERATION (7) OF THE NLTASS WITH REGARDS TO THE DIAGNOSTIC XY-PLANE (26)

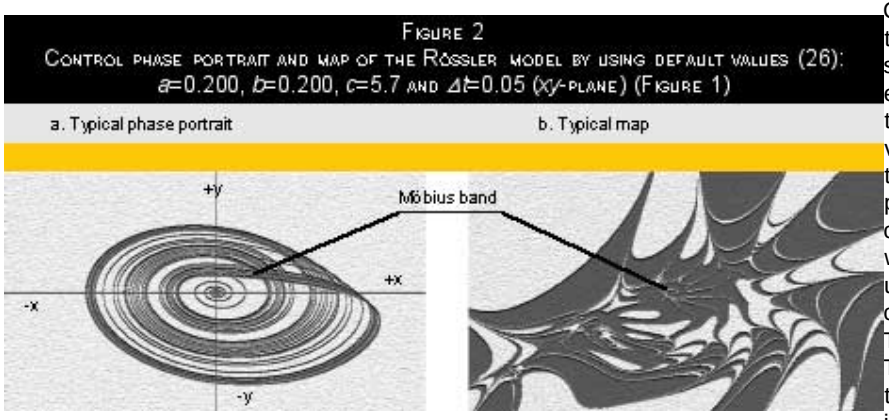


The Rössler's chaotic attractor, as a linked NLTASS symptom-nodes' set of recurrent diagnostic states, was derived from the Lorenz model (28,36,37). Where the three variables (*x*, *y* and *z*) and the three parameters (*a*, *b* and *c*) are components of the dynamical diagnostic system of alcoholism, given that the spreading effect of the symptom-nodes is achieved with only linear terms: *y*, *a,* and *c*, because the clinician meaning of *x* and *z* in [*z' = b + z (x c) (3)*] is the diagnostic single nonlinear term. To confine the spreading action of the symptom-nodes within a bounded attractor, the clinician nonlinear term -*x*, *z*- is required. On the contrary, if the full diagnostic system of three equations was linear, the spreading would merely continue as all trajectories of the symptom-nodes diverge to infinite distance from the diagnostic origin. The spreading effect may be cancelled during the folding action of the symptom-nodes (Table I).

The diagnostic constant c in the third equation [z' = b + z (x- c) (3)] acts as a threshold for switching on the diagnostic nonlinear folding action over the other two equations: (1) and (2), shown in Figure 1 following the dotted arrows 11 and 14 projected from c (Table I).

Considering the third equation [z' = b + z (x- c) (3)] alone or with the diagnostic z-subsystem, whenever the clinician value of x is less than the diagnostic constant c, the coefficient of z is negative and the diagnostic z-subsystem is stable, tending to restore to a clinician value near to: -b / (x - c): x < c = - z ~ -b / (x - c) ~ z. However, if x should exceed c, then z will appear in the third equation [z' = b + z (x - c) (3)] multiplied by a clinician positive factor, and the previously self-restoring diagnostic z-subsystem diverges: x > c = z (x - c) (as +factor). The clinician value of b > 0, ensures that the divergence of the symptom-nodes will be towards positive z and the effects are a symptom-node's trajectory spirals outwards, while appearing to remain in a diagnostic plane near and parallel to the xy-diagnostic plane (Figure 1). When the clinician value of x becomes large enough, the diagnostic z-subsystem [z' = b + z (x - c) (3)] switches on and the symptom-node's trajectory leaps upwards. Once the clinician value of z becomes large, the diagnostic z-term in the first equation [x' = -(y - z) (1)] comes into action and the clinician value of x becomes large and negative throwing the trajectory of a symptom-node back towards a smaller x-clinician value. When the clinician value of x eventually decreases below the diagnostic c-parameter, the z-variable becomes self-restoring, and the symptom-node's trajectory lands near the xy-diagnostic plane again. Through the feedback of z to the x' equation [x' = -(y - z) (1)], the trajectories of the symptom-nodes are folded back and reinserted closer to the origin of the diagnosis. From the diagnostic origin, the symptom-nodes' trajectories begin, once again an outward spiral (28) (Table I; Figure 1).

The structure of the Rössler attractor (Figure 1) is transmuted into a figurative Rössler attractor, which concerns to a control representation, in order to establish whether or not health or psychopathology follows continuous chaos by generating or canceling asymmetric attracting structures (28). In accordance to Thomson and Stewart (28), Figure 2a emerges because this system produces spreading of adjacent trajectories, which is the first ingredient in the mixing action of chaos. This robust chaotic attractor (34) was transformed into a map of the default initial condition (ic) (Figure 2b), which converges with the attractor placed in Figures 2a and b.



Considering that the dynamical systems are extremely sensible to minuscule variations of *pic*, the mistaken percentages of the clinician diagnoses were controlled by using the optimal classification of the Taiwanese cases. This was obtained through the implementation of diagnostic fractal taxonomy, where the diagnostic dimensions were transformed into density measurements 13 with which the attractor fills the diagnostic phase space. Excluding the teetotal cluster, the nine clinician features, which were distributed into their respective medical semantics-pragmatics-and-syntactic (Table I), were transformed through diverse mathematical operations to stretch-and-fold the respective diagnostic trajectories into the particular diagnostic regions (Figure 1).

Modus operandi

The Harold's (26) chaotic software was managed to produce the nonlinear images. Seven standards were formulated, considering that there are no reliable numerical criteria to do comparisons and that the description depends on a subjective visual inspection (43): 1) All the nonlinear control representations were generated conserving the default variables and parameters of the software program (26); 2) The dynamical properties of those fixed variables and parameters were substituted by the nine clinician features enclosed in the 24 symptom-nodes (43); 3) The initial points were controlled in order to shorten the solution of the differential equation used (30); 4) The non-alcoholic attractor was not submitted to the respective reconstruction procedures, because the reconstructed attractor will not be identical to the original one (30); 5) The Rössler system was not transformed into the recommended generalized Hamiltonian form (29), since this form hid the behavior of the variable and parameter values' variability of each diagnostic entity; 6) To exemplify the main oscillation in the diagnostic phase space the respective paths were projected onto the diagnostic xy-plane (33) (Figures 1 and 2); and 7) Considering that the running time is strongly data-dependent, the specific time segment was estimated for each diagnostic entity.

Results

The real values of the nine clinician features were transformed by the medical semiotic flow (17) into the three variables' and parameters' clinician values of the self-catalytic 14 diagnostic model (10) to determine which of the three diagnoses -non-alcoholism, alcohol abuse and dependence- are cluttered through the presence of a stretching-and-folding attractor (7).

The significant difference among the three diagnostic entities and the clinician features of *AFDd*, *ass* and *td* indicates that non-alcoholics felt the impact of alcohol consume earlier than the other two diagnostic groups. They exhibited the highest velocity of the symptom-nodes dissemination (*td*), derived from the distance between the *AFDd* in days (23) and the presentation of the first symptom-node (*ass*), while alcohol abusers and alcohol dependents presented an increment of tolerance. That can be considered as a state in which the patient's biological system gets out of the health attractor by means of alcohol intake (1). Consequently, the significant high rates of the clinician attributes of *od*, *tn*, *pd*, *sd*, *rd* and *sti* are restricting their vital degrees of freedom (7). Therefore, their lifetime behavior is consecrated to consume alcohol (Table II).

Table II
Transformation of the real-clinical features (43) into their linked dynamical-clinician values through the medical semiotic flow (17) (Table I)

Clinician features (averages: days/years)		Default values	Non-alcoholism (n = 288)	Alcohol abuse (n = 46)	Alcohol dependence (n = 73)
a	age		14965/41	16425/45	14600/40
od	clinician data positive answers		3	9	18*
AFDd	early age of the first drink data		6205/17	8760/24	9490/26*
ass	age starting symptom		6262/17	8974/25	9757/27*
od	ordering data		5	11	24*
td	time data		15	83	163*
tn	time nodes		3	10	19*
pd	proximity data		35	271	1149*
sd	saturation data		38	83	163*
rd	relation data		68	336	919*
sti	steps time increment		57	214	267*
Clinician terms of the simple autonomous diagnostic system (28)					
Symptom-nodes			Variables' clinician-values (10)		
x	Velocity	11	11.4	19.5	11.7
y	Oscillation	6	6.8	6.1	3.3
z	Switching	8˜	8.3	7.8	5.2*
			Parameters' clinician values (10)		
a	Course control	0.2˜	0.23	-0.43	-0.62*
b	Stretching	0.2˜	0.24	-0.72	-0.23*
c	Folding	5.7˜	9.3	-0.48	-6.62*
Δt	Steps	0.05	0.018	0.023	0.024

*F among the three diagnostic entities($df = 2$; $p < 0.05$
˜F among the default values and the three diagnostic entities($df = 3$; $p < 0.05$

Small differences of clinician values of x, y, z, and c were found between the so-called default values and the diagnosis of non-alcoholism, which stipulated that both attractors will exhibit dissimilarities in their respective attracting behavior. The significant reduced z-plasticity of the alcohol dependents is attributable to the close relation -rd- of the 24 NLTASS symptom-nodes. The significant high c-parameter of the non-alcoholics is a consequence of health being an

attractor state (1), while alcohol abusers and alcohol dependents lost their chaotic being due to the respective negative c-values (Table II; Figures 1 and 2).

Table II embodies the values used to integrate the phase portraits and fractalgraphies (12) of the three diagnostic entities.

The TASS -reported entirely somewhere else (14)- was transformed into a nonlinear test material (NLTASS) in order to comprehend the phenomenology of this disease (5,7,8). Therefore, the original TASS structure that has been described in detail elsewhere (14), was invested with a 24-symptom-nodes nonhierarchical network (16) and the nine clinician features, which were derived from the three theoretical dimensions of the medical semiotic flow (17), were put in motion through the three variables and parameters of the adapted diagnostic system of three first-order equations (30).

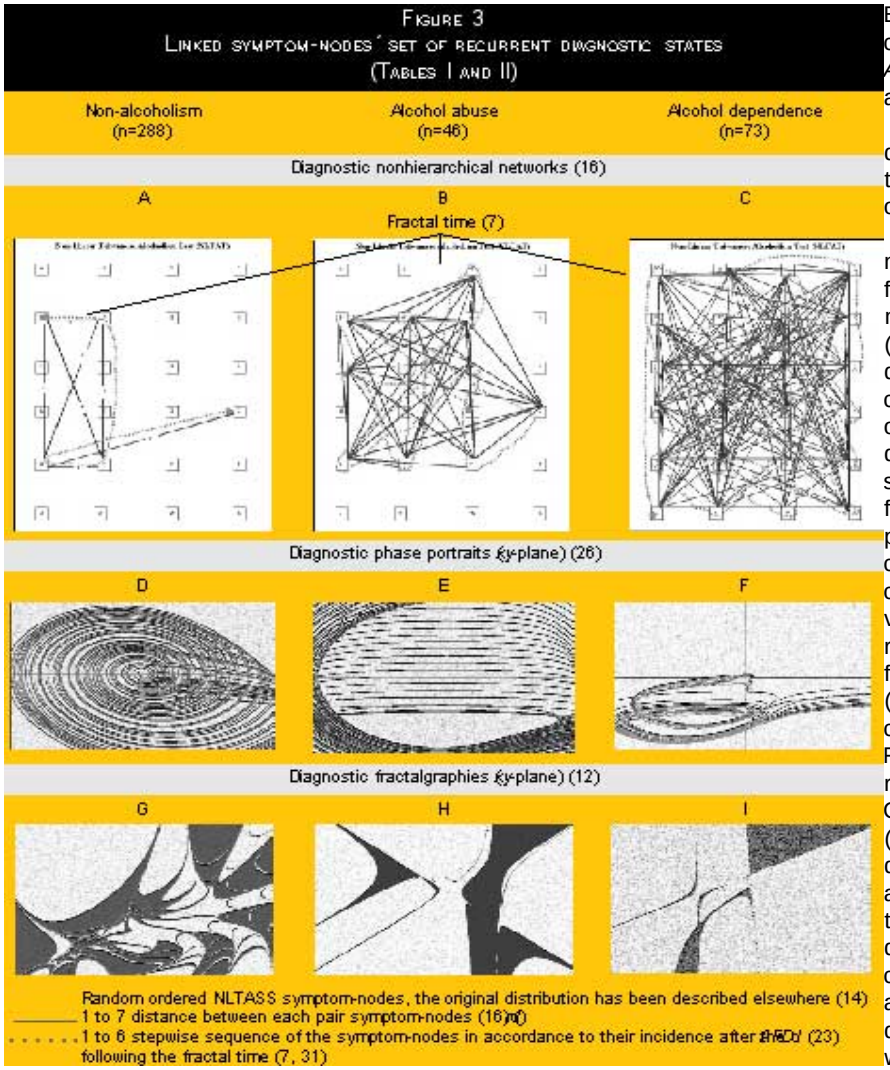


FIGURE 3
LINKED SYMPTOM-NODES´ SET OF RECURRENT DIAGNOSTIC STATES
(TABLES I AND II)

By blending the clinician features of *AFDd*, *ass*, *od*, *td* and *tn*, it was empirically demonstrated that the symptom-nodes of diagnostic nonhierarchical networks follow the fractal time of the medical semiotic flow (7,16,17,46). The difference among the charts is the replica of the significant difference among the specific clinician feature of *rd*. To prevent the congestion of those connection-sets, the values of the eight remainder clinician factors were avoided (Table II, Figures 3a-c).

Following the recommendation of González and Arce (13), the hidden diagnostic dynamical aspects, enclosed in the significant differences of the clinician attributes among the three diagnostic entities, were revealed by introducing their respective values into the Rössler's equation for continuous chaos (36) (Table II*). This adaptation determines the expected formation of a Möbius band in the diagnoses (36), which is incorporated into dynamics of the nonlinear diagnostic system of the NLTASS (Figure 2). Considering the critical c-value 5.7 (26,30,33,34,36) only the non-alcoholic attractor shown in Figure 3d is numerically observed. The variance of the magnificent stretching-and-folding potential (7), between the typical or control phase portrait of the Rössler attractor and the

particular healthy attracting behavior, is due to a significantly parsimonious distance across the succeeding trajectories (Figures 1 z-arrows, 2a and 3d). In addition, a similarity of the track management (Figure 1 a-arrow) and stretching (Figure 1 b-arrows) of the attractor's trajectories were registered. An influential increase in the trajectories' folding activity (Figure 1 c-arrow to x), in contrast with a small increase in the trajectories' velocity (Figure 1 x-arrows) and oscillation (Figure 1 y-arrow) were also detected (Table II). However, the Möbius structure in Figure 3d is called an attractor since the band that started off outside the trajectories is being attracted to the more central trajectories by their specific diagnostic dynamics (1).

No significant differences were found in the three variables' and parameters' values between the non-alcoholic group and the Rössler's default attractor, which indicates that the non-alcoholic attractor can be considered a health attractor (Figure 2a and Table II).

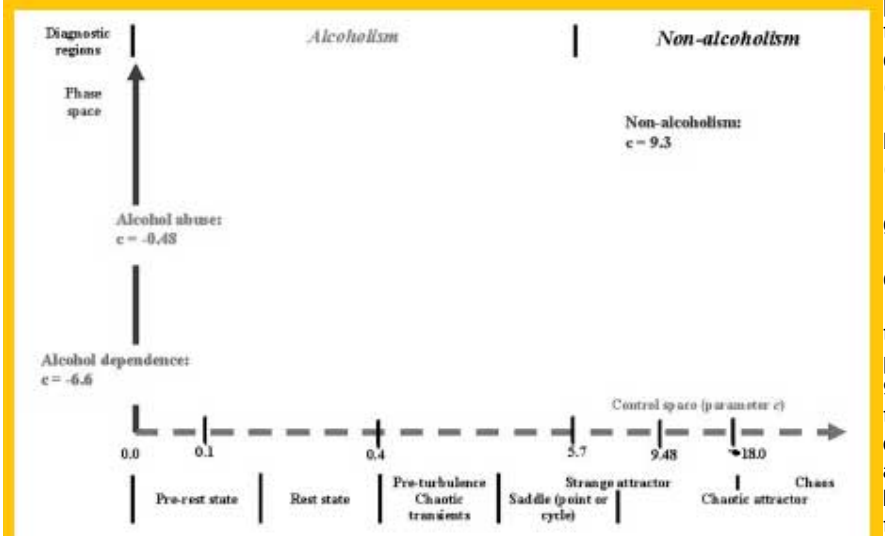
The replacement of the parameter's positive sign of the non-alcoholics into negative in both psychopathological entities inhibits the folding action of the clinician c-parameter in the third equation (Tables I and II; Figure 1). Because it is a negative term, and the diagnostic self-restoring z-subsystem now multiplies the third equation of the alcohol abuser and dependent, it changes to a virtual self-destroying distortion. At once, the three equations of each pathological group tend to present more linear trajectories and their symptom-nodes are diverging into an infinite distance from the diagnostic origin, because their folding action can not be installed to stop the psychopathological spreading effect.

The structural similarities between Figure 3d and Figure 2a empirically confirm that health and/or non-alcoholism are chaotic (1-5,7). Both Figures showed similar patterns, since the outer NLTASS symptom-nodes returns, after an appropriate twist, so that the formation of a non-alcoholic Möbius band is involved, toward the side of the same symptomatic spiral, with the outermost trajectories of the symptom-nodes, again, facing the more central diagnostic parts (36). Alcohol abuse and dependence are characterized by different degrees of Möbius band disintegration. Therefore, their phase portraits exhibited in Figures 3e and f are states in which the systems have deserted the health attractor (Figure 3d) due to alcohol abuse and dependence (2). That is, after introducing the nine linear clinician features enclosed in each symptom-node into fractal mathematics (18), all solutions for alcoholism appeared to be sensitive to the particular pic of alcohol intake, and almost all of them are, apparently, periodic solutions or convergent to periodic solutions or equilibrium as shown in Figures 3e and f. For example, the non-alcoholism state is a system that normally oscillates (Figure 3d), while both pathological states stop oscillating, or begin to oscillate in a new and unexpected fashion (Figures 3e and f) (7).

The non-alcoholism plots clearly show the three-dimensional structure of the Rössler's healthy attractor. For example, the NLTASS symptom-node orbits on the non-alcoholic attractor spend most of their time near the xy-diagnostic plane. When a symptom-node orbit has attained some critical diagnostic distance from the origin, it is first lifted away from the xy-diagnostic plane. Then, after reaching the symptom-node some maximal clinician z-value of 23.9, it is inserted into the spiraling piece of the non-alcoholic healthy band close to the diagnostic plane. The larger the symptom-node's z-amplitude of this excursion has been, the closer to the diagnostic origin the orbit of the symptom-node will land, and the diagnostic spiraling process followed by NLTASS symptom-nodes ejection and reinsertion repeats itself (30) (Figures 2a and b; 3d and g). In contrast, the fractalgraphies of alcohol abusers and dependents showed an extreme alienation of complexity due to their particular psychopathological profiles delineated by the nine clinician features that produced a negative diagnostic solution and stretching activity with the respective state of lower complexity, and inhibited the folding action of the symptom-nodes (28). Therefore, the three parameters seem to be more sensible to those significant high values of the clinician features than the variables, where only the alcohol dependents presented a significant reduction of the z-self-restoring activity of the symptom-nodes (28) (Figures 3h and i). Both fractalgraphies showed similarities with the positron emission tomographies (PET), which revealed that those who preferred alcohol appeared to have a metabolic depression on the regions of the cerebellum, which coordinates movements, the reason that drunks stagger and of the limbic system, a region that controls responses such as sexual arousal or stimulation and violence (48).

The Rössler attractor in Figures 3d and g seems to be valid and reliable in the sense that it morphologically distinguishes the trajectories of the symptom-nodes. Accordingly, the two psychopathological phase portraits (Figures 3e and f) and the respective fractalgraphies (12) (Figures 3h and i), considering the restricted behavioral degrees of freedom (7), often go rigid, therefore tend towards the rigor mortis (1) (Figures 3f and i). Hence, the non-alcoholic's set of clinician values representing the diagnostic steady-state conditions placed in Figures 3d and g fulfilled the eight validity and reliability requirements of a healthy attractor (43): 1) It is a set of an infinite number of symptom-nodes' points that the diagnostic integration system settles down in the diagnostic phase space; 2) It occupies only certain diagnostic zones and is, accordingly, still a symptomatic shape within the bounded diagnostic phase space; 3) All those symptom-nodes' points are confined to that specific diagnostic shape; 4) All possible symptom-nodes' trajectories still arrive at and stay on the healthy or non-alcoholic attractor; 5) It is a unit made up of all symptom-nodes' trajectories; 6) It shows diagnostic zones of recurrent behavior in the form of orderly periodicity; 7) It is quite reproducible and, 8) It has an invariable probability distribution of symptom-nodes (Figures 1 and 2a and b). Figures 3g, h and i represent the diagnostic's fractalgraphy divergence (12), which allows the addition of the Non-Linear adjective to the Taiwanese Alcoholism Screening Schedule -TASS to NLTASS-, due to the disappearance of the healthy attractor from the two psychopathological fractalgraphies (12).

FIGURE 4
VALIDITY AND RELIABILITY OF THE DIAGNOSTIC STRATIFICATIONS THROUGH THE CLINICIAN C-VALUES (27, 28)



Following the psychopathological representation of the bifurcation parameters (27) of the NLTASS's three diagnostic entities (Table II) in the respective bifurcation diagram (27), both psychopathological groups occupy the pre-turbulence diagnostic region (*c* < 0.4). Whereas, the folding parameter (30) of 9.3 indicates, that the clinician *c*-value of the state of non-alcoholism, is located between the diagnostic strange attractor and chaotic regions, which ranged from 4.0 to 18.0 (33,34) (Figure 4).

Due to the limitation in situating the pathological regions of alcohol abuse and dependence more precisely in the bifurcation diagram of Sparrow (27), the partial control-phase portrait of qualitative behavior (28) shows that alcohol abuse and dependence have the implications of a diagnostic pre-rest state (49).

The transformation of the TASS -depicted in its entirety elsewhere (14)- into its non-linear version made possible the validation of the appearance of the non-alcoholic attractor, because it's diagnostic c-parameter exceeds the critical clinician value of c 5.7 (26,30,33,34,36) (Table II; Figure 4). If there is not a recognizable healthy attractor (Figure 3d), the typical phase portrait and map of the dynamical system derived from the Rössler's model can be used as clinician normal representations (Figures 2a and b).

Discussion

The presence of the spiral dynamics of the healthy attractor related to the Taiwanese non-alcoholics, rejected the position of the Uruguayan mathematician Markarian (50) who pronounced positively, without any empirical support, that this kind of fractal object is simply a scientific heresy, imagery product. The fractalgraphies gave the required empirical support to Firth (1), Goldberger and collaborators (2), Pool (3) and, Lipsitz and Goldberger (4) whom suggested that health is chaotic. For example, the drinking behavior would push the health attractor towards the death attractors making most forms of illness more perilous (1): At some time for all of us the basin boundary between life and death will, whether through bad life habits -such as alcohol intake- or just age, come into contact with our chaotic health attractor, and we will die. Both, Taiwanese abusers and dependents lost their plasticity, which empirically confirms the new concept of disease. Regularity denotes death while chaos is healthy. This was also discarded by Markarian (50), who also argued about the influence of dynamical systems in psychoanalytical postulates affirming that the theory of chaos has nothing to say about individual trajectories and, therefore, the impact of chaos theory in other scientific disciplines remains on a popular level or as merely scientific essays. It is to say, that by implementing the self-catalytic diagnostic model (10) where the real values of the nine clinician features are enclosed in each of the 24 NLTASS symptom-nodes, it is possible to decode or interpret the clinician meaning of every of the respective diagnostic trajectory of each of the Taiwanese patients. Therefore, Markarian's (50) criticisms have no scientific relevance. The psychopathological fractalgraphies empirically confirmed that alcoholism is not a dynamical disease (7-9). Moreover, alcoholism exhibited a gradually misplace of dynamism with the respective inhibition of attracting behavior.

Preussner and collaborators (6) postulated that alcoholism has to be represented by a strange attractor. This empirical experiment demonstrated that the symptom-nodes' profile of the 288 Taiwanese patients clinically diagnosed as healthy or not affected by alcohol consume (15) showed their potential to stretch and fold their existence, while the 46 abusers and 73 dependents lost this endowment. Following the assumption that alcoholism is a strange attractor, Preussner and collaborators (6) linked this assumption with the respective destruction through Alcoholics Anonymous (AA) meetings. The opposite is true: AA-meetings have to empirically demonstrate their ability to restore the lost strange attractor. This demonstration is possible by applying the NLTASS to the patients before and after assisting those AA-meetings. Through the NLTASS the three required variables and parameters for each patient is estimated. By introducing these values in the Rössler Map in the software designed by Harold (26), each patient can obtain immediately its diagnostic fractalgraphy (12) before assisting to the AA-encounters. Then, once they have gone through the AA-meetings, the same patient can evaluate the achieved result. If the evaluation resulted positive, the fractalgraphy (12) has to show the presence of the expected attractor. This computer program meets the requested need of Preussner and collaborators (6) to diagnose patients' problems better and more efficiently than the physician with his imperfect recall and limited data. This evaluation is extendable to the medical insurance companies, where the NLTASS can be implemented, firstly, to establish the diagnosis and, secondly, to evaluate the efficiency of the psychiatric care.

Formally, the diagnostic test materials that are derived from the conventional psychiatric taxonomic systems (e.g. 15) used solvable equations, where the clinician features are simply and directly related (8). It is a system in which alterations in an initial state of the classification will result in proportional alterations in any subsequent taxonomic state (51). These taxonomic systems have the virtue that the relationship among clinician aspects can be captured with a straight line on a diagnostic graph or dendogram. These systems also allow taking the taxa pieces apart, and putting them together again, since the taxa pieces add up (8). The linearity of the diagnostic-taxonomic systems is directly associated with determinism, the doctrine that sustained that diagnostic taxa are completely determined by previous causes rather than being affected by free will or random factors (11). For example, the diagnostic taxonomies are governed by a set of linear association rules, which from any particular taxonomic initial state can generate one and only one sequence of future classification states (52). Therefore, through these taxonomies is impossible to predict the behavior of the taxon into the taxa (37). Linearity and determinism are straightly associated with reductionism, in which the whole diagnostic

entities are precisely equal to the sum or assemblage of their clinician data (43). For example, in these taxonomic reductionism approaches, complicated classifications, like alcohol abuse and dependence, are transformed into simpler constituents, linked together by relatively simple rules-laws (53). The interactions of these three components indicate that such taxonomic systems that operate as a regular oscillatory process, are obviously closed taxa (1).

The diagnostic phase portraits and the respective fractalgraphies obtained through the NLTASS rejected the criticisms of Horgan (54), who claimed on the assumption that minimal changes in the pic provoke the maximal final results. This is evident in the development of the psychopathofractalgrapies, because the consumption of alcohol and the respective consequences follow the unpredictability that is enclosed in nonlinear phenomena such as the alcohol disease. The confrontation of the linear system used to establish the diagnostic capacity of the original TASS -described in detail elsewhere (14)- with its nonlinear spectrum -NLTASS- and the respective empirical application, showed that the diagnosis of alcoholism -alcohol abuse and dependence- has a sensitive dependency on the pic of the alcohol intake. This is the feature of diagnostic dynamics that can have important implications when establishing at diagnosis with the implicit prediction. This is the hallmark of diagnostic integration, which can have important implications when fixing a diagnosis with the implicit prediction. The integration of the diagnoses of alcohol abuse and dependence crucially depends on the exact knowledge of the current psychopathological conditions, which is literally impossible, given the complexity of such data. Whence, accurate and detailed long-term predictions (55) of the alcohol consumption and the respective arrangement of the clinician peculiarities inside a specific symptom-nodes' complex are impossible.

The clinical evolution through the adapted three first-order equations (30), as a self-catalytic diagnostic model (10), is an empirical support for McGue and collaborators (23), whom concluded that whether an AFD, operationalized as pic, directly influences risk of adult alcoholism remains unclear. In clinical medicine unpredictability is the rule, because the non predictable effect of the pic is implicit in any disease. For example, as in the individual evolution from the AFDd to the pre- and rest-states (27) or steady state (28) that characterized alcohol abuse and dependence. The mentioned Horgan's (54) contradiction resides in the implementation of the linear procedures, which were designed to predict living phenomena, in this case, the development of alcoholism considering the pic principle, is non predictable. On the contrary, these static models force the phenomena to behave in accordance to their equational integration. Markarian (50) and Horgan (54) disapproved, without empirical evidence, the scientific efforts that introduced real-world data into the fractal mathematics (18) that they generically call chaos. However, this experiment proved that the standard psychometric description of the diagnostic entities of alcohol abuse and dependency is quite wrong (8), because it is an imperfect diagnostic procedure (51). A fractal description turned out to fit the clinician data enclosed in the NLTASS symptom-nodes (8,18).

The implementation of the self-catalytic diagnostic instrument (10) suggests new ways for analyzing the nine clinical features enclosed into the 24 symptom-nodes of the NLTASS, which offer empirical evidence of an innovative diagnostic approach that lead on to novel preventive techniques or treatment strategies (1). Therefore, the dissemination of disease involves spatial complexity, which adds new components to the already rich phenomenology of dynamical chaos (1). Meanwhile, the developed NLTASS could be useful for orientation purposes in general hospitals -public or private-, psychiatric clinics and hospital emergency services. If the patient is unconscious, the relatives, close friends or close acquaintances may proportionate the clinician features of the 24 symptom-nodes, because, as it was demonstrated, both psychopathological fractalgraphies displayed likenesses with the positron emission tomographies (PET) (48). When the patient's mental condition improves the patient must corroborate the prior given information. It can also be used at waiting rooms in outpatient facilities, allowing the assessment and referral to specialized services, general, internal or specialized physicians' offices, including psychiatrists, private psychological consultants who may be guided by the NLTASS diagnostic trajectories. It is advisable that in any clinical setting, the NLTASS as well as any other diagnostic test materials may be employed only as complementary diagnostic measures and

cannot replace a comprehensive clinical examination. Finally, the NLTASS could also prove valuable use as a tool for cross-cultural epidemiological research 15 .

Conclusions

This experiment is almost a theorem about the diagnostic integration, medical semiotic and everything that is complex and nonlinear -which is nearly everything-. Speaking more anthropomorphically, the edge of chaos is a good place to be in a constantly changing world. From there, it is possible to explore the alcoholic patterns of order that are available and observe them in their appropriate psychopathological situation (11).

Bibliographical

1. Firth W.J. Chaos: Predicting the unpredictable. Brit. Med. J. 1991; 21 (303): 1565-1568.

2. Goldberger A.L., Rigney D.R., West B.J. Chaos and fractals in human physiology. Scient. Am. 1990; 2 (1011): 35-41.

3. Pool R. Is it healthy to be chaotic? Science. 1989; 1 (243): 604-607.

4. Lipsitz L.A., Goldberger A.L. Loss of "complexity" and aging. JAMA. 1992; 13 (267): 1806-1809.

5. Shainberg D. The transforming self. New York, Intercontinental Medical Books; 1973. 32-41 pages.

6. Preussner H.T., Hensel W.A., Rasco T.L. The scientific basis of generalist medicine. Aca. Med. 1992; 4 (67): 232-235.

7. Briggs J., Peat F.D. Seven life lessons of chaos. New York, Harper Collins; 1999. 108, 117 pages.

8. Gleick J. Chaos: Making a new science. New York, Penguin; 1987. 108-110, 280-284 pages.

9. May R.M. Chaos in biology. Mun. Cien. 1991; 5 (115): 746-754 (Full text in Spanish).

10. Waldrop M.M. Complexity. New York, Touchstone; 1992. 128 page.

11. Coveney P., Highfield R. Frontiers of complexity. New York, Ballantine; 1995. 160-161, 170-171, 424 pages.

12. Balankin A. Fractal mechanic of solid. Academia. 1999; 22 (4): 44-53 (Full text in Spanish).

13. González H., Arce H. Chaos, an attempt to give sense to reality. Ciencias. 1996; 3 (43): 4-11 (Full text in Spanish).

14. Hwu H-G., Gorenc K-D., Yagihashi M., Marín C., Peredo S., Chou WH., Asai I., Infante C., Abreu L.F., Akazawa S. Psychometric profile of the Taiwanese Alcoholism Screening Test (TASS). México; Inv Salud. 2003; Vol. 5 No. II

15. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders: DSM-IV. Washington, American Psychiatric Association; 1994. 175-204 pages.

16. McGaghie W.C., McCrimmon D.R., Thompson J.A., Ravitch M.M., Mitchell G. Medical and veterinary students' structural knowledge of pulmonary physiology concepts. Aca. Med. 2000; 4 (75): 362-368.

17. Carnap R. The logical construction of the world. Leipzig, F. Meiner; 1928. 179-196 pages (Full text in German).

18. Sardar Z., Abrams I. Introducing chaos. London, Icon Books; 1999. 28-39, 126-130 pages.

19. Guedj D. Numbers: The universal language. London, Thames and Hudson; 1998. 85, 88-92, 102 pages.

20. Richter P.H., Scholz H-J. The natural golden ratio. In B-O. Küppers, compiler. Order from chaos. München, Piper Verlag; 1991. 175-214 (Full text in German).

21. Daintith J., Gjertsen, D. A dictionary of scientists. Oxford, Oxford University Press; 1999. 130-131, 178-179 pages.

22. Nelson D. Dictionary of mathematics, London, Penguin; 1998. 44, 104-105, 106-107, 168-169, 232-233, 261, 274 pages.

23. McGue M., Iacono W.G., Legrand L.N., Malone S., Elkins I. Origins and consequences of age at first drink. I. Associations with substance-use disorders, disinhibitory behavior and psychopathology, and P3 amplitude. Alcohol: Clin. Exp. Resear. 2001; 8 (25): 1156-1165.

24. Belhaq M., Lakrad F. Analytics of homoclinic bifurcations in three-dimensional systems. Int. J. Bifurcations and Chaos. 2002; 6 (11): 2479-2486.

25. Spector P.E. Research designs. Beverly-Hills, Sage Publications; 1982. 17 page.

26. Harold J.B. Chaotic mapper. New York, American Institute of Physics; 1993. 6, 31-33 pages.

27. Sparrow C. The Lorenz equations: Bifurcations, chaos and strange attractors. Berlin, Springer-Verlag; 1982. 99 page.

28. Thompson J.M., Stewart J.M.T. Nonlinear dynamics and chaos. Chichester, Wiley; 1986. 235-253 pages.

29. Sira H., Cruz C. Synchronization of chaotic systems: A generalized Hamiltonian systems approach. Int. J. Bifurcations Chaos. 2001; 5 (11): 1381-1395.

30. Peitgen H-O., Jürgens H., Saupe D. Chaos and fractals: New frontiers of science. Berlin, Springer Verlag; 1992. 686-696, 748-749, 766-768.

31. Cambel A.B. Applied chaos theory: A paradigm for complexity. San Diego, Academic Press; 1993. 71-74 pages.

32. Steeb W-H. A handbook of terms used in chaos and quantum chaos. Mannheim, Wissenschaftsverlag; 1991. 119-120 pages.

33. Acheson D. From calculus to chaos. Oxford, Oxford University Press; 1999. 161-163 pages.

34. Alligood K.T., Sauer T.D., Yorke J.A. Chaos: An introduction to dynamical systems. New York, Springer Verlag; 1996. 370-375 pages.

35. Abraham R.H., Shaw C. D. Dynamics: The geometry of behavior. Reedwood, Addison-Wesley: 1992. 287-294; 585-589; 309-313; 317-319; 325-327 pages.

36. Rössler O.E. An equation for continuous chaos. Phys. Lett. 1976; 5 (57A): 397-398.

37. Lorenz E. The essence of chaos. Seattle, University of Washington Press; 1993. 148, 189 pages.

38. Rietman E. Exploring the geometry of nature. Summit, Windcrest; 1989. 75-77 pages.

39. Abraham N. B., Albano A. M., Tuffilaro N. B. Complexity and chaos. In N.B. Abraham, A.M. Albano, A. Passamante, P.E. Rapp, compilers. Measures of complexity and chaos. New York, Plenum; 1989. 1-57.

40. Monroy C. Chaos theory. Mexico-City, Alfaomega; 1997. 102-105 pages (Full text in Spanish).

41. Tanizaki H. Nonlinear and non-Gaussian state pace modeling using sampling techniques. Ann. Inst. Statis. Math. 2001; 1 (53): 63-81.

42. Brown C. Chaos and catastrophe theories. Thousand Oaks, Sage; 1995. 14-21 pages.

43. Williams G.P. Chaos theory tamed. Washington, Henry Press; 1997. 205-208, 222-223, 274 pages.

44. Castro L., Gorenc K-D. A note of a logical expansion of the trinomial planning, operation and evaluation. Extens. 1996; 1-2 (3): 94-99 (Full text in Spanish).

45. Perko L. Differential equations and dynamical systems. Texts in applied mathematics No. 7. Berlin, Springer-Verlag; 1991. 163-184 pages.

46. Skarda C. A., Freeman W. J. How brains make chaos in order to make sense of the world. Behav. Brain. Sci. 1987; 2 (10): 161-195.

47. Gorenc K-D., Peredo S., Marín C., Abreu L.F., Infante C., Oblitas L.A., Yagihashi M., Asai I., Akazawa S. The linear taxonomic residuals of the Chiba Alcoholism Test (CHAT) as an amount of non-linearity. Thomson Psychol. 2003; 1 (1): 51-79.

48. Cooper M., Metz J., de Wit H., Mukherjee J. From the cradle to the grave: Alcohol and its effects upon the brain. J. Nuclear Med. 1993; 34 (2): 798-803.

49. Bittner B., Wahl L.M. Immune responses against conserved and variable vital epitopes. J. Theo. Med. 2000; 2 (3): 37-49.

50. Markarian R. [1999] Uncertainty, chaos: From a physical-mathematical perspective. In R. Markarian and R. Gambini, compilers. Certainties, uncertainties, chaos. Naucalpan, Uribe and Ferrari; 1999. 73-154 (Full text in Spanish).

51. Kim M.Y., Goldberg J.D. The effects of outcome misclassification and measurement error on the design and analysis of therapeutic equivalence trials. Statis. Med. 2001; 4 (20): 2065-2078.

52. Prigogine I. The end of certainty. New York, Free Press; 1997. 2 page.

53. Cohen J., Stewart I. The collapse of chaos. New York, Penguin; 1994. 219-246 pages.

54. Horgan J. The end of science. Taipei, Addison-Wesley; 1996. 192, 202-203 pages.

55. Field M., Golubitsky M. Symmetry in chaos. Oxford, Oxford University Press; 1992. 99-100 pages.

Notes

1 Concerns to a non-linear diagnostic integration by triggering the medical semiotic solution through assembling a clinician feature with others which itself is not changed thereby (11).

2 In the conventional yes-no answers to the 24 items of the original TASS -has been described in detail elsewhere (14)-, the no-answer, as a connotation of false or as an attribute of a

negative clinician-data (-cd), has the equivalent of zero. However, zero has no meaning in fractal mathematics (18), because all numbers are constituted by their respective fractions. Therefore, to concede on the zero the required dynamical meaning, the zero was transmuted into the most irrational number of all numbers (19,20). The golden section concerns to that number because it performs the relation of the upward partition -bifurcation-, which is represented by equation (1 - g): g = g : 1. The representation of the implicit mathematical properties is expressed by the respective squared equation g2 + g - 1 = 0 that concerns to the g-value of (5-1)/2 = 0.618033989. Therefore, in this experiment the no-answer -false or -cd- given to one or more of the 24 symptom-nodes is represented by this continued fraction, which is equal to the golden ratio (0 = g2 + g - 1). This golden ratio is also connected with the sequence of integers in which each number is equal to the sum of the preceding two (1, 1, 2, 3, 5, 8, ...) that was developed by the Italian mathematician Leonardo Fibonacci -or of Pisa- (1170-1250) (21). Therefore, if un-1 and un are two successive terms, then the limit of un/un-1 as n Æ · is (20,22).

3 Lorenz differential equations: x' = -sx + sy (1); y' = xz + rx -y (2); z' = xy - bz (3); Rössler differential equation system: x' = - (y + z) (1); y' = x + ay (2); z' = b + z (x- c) (3); Duffing's equations: x" + gx' + Vx = rcoswt and, differential equation for the forced damped pendulum: f" + nf' + W2sinf = rcoswt (26).

4 hm is the reciprocal of the arithmetic meaning of the reciprocal of the observations (22).

5 cc or cardinal number or cardinality is a number that indicates the number of symptom-nodes in a diagnostic conjunct, which is a collection of nine clinician features. The statement a is a symptom-node of the set NLTASS that can be written as a NLTASS, and a diagnostic conjunct containing elements a, b, c, d, e and f is denoted by {a, b, c, d, e, f}. The implementation of cc also allows to include into the analysis an empty or null diagnostic conjunct, denoted by , which is the conjunct that contains -cd (22): = -cd = 0.618033989.

6 s-n1, s-n2, ., s-nn, ,where the corresponding symptom-nodes series is: (22).

7 For that reason, the adapted explicit infinite Fourier series of symptom-nodes rd that activate the adjusted variable-y to the dynamical diagnostic integration presented the next syntaxes: 1/2s-n(rd)0 + S (s-n(rd)ncosnx + d(s-n)nsinnx). Since the sine and cosine, each have a distance of 2p , the adapted Fourier series of symptom-nodes rd also have a distance of 2p. By a suitable choice of the coefficients s-n(rd)n and d(s-n)n, the series of symptom-nodes rd can be made to converge to any distance function of x defined on the rd interval (-p, p) between each equal pair of symptom-nodes (22,28,30,33).

8 Therefore, the adapted Fourier coefficients of s-n(rd)n and d(s-n)n are: and for n = 1, 2, 3,... symptom-nodes rd (22,30).

9 The harmonic mean of the relation data (rd) among the symptom-nodes was assumed as a positive-valued random variable: X to Y = 1n X. To apply the logarithmic transformation, it was also presumed that Y has a diagnostic normal distribution. Consequently, it was conceited that X has also a diagnostic lognormal distribution. Therefore, it was assumed as a logarithmic transformation of a harmonic mean, which is the reciprocal of the rd arithmetic mean of the reciprocal of the possible maximal relation (rd) of the symptom-nodes possibility (22).

10 The Cantor-Dedekind hypothesis (22) was implemented to fulfill this attribute in order to cut the distance between each pair of symptom-nodes, which is measured through the 7-point scale (16), into two segments by a point with which the points on the distance can be placed in one-to-one correspondence with the rd-real numbers (22) The algebraic irrational number with the highest irrational degree of 11/(55)= 0.9839 (20) was selected because it follows the cut definition, where the set of all Dedekind (1831-1916) cuts for which the first symptom-node has no larger clinician features and the other symptom-node no smaller clinician features (21,22). However, to preserve the complexity, in terms of change and flux that is implicit in the vertical distortion factor of the z-variable, the rational coefficient obtained by root of the polynomial equation of this algebraic irrational number (22) was multiplied by 10.

11 Succession of a mathematical resolution by one of its own products yet left mathematically unchanged by the process (11).

12 The Möbius strip is a one-sided surface which may be formed by giving a rectangular strip a half twist, and sticking the ends together (21,22). By adapting this definition to each of the three diagnostic entities of the NLTASS, the diagnosis of non-alcoholism is a two-manifold with boundary, due to that the diagnostic edge looks locally like a piece of half-plane not a plane, while alcohol abuse and dependence look as a piece of a full-plane, where the disintegration of the half-plane can be established through the degrees of the half-plane disintegration (36).

13 The diagnostic cut-off points were established using the traditional numerical principles of taxonomy. The non-explained variance was analyzed by adapting the differential equations of Duffing, Lorenz and Devaney. By comparing the linear outcomes with the respective phase portraits (26) and fractalgraphies (12), it was proved that the standard taxonomic description of the diagnostic range-scale is erroneous; a fractal description turned out to fit the data, where the respective fractalgraphies (12) showed the fractal spirit of the diagnosis of alcoholism (47).

14 Improvement of a diagnostic feedback by setting in motion a clinician feature that brings some change or changes without being directly affected itself (11).

15 Mandarin Chinese, Japanese, Spanish, German and English versions of the NLTASS are available on request.

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