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Algorithmic Recursive Sequence Analysis

Algorithmic Structuralism:

Formalizing Genetic Structuralism:

An Attempt to Contribute to Making Genetic Structuralism Falsifiable

Abstract:
A method for the analysis of discrete finite character strings is presented. Postmodern social philosophy is rejected. A naturalistic sociology with falsifiable models for action systems is approved. The algorithmic recursive sequence analysis (Aachen 1994) is presented with the definition of a formal language for social actions, a grammar inducer (Scheme), a parser (Pascal) and a grammar transducer (Lisp).

Algorithmic Recursive Sequence Analysis (Aachen 1994) is a method for analyzing finite discrete character strings.

Ndiaye, Alassane (Role-taking as a user modeling method: global anticipation in a transmutable dialogue system 1998) and Krausse, CC, & Krueger,FR (Unknown signals 2002) published equivalent methods. It is ingenious to simply think something simple.

Since the beginning of the 21st century, the construction of grammars from given empirical character strings has been discussed in computational linguistics under the heading of grammar induction (Alpaydin, E. 2008: Maschinelles Lernen, Shen, Chunze 2013: Effiziente Grammatikinduktion, Dehmer (2005) Strukturelle Analyse, Krempel 2016: Netze, Karten, Irrgärten). Mit sequitur definieren Nevill-Manning und Witten (Nevill-Manning Witten 1999: Identifying Hierarchical Structure in Sequences: A linear-time algorithm 1999) define a grammar induction for the compression of character strings. Graphs, grammars and transformation rules are of course just the beginning. Because a sequence analysis is only complete when, as in algorithmic recursive sequence analysis, at least one grammar can be specified for which a parser identifies the sequence as well-formed,

with which a transducer can generate artificial protocols that are equivalent to the empirical sequence under investigation and to which an inductor can produce at least one equivalent grammar. Gold (1967) formulated the problem in response to Chomsky (1965).

Algorithmic structuralism is consistent, empirically proven, Galilean, naturalistic, Darwinian and a nuisance for deeply hermeneutic, constructivist, postmodernist and (post)structuralist social philosophers. I welcome heirs who continue the work or seek inspiration.

A social action is an event in the possibility space of all social actions. The meaning of a social action is the set of all possible subsequent actions and their probability of occurrence. The meaning does not have to be understood interpretively, but can be reconstructed empirically. The reconstruction can be proven or falsified by probation tests on empirical protocols.

From the mid-1970s to the present, irrationalist or anti-rationalist ideas have become increasingly prevalent among academic sociologists in America, France, Britain, and Germany. The ideas are referred to as deconstructionism, deep hermeneutics, sociology of knowledge, social constructivism, constructivism, or science and technology studies. The generic term for these movements is (post)structuralism or postmodernism. All forms of postmodernism are anti-scientific, anti-philosophical, anti-structuralist, anti-naturalist, anti-Galilean, anti-Darwinian, and generally anti-rational. The view of science as a search for truths (or approximate truths) about the world is rejected.

The natural world plays little or no role in the construction of scientific knowledge. Science is just another social practice that produces narratives and myths no more valid than the myths of pre-scientific epochs.

One can observe the subject of the social sciences as astronomy observes its subject. If the object of the social sciences eludes direct access or laboratory experiments like celestial objects (court hearings, sales talks, board meetings, etc.), the only thing that remains is to observe it purely physically without interpretation and to record the observations purely physically. The protocols could of course also be interpreted without reference to physics, chemistry, biology, evolutionary biology, zoology, primate research and life science. This unchecked interpretation is then called astrology when observing the sky. In the social sciences, this unchecked interpretation is also called sociology. Examples are constructivism (Luhmann), systemic doctrines of salvation, postmodernism, poststructuralism, or theory of communicative action (Habermas). Rule-based agent models have therefore previously worked with heuristic rule systems. These control systems have not been empirically proven. As in astrology, one could of course also create computer models in sociology, which, like astrological models, would have little empirical explanatory content. Some call this socionics. However, the protocols can also be interpreted taking into account physics, chemistry, biology, evolutionary biology, zoology, primate research and life science and checked for empirical validity. The observation of celestial objects is then called astronomy. In the social sciences one could speak of socionomy or sociomatics. That's actually sociology. This would not result in big

world views, but as in astronomy, models with a limited range that can be empirically tested and can be linked to evolutionary biology, zoology, primate research and life science. These models (differential equations, formal languages, cellular automata, etc.) allow the deduction of empirically testable hypotheses, so they would be falsifiable. Such socionomy or sociomatics does not yet exist. I would prefer formal languages as model languages for empirically proven rule systems. Because rule systems for court hearings or sales talks, for example (models with limited range, multi-agent systems, cellular automata) can be modeled with formal languages rather than with differential equations.

Algorithmic structuralism is an attempt to help translate genetic structuralism (without omission and without addition) into a falsifiable form and to enable empirically proven systems of rules. The Algorithmically Recursive Sequence Analysis is the first systematic attempt at a naturalistic and computer-based formulation of genetic structuralism as a memetic and evolutionary model. The methodology of Algorithmic Recursive Sequence Analysis is Algorithmic Structuralism. Algorithmic structuralism is a formalization of genetic structuralism. Genetic structuralism (Oevermann) assumes an intention-free, apsychic possibility space of algorithmic rules that structure the pragmatics of well-formed chains of events in text form (Chomsky, McCarthy, Papert, Solomon, Lévi-Strauss, de Saussure, Austin, searle). Algorithmic structuralism is an attempt to make genetic structuralism falsifiable. Algorithmic structuralism is Galilean and as incompatible with Habermas and Luhmann as Galileo was with Aristotle. Of course, one can try to remain compatible with Luhmann or

Habermas and to algorithmize Luhmann or Habermas. All artefacts can be algorithmized, for example astrology or chess. And one can model normative agents of distributed artificial intelligence, cellular automata, neural networks and other models with heuristic protocol languages and rules. This is undoubtedly theoretically valuable. So there will be no sociological theoretical progress. A new sociology is sought that models the replication, variation, and selection of social replicators stored in artifacts and neural patterns. This new sociology will be just as incompatible with Habermas or Luhmann as Galileo could be with Aristotle. And their basic theorems will be as simple as Newton's laws. Just as Newton operationally defined the terms motion, acceleration, force, body and mass, this theory will algorithmically and operationally define the social replicators, their material substrates, their replication, variation and selection and secure them through sequence analysis. Social structures are linguistically coded and based on a digital code. We are looking for syntactic structures of a culture-encoding language. But this will not be a philosophical language, but a language that encodes and creates society. This language encodes the replication, variation, and selection of cultural replicators. On this basis, normative agents of distributed artificial intelligence, cellular automata, neural networks and other models will then be able to use protocol languages and rule systems other than heuristics in order to simulate the evolution of cultural replicators.

Algorithmic structuralism moves thematically in the border area between computer science and sociology. Algorithmic structuralism assumes that social reality itself (wetware, world 2) is not capable of calculation. In its reproduction and transformation, social reality leaves traces that are purely physical and semantically unspecific (protocols,

hardware, world 1). These traces can be understood as texts (discrete finite character strings, software, world 3). It is then shown that an approximation of the transformation rules of social reality (latent structures of meaning, rules in the sense of algorithms) is possible by constructing formal languages (world 3, software). This method is the Algorithmic Recursive Sequence Analysis. This linguistic structure drives the memetic reproduction of cultural replicators. This algorithmically recursive structure is of course not (sic!) compatible with Habermas and Luhmann. Galileo is not compatible with Aristotle either!

Through the production of readings and the falsification of readings, the system of rules is generated informally, sequence by sequence. The informal rule system is translated into a K-system. A simulation is then carried out with the K-System. The result of the simulation, a terminal, finite character string, is statistically compared with the empirically verified trace.

This does not mean that subjects in any sense of meaning follow rules in the sense of algorithms. Social reality is directly accessible only to itself. The inner states of the subjects are completely inaccessible. Statements about these inner states of subjects are derivatives of the found latent structures of meaning, rules in the sense of algorithms. Before an assumption about the inner state of a subject can be formulated, these latent structures of meaning, rules in the sense of algorithms, must first be validly determined as a space of possibility of meaning and meaning. Meaning does not mean an ethically good, aesthetically beautiful or empathetically comprehended life, but an intelligible connection, rules in the sense of algorithms.

The latent structures of meaning, rules in the sense of algorithms, diachronically generate a chain of selection nodes (parameter I), whereby they synchronously generate the selection node t+1 from the selection node t at time t (parameter II). This corresponds to a context-free formal language (K-systems), which generates the selection node t+1 from the selection node at time t by applying production rules.

Each selection node is a pointer to recursively nested K-systems. It is possible to zoom into the case structure like with a microscope. The set of K-Systems form a Case Structure Modeling Language "CSML".

The approximation can be brought as close as you like to the transformation of social reality. The productions are assigned dimensions that correspond to their empirically secured pragmatics/semantics. Topologically, they form a recursive transition network of discrete, nonmetric sets of events over which an algorithmic rule system works.

K-systems K are formally defined by an alphabet ($A := \{a_1, a_2, \ldots a_n\}$), all words above the alphabet (A*), production rules (p) the occurrence measure h (pragmatics/semantics) and an axiomatic first character string ($k_0 k_1 k_2 \ldots$):

$$K := (A, P, k_0)$$
$$A := (a_1, a_2, \ldots a_n)$$
$$p := A \rightarrow A$$
$$p(a_i) \in P$$
$$p := A \times H \times A$$
$$H := (h \mid 0 \leq h \leq 100 \wedge h \in N)$$
$$k_0 \in A^* \wedge k_i \in A$$

The appearance dimension h can be expanded in terms of game theory (cf. Diekmann).

Starting from the axiom k_0 , a K-system produces a character string $k_0k_1k_2$... by applying the production rule p to the character i of a string:

$$a_{i+1} := P(a_i)$$
$$k_i := a_{i-2}a_{i-1}a_i$$
$$k_{(i+1)} := a_{i-2}a_{i-1}a_i P(a_i)$$

A rigorous measure of the reliability of the assignment of the interacts to the categories (provisional Formative since in principle it can be approximated ad infinitum) is the number of assignments made by all interpreters (cf. MAYRING 1990, p.94ff, LISCH/KRIZ1978, p.84ff). This number then has to be normalized by relativizing the number of performers. This coefficient is then defined with:

$$R_{ars} := \frac{N * Z}{\sum_{i=1}^{N} I_i}$$

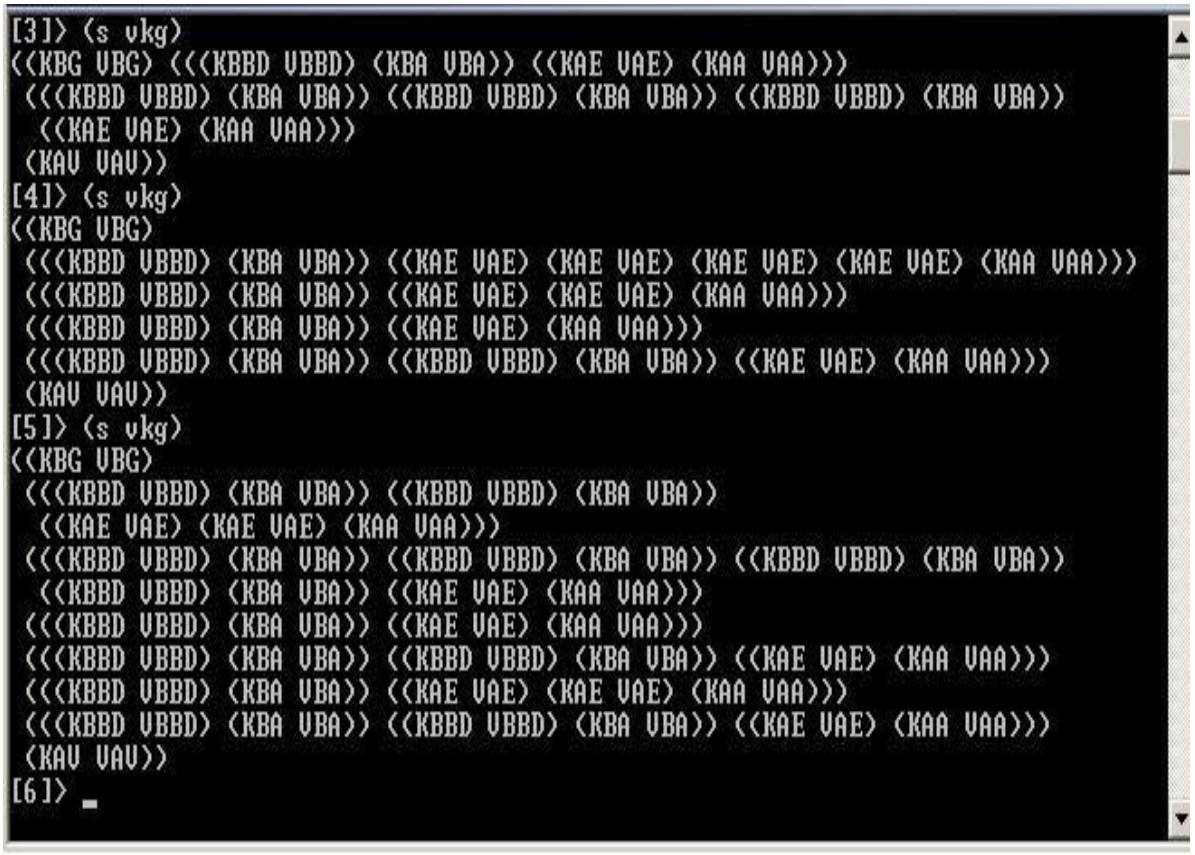
N:= Number of interpreters

Z:= Number of totally matching assignments

Ii:=Number of assignments of the interpreter Ii

An example session under clisp with the K-system for sales calls:

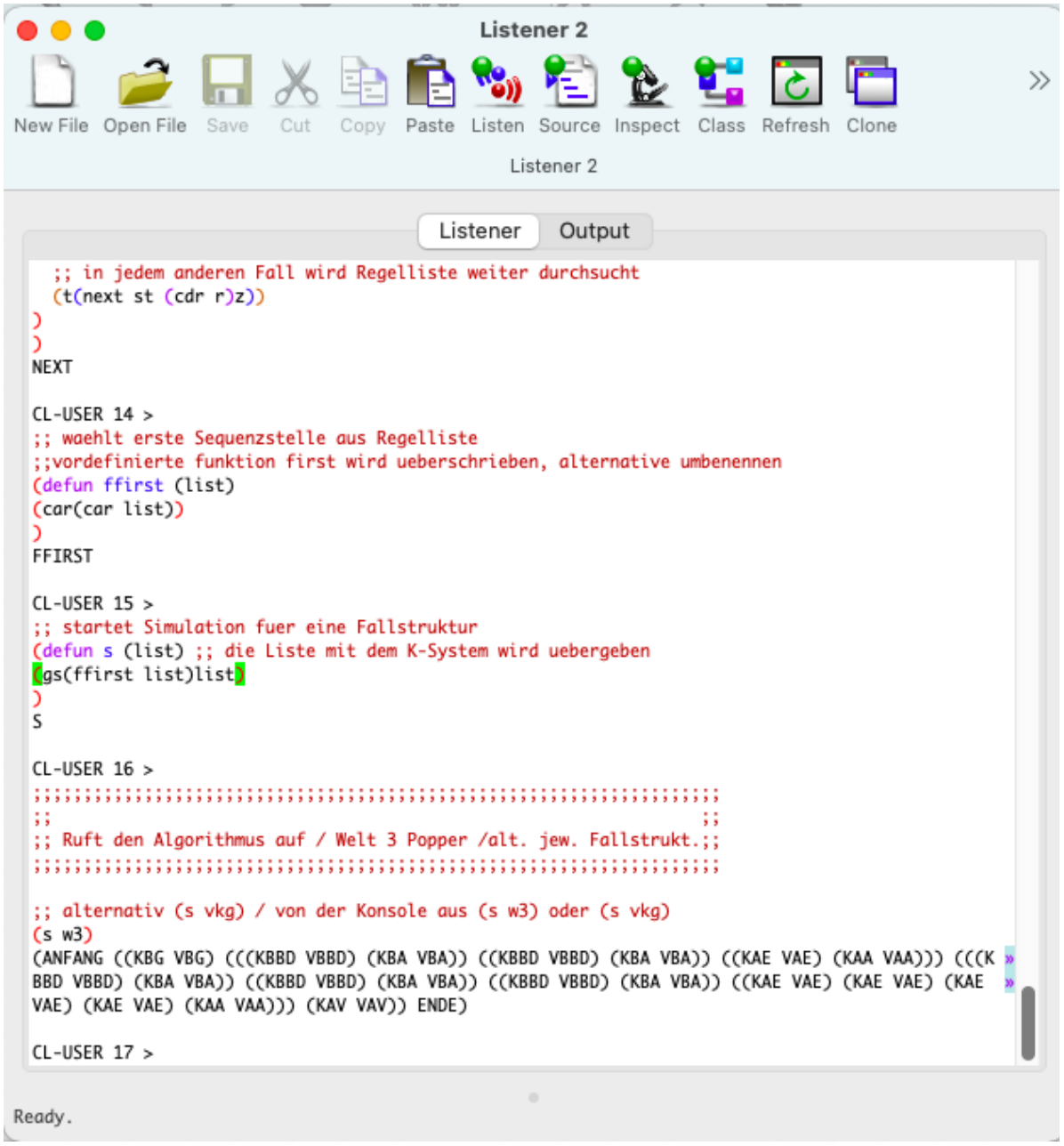
The example is the result of extensive sequence analyzes of salesin 1994, 1995 and 1996. Large amounts of traces of sales and purchase interactions were secured: tape records of interactions in retail and markets. A selection of these protocols were transcribed and subjected to extensive objective hermeneutic interpretation. A transcript from this selection was then subjected to a complex, complete algorithmic recursive sequence analysis. All work was extensively documented and fully summarized. (The documents will be made available in full on request.)



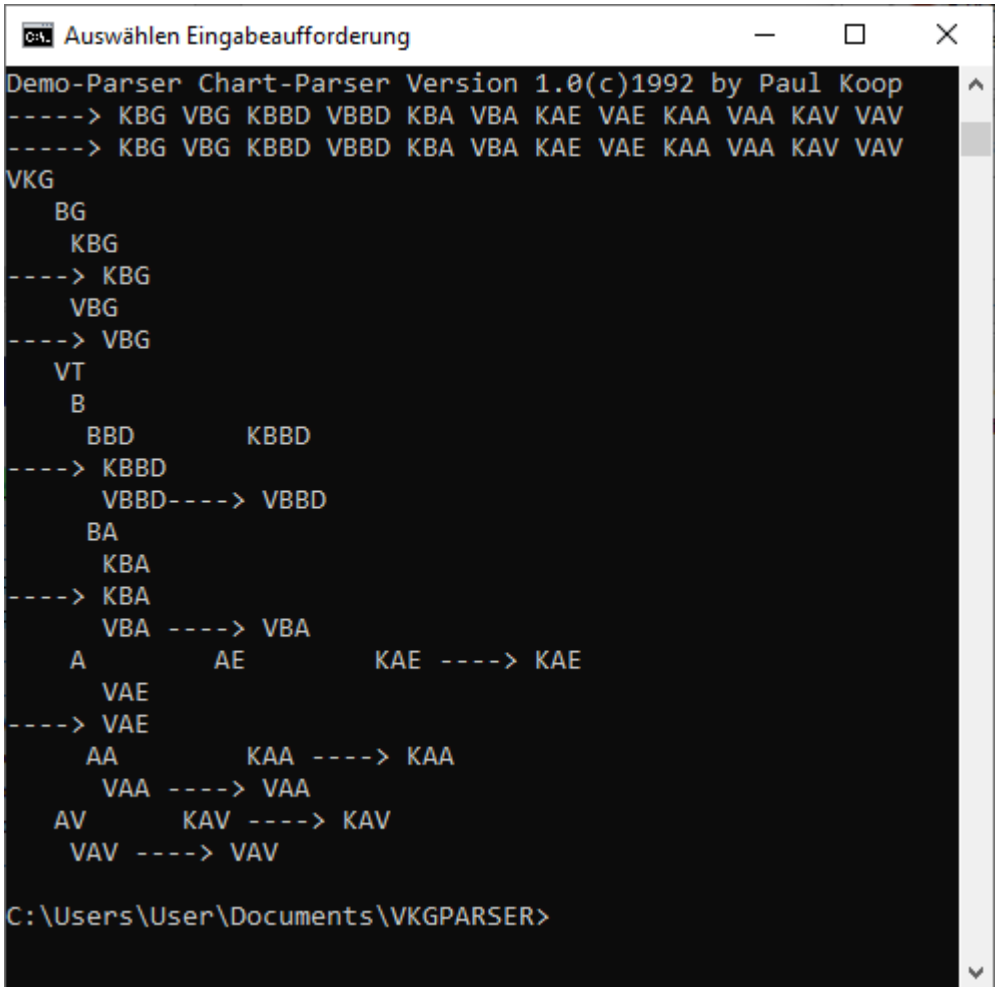
Paul Koop K-System VKG transducer sales pitch in Lisp

```
;; Korpus
   (define korpus (list 'KBG 'VBG 'KBBd 'VBBd 'KBA 'VBA 'KBBd 'VBBd
                        'KBBd 'VBBd 'KBA 'VBA 'KBBd 'VBBd 'KBA 'VBA 'KAE
                        'VAE 'KAE 'VAE 'KAA 'VAA 'KAV 'VAV));

;; Lexikon
   (define lexikon (vector 'KBG 'VBG 'KBBd 'VBBd 'KBA 'VBA 'KAE 'VAE
                           'KAA 'VAA 'KAV 'VAV)) ;; 0 - 12

➤ (transformationenZaehlen korpus)
➤ (grammatikerstellen matrix)
(KBG -> . VBG)
(VBG -> . KBBd)
(KBBd -> . VBBd)
(VBBd -> . KBBd)(VBBd -> . KBA)
(KBA -> . VBA)
(VBA -> . KBBd)(VBA -> . KAE)
(KAE -> . VAE)
(VAE -> . KAE)(VAE -> . KAA)
(KAA -> . VAA)
(VAA -> . KAV)
(KAV -> . VAV)
➤ (matrixausgeben matrix)
010000000000
001000000000
000400000000
001030000000
000003000000
002000100000
000000020000
000000101000
000000000100
000000000010
000000000001
000000000000
➤
```

Paul Koop K-System VKG inductor session Scheme



Paul Koop K-System VKG transducer session with Lisp



Paul Koop K-System VKG PARSER session at the console (Created with Object Pascal)

The characters of the character string have no predefined meaning. Only the syntax of their combination is theoretically relevant. It defines the case structure. The semantic interpretation of the signs is solely an interpretive achievement of a human reader. In principle, a visual interpretation (which can be animated) is also possible, for example for the automatic synthesis of film sequences.

A human reader can interpret the characters:

sales	talks VKG
sales	VT
requirement	B
conclusion	A
greeting	BG
required	Bd
requirement argument	BA
final objections	AE
sale	AA
farewell	AV
prepended K	customer
prepended V	seller

1	(setq vkg '(((s bg)100(s vt)) ((s vt)50(s vt)) ((s vt)100(s av))))	parameters II
2	(setq av '((kav 100 vav)))	parameters II
3	(setq bg '((kbg 100 vbg)))	parameters II
4	(setq vt '(((sb)50(sb)) ((sb)100 (sa))))	Parameter II

5	(setq a '(((s ae)50(s ae)) ((s ae)100(s aa))))	Parameter II
6	(setq b '(((s bbd) 100 (s ba))))	Parameter II
7	(setq aa '((kaa 100 vaa)))	Parameter II
8	(setq ae '((kae 100 vae)))	Parameter II
9	(setq ba '((kba 100 vba)))	Parameter II

10	(setq bbd '((kbbd 100 vbbd)))	Parameter II
11	(defun gs (sr) (cond ((equal s nil)nil) ((atom s)(cons s(gs(next sr(random 100))r))) (t (cons(eval s)(gs(next sr(random 100))r)))))	Parameter I
12	(defun next (srz) (cond ((equal r nil)nil) ((and(<=z(car(cdr(car r))))) (equal s(car(car r))))(car(reverse(car r)))) (t(next s (cdr r)z))))	Parameter I
13	(defun first (list) (car(car list)))	Parameter I
14	(defun s ( ) (setq protocol(gs(first vkg)vkg)))	Parameter I

It was a reliability coefficient of

$$R_{ars} = \frac{2*35}{118} = 0.59$$

Correlations

		Kodierer1	Kodierer2
Kodierer1	Correlation		,59
	Sig.		,09
Kodierer2	Correlation	,59	
	Sig.	,09	

Test Statistics

	Kodierer1	Kodierer2
Chi-Square	2,60	2,00
df	6	5
Asymp. Sig.	,86	,85

measured.

However, social reality itself is not capable of calculation and is only accessible to itself at the moment of transformation.

Humanities, constructivist and postmodern approaches are methodologically foreign to me. I left Mead, Parsons, Weber, Simmel, Mannheim/Scheler, Berger/Luckmann, Maturana, Varela, Habermas and Luhmann behind me. Albert, Axelrod, Esser, Diekmann, Troitzsch, Popper, Brezinka, Rössner, Dawkins, Dennett, Hofstadter, Rucker, Blackmore convince me more. Personally, I prefer a linguistic evolutionary perspective and the associated modeling of cultural replicators with formal languages. From the discrete structure of matter emerges the linguistic structure of biological evolution and the linguistic structure of cultural replicators. I therefore prefer an algorithmic structuralism.

Attachments

1. Sequence Analysis
2. Categories
3. Grammar Transducer (Lisp)
4. Grammar Parser (Pascal)
5. Grammar Inducer (Scheme)

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