ABSTRACTS (oral presentations)

Hermann HAKEN Stuttgart (D)

Intelligent behavior — a synergetic view

Ultimately, intelligent behavior is based on processes that go on in a complex system, namely that of neurons, and appears as emergent properties. Since a systematic study of such phenomena is performed in the interdisciplinary field of synergetics, it is a challenging task to apply its principles and insights to a theoretical study of intelligent behavior, or more generally, of intelligence. In my opinion, an IQ cannot be defined universally but must be task specific. Typical thought processes are: drawing analogies, i.e. finding isomorphisms between otherwise different systems or processes, possibly using specific transformations or the use of metaphors. Another basic process is that of association as is, for instance, used in pattern recognition, or as suggested by the author in decision making. Solving a jigsaw puzzle probably rests on associative actions. Intelligent behavior has been mimicked by algorithms on both serial and parallel computers, and the important notion of embodiment and situatedness with respect to robots has to be taken into account. It is suggested that the order parameter concept and slaving principle allow us to formalize and operationalize the acts of drawing analogies and performing associations. Creativity is seen as connecting seemingly unconnected facts that may be put into formal analogy to jumps over hills in synergetic potential landscapes.

J.A. Scott KELSO Boca Raton (USA)

Towards a dynamic cognition

Can the concepts, methods and measures of self-organized coordination dynamics provide a foundation for a dynamic theory of cognition? Behavioral and brain studies of cognitive strategy, learning, memory, attention and intentional behavioral change suggest an affirmative answer, provided information is expressed in the same space of variables that defines the pre-existing repertoire or knowledge base. "Representation" in this view takes the form of meaningful informational variables and their (parameterized) dynamics, the origins of which lie in the coupling of action and perception.

Jean-Jacques TEMPRADO , A. **Monno**, P.G. **Zanone** & M. **Laurent** Marseille (F)

Attention effects on bimanual coordination dynamics

This communication presents the results of a series of experiments carried out to study the effects of attention on the bimanual coordination patterns dynamics. We were interested in (1) how the focalization of attention modify the stability of preferred bimanual coordination patterns and (2) what does it cost for the CNS to maintain and to stabilize in-phase and anti-phase patterns. We used a dual-task paradigm: a bimanual coordination task associated to a Reaction Time task, with different attentional priorities given to the different tasks. Relative phase variability allowed to assess the stability of the coordination patterns. RT measured the central cost associated with performing and stabilizing the patterns. Results showed that: (1) at a behavioral level, the coordination dynamics (i.e., pattern stability and phase transition) may be modified by the focalization of attention, (2) the central cost associated to the maintain and the stabilization of coordination patterns depends on their initial stability: the more stable (in-phase) is the less costly to perform for the CNS, (3) relative phase variability and RT covary with the scaling of oscillation frequency around the preferred frequency, (4) high frequency levels destabilized the anti-phase pattern until a switch occurs toward the in-phase pattern. Before the

transition, relative phase variability of anti-phase pattern and RT increased; after the transition, both relative phase variability and RT decreased. These results suggested that: (1) relative phase is a variable controlled by the CNS, (2) maintaining and stabilizing preferred coordination patterns incur a measurable cost at the CNS level and (3) pattern stability and central cost share a common dynamics.

Franz MECHSNER Munich (D)

Perceptual coding in bimanual circling

We hypothesized that the symmetry tendency in bimanual circle drawing originates in a common representational medium for perception and action, and not in a motoric frame of reference which is separated from perception. Eight subjects produced circling movements of two visible handles, either in symmetry (in-phase) or in anti-phase, by means of two hidden cranks. Whereas the movement of the left crank and handle were equivalent, the right handle's circling frequency was 4:3 times faster than the frequency of the right crank and hand. The participants were generally able to perform symmetric movements of the visible handles up to rather high frequencies. Anti-phase movement patterns were less stable than in-phase patterns. With higher frequencies switches form anti-phase into in-phase occurred. These coordinative phenomena are obviously organized with regard to the visible handles, i.e., in a perceptual frame of reference. In addition, the experiment reveals that most complex movements, namely circling the hands in a 4:3 frequency ratio, can easily be executed in favor of a simple effect. Tool movements are organized in the same way than body movements.

Francisco VARELA Paris (F)

Neural synchrony and non-linear dynamics during conscious brain integration episodes

(*abstract not yet available*)

Tin-cheung CHAN Hong-Kong (CN)

The role of synchronization in perception-action

It has been claimed that synchronization between brain areas is an effective mechanism to reorganize the cortical connections in a large-scale network. To investigate such mechanism of self-organization in long-range connection, two experiments were conducted with EEG analyzed with multivariate autoregressive (MVAR) modeling. In Experiment 1, participants pressed a button to discriminate colored forms. O2 was found synchronized with T4 and C3 at around 200 ms for discrimination while T4 and C3 were synchronized at 400 ms for action. When sound was presented simultaneously, perceptual synchronization occurred earlier while response synchronization fluctuated causing a delay in RT. In Experiment 2, two numbers were presented before the discrimination of colored shapes. Participants pressed a button only when the sum of two numbers was odd. ISI was also varied. O2 was found synchronized with F4, T4 and C3 at 100 ms for computation, O2 was found synchronized with T4 at 200 ms, and F4, T4, and C3 were found synchronized around 300-600 ms depending on the ISI. Results suggest that synchronization obtained with MVAR modeling indicate the co-activation of brain areas. Results suggest that perceptual synchronization is not delayed by simultaneous tasks but response synchronization can be affected.

Mark MOLNAR Budapest (HUN)

Non-linear event related potential correlates of cognitive perceptual processes

Only in the last decades have those methods become available by the help of which the predominantly non-linear features of brain electrical activity (electroencephalogram, EEG) can be analyzed. Among the non-linear algorithms the time-dependent dimensional ones appear to be the most sensitive discriminators. In the present study dimensional responses were examined that accompanied the P3 event-related (ERP) component in human (auditory odd-ball) and animal (chronically implanted [auditory cortex, vertex, dorsal hippocampus] cats, classical aversive conditioning) experiments. For data processing the point correlation dimension (PD2) was used suitable for the analysis of time-dependent changes of dimensional complexity in data streams with non-stationary changes. Phase randomized surrogates were used as control data. Significant dimensional reductions accompanied the P3 wave the pattern of which proved to be task-dependent and showed regional specific features. In human subjects, larger P3 components were associated with more pronounced PD2 decreases. Analysis of the data collected in animal experiments showed that the dimensional changes elicited by the reinforced signal stimulus were clearly dependent upon recording sites but in general resembled those observed in the human. The results are interpreted within the scope of our "non-linear cooperativity" hypothesis.

Richard SHIFFRIN Bloomington (USA)

Bayesian modeling of memory and the relation to principles of self-organization

Very successful models have been developed in recent years, for both accuracy and response time, for such behaviors as explicit memory (recognition and recall), implicit memory, short- and long-term priming, and lexical decision, based on the premise that participants act in a (close to) optimal way, given the physical and informational constraints of the task and the participant. The idea is that adaptive learning eventually produces such optimal performance. Examples of these developments are described, and the principles that underlie the developments are related to those that have motivated progress in dynamical systems and self-organization.

Juval PORTUGALI Tel Aviv (ISR)

SIRN (Synergetic Inter-Representation Networks), or what can cognitive mapping reveal about the mind

In the history of the cognitive science Tolman’s (1948) 'cognitive map' is often given the credit of being one of the notions that have exposed the shortcomings of behaviorism and gave rise to cognitive science. It is also given the credit of playing a central role in establishing the 'information processing approach' (IPA) as the dominant approach of this new science of mind. More recent studies on cognitive mapping, in particular from the perspective of synergetics, seems to cast doubts as to the truism of the IPA that Tolman’s notion of cognitive map helped to establish. These doubts concern a central assumption implicit in cognitive science: That the process of cognition is confined to the brain (skull), with the implication that all forms of external representations, be they mimetic, lexical, or the production of stand-alone material tools, are artifacts and as such not part of the very process of cognition. The notion of SIRN (Synergetic Inter-Representation Networks) suggests an alternative view, that can be described by means of five propositions: (1) Humans have an innate capability for representation that comes in two forms: internal and external. The latter include bodily representations (mimetic, lexical etc.), as well as stand alone objects. (2) Representations are ad-hoc, task-specific, entities that emerge out of the dynamics of cognitive processes. They are termed representations by virtue of the property that they enfold semantic information that can be measured by means of

Shannonian information. (3) The boundaries of the cognitive system should be perceived as distinct from the boundaries of the brain (the skull) and the body (skin), with the implication that the elements of the cognitive system often include internal AND external representations. (4) Many cognitive processes, cognitive mapping included, evolve as an interaction between internal and external representations. (5) The cognitive system is a self-organizing system the dynamics of which is captured by Haken's synergetics approach to self-organization.

The notion SIRN combines, in fact, two terms. One is Synergetics — Haken's theory of self-organization as applied to the study of brain functioning and cognition (Haken, 1996). The other is IRN (Inter-Representation Networks) that was developed by Portugali (1996) as an approach to cognitive mapping. SIRN is thus a model and a theory that cast the notion of IRN into the formalism of synergetics (Haken and Portugali 1996). In my presentation I'll elaborate on the above propositions and illustrate them by reference to empirical studies in two domains: cognitive mapping in the context of solitary exploratory behavior of animals and humans and, cognitive mapping in the context of collective city dynamics.

J. Richard EISER Sheffield (UK)

Attitudes as attractors

All systems (unless they are completely random) embody constraints that mean that some potential patterns of activity will be more likely to occur than others. These patterns are termed *attractors.* Many psychological theories of motivation, cognitive balance, etc. assume homeostatic mechanisms that can be viewed as dynamic systems dominated by one or more such attractor. Attractors define the states into which a system is likely to move. Hence, *change* in a system is analogous to 'movement' towards and between attractors (and/or away from 'repellors'). This paper will illustrate how this concept can be applied to a number of issues in theories of attitude organization and change. Specifically, it is assumed that attitude positions that are easily recalled and strongly held constitute attractors. Hence, the likelihood, at any point in time, of a person's attitude changing, or resisting change, depends on its proximity to one or more attractor positions. The power of a given attractor position, at any point in time, depends on the consistency of the information, associations, and social influences by which it is activated. Such associations are *learnt* and hence change *dynamically* over time as a consequence of feedback from experience and from the behavioural consequences of adopting a specific attitude. Evidence for this conceptual framework will be provided by connectionist simulations of attitude formation

Fred KEIJZER Leiden (NL)

Self-organization and the agenda of psychology

The use of concepts from dynamical systems theory, and in particular the notion of self-organization, has important repercussions for psychological explanation. Psychology targets personal level «mental and behavioral» phenomena, and tries to formulate subpersonal mechanisms to explain these phenomena. Traditionally, the tendency is to formulate proposals for subpersonal mechanisms in a way that stays very close to the personal level phenomena. For example, the phenomenon of attention has given rise to a large number of proposals for specific attention mechanisms. The notion of self-organization makes a difference here, because it provides a conceptual approach in which higher-level patterns are produced by very different lower-level processes. By using a conceptualization based on self-organization, proposals for subpersonal mechanisms to explain mental and behavioral phenomena can be dislodged from these surface phenomena without giving up the phenomena, as happens in reductionism. The consequence is that psychology acquires a new freedom to develop

subpersonal explanations, which no longer need to mirror personal level characteristics. This opening up of new themes for psychology's agenda can be illustrated by looking at the notion of representation in the context of self-organization and the explanation of behavior.

Maria E. QUILICI GONZALES & **Maria C. DEL-MASSO** São Paulo (BR)

Socio-cultural memory and self-organization

Based upon Vygotsky (1993) and basic principles of self-organization (Ashby, 1962, Gonzales et al, 1996), the present paper investigates dynamical aspects of socio-cultural memory. This is contrasted with the traditional information processing view in cognitive science (Frawley, 1997), in its intrinsically connected link to symbolic information processing. Leaving aside the paradigm of symbolic information, we propose an analysis of memory in terms of dispositional states that are critically self-organized. These can be understood as states whose dynamic causal properties, when encountering adequate conditions, produce synchronic specific events - characteristic of complex systems. In this sense, dispositional states constitute causal propensities and, as we shall argue, they provide powerful elements to understand socio-cultural memory.

Michael MAHONEY Denton (USA)

Oscillative dynamics and systemic order in human psychological development

Human experience reflects the operation of multiple and interacting oscillative patterns. This presentation focuses on the overall challenge of maintaining systemic integrity or coherence in the face of lifelong perturbations. Although oversimplifying, this challenge can be viewed as one involving what Johann Herbart and Jean Piaget called “equilibration,” the vital gesture of balancing novel experiences (disorder) with familiar activity patterns (order). One argument to be proposed is that traditional labels of psychiatric disorder are actually references to contextually dysfunctional patterns of establishing or protecting a viable experiential order. This is reflected in the frequent pattern of reduced variability in activity patterns (e.g., in obsessive-compulsive patterns, which are among the most orderly of the so-called disorders). The idea is developed that a dynamic systems approach to lifespan psychological counseling is worthy of elaboration and practical evaluation. Such an approach might, for example, highlight the stabilizing (order-enhancing or order-protecting) functions of human relationships and symbol systems. In the context of the safety, stability, and encouragement afforded by such relationships and systems, developmental challenges can be individually paced and patterned, with generous respect for periods of “expansion” and “contraction” in the process. This is the essence of what are being called the “constructive” or “constructivist” therapies, which reflect a dynamic systems approach to human experience and its development.

Günter SCHIEPEK Munich (D)

Emotion and cognition in therapy-induced order transition

If on a very basic level cognitions can be conceptualized as the processing of distinctions, then certainly a great variety of complexity levels of cognitions will exist - from elementary perceptions to self-schemata and other products of self-consciousness loops. The question we will discuss is if cognitions on different complexity degrees follow similar self-organizing principles and conditions. Supposed we can identify these conditions - suggested by some of synergetics' core assumptions - then they should help us to trigger learning and other phase-transition like phenomena. In order to do this, stable and instable (transitions preparing) phases have to be identified and discriminated. Estimating local fluctuations in time series can help

realizing this identification job. The role-variety of emotions during transitions of cognition and behavior attractors contributes to an understanding of affect-cognition relationships.

Jane ABRAHAM Blacksburg (USA)

Dynamic systems theory: applications to pedagogy

Theories of learning affect how cognition is viewed, and this subsequently leads to the style of pedagogical practice that is used in education. Traditionally, educators have relied on a variety of theories on which to base pedagogy. Behavioral learning theories influenced the teaching/ learning process for over 50 years. In the 1960s, the information processing approach brought the mind back into the learning process. The current emphasis on constructivism integrates the views of Piaget, Vygotsky, and cognitive psychology. Additionally, recent scientific advances have allowed researchers to shift attention to biological processes in cognition. The problem is that these theories do not provide an integrated approach to understanding principles responsible for differences among students in cognitive development and learning ability. Dynamic Systems Theory offers a unifying theoretical framework to explain the wider context in which learning takes place and the processes involved in individual learning. This paper describes how principles of Dynamic Systems Theory can be applied to cognitive processes of students, the classroom community, motivation to learn, and the teaching/learning dynamic giving educational psychologists a framework for research and pedagogy.

Esther THELEN Bloomington (USA)

A dynamic systems approach to cognitive development

A central tenet of a dynamic systems approach is the continuity of time scales and processes in the development of behavior. In this view, there is no sharp distinction between the domain considered purely "conceptual" and the perceptual-motor processes that give rise to concepts. I illustrate these ideas with several experiments with infants and toddlers illustrating the profound embodiment of cognitive processes. I make the point that cognition begins in embodied processes and remains coupled to and embedded within them.

Monica COWART North Andover (USA)

An affordance field for guiding movement and cognition

Thelen et al. (the dynamics of embodiment, BBS preprint) claim, "the unified field is the essential notion of embodiment." Our goals are 1) to discuss why a unified field is important for embodiment, 2) to explore in what sense the Thelen et al. field is embodied, and 3) to offer a sketch of how the proposed field can be modified to provide an embodied account of behaviors more abstract than reaching. In short, Thelen et al. discuss a "where" field, but eventually a "what" component must be developed to address issues of intentionality. Our suggestion is for an action field built out of affordances that can complement a dynamic systems analysis.

Wolfgang TSCHACHER Bern (CH)

The relationship of cognition with valences

In trying to transcend the information processing paradigm in cognitive science, the notion of cognition as emerging from a self-organizing complex system comes into view. It is argued that the relationship of a complex cognitive system with valences of the environment (Gibson's affordances) is analogous to the relationship of any self-organizing complex system with its

non-equilibrium control parameters. Pattern formation in a self-organizing system tends to reduce the system's distance from equilibrium (sometimes called exergy). Thus, self-organization is an optimizing process. If this property is regarded in the context of cognition, a hypothesis concerning intentionality and consciousness of cognitive systems results - the optimality function inherent to synergetic systems can be proposed as a third-person explanation of the intentionality and purposiveness of conscious cognitive acts. From a first-person perspective, the subjective experiences of qualia such as intentions, pain, or color perception, are indicators of the phenomenon of cognitive self-organization.

Luc STEELS Brussels (B)

Dynamical modeling of language

This talk takes the viewpoint that speech is an adaptive behavior. It focuses on the problem how individuals can recognise, produce, and acquire the speech sounds of their language community and how a sound system may emerge in a population from scratch and how they can be transmitted between generations. Concepts of dynamical systems play a central role in the proposed models. Speech requires the real-time control of a many-degrees of freedom articulator, and the extraction of significant features from a continuous acoustic signal. Moreover at a collective level, self-organisation, selection and co-evolution appear crucial for explaining the origins of speech sounds and the universal tendencies found in human speech sounds.

Willem HASELAGER Nijmegen (NL)

The dynamics of imagined action

This paper addresses Clark's (Clark & Toribio, 1994; Clark, 1997) challenge to dynamical systems theory to deal with 'representation hungry' cognitive tasks (Clark & Toribio, 1994) by investigating imagined action. In the experiment, subjects were required to imagine whether an action involving reaching with a rod would lead to success or not. The results from the experiment are in full agreement with a dynamical model, extended from Tuller, Case, Ding & Kelso (1994). The reported experiment and model indicate that imagined action can be understood as a dynamic phenomenon, thus answering Clark's challenge. The dynamic account is contrasted with potential representational accounts and a case is made for the motto: 'Don't use representations in explanation and modeling unless you really have to.'

Gert WESTERMANN Paris (F)

Constructivist models of cognitive development

Recently there has been mounting evidence that the cortex develops in an activity-dependent, constructivist way by construcing connections between neurons based on experience. I argue that this property of cortical development is essential and should not be neglected in computational models of cognitive development. I present a constructivist neural network model of the acquisition of the English past tense that accounts for the human data better than previous, non-constructivist models. The same model is used for simulating the selective breakdown of irreguar inflectional processing in German agrammatic aphasics. While this breakdown has been traditionally taken as evidence for two qualitatively distinct processing mechanisms for regular and irregular verbs (symbolic rule and associative memory), I show how such dissociations can emerge without prespecified modules and based on a single associative mechanism, when constructivist development of the system is taken into account.

Kerstin WITTE, Holger BOCK, Ulrich STORB & Peter BLASER

A synergetic approach to describe the stability and variability of motor behavior

The problem of the stability and variability of movement cannot be satisfactorily solved by means of linear methods. Therefore, we used a synergetic approach to describe the human movement coordination. On this base we developed a complex model of the movement coordination. For the dynamics of the order parameter we used the model of an periodic attractor with chaotic characteristic. The model was successfully applied to tapping-experiments with the feet and to the transition from walking to running.

Poster abstracts

Paolo CAPPELLOTTO

Order from disorder in panic attacks: the dynamical systems and personal construct psychology

The purpose of this paper is to propose a postmodern framework for psychotherapy on a constructivist model (a Kellian perspective) from the author's clinician practice based, also, on the dynamical systems approach to psychology.

Guido STRUNK & Anett HERMANN

Career patterns of men and women. A computer simulation study based on co-operating intelligent agents

The purpose of this interdisciplinary investigation is to expand our knowledge about self-organization processes of dynamic systems as well as processes of the emergence of social order structures, in particular the inequality between men and women in the more highly qualified job market. The basis of this project is to generate a computer simulation of the substantial development of social processes. While simulating these processes, autonomous agents are used. For each of those agents on a microscopic level a set of social rules is defined, which effects are to be studied based on mesoscopic or macroscopic self-organization phenomena. Within each case various rule sets for "male" and "female" agents are modelled to observe the different effect on the distribution of the agents in the "job market". As basis for defining the rule sets, theoretical work about man federations and the tournament theory of Rosenbaum are consulted (1979, 1984) for the explanation of career pattern.

Maria Eunice Quilici GONZALES, Maria Cândida DEL-MASSO, Mariana C. BROENS & Carmen Beat MILIDONI

Personal identity, self-organization and autonomy

Cognitive science has brought about a revolution in the study of mind by showing that thought and intelligence are not the unique prerogative of living organisms (human or non-human), but are also characteristics of complex self-organizing systems. In this context we investigate the implications of this perspective for the problem of personal identity. Our central question is that of the relation between the self-organizing process of identity formation and the human subject. First of all, we shall argue that there can be a process of identity formation without a reflexive human subject, owner of a personal identity. We try to show this by arguing that the notion of a reflexive subject should be understood as posterior to the concept of identity and not as a pre-condition of it, and that in self-organizing systems personal identity could be understood as an emergent product of action and thought. We suggest that this conclusion is a natural consequence of considering humans as complex dynamical systems in which processes of self-organization occur.

By self-organization we understand those processes through which new forms of organization emerge solely from the dynamic interaction which arises among elements which are initially independent and which have come together by chance, without any a priori plan, intention, or central controller. Based on the work of Ashby, we make a distinction between primary and secondary self-organization. The first refers to a process or situation in which independent elements act so that they evolve towards forming a system whose parts are co-ordinated (Ashby,

1962, p.266). The second includes the first, adding to it learning mechanisms and criteria of relevance for distinguishing and selecting between good and bad forms of organization. This makes possible the emergence of autonomous systems. Our thesis is that it is only when a human subject reaches this level of autonomy, and is capable of identifying itself as distinct from its environment, that the notion of a subject capable of personal identity begins to be delineated. This process of delineation takes place by means of the organism's interactions with a social environment in which language plays a crucial role in the process of secondary self-organization, since language optimises the process of learning the parameters which will crystallise the notion of an autonomous subject.

Christian SCHUBERT , Astrid LAMPE, Gerhard RUMPOLD, Paul KöNIG, Dietmar FUCHS, Emil CHAMSON, Gerhard SCHüSSLER

The perturbation of the dynamics of neopterin - a central immune parameter - by individually meaningful daily incidents

System theoretical conceptions in psychosomatic medicine suggest that individually meaningful stressors interfere with the dynamics of biological processes. Until now, this had never been proven empirically in an individual under natural conditions. In this "integrative single-case study" we investigated whether individually meaningful daily stressors are able to interfere with the dynamic course of neopterin, a central parameter of the immune system.

A 40 year-old woman suffering with systemic lupus erythematosus (SLE), a chronic autoimmune disease, collected her overnight urine for a period of 63 days on a daily basis. Each day, she also answered questions about her emotional state and daily routine. Furthermore, she was interviewed on a weekly basis to identify individually meaningful daily incidents. Using the resulting biological, psychological and psychosocial time-series statistical analysis was performed by ARIMA-modeling.

The statistical analysis revealed that two incidents, the departure of the patient's son as well as the patient's 40th birthday party, led to characteristic phase transitions in the release of neopterin. In conclusion, using a new integrative research approach in psychosomatic medicine we were able to demonstrate the perturbing influence of individually meaningful daily incidents on the dynamics of neopterin, a central immune parameter.

Ruben BENANTE

Internet: The new primordial soup.

It is very difficult for biologists to classify virus as having life since they depend on other life forms to survive, reproduce and so on, but when they are in their optimal environment they represent all characteristics necessary to life, they represent self-organization (using many mechanisms such as mutation) and they evolve escaping from man-made vaccines. The direct and crude attempt to create artificial intelligent life seeing the computer as an idealized body has been upset, but the cunning vital force had already invaded the virtual world persisting like a cactus growing up in cruel conditions. In this vision the isolated computer which was the central point in the personification of the intelligent machine is now only a constituent of a virtual environment that will produce a life of its own.

C.T.J.S. NASCIMENTO, I.M.L.D'OTTAVIANO & A.M.PELLEGRINI

The emergence of order in young children's playing activities.

The process of self-organisation is defined as the appearance or restructuring of a form due to this process itself (Debrun, 1996). As such, it does not emerge in the vacuum but takes place due to the relationships among the elements that constitute the system. Therefore, the process is not predetermined by rules or laws. Debrun points out that there will be self-organisation when the elements that are involved in the process cooperate and compete among themselves, giving support to the maintenance of a form that already exist or the emergence of a new form. In the present study we try to identify how children 3 - 4 years old self-organise (the group as a system) and learn basic motor skills (each child as a system) while freely playing in an area of the playground without toys and apparatus. Children activities were registered in video for 15 minutes. We looked for the emergence of geometrical representations of children displacement in the environment that remained for at least one minute and we found groups of children running in straight line, diagonal or circle. Therefore, some order in the children's activities emerged naturally and spontaneously and they last for awhile when the children disperse and new forms emerged. In terms of the learning of motor patterns, three different events were identified: (1) individual actions, when the child explores the environment and his (her) own body; (2) imitating a peer model, performing an action after observing the performance of another child; (3) looking for a partner for a conjoined action. The results of the video analysis suggest that self-organised forms emerge during children's free playing time in the school setting and learning basic motor patterns takes place from the relationships established among the children as they explore their own actions, monitor the activities of others, help each other and show what must be done in the action.

Ruben BENANTE

Self-organization on hybrid neural networks

This paper intends to study the emergent properties of the Hybrid Neural Network Hopfield-Kohonen (HNN H-K) allowing us to classify it as being self-organized or not. To do this it is necessary to discuss the real possibility of self-organization in artificial neural networks. The self-organization theory includes factors that not always are taken in account. For instance, is it possible to obtain a neural network presenting secondary self-organization in the Ross Ashby meaning? And what is the importance of the environment on systems that present self-organization?

Valentino POMINI

Monitoring of daily states by chronic psychiatric patients : a tribute to the vulnerability model of schizophrenia and other psychiatric disorders

The vulnerability-stress model is now widely accepted in the understanding of schizophrenia and tends to be applied in the case of other major psychiatric disorders. It assumes that psychiatric symptoms are dynamical and result from complex interactions between relative stable (or traits) variables, such as biological and psychological (or cognitive) vulnerabilities, internal changing states (emotion, cognitions) behaviors, and external events (stress factors). Based on the results of a great number of experimental but focalised studies (eg. cognitive deficits, biological markers, expressed emotion in families, etc.), this model implies too many variables for it to be holistically validated. In fact, it appears impossible to measure simultaneously all the implicated variables, and to examine in detail how they interact during different phases of the mental illness. To grasp this complex problem, it appears necessary to

conduct studies about the dynamics of psychosocial parameters influencing the mid and long term evolution of chronic psychiatric patients. The idea of our project is to verify how single daily evaluations by both patients and caregivers can be used as scientific data which can provide useful information for the modeling and the prediction of mid term evolution (3-4 months). The poster presents a new instrument designed for this purpose, based on the vulnerability-stress model, and adapted to the clinical daily practice in the long term care of psychiatric patients. It tries to translate the major psychosocial parameters of this model (internal vulnerabilities/ressources, external ressources, stress factors, and psychological state of the patient) in rather simple evaluation scales. The complete instrument will be presented in detail, with the results of a first validation study.

Paul ZIOLO

Memes and Morphologies: neural Catastrophe Induction through the Socialisation Process.

This paper presents a generalised catastrophe-theoretic treatment of the archetypes and morphologies underlying speech patterns and other forms of cultural expression. We begin by introducing the relevant aspects of catastrophe theory, then proceed to show how elementary and higher-order linguistic archetypes are derived from the basic manifolds originally identified by Rene Thom, and how meaning is ascribed to these archetypes through 'attributional dynamics'. We show how these archetypes relate to one another through 'enfielding', how they may manifest themselves within neural networks and how they are induced over time through 'memes' that accompany traumatic events occuring during critical phases of personal growth. We present an example of how such an approach may assist interlingual fantasy analysis by applying it to an analysis of Hitler's speech to the Hitler Youth at Nuremberg, 1934. Invoking Haken's synergetic paradigm of order parameter emergence, we conclude by briefly examining the generalised Thom-Pomian historical chreod, showing how archetypes induced during childhood may play a major role in later trauma re-enactment at social and political levels.

Andrzej KOKOSKA & Andrzej BIELECKI

Dynamical systems model of information metabolism and perspectives of its application in psychotherapy

The concept of information metabolism was introduced by Antoni K'pifski and applied to description of mental processes in a series of monographs on mental disorders in the 70-ties. More recently it was reformulated by Kokoszka and mathematized by Bielecki in terms of dynamical systems theory. Those works are briefly summarized and perspectives of the application of this approach to psychotherapy are discussed. This mathematized model may be helpful in preparation of the multidimensional psychotherapeutic diagnosis including estimation of possibilities to: maintain the order, assimilate new data, eliminate unnecessary information, and preserve boundaries.

Roumiana NIKOLAEAVA

Mathematical approach to description

The holistic approach to description of living systems is based on the concept that the living organism is itself part, participant and contributor to its world of observation.Two fundamentally different forms of description, endo- and exo-, corresponding to different epistemological attitudes, in relationship to whether the observer is situated in or out of the system, reflect the constraints of the observer, concerning the notion of time. As the

informational detachment is only possible if accompanied with temporal (exophysical) detachment, the endo- and exo- descriptions of the system have to be compatible. A mathematical approach to this problem is discussed.

Roul Sebastian JOHN

Comparative cognitive robotics: A framework for studying self-organized cognition in autonomous agents

There is a shared belief in contemporary science that the development and study of autonomous robots, which adapt to their complex environments in a self-organized way, opens up a wealth of new possibilities for the study of cognition and intelligence. However, this new field is still in search for a common methodology which would allow to develop robots as scientific models of cognitive phenomena. Building on an analysis of the current approaches in this field, which lead to the new concept of self-organizing models, we have developed the approach of Comparative Cognitive Robotics. In this approach, we combine empirical learning research with animals, experiments on implicit learning in humans, and robot modeling in a unified framework for studying self-organized cognition in autonomous agents. We believe that this framework could serve as a new basis for an empirical cognitive science. At the same time, we propose to distinguish (at least) three ranges of phenomena in cognition requiring different approaches for their study that should be kept apart in order to avoid the confusions and irrational hopes which still show in the current methodological discussions in cognitive science.

Bernhard BIERSCHENK

Nature's string stiching device for the production of a language space

No one has ever been able to look into the language space nor has anyone been able to measure the phenomenon of consciousness without the interference of an observer. This paper is changing the situation completely. From now on it is possible to produce measures of consciousness without the presence of classical observation devices. In particular, the observation problem can be bypassed since the "observer" is part of the "observed". This means that the phenomenon is describing itself. Since there is no longer any need for mirroring the state of consciousness by the state of an apparatus, the classical problem of an observation on the apparatus has disappeared. It is shown that the measurement situation has been changed fundamentally. A full description is attainable through the establishment of the geometrical shapes of involuted textual flows.

Inger BIERSCHENK

The correspondence between an evolving mental space and text production

A main line of thought in modernistic prose concerns the efforts of transforming scientific concepts into literary forms. This paper presents a study, which formulates the hypothesis that, despite these efforts, a clear distinction should be found between the theory and mind of an author and his text producing practice. A text sample from a well-known American Nobel Prize holder has been studied by means of Perspective Text Analysis, by which the space of a text can be established and measured. Contrary to the hypothesis, the result shows a perfect consistency between mind and practice in the sense that this author is proved to be a functionalist throughout. A functionalistic text is not producing any shadow, that is, any information below see level.

Jorge Barros PIRES

Cognition: a reflection on Charles S. Peirce's philosophy

The philosophical attitude found in areas of research on cognition, such as the Cognitive Science, is a species of mechanical physicalism. The basic idea of Cognitive Science is that cognition is information processing follows certain universal logico-mathematical laws. The notion of information is inspired by a mechanistic point of view of Nature and Chomsky's theory of a deep generative grammar behind all languages. The idea of subjective dimension of concept of information has being totally cast aside. But the fundamental problem remained unsolved. Information, in the sense of Information theory, has nothing to do with spontaneity and intentions. The mathematical theory of information collapses in the moment unpredictability and intentionality enter the scene. Although information be considered the key to understand cognition, the notion of cognition can not be treated in a satisfactory way by the informational and communicational theories. A possible solution to this problem is given by Charles Peirce's (1839-1914) in his semiotics. The semiotics studies are not necessarily in contradiction with Cognitive Science theory, but this theory have a problem in the concept of cognition. The notion of cognition can not be simply reduced to information. It should be understood as a sign process, for there is no message, communication or information without signs.

Maja STORCH *&* Ferdinand KELLER

Exploring the development of inner control with time series models

In a previous article, we examined time series methods for evaluating the dynamics of personality change in thirteen students who attended a course of personality development based on Jungian theory. The Jungian theory considers the self neither as state nor as trait but as a phenomenon resulting from emergent processes in the psyche. Current research (Tschacher, 1997) supports this view of the self within a different theoretical context. In order to assess this type of processes, the students of our study rated their mood, activity, tension, and feeling of inner control on visual analogue scales two times a day for four months.

To evalute the expected smooth transformations in personality the following hypotheses were empirically tested by the time-variation of parameters in subsequent time windows:

1) Increasing stability in mood and in the feeling of inner control by decreasing standard deviations
2) higher innerpsychic coherence by increasing autocorrelation coefficients
3) dissociation between mood and feeling of inner control by decreasing cross-correlation coefficients between these two dimensions.

The application of several statistical tests showed that hypothesis 1 could be accepted while the other two hypotheses could not be confirmed. In this poster, we extend these results by a new set of data assessed with the same students in a second course of personality development. Additionally, special weight is given to the problem of operationalizing inner control in an empirically and theoretically satisfying way. We also give sketches of the design of a future study to improve our time series approach.

Nina JACOBSHAGEN & Wolfgang TSCHACHER

Process Analysis of Crisis Intervention

A sample of 40 in-patients, who were assigned to treatment in a psychosocial crisis intervention unit, was monitored to study the process of crisis intervention. The process data consisted of

patients' self-ratings of the variables mood, tension, and cognitive orientation which were assessed three times a day. Linear trends were found pointing to an improvement of mood, a reduction of tension and an increase of outward cognitive orientation in the course of crises. Linear time series models (vector autoregression) of the process data were computed to describe the prototypical dynamic patterns of this sample. It was found that, on average, outward cognitive orientation preceded improved mood. Additionally, the outcome of crisis intervention was evaluated by pre-post questionnaires to study the relation of process to outcome. This investigation showed that the time series models partially predicted the treatment effect, notably the outcome domain 'Reduction of Social Anxiety'.

Marc LEWIS

The role of emotion in corticolimbic self-organization

From a complex systems perspective, individual developmental outcomes (e.g., personality patterns, coping mechanisms, psychopathology) appear to derive from the recurring real-time self-organization of particular cognitive constellations, or meanings, over multiple occasions. Emotional processes may influence developmental outcomes through their constraints on these real-time cognitive events. What sort of neural mechanisms are consistent with this picture?

Development can be viewed as the laying down of neural organization over months and years. What gets maintained are synaptic configurations that favour the recurrence of particular real-time patterns. These configurations derive from the formation and strengthening of synapses that dispose the brain to repeat performances of the same self-organizing interpretations, expectancies, and goals across many occasions.

Four neurodevelopmental mechanisms suggest that this process of neural sculpting is bound up with emotion. First, individual differences in emotional dispositions (e.g., temperament) guide the selection and strengthening of cortical and limbic synapses in infancy, by constraining attention and inhibition (Derryberry & Rothbart, 1997). Second, the selective mechanisms underlying cortical crystallization appear to be centered in corticolimbic areas where cognitive appraisals and emotional states are synchronized (Schore, 1994; Tucker, 1992; Freeman, 2000). Third, neuromodulator action during prolonged affective states maintains corticolimbic organizations that eventually supersede the brain’s early plasticity (Schore, 1994). Fourth, intense emotional experiences yield permanent conditions of "limbic hyperexcitability," as when abuse and neglect early in life "kindle" depression or anxiety with increasing predictability over the years (Harkness & Tucker, 2000). These neural mechanisms will be outlined and integrated within a psychological account of emotional constraints on cognitive self-organization.

L. SIBILIS & S. BORGO

Discriminant features of children's drawings identified with artificial neural networks

Hypothesis. The present study is based on the hypothesis that cognitive representations of specific themes, as they appear in children's drawings, can be used to discriminate among different psychopathological categories, on the basis of a theoretical recursive model of drawing production, and a minimal number of predictive independent features.

Method: We have gathered 240 drawings from 80 children of elementary schools, related to 3 different themes ("meadow," "house," "mountain") during a screening implemented in the school. The drawings have been assessed by two independent psychologists as having 44 characteristics, either of formal or content type, and dichotomically scored on each of them.

After 1 and 2 years new evaluations with the same method and variables have been performed on the same subjects, on new drawings. At follow-up, children could be classified into 4 groups according to the presence or absence of observed psychopathology and of its type (cognitive, behavioural, or psychosomatic disorders). An analysis of differences between each abnormal subgroup and the normal children subgroup has been performed by means of an artificial neural network (ANN) of backpropagation type (three layers perceptron), with a minimal number of independent predictive variables. Each sample has been divided into two subsamples: on the first the ANN has been trained, on the second it has been verified.

Results. For children with cognitive and behavioural disorders only, but not for psychosomatic children, the ANN could be trained up to satisfactory solutions, allowing a correct prediction from 80% to 100% of the cases at follow-up screening.

Michael REICHERTS and Sandrine PIHET

Perceiving changes and the "emergence of events": Self-organisational aspects during self-monitoring of well-being indicators and stress in the natural setting

Psychological processes during daily life self-monitoring of well-being and stress variables are analysed in terms of the non-linear paradigma. Based on study with 44 young adults entering the work force we used multivariate systematic self-observation combining time (hourly recordings) and event-based self-monitoring. "Classical" individual time-series analyses allow to assess strength of impact of stressful events on well-being process variables. However, data suggest also that there are individual threshold and non-linear characteristics of perceived state variables linked with the perception and recording of events as "emergent" units of experience, which could be interpreted as self-organisational terms. Implications of cognitive variables (self-attentional processes, action vs state orientation) in these processes are discussed.

Ewald Johannes BRUNNER

Cognitions in groups - Some remarks from the viewpoint of the theory of self-organization

In the social sciences, especially in social psychology, social groups are often considered as units that are governed by own system rules compared with the behavior of the single members of the group. Groups, for example, can - under certain circumstances - be more efficient in problem-solving tasks than single problem-solvers. The question is why groups are more efficient. According to the theory of self-organization cognitions in groups show a synergetic effect (as an emergence phenomena) if the corresponding parameters are optimized (optimal group size; unhindered flow of information; etc); cognitions in groups then follow the principles of order formation in the sense of the theory of self-organization.

Sibylle HEUNERT

Collective skills in work teams: evaluation of dynamics

These last years have seen the ongoing emergence of the concept of work teams in the public mind as well as in private organizations. Yet, knowledge about collective skills is still at an early stage. There exists much research about group dynamics, but only a few specifically focus on collective skills of work teams. But what makes this form of work so interesting? What specific skills emerge from a work team? How can we observe and develop these? How is it that the same departure conditions lead to the development of one team and not of another? To answer these questions, we must consider the team a complex, adaptative, dynamic (Mc Grath, 1997) and self-organized (Langenthaler & Schiepeck, 1995) system. This system "team" evolves through time in between individual and team references. The collective skills are thus

seen as an oscillation between these two references and evolve as a complex process based on minimal emerging conditions. The poster will present this theorical conception that breaks the classical paradigm and proposes a modelization of the emergence of collective skills. The operationalization is made by a specific instrument, the "Self-evaluation Global Graphic", that should reflect the emerging conditions of collective skills in a real work team.

Koorosh MASSOUDI

Explaining transition of quality of life (QOL) by individual configurations

In the last 15 years, numerous studies on QOL measures have been developed, most of them approaching their subject by traditional psychometric procedures. Referring to pre-determinated definitions and specific theoretical basis, these studies generally present indicators of QOL in particular domains of life and do not approach QOL in a global way.

Our study is based upon a definition of QOL as a complex phenomenon resulting from a dynamic interaction of various life areas (such as professional, personal, social and health-related) within an individual's life. The survey of an initial sample of 1565 subjects fulfilling their vocational training in five professional domains (electronics, banking, cooking, nursing and sale) allowed to observe their evolution and transition into professional life through a period of three years. The investigation consists of three waves (t1, t2, t3) in which an identical questionnaire of 417 items was submitted to the participants. Using a bottom-up exploratory methodology, we were able to highlight a coherent structure of the results : four clusters or typologies of QOL, two of them representing high QOL and the other two representing low QOL. This general structure remains stable through time, even though individual transitions from one type to another can be noticed. These transitions mostly show that entering professional life, the population becomes more adapted to social norms of adult age, giving up idealistic and rebellious values of the past.

According to our basic idea, we examined qualitative configurations of individual situations and their dynamical interactions through the three years of the study. A graphical analysis using Karnaugh maps was used to identify individual configurations, as well as mechanisms of compensation. Individuals transiting from a same type of QOL to another do not change in a unique way, even if there is a general tendency. This observation confirms our attempt to approach QOL as a complex dynamics of individual configurations.

Andreas LIENING

Self-Organized Multimedia Learning (Multimedia Presentation)

The concepts and methods of self-organization provide a good basis for developing distance learning courses. Over the past five years different courses have been developed and put into practise in the field of further education. All of these courses in the field of business studies are computer- and internet-based.

The computer-based instruction is therefore unique in several ways: Traditional learning-software can often be described as "drill and practise", linear programs which are based on older behavioristic models and basically lead to learner conditioning. In contrast to this kind of traditional learning-software the new learning programs follow the concepts of self-organisation and I therefore refer to them as multimedia learning-tools. These tools support individual learning processes on a high level and allow even complex case studies to be dealt with by self-organized learning. The computer-based learning-tools are part of a corresponding didactic

concept.

During the learning process, the learners are not meant to orientate themselves at the logical, systematic structure of the subject which they are working on. That is to say, they are not confronted with the finished product when they are given an exercise or a task. Instead, they are meant to solve the problems in a creative way and search for patterns and strategies of solutions. They are meant to re-discover the learning contents. This creative, constructive and self-organisized learning process is supported by the multimedia learning-tools, which further contribute to a higher motivation.

Nicole BAUR

Embodied cognition

Keywords: self-management training, personality development, psychotherapy process research, Damasio's thesis of somatic markers, embodied cognition, situated cognition

Zeno KUPPER, William SPAULDING & **Wolfgang TSCHACHER**

Altered Cognitive Functioning in Schizophrenia

Objective: Both from a theoretical and from a clinical point of view altered cognitive functioning is a key issue in schizophrenia. Current theoretical thinking regarding cognitive dysfunction in schizophrenia is mainly based on models of information processing. In this contribution, we review the validity of information processing approaches to altered cognitive functioning in schizophrenia. Methods: The domains of (A) basis research, (B) functional assessment, and (C) therapy and rehabilitation are reviewed with regard to the merits and limitations of information processing approaches. Results: (A) In basic research the search for a 'basic' cognitive dysfunction in schizophrenia has been only partially successful. (B) For functional assessment of cognitive dysfunction measures that include learning have been proposed to be particularly important (1). (C) Therapeutic and rehabilitative approaches targeting cognition have shown to be helpful in improving social behavior, however no cognitive mediators were found (2). Conclusions: In departure from an information processing view focused on localized computational dysfunction, these results suggest a situated interactive view of cognition in schizophrenia and related disorders.

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