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Deriving the Cognitive Drive & Constant

[1] Orsolya Selymes

[1]Doctoral School of Psychology, Eotvos University, Budapest

Email: mail@selymes.com

Abstract – The paper discusses modifications necessary to be performed on Lewin's Field Theory (1951) in order to derive the cognitive constant and the behavior of the cognitive drive, deriving also a universal model of cognition in intelligent systems.

Keywords – Field Theory; Cognitive constant; Cognitive drive

1. Introduction

There is a saying in Hungarian: *How does the boot get on the table?* The saying refers to situations where things occur unexpectedly or out of context. For our purposes, it is good enough to simply ask: how does the table get into the room? For in order to reconstruct the route of the table, we need to understand the behavior of systems beyond gravity, electromagnetism, the weak and the strong force. This is to say, if we want to be able to reconstruct human intelligent systems and their behavior, we need to be able to reconstruct cognition by the categories that emerge as its own controling variables, whether we talk about gestures, thoughts, feelings, memories, emotions; intentional or unintentional cognition.

2. Field theory and the cognitive drive

Let us then suppose that any influence occurring as a product of a cognitive system (*i*) is denoted as an element of the set C (cognition).

(1) $i \epsilon C$.

Let us further suppose that the products of cognitive systems are all functions of the *cognitive drive:*

(2) $I = F(D, E)$.

Note, that this is different from

(3) $B=F(P, E)$.

put down by Zeigarnik as referred to by Lewin [1]. The basic statement of Field Theory, that *behavior has to be derived from a totality of coexisting facts* and that these coexisting facts have the character of a dynamic field also claiming that the state of any part of this field depends on every other part of the field. At the same time, Field Theory proposes the following categories and constructs for handling data: position, locomotion, cognitive structure, force, goal, conflict, fear, expectation, hope, guilt, power, values, intention, frustration, learning, regression, conflict, resistance to change. We can see that such a selection of categories would not satisfy our prerequisite to contain only formalized (mathematically derived) categories. Field Theory takes a necessary step in supposing complexity in an intelligent system requires that we denote a number of dimensions in a mathematical model to cover variance of the data; at the same time, it satisfies itself by making assumptions like *"frustration has the same dimension as conflict"* or: *"conflict refers to [...] the overlapping of at least two force fields"* [1]. A purely mathematical theory takes the route instead to derive a model that contains purely abstract variables and does not rely on arbitrary constructs. Instead of using categories like these, and based on what has been said above; it is possible for any value (i) of a cognitive set to be derived in a formal model onto the abstract constant (c) that infers a hypothesized set of cognitive properties; where

(4) $(i_1, i_2, \ldots i_n) = ((i_1, i_2, \ldots i_{n-1}), c_n)$ $(n \geq 2)$.

Here (i) can denote any cognitive incident and (c) is our cognitive constant, the greatest common divisor to any (i). Starting out from the assumption that cognition is an induced set that is brought about systematically; it is possible to reconstruct a full trajectory of cognitive outcomes with:

(5) $C = P(\sum((p(cogn)+x)/c))$.

This step has not been taken by Field Theory and its consequences are numerous. Initially, Field

Theory presumes that change of some state of a field in a given unit of time can be denoted by:

(6) dx/dt;

and proposes that the intention to reach a certain goal G (to carry out an action leading to G) corresponds to a tension (t) in a certain system (SG) within the person so that

(7) $t(SG)>0$.

Intention here is taken as the observable syndrome presumed as coordinating a dynamic construct (system in tension). Field theory then assumes that systems can be described by tension that is released if a goal is reached:

(8) t(SG)=0 if P□G.

Field Theory also describes the relation between need and locomotion:

(9) $t(SG)>0$ *if fP,G* >0.

Field Theory also presumes that communication between tension systems occur according to fluidity of the field; wherefore change in (psychological) tension difference of neighboring systems can be described by the following functions: time interval and fluidity.

(10) $|t(S^1)-t(S^2)o|-|t(S^1)-t(S^2)Ti| = F(Ti, fl)$;

which however are being interfered by emotion or strong tension. Also, time effects:

(11) $dx/dt = F(St-n)$.

which can be written only if function

(12) $St = F(St-n)$.

is known.

3. Deriving the cognitive constant

To complete a mathematical description of intelligent systems, we need to go beyond substantial denotations such that describe learning in a cognitive system as change in knowledge; valence; values; connection to reality; or structure; and take into consideration permanent and universal attributes of cognitive attributes of an intelligent system. Furthermore, for a mathematical description, we cannot assume persons to be the elementary units for observation; as well as we cannot presume tension to operate as inherent attributes staying within systems. This is to say that in order to give a full coherent mathematical description of cognitive systems, we have to take affordant, embodied, core cognitive, permanent structural, algorithmic, generative and periodic attributes of cognitive systems into consideration also and look for systemic attributes in data. The next task therefore, after deciphering a cognitive constant (the basic element or 'atom' inherent in cognitive systems) is then to discover what controlling variables are to be found in the behavior of *D(i) (the cognitive drive);* and figure out what sorts of ramifications one has to denote in E (environment) to be able to decipher the interference rules which are most relevant for modelling or experimental purposes. Systematicity of cognition (such as tables appear in rooms with a certain systematicity) and in particular systematicity of interference between cognition and the rest of environment in fact leaves us with the assuption that a basic set of cognition irrespective of culture, environmental setting or person does exist; thus giving legitimacy to a search for a hypothetical set (c), the greatest common divisor of anything cognitive also. This encourages us to elaborate a c-theorem further. The c-theorem raises the question: what is the greatest common divisor of cognitive systems? Thus, it answers the question: *'What am I, as a theory?'* By deriving such a theory, we will be able to point out (1) core categories in the cognitive process, and (2) the sequence of transformative operations that lead to the equation that describe the 'ultimate learning rule'. This is done through procedures that perform operations similar to those performed under the Discrete Fourier Transform; periodic sampling; digital filtering; convolution; window functions; and signal averaging. As currently no mathematical theory exists to perform such a denotation, this had to be performed first through emerging categories that describe the sum of outcomes in an intelligent system's learning patterns over time. Such a description (equating cognitive changes and physical changes in a system over time) can account for any variance in a complex living system or difference between complex living systems.

A hypothetical set of *core* cognitive algorithms consists formally of only prime algorithms; these are algorithms that share an unequivocal complexity value and can not be simplified, broken down or saturated any further by systematic and scientific analysis or a formal denotation (practically, these can only be divided by themselves and by the value *one).* It is exactly at this level of prime algorithms that a basic and unequivocal set (c) can be seen emerging from analysis. The benefit of such an emerging global set and a c-*theorem* is that these provide us with descriptive and predictive models based on the assessed behavior of that set (c) in correlation with contextual properties of cognition on the one hand; and in correlation with interference effects, global indicator distribution patterns, or any systemic attributes in a physical environment on the other. At the same time, any search for core algorithms across the cognitive process requires that one also looks for clues for finding traces of structure. Cognitive algorithms operate through transformations abiding to attributes and structure of context, and thus are identifiable on a number of operational levels and across both implicit and explicit cognitive outcomes. Formal (e.g. dilation) models provide us in fact with tools to describe, measure and predict sums of induced effects. These can be used as describing a cognitive system or a system related to a (cognitive) system but they serve as reference only along particular (e.g. scaled) attributes of that system. Given that any model of complex systems contains unequivocal denotations of structure also, with structure being a core contributor to system outcomes; any properly formulated formal description needs to take structure of cognition into account also. Stretch properties and patterns may in fact follow a variety of rules depending on specific structural (textural, transportational, transformational, connectional, etc.) attributes.

To handle the complex variety of systemic and global categories and interferences of cognition however, a formal model instead takes as a starting point the stance that cognitive outcomes are induced and should be handled as such. Note that besides using induced effect outcomes of cognition, and as a consequence also, a further shift from traditional models is taken in such a systemic approach by dealing with cognitive (mental) outcomes as themselves stances of *behavior:*

(13)$B(x)=C(x); C(x)=B(x);$

where B(x):behavioral momentum; C(x):cognitive momentum. A model that eliminates heuristics about causation remarks simple constant values that change along with the changes occurring in a closed set of cognitive momentum across time (t). For example, for a fixed cognitive set at constant (C(x)) value external *interference* and *potential* will correspond at a constant:

(14) $I/P=constant;$

while at a fixed interference value (I);

(15) $C(x)/P=constant;$

will also be true; making

(16) $\Delta C(x)/\Delta P=constant.$

Similarly, we can find more of such permanent relationships between (c) and measurable cognitive properties, such as:

(17) $\Delta C(x)/\Delta A=constant;$

(18) $\Delta C(x)/\Delta p=constant$ *or* $\Delta C(x)/ \Delta S=constant;$

(19) $\Delta C(x)/\Delta C=constant; \Delta C(x)/\Delta CC=constant.$

While (17) refers to attentional properties; (18) to pressure or stress; (19) is a denotation of communication or communication costs in a system.

That is, if we are to calculate either C(x) or particular properties in context for C(x) it is done in an inverse manner; based on the sum effect of that particular cognitive momentum assessed from environment. Core algorithmic properties are difficult to assess from a complex set of data presented by either regular appointed communication or experimentally produced situations; these can however be found in the variations in unadjusted and uncontrolled (*vomitific*) properties of any communication (behavior) directly; or can be deciphered indirectly from any emerging learning patterns by capturing changing properties of the cognitive process itself or properties in interference with cognition. As discussed above, such a mode of investigation requires an initial *inversion* of a decision theory [2]; and an examination of cognitive outcomes as outcomes of *induction* rather than that of intention, goal-directedness, planning and adjustments in thinking, habits or behavior. The term vomitific cognition denotes here incidents that are relatively uncontrolled (with a control or sessility function

(20) $f{:}f\leq n;$

and a motility value

(21) $f'{:}f'\geq m;$

unforced, generated and induced internally as a consequence of generative dynamics rather than environmental influence, interference or regulatory stress; and characterized with comparatively low affordance

(22) $a{:}a\leq q$

levels. In such a designation, incidents of spontaneous spoken language are contrasted for example with academic written language, depending on the levels at which these contain non algebraic versus algebraic (attention and consciousness) processes [3]. Dynamic organization in cognitive systems require a denotation of a number of laws, a thorough description will necessarily include particular laws of: *media; generativity; interference; transfer; remains; reflexivity;* and *regulation*.

Further, a formal model ties cognitive outcomes on both a conceptual and a measurement level to the induced (associated) changes observed in an arbitrary (e.g. immediate) physical context such as setting or discourse. Also, a formal model hypothesizes a *complex manifold* on a formal space (S(c)) for cognition in order to account for *all* variations of (c) and drawn by interference with context (*spacetime* in terms of physics) and so our mathematical theory will have to account for five fields (a four dimensional space plus an extra dimension). Finally, a formal model provides us with computation paths along *indicator (e.g. stretch or dilation)* and *algorithm (e.g. complextiy)* functions by projections worked out on the denoted formal space (Sc) necessary to describe in exclusive and unequivocal sets the outcomes of any cognitive operation.

In more detail: a coherent theory summing up basic processes in cognition should be grounded in that it should not require any confirmatory support from statistical tools; e.g. we do not need probability measurements to define hypothetical values of gravity or formally predict values attached to electromagnetic properties on any given point in a regularly dimensionated space (S). Current models of cognition on the other hand cannot account for probabilities of future cognitive outcomes. For example, if we place a man (M) on point (A) in that space (S), and push him with force (F) (or influence him with communication (C)), based on current models we do not know what will happen next. He can move towards along vector (V) while gravity that slows him is (G), and can stop on point (B). Or: he might simply turn around and push us back. We also will not be able to predict his thoughts, his stream of consciousness or his sensations. Note, that there is a distinction here to be made between variability (e.g. the *number of alternative ways in which each interactant might behave*as put by [4] for example); and uncertainty (the behavior of *variance* in probabilities attached to those specific alternatives).

Uncertainty in cognizant living organizations does not stem from a general and inherent impossibility to decipher predictive rules of human cognition or behavior however. In fact, provided we have the possibility to observe both the position of (M) and force (F) or communication (C) over an (n) dimension of formal space, *uncertainty* in predicting outcomes in this case would have to be a result of an insufficient theoretical or conceptual (formal) basis to our analysis. With a fully sufficient theory, we can attach translational invariance to any cognitive outcome in a model as well as identify transformational attributes e.g. connect weighs to variables of interference contributing to those outcomes with functional equivalence. As discussed: cognition can be modeled thus formally as a systematic and systemic process that responds to (and can be described through) non-cognizant environmental attributes, omitting this way *interpretations* in research and modeling; a necessary step that becomes obviously so when the ambivalence inherent in any designations and characterising also the cognitive process itself, e.g. properties of attention such as *comparativity* and insinuation are remembered.

Simply put: cognition, just as our physical environment, is devoid of a state of rest. Previous models took any organization of cognition as performing in an either arbitrary, subjective or deterministic process that corresponds to other cognitive systems or to its own non-cognitive properties as if it was a closed system. Consider however that, firstly, cognition is a contextual enterprise, thus, abiding to environmental influences. Furthermore, idiosyncracy in cognition does not by itself yield subjectivity; idiosyncracy is associated rather with a particular variance of the following:

position (modeled simply on an (n) topographic, informational, emergent, etc. dimension of a formal space);

relational position (manifested and modeled through reflections of the self as related to other constructs);

perspective (modeled simply by position, relational position and background properties)*;*

and a variance of *insinuation* (modeled by projections of time, e.g. as appears in models of learning, development, evolution, etc.)

Strictly speaking, neither of the above contribute to the circumstance called *subjectivity*, provided we abide to a technical or formal vocabulary while describing a theory or a model. In fact, while 1-4 projected onto a formal space as (n) transformation of (c) (a core set of cognitive attributes) with value (C(x)) in any observed system defines idiosyncracy value (I(n)); at the same time 1-4 in any observ*er* system appears as variations in the attributes of measurement (M(n)). Variations in any incident thus are brought about by 1-4 properties of any contributor cognitive organizations; while those incidents are observed as based on 1-4 in measurement (observer) models resulting in further variations. Multistabilities may stem furthermore from the relativity as a result of any means of comparativity (referring here to both internal category-based ambiguities in a cognitive system; and to relativities of inertial frames). The stance that the forces operative in a dynamical system are not independent of observer and inertial frame is expressed also in physics (theory of relativity). Thus, denying the existence of an absolute standard of rest is a stance that can be taken into consideration and implemented in a formal cognitive model also but with heightened complexity.

The restlessness hypothesis implies that cognizing systems, because of their exponentially dynamic nature, are in a state of equilibrium only in theory. This is to say that a permanent

(23) $y>0$

value for ambivalence is expected ((y) is potentially expressed as for example measures of dissonance or stress, or as distance measured from a point of relative or local maximum of zero cognitive velocity). This is to say, that any formal model of cognition needs to account for the levels of uncertainty inherent in an ambivalent and dynamic cognitive system if not otherwise but on a conceptual level. Models that do not contain uncertainty of outcomes do not reflect the full array of general organizational properties of cognition. Referring to the proposition in Godel's theorem, and using it as reference for a description of formal thinking in general; it can be stated that cognitive models can not rule out hypothetical attributes in any exosystem that are potentially incomprehensible and undetectable for any cognitively structured organization, or for the particular cognitive organization that we share. This however does not imply that operant models of cognition are impossible to be built or used as tools across operations.

4. Discussion

To sum up, it is proposed here that subjectivity is inherent in cognition and theorizing only as *interpretative identifications* equating outcomes and explanatory frameworks. At the same time; neither relativity of position and inertial frame, nor the multistabilities of measurement or modelling are disturbed by effects of subjectivity in cognition. For that reason, *subjectivity does not need to be accounted for in order to formally model cognitive outcomes*. We have seen before [5] that emotions for example can, too, be modeled along their non-psychological organizational properties (laws). In fact, traditional and laymen theories that deny the feasibility of predictive approximations in a cognitive process and which attach to human cognition hypothetical contingencies, and subjectivity next to arbitrary or deterministic developments, *cannot be demonstrated by proof in cognitive systems.* On the other hand, and meanwhile, variations of outcome have been in fact observed and found systematic in relation with physical systems (e.g. from elements and impetus to particular quantum properties), as well as in biological and ecological forms (e.g. from genes to the cellular automaton); justifying a seach for such formally defined rules and core attributes, impetus, etc. in cognition also.

This step seems ever so important if we remember the fact that social, natural and formal science outcomes are also outcomes of cognitive (mental and pseudo-mental, e.g. organizational) systems in operation; thus not unrelated to systemic and general properties of the cognitive process itself. Taking into perspective that we are not only minds that interfere with each other while being influenced by context, but rather it stands that we have developmental, generative, and other specifically cognition-related qualities also that correspond to environment; the systemic approach that takes into account all of the global properties of cognition appears to be potentially beneficial for the purposes of building a basic formal model. [1] In terms of operational tool construction, the approach to model cognitive outcomes by identifying incidents of induced cognition makes a designation that discriminates variables that refer to:

the basic and systemic cognitive attributes which hence model *any* cognitive operation as a system corresponding at the same time to both the cognitive process itself (e.g. as attention attributes) and to environment as a larger system (stress conductance, withdrawal and transfer are examples here);

and variables that are not required for a global description and thus contribute to local descriptions of cognitive outcomes but not to the modeling of any systemic operation of cognition as a dynamic and context-sensitive process (such local ramifications are: conscious and unconscious cognitive outcomes; unintentional and intentional cognition; goals; behavior versus thoughts; etc).

Cognitive outcomes can be modeled in a formal model based on a proportionate reduction of global and systemic outcomes; rather than any local theories of interpretative identifications. On a conceptual level, this is to point out that variations in a cognitive system correspond at any time to both (c) and environment; and can be modeled in formal models by associating a particular set of operations and steps that describe deviation from (c), using an assigned set (as for example a binary set $\{0, 1\}$ is used in computing; or DNA sequencing is applied in genetics). Before we turn to the question of multistabilities of cognition that require a mathematical (formal) reduction en route formally denoting a (c) cognitive constant and to keep effects of uncertainty and ambivalence on a minimum level in our model, let us suppose that we have a hypothetical cognitive system (organization) where we know the following:

learning (insinuative) interference value (z);

experience effect (inference) value (e);

perspective product (p);

relational value (r);

comparativity product (c);

and where z=0 (meaning the system is newly born); e=max (all variance in environment is observed); p=0 (all perspectives are taken into account); r=0 (the system has zero relations); c=0 (every potential comparative variation is accounted for); with a stable value for external interference: y=0.

Such a cognitive system:

contains at any value (V(x)) as an integral multiple the constant (c);

[1] This is to say, that interference of a single mind or interference between multiple minds is not the only hidden variable in question. Nonlocality, entanglement, superposition and quantum interferences that appear as natural properties of observed physical systems are on the one hand also imposed as rules of physics on embodied representations of cognitive outcomes. This has however decreasing relevance in an operational sense when systemic cognitive and physical attributes are also considered. In models of *quantum cognition*, quantum behavior of physical systems is discriminated from the similar model used to calculate probabilities of cognitive outcomes. In quantum cognition it is generally proposed that finding the exact value of (c) can be done with the help of the quantum probabilistic model that calculates probabilities for (pa(x)) by observations of (a) under the complex of cognitive conditions (C) (note that (C) here is not referring to cognition but the context of cognition), where (pa(x)) is the probabaility to get the result (x) for observation of (a) under the complex of cognitive conditions (C). *PaIb(xIy) = the number of results a= x under context Cx/ the total number of observations under Cy; xeX, yeY;* (see further details of this particular cognitive model in [6].

can be described across time by the sum of changes occurring in (C(x)) which denote change to a change in value for non-behavioral cognitive variables;

contains multistabilities that can not be excluded by excluding variations and uncertainties of measurement; but outline sructural properties of a dynamic cognitive system. Embodiment, interpretive (e.g. somatic and gestural), as well as affordant (actualizational, potentiational), transmissive multistabilities are such in the human cognitive operation. Furthermore; it also

operates in interference with other systemic properties of environment;

operates in a constant state of non-rest, and along basic algorithms such as tension release through operationally coherent but also mutually exclusive channels (e.g. aimless motor action, cognitive heuristics, verbal and nonverbal communication, etc.) maintaining a certain nonzero value to ambiguity (stress); and

operates with a complexity that incorporates both complexities of physical systems and complexities of generative systems (maintaining special attributes such as: attenion; dissonance; and in particular dissonance and ambivalence based on dissociative and contrast-generating properties of attention; discriminatory properties of living systems; etc.) Added, that cognition as a system can be described by a set of attributes responsible for its non-interference based increase in complexity, denoted by the common nominator: *generativity*. Generative (referring to non-interferential or context-evoked change in a system) properties of the cognitive process also need to be contained in our cognitive constant (c).

Can we, besides accounting for ambivalence and multistability, point out a permanent set of attributes to cognition across time and most of all: can we reconstruct cognitive processes based on such a formally derived constant (c)? To answer that question, take the following into account. For one, it can be assumed that (M)? actions will be in correspondence with our material environment. If we place a child (M on point (A in space (S, and allow him to move freely, we do not know what will happen next. He can move towards along vector (V while gravity that slows him is (G, and can stop on point (B. Or he might do something entirely different; leaving us only with two assumptions: one that explains that (actions of M will be in correspondence with rules organizing our material (physical) and cognitive environment; and one that assigns coherence to (M as an organization. On the other hand, the basic attributes and constraints of cognition; those that *remain stable* accross all incidents, settings, and contexts are not the functions in operation on sub-systemic (e.g. personality, social, cultural, structural) levels but those operating on the levels of *basic impetus* and *basic algorithms*. Let us take the following example. We are sitting in front of a screen (S) and watching a black and white animation, with the time intervallum (t), where

(24) $0 < t < T$.

Let us suppose further that there is one point on the screen that contains throughout the length of the animation movie the same color, with value (x=d). Whether or not we know the exact position for (x), and whether or not we can identify (x) on the screen, the sum of variations in color values for the whole of the movie can be calculated as a sum of local deviations from any (d’) external to (S) fot (t). The variations in the sum of deviations from (d) will firstly be comparable to that of (d’); and second, it will denote a value that is appropriate for the purpose of comparing sets (m) and (m; with a measure of any interference value or exernal variable under (t).

5. Conclusion

While current theorizing denotes for example the following variables that need to be computed if one wishes to reconstruct the behavior of an intelligent system: trigger, ability to act, and motivation to act [7]; a c-theorem works with physical (algorithmic, mechanical, molecular, etc.) descriptions. The above mentioned categories emerge somewhat differently in a c-theorem. Namely, the following calculations are made possible with the system of the c-theorem: denoting spring in an intelligent system spring:S, it will be true that

(25) $S = cGM$;

where c is the cognitive constant, G is generativity and M is motive. Motive can be calculated in terms of non-spatial distance denoted by dissonance (tension) in a system:

(26) $M = D^2c$;

where D is dissonance. It is possible to describe the conservation of motive between systems:

(27) $\Delta D^2c = -\Delta D^2c$.

Origins of a generative spring can be modeled by the appropriate physical denotation modeling cleavages, tension and reflectivity (diffraction) in the cognitive process. Dissonance can be measured based on physical parameters of a cognitive system. The discrepancy between spring and trigger, motive and motivation is that while spring and motive are coherent and contextually insensitive categories, trigger and motivation are categories that cannot be inserted into a mathematically defined exclusively corresponding and coherent conversion using n dimension. The former are categories on which calculations can be based without theoretically assigned conversions, allowing for a mathematical model to serve as "the first basis from which a thing is known" (Aristotle in Met., 1013a145) rather than a set of arbitrary categories joined together in any assigned theory. A c-theorem would also refrain from theoretically constraining motive (a gesture performed by denoting the category 'ability to act') and computes rather than explaines change in an intelligent system.

Describing periodicity and generativity in cognitive systems goes in line with theories of Sheldrake [8] and Steinhardt, & Turok [9]. Let perpetuation in a system be denoted by P; interference by I, such as

(28) $I(1)+I(2)+...+I(n)+I(n+1) = \sum I$;

and generativity by G. We can then say that

(29) $\omega(\Delta I) = t/P = t\Delta u$.

Calculating time (T) then makes

(30) $T = G/\omega(\Delta I)$.

Considering pulse rate (f) such as

(31) $f = 1/T$.

then makes

(32) $f = 1/T = \omega(\Delta I)/G$.

The next step in the model is to describe the conversion between the two constants: time (t) and the cognitive constant (c). At this point we expect the conversion to look something like:

(33) $t = c^3$.

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Vitae

Orsolya Selymes was born in Budapest. She is currently a PhD student at the Doctoral School of Psychology at Eotvos University. She works as a trainer and counsellor in Hungary and in the United Kingdom. Her research areas are the following: culture; unintentional and compulsive behavior; computational cognitive science; formal modeling of intelligent systems; mathematical psychology. Her work includes building developmental tools; figuring out transformations between natural systems and learning and environmental models; and using convolutive and grounded methodologies in counseling.