Relevance of Meaning, Semantic Dispositions, and Text Coherence

Modelling Reader Expectations from Natural Language Discourse*

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Abstract

Relevance of meaning is defined to be a variable, aspect dependent relation of word-meaning and/or world-knowledge representations which form dynamic structures of *semantic dispositions*. These will be introduced to model the *expectations* which — other than the widely recognized linear/syntagmatic/referential forms of text-connectedness (*connexity/cohesion)* — can be derived from the discourses' less accepted associative/paradigmatic/sense-relational properties, i.e. the more dynamic means of textuality (*coherence*). Involving interpreters' knowledge of word-meanings/world-structures activated, a procedure is given for the empirical reconstruction of their representation and relevant organisation.

1. The notion of textuality has been the core domain of interest and research in textlinguistics for some time now. As such, it has widely become accepted to be analysable under mainly two aspects which allow to isolate sets of properties of essentially two kinds: those that can be observed to structure the linear arrangements of language elements, constituting a text-sequence's *connexity* and/or *cohesion* by more or less overt linguistic indicators, and those others that can be assigned only

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on the basis of the hearer's/reader's background knowledge and his respective expectations which may (or may not) in the process of understanding be activated to constitute a discourse-string's *interpretability* and/or *coherence* by more or less covert cognitive means.[1]

As the former kind of phenomena may well be characterized by way of properties which sequences of language items may exhibit when aggregated in accordance with the respective linguistic rule system, so is the latter to be described by properties which concern the process that relates a string of aggregated language signs and an interpreter's activated knowledge in the course of his or her (actual or intended) comprehension of them. The study of textlinguistic phenomena of the first kind, like *connexity* and *cohesion*, therefore, can be based straight forwardly on conventional linguistic approaches to morpho-phonetics, syntax-grammar, and lexico-semantics properly adjusted and/or extended to cover the textual domain, whereas the concepts of *coherence* and *interpretability* leave the linguist in want of more adequate approaches than traditional linguistics can yet provide on e.g. memory structure, knowledge representation, and comprehension processes. At least some sound hypothesizing is needed on these components of cognitive activities in order to understand on what basis and why strings of natural language items are so easily recognized as fragments of discourse (in case they really are) even when linguistic elements usually indicating their textuality are absent.

Distinguishing phenomena of textuality in this way, i.e. according to their being abstractable from vs. being dependent on their pragmatic settings or contextual situations of communicative language usages, is to follow the linguistically seminal distinction of *competence* and *performance* in the very sense which allows to differenciate between the systematic abstractions of properties derived from bundles of features of language phenomena on the one hand, and the realizations of such properties within bundles of features to be observed in individual instances of actual language production and/or reception on the other. However, considering the observable empirical object *discourse* **not** in view of an pragmatically isolated and abstract theoretical object text whose *connexity/cohesion* conditions are to be (re-)constructed in terms of linguistic categories, but **instead**, focussing on the relation that builds up between the identifiable empirical object *discourse* and the

[1] Without necessarily complying with all of the theoretical implications — particularly in view of the semantic modelling of natural language meaning and understanding in Hatakeyama/Petöfi/Sözer (1983) and Petöfi/Sözer (1985) — their terminological clarifications are gratefully employed where acceptable. This applies to the fundamentally semiotic characterization of meaning as a constitutional process of interpretation (relating language signs, their co- and contextual features, and their interpreters schematized in the semiotic pyramid), it equally applies to the different object-types of textlinguistics which can be distinguished (natural language material vs. theoretical construct, mental image vs. physical representation of verbal signs), and it finally applies to certain properties and features on either side of language or cognitive structures (pragmatic relevance, co- and contextual connectedness, knowledge of word meanings and world structure fragments, derivable semantic expectations) which are postulated to be necessary — though not sufficient — conditions for the different types of (natural, theoretical, and/or automated) interpretation of strings of natural-language signs.

identifying theoretical subject *interpreter* under specific pragmatic conditions, this changed view will shed some light not only on this relation's properties and on how these may be specified, described, and represented, but also on how these might help to explain the textual phenomena of *coherence*:

- The above distinction reveals, *firstly*, that recognition, identification, and interpretation of any of the afore mentioned linguistically and/or cognitively derivable phenomena presuppose some understanding enabled by the availability of settings of respective knowledge. This concerns either that of theoretical abstractions specifying properties or the command of practical rules producing actual realisations. The former setting will generally be provided by more or less comprehensive theories and/or reliable models of linguistics proper, the latter has still to be based — in want of an encompassing systematic approach — on fragments of cognitive theory, on some experimental and empirical models, and — very widely — on introspective and individual communicative experience.

- It reveals, *secondly*, that — in view of the explanatory purpose of textlinguistic theory — there is an obvious asymmetry of evidence that systematic linguistic abstractions on the one hand and/or directly observable but varying language material on the other can provide in view of a solution to the problems of textuality. In order to solve them, properties of the empirical object *discourse* and of the theoretical object *text* will have to be understood in their mutual interdependency as mediated by the author's/recipient's *cognitive activities*, and the notions of *connexity/cohesion* and *coherence* will have to be related to (perhaps be identified as theoretical derivatives abstracted from) processes of natural language comprehension. Presently, however, the frame of textlinguistics and discourse-analysis where, originally, the above notions of textuality have been developed to overcome the restricted focus of sentence-bound and competence-oriented linguistics proper, only reflects and repeats its methodological bias on a different level of semiotic strata.

- And, *thirdly*, it reveals that the terminological differentiation of *connexity/ cohesion* and *coherence* paralleled above to that of *text* and *discourse* does not only correspond to the general *competence-performance* distinction which were to be attributed to more linguistic or more cognitive interests under which textlinguists currently try to tackle the problem of textuality. Rather, considering all these differentiations simultaneously, they may be interpreted as indicating a significant and profound epistomological transition. It concerns the necessary shift from more conventional linguistic approaches that analyse and describe *structures* abstracted from language phenomena or observed to organize categorized language material, towards more recent approaches that try to characterize the modular activities underlying cognitive processes by *procedures* whose analytical performance — among other simulations — may eventually result in automatic abstracting and categorizing, and whose gener-

ative capacities — among other synthetic results — may eventually produce linguistic structures like *texts* or even language strings in the form of *discourse* respectively, depending on the data bases such *procedures* are made to operate on.

This new realm of focal interests, of analytical and generative methods employed, and of the theoretical and/or empirical objects constituted thereby gave rise to investigate a procedural conception of empirical analysis and formal representation of vague word meanings (Rieger 1980, 1981a,b) in view of its possible applicability in textlinguistics. Developed within the frame of automated associative knowledge representation (Rieger 1984a) as analysed from natural language discourse (Rieger 1982), the notion of *semantic disposition* (Rieger 1984d, 1985a) will be introduced as an operationally defined theoretical construct derived from a model of memory structure of stereotype word-meaning and/or world-knowledge representation. It allows for the generation of (semantic) expectations which will vary — for any specified subject domain and depending on the aspect under which it is accessed — according to what appears to be *relevant* (Rieger 1984b, 1985b).

2. As a case in point, the following example of three German sentences which have slightly been modified (and translated) for the purpose, may serve to illustrate the problem we are going to deal with.

> ... Den Arbeitsmarkt beherrscht ein allgemeines Überangebot von Personen, die nach Lehre und Ausbildung verantwortbar nur in Wirtschaft, Verwaltung und Werbung eingesetzt werden können. Die Industrie sucht Berufsgruppen, die über Kenntnisse und Erfahrungen auf dem Gebiet der Computertechnologie (Diplom) verfügen und den Wunsch haben, ihre Fähigkeiten an leitender Stelle auszuüben. Organisationen zur Unterrichtung und Schulung auf Verbands- und Gebietsebenen, in Städten und Unternehmen versuchen allgemeine Informationen über "Elektronik" zu geben ...[2]

Although there are no linguistic categories explicidly indicating these sentences' *connexity* as a fragment of *text*, they will immediately be identified by any native speaker (of German) as a *coherent* fragment of *discourse* reporting on the unemployment problem as its general subject. Other than being attainable from the linguistic and/or semantic structuredness of every single sentence, the immediate impression of coherence concerning the whole three phrases' piece of discourse is more of a function of the hearer's/reader's knowledge than of the linguistic indicators, or rather, activators that prepare a portion of knowledge for access.

Taking up ideas expressed within the theory and models of *spreading activation* as advanced by Quillian (1968), Olson (1970) and Collins/Loftus (1975), the

[2]The situation on the labour market is determined by a general surplus of people who — according to apprenticeship and training — can be employed only in business, administration or public relations. In industry opportunities are open to persons who have knowledge and experience in the field of computer technologies (Diploma) and wish to experience their capabilities in leading positions. Organized activities in schooling and education of cities and firms try on different regional and trade controlled levels to provide general information on "electronics".

process of activation may be thought of as being triggered as soon as the lexical items are identified and well before the propositional meaning of the whole phrase, let alone of all three sentences, is understood. Under the notion of *priming* this process of selective activation of knowledge compounds has found immense consideration both in theoretical and empirical research (e.g. LORCH 1982; FLORES D'ARCAIS/JARVELLA 1983) and there is good reason to ask whether the propositional meaning of any peace of discourse can be understood at all without a preselective activation of a relevant fragment of knowledge available to the (natural or artificial) cognitive system (SWINNEY 1979). The present effect of *coherence* could be explained by the fact that every single lexical item employed in all three sentences would have to be in line with a sort of forecast which the potential hearer/reader is able to make on identifying a lexical item. Such identification will trigger a process which selects portions of his/her knowledge to make them accessible to activation. These portions of activated knowledge structures constitute a hearer's/reader's (semantic) *expectations* which could further be specified if the lexical items identified by the hearer/reader appeared to be organized according to a certain plausibility and/or relatedness of their contents. If their organisation — under the thematic *aspect* of the subject domain — corresponded to that of the hearer's/reader's own expectations, they would in turn, and only then, be considered *relevant*.

The *aspect* under which particular word meanings may appear to be *relevant* constitute semantic *dependencies*. These do not lend themselves easily — if ever and at all — to definitions in terms of universally applicable static rule systems like those governing logical deduction, propositional inferences, or conceptual hierarchies (e.g. WEINGARTNER 1984). Changing with varying co- and contextual features, *relevance* of meaning and aspect *dependency* constitute properties of dynamic concept organisation of which different interlocutors make use of differently within differing subject domains depending on their more or less diverging semantic and/or world knowledge structures concerned. In order to explain why apparently some degree of intersubjectivity can always be guaranteed, a common system of very basic conceptual meanings has to be postulated which prevents their representations to become organized in a totally idiosyncratic way. Being phenomena of communicative language performance in specific subject domains, *aspect dependency* and *relevance of meaning* then — by definition — can only be observed and ascertained in actual discourse as embedded in its situational and pragmatic settings.

Thus, *relevance* appears to be defined as an performative phenomenon of evaluating a contents-driven *dependency* relation between lexical items in a subject domain under a specific *aspect* according to some systematic organisation of their corresponding conceptual meaning compounds. So far, these have been thought of as word-meaning and/or world-knowledge structures available to the individual speaker/hearer as he/she performs the respective evaluation. Conceptual representations can realistically be conceived as a system of intersubjectively structured *stereotypes* (RIEGER 1984d) whose labels may be lexical items and whose meanings are determined by their mutual representational adjacencies rather than by list of (meta-language) markers, properties, intensions, etc. (ROSCH 1975). Such a system

constitutes a fragment of common knowledge as the prerequisit for specific subject domains to be identified in the cognitive activities of interlocutors communicating. Therefore, their actual discourses will have to be analysed and described on the bases of, rather than under abstraction from those co- and contextual features that determine the cognitive frame of any possible communicative interaction.

It has been argued elsewhere (Rieger 1979) that this frame — in very much the same sense as in *frame*-semantic theory — determines which language items tend to be used in strings of discourse that interlocutors engaged to communicate on certain subject domains will produce. The conceptual contents conveyed by pieces of discourse seems to be determined baiscally through the lexical items aggregated (i.e. selected by the author and interpreted by the reader according to cognitive principles) rather than by application of linguistic rules on this lexical material to express certain propositions, assign truth values to every single one of them, or to indicate their connectedness and/or cohesion. Whereas the linguistic rule system functions more like a specifying filter to properly organise language items into linear structures, the varying relation of *aspect-dependent relevance* can perhaps better be understood as an dynamic principle of organising word-meaning and/or world-knowledge representations in a multi-dimensional system structure. Rather than being attainable from the linguistic and/or semantic structuredness of the singular piece of discourse, this organising principle can more realistically be conceived of as a procedure operating on the knowledge which the interpreting (natural or artificial) system has acquired, structured, and modified in a multitude of (not only language understanding) cognitive processes. It can be reconstructed — at least on a fundamental and base-line level — by recourse on a textlinguistic, quantitative analysis of a great number of pragmatically homogeneous discourses. These represent those variable results of combinatorial and selective processes which any producer of coherent language strings has to perform on his/her word meaning and/or world knowledge background (memory structure) in order to come up with an interpretable verbal realisation. As a piece of discourse it preferably provides exactly those linguistic activators of contextual-pragmatic and lexico-semantic dimensions that will enable its potential interpreters to perform similar processes on his/her own word-meaning and/or world-knowledge base without the implication, however, to arrive necessarily at the same results. Both these sign processing activities whether productive (intending, searching, formulating) or recipient (identifying, interpreting, understanding) contribute to the process of *meaning constitution* which operates on the structured memory of word meaning and/or world knowledge.

What these knowledge bases may look like, what entities they might be composed of, how they are to be represented, and what material has to be analysed in what way in order to arrive at some data structure from which relevant expectations can be generated according to certain cognitive clues under specifiable conditions of either language production or language interpretation, are some of the questions that will be adressed even though only tentative answers might yet be given.

3. Natural language discourse provides abundant data which can be restricted to limited subject areas, specified textual typologies, economic/social/educational status of interlocutors, etc. for the reconstruction of those relational structures of (conceptual) word meaning and/or world knowledge which language users have to employ in order to communicate. In linguistic semantics, cognitive psychology, and artificial intelligence, however, most of the necessary data concerning lexical, semantic, and/or external world information is still provided introspectively. Researchers are exploring (or make test-persons explore) their own linguistic/cognitive capacities and memory structures to depict their findings in (or let hypotheses about them be tested by way of) various representational formats (lists, arrays, trees, nets, active networks, etc.) of entities whose ontological status is left unclear. It is widely accepted that model structures resulting from such analyses do have a more or less ad hoc character and tend to be confined to their limited theoretical or operational performances within a specified subject domain and/or implemented system. These approaches — by definition — can only map what of the world's fragment under investigation is already known to the analysts, not, however, what of it might be conveyed in discourses unknown to them. Being basically *interpretative* in the sense that the analysts depict their own (or their experts') knowledge, such representations will not only be restricted quite naturally to undisputed informational structures which consequently can be mapped in accepted and well established (concept hierarchical, logically deductive) formats, but these knowledge systems also tend to lack the flexibility and dynamics of more *constructive* model structures which automatic meaning analysis and representation algorithms can provide to allow for the dynamic acquisition, modification, and/or restructuring of a system's own knowledge components, however shallow and vague these may appear compared to human concept processing (Rieger 1984c).

Other than these more orthodox lines of introspective data acquisition in meaning analysis and knowledge representation research, the present approach has been based on the algorithmic analysis of discourse that real speakers/writers produce in actual situations of performed or intended communication on a certain subject domain. The approach makes essential use of algorithmic means to detect within a set of input discourses the differences of usage regularities of lexical items. Specified numerically, these data serve to map each lexical entry onto a fuzzy subset of the vocabulary employed that serves to decribe an item's conceptual stereotype meaning. The set of such fuzzy subsets (Zadeh 1965) forms a system of stereotype concept representations which constitutes a topological space structure whose abstract elements are related by mutual distances.

For the quantitative analysis not of propositional strings but of their elements, namely words in natural language texts, rather simple statistics serve the basically descriptive purpose. Developed from and centred around a correlational measure to specify intensities of co-occurring lexical items used in natural language discourse, these analysing algorithms allow for the systematic modelling of a fragment of the lexical structure constituted by the vocabulary employed in the texts as part of the concomitantly conveyed world knowledge (Rieger 1980).

ARBEIT	*0.000*				
ALLGEMEIN	8.332	ANBIET	8.756	AUSGAB	10.392
STADT	10.711	PERSON	11.075	LEHR	11.811
GEBIET	11.831	VERBAND	12.041	UNTERNEHM	12.130
VERKEHR	12.312	HERRSCH	12.362	VERANTWORT	12.543
EINSATZ	13.980	STELLE	14.120	WERB	15.561
ORGANIS	16.146	VERWALT	16.340	MODE	16.842
GESCHAEFT	16.873	UNTERRICHT	18.275	BITT	19.614
...		...		...	

Table 1: Topological environment E⟨ARBEIT⟩

A correlation coefficient appropriately modified for the purpose has been used as a mapping function (Rieger 1981a). It allows to compute the relational interdependency of any two lexical items from their textual frequencies. Those items which co-occur frequently in a number of texts will positively be correlated and hence called *affined*, those of which only one (and not the other) frequently occurs in a number of texts will negatively be correlated and hence called *repugnant*. Different degrees of *word-repugnancy* and *word-affinity* may thus be ascertained without recurring to an investigator's or his test-persons' word and/or world knowledge (*semantic competence)*, but can instead solely be based upon the usage regularities of lexical items observed in a corpus of pragmatically homogeneous discourses, spoken or written by real authors in actual or intended acts of communication (*communicative performance*).

Following a system-theoretic approach and taking each word employed as a potential descriptor to characterize any other word's virtual meaning, the modified correlation coefficient can be used to map each lexical item into fuzzy subsets (Zadeh 1971) of the vocabulary according to its numerically specified usage regularities. Measuring the differences of any one's lexical item's usages, represented as fuzzy subsets of the vocabulary, against those of all others allows for a consecutive mapping of items onto another abstract entity of the theoretical construct. These new operationally defined entities — called an item's *meanings* — may verbally be characterized as a function of all the differences of all regularities any one item is used with compared to any other item in the same corpus of discourse.

The resulting system of sets of fuzzy subsets constitutes the *semantic space*. As a distance-relational data structure of stereotypically formatted meaning representations it may be interpreted topologically as a hyperspace with a natural metric. Its linguistically labelled elements represent *meaning points*, and their mutual distances represent *meaning differences*.

The position of a meaning point may be described by its semantic environment. Tabs. 1 and 2 show the *topological environments* E⟨ARBEIT⟩ and E⟨INDUSTRI⟩ respectively, i.e. those adjacent points being situated within the hyperspheres of a certain diameter around their central meaning points ARBEIT/labour and INDUSTRI/industry as computed from a text-corpus of German newspaper articles

INDUSTRI	*0.000*				
SUCH	2.051	ELEKTRON	2.106	LEIT	2.369
BERUF	2.507	SCHUL	3.229	SCHREIB	3.329
COMPUTER	3.667	FAEHIG	3.959	SYSTEM	4.040
ERFAHR	4.294	KENN	5.286	DIPLOM	5.504
TECHNI	5.882	UNTERRICHT	7.041	OGANIS	8.355
WUNSCH	8.380	BITT	9.429	STELLE	11.708
UNTERNEHM	14.430	STADT	16.330	GEBIET	17.389
...		...		...	

Table 2: Topological environment E⟨INDUSTRI⟩

comprising some 8000 tokens of 360 types in 175 texts from the 1964 editions of the daily Die Welt.

Having checked a great number of environments, it was ascertained that they do in fact assemble meaning points of a certain semantic affinity. Further investigation revealed (Rieger 1983) that there are regions of higher point density in the semantic space, forming clouds and clusters. These were detected by multivariate and cluster-analysing methods which showed, however, that both, paradigmatically and syntagmatically related items formed what may be named *connotative clouds* rather than what is known to be called *semantic fields*. Although its internal relations appeared to be unspecifiable in terms of any logically deductive or concept hierarchical system, their elements' positions showed high degree of stable structures which suggested a regular form of contents determined associative connectedness (Rieger 1981b).

4. Following a more cognitive understanding of meaning constitution, the semantic space model — as outlined above and developed in detail elsewhere (Rieger 1981a, b) — may now become the basic component of a word meaning and/or world knowledge representation system which separates the format of a fundamental (stereotype) meaning representation from its latent (dependency) relational organization. Whereas the former is a rather static, topologically structured (associative) memory model representing the data that text analysing algorithms provide, the latter can be characterized as a collection of dynamic and flexible structuring processes to re-organize these data under various principles (Rieger 1981b). Other than declarative knowledge that can be represented in pre-defined and static semantic network structures, meaning relations of lexical *relevance* and *semantic dispositions* as well as *expectations* which are heavily dependent on context and domain of knowledge concerned will more adequately be defined procedurally, i.e. by generative algorithms that — in processes of simulated comprehension (intention and/or interpretation of language strings) — induce them on changing data only and whenever necessary. This is achieved by a recursively defined procedure that produces hierarchies of meaning points, structured under given aspects according to and in dependance of their stereotype meanings' relevancy (Rieger 1984b; 1985b).

Corroborating findings in *spreading activation theory* and the subsequent models and experimental results of *priming* processes mentioned above, a new algorithm has been developed which operates on the semantic space data and generates — other than in RIEGER (1982) — dispositional dependency structures (DDS) in the format of n-ary trees which constitute *semantic dispositions*. Given one meaning point's position as a start, the algorithm of least distances (LD) will *first* list all its neighbouring points and stack them by increasing distances, *second* prime the starting point as head node or root of the DDS-tree to be generated before, *third*, the algorithm's generic procedure takes over. It gets the first entry from the stack, generate a list of its nearest neighbours, determines from it the least distant one that has already been primed, and identifies it as the ancestor-node to which the new point is linked as descendant-node to be primed next. Repeated succesively for each of the meaning points stacked and in turn primed in accordance with this procedure, the algorithm will select a particular fragment of the relational structure latently inherent in the semantic space data to reorganise it depending on the aspect, i.e. the initially primed meaning point the algorithm is started with. Working its way through and consuming all labeled points in the space structure — unless stopped under conditions of given target nodes, number of nodes to be processed, or threshold of maximum distance — the algorithm transforms prevailing similarities of meanings as represented by adjacent points to establish a binary, non- symmetric, and transitive relation of *semantic relevance* between them. This relation allows for the hierarchical reorganization of meaning points as nodes under a primed head in an n-ary DDS-tree (RIEGER 1985a).

Without introducing the algorithms formally, some of their operative characteristics can well be illustrated by way of a few simplified examples. Beginning with the schema of a distance-like data structure as shown in the two-dimensional configuration of 11 points, labeled a to k (Fig. 1.1) the stimulation of e.g. points a, b or c will start the procedure and produce three specific selections of distances activated among these 11 points (Fig. 1.2). The order of how these particular distances are selected can be represented either by step-lists (Fig. 1.3), or n-ary tree-structures (Fig. 1.4), or their binary transformations (Fig. 1.5).

It is apparent that stimulation of other points within the same configuration of basic data points will result in more or less differing trees, depending on the aspect under which the structure is accessed, i.e. the point initially stimulated to start the algorithm with.

Applied to the semantic space data of 360 defined meaning points as calculated from the text corpus of the German newspaper DIE WELT, the two *Dispositional Dependency Structure (DDS)* of ARBEIT/labour and INDUSTRI/industry are given in Figs. 2 and 3 as generated by the procedure described.

The numerical values given for each node represent (first value) its absolute distance from its ancestor in the DDS-tree and (second value) its relative degree of relevance according to that tree's structure. As a node's *criteriality* the latter is to be calculated with respect to its root or aspect and has been defined recursively as a function of both, the node's distance value and its level in the tree concerned. For a

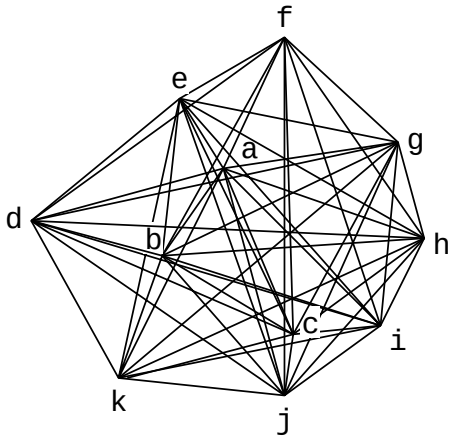


Figure 1.1

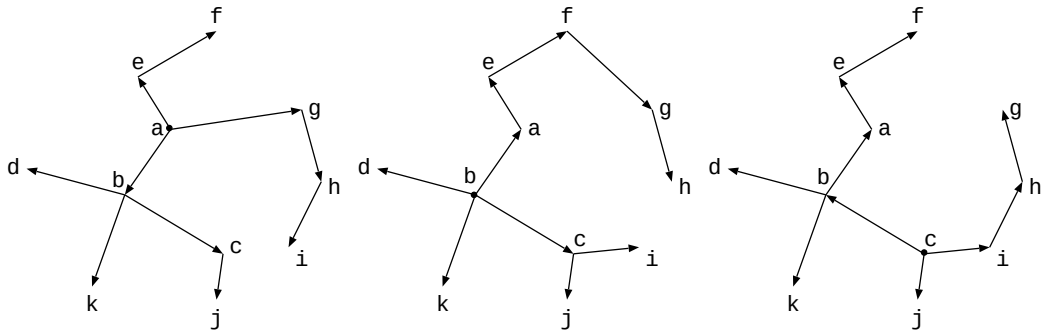


Figure 1.2

wide range of purposes in processing *semantic dispositions* in the procedural format of DDS-trees, different criterialities of nodes can be used to estimate which paths are more likely being taken against others being followed less likely under priming of certain meaning points. Source-oriented, contents-driven *search* and *retrieval* procedures may thus be performed effectively on the semantic space structure, allowing for the activation of *dependency paths*. These are to trace those intermediate nodes which determine the associative or dispositional transitions of any target node under any specifiable aspect.

Using these aspect-dependent and target-oriented tracing capabilities within DDS-trees proved particularly promising in an *analogical*, contents-driven form of automatic inferencing which — as opposed to *logical deduction* — has operationally be described in Rieger (1984d) and simulated by way of parallel processing of two (or more) DDS-trees. For this purpose the algorithms are started by the two (or more) meaning points considered to represent the *premises*, of say, ARBEIT/labour and INDUSTRI/industry. Their DDS-trees will be generated before the inferencing procedure begins to work its way (breadth-first, depth-first, or by maximum

Step	z_d		z_a
0	a	→	a
1	e	→	a
2	b	→	a
3	c	→	b
4	f	→	e
5	g	→	a
6	d	→	b
7	h	→	g
8	i	→	h
9	k	→	b
10	j	→	c

Step	z_d		z_a
0	b	→	b
1	a	→	b
2	k	→	b
3	d	→	b
4	e	→	a
5	c	→	b
6	j	→	c
7	i	→	c
8	f	→	e
9	g	→	f
10	h	→	j

Step	z_d		z_a
0	c	→	c
1	j	→	c
2	i	→	c
3	b	→	c
4	h	→	i
5	k	→	b
6	a	→	b
7	g	→	h
8	d	→	b
9	e	→	a
10	f	→	e

Figure 1.3

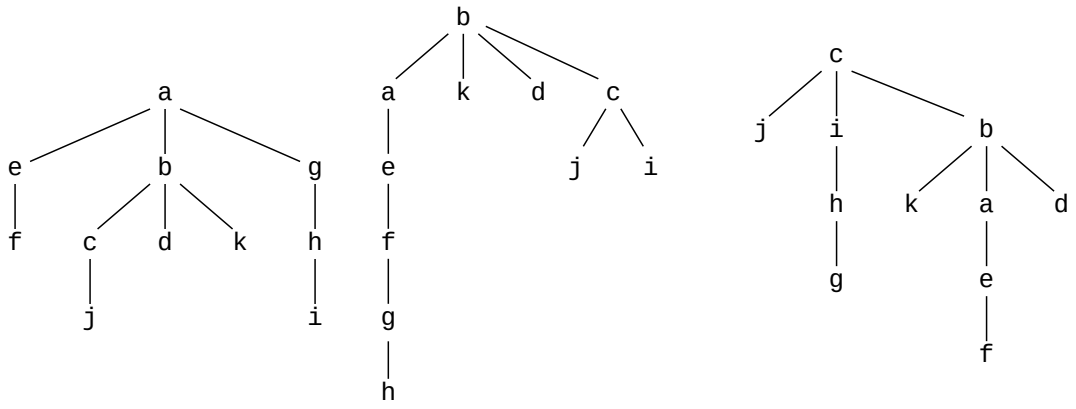


Figure 1.4

criteriality) through both (or more) trees, tagging each encountered node. When in either tree the first node is met that has previously been tagged by activation from another priming source, the search procedure stops to activate the dependency paths from this *concluding* common node — in the present case STELLE/position for both breadth- and depth-first and ORGANIS/organisation for max-criteriality searches — in the DDS-trees concerned and separately depicted in Figs. 4.1 and 4.2.

Finally, coming back to the piece of discourse which has been given above in order to illustrate the effect of the three sentences' *coherence*, we are now in the position to clarify the reason by way of the *semantic dispositions* generated on the basis of the *semantic space* structure computed from Die Welt.

According to that knowledge base which — as a daily newspaper corpus will suggest — appears to be sufficiently general, the three sentences are easily interpreted as *coherent* because the *relevant* conceptual meaning representations that will be selected and activated under the *aspects* of identifiable lexical items in the discourse

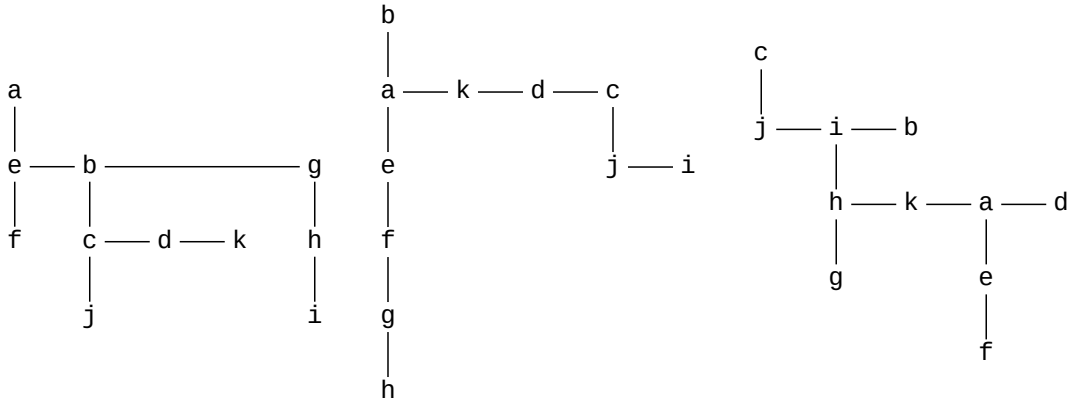


Figure 1.5

... *arbeit* — *markt* — *herrsch* — *allgemein* — *anbiet* — *person* — *lehr* — ausbild — *verantwort* — *wirtschaft* — *verwalt* — *werb* — *einsetz* — *industri* — *such* — *beruf* — grupp — *kenntnis* — *erfahr* — *gebiet* — *computer* — *techn* — *diplom* — verfueg — *wunsch* — *faehig* — *leit* — *stelle* — ausueb — *organis* — *unterricht* — *schul* — *verband* — *gebiet* — ebene — *stadt* — *unternehm* — *versuch* — *allgemein* — *inform* — *elektron* — *geb* ...

Table 3: Lexemes (italics indicate DDS-expected)

do overlap to a very high degree. Although only the DDS-trees of ARBEIT/labour (Fig. 2) and INDUSTRI/industry (Fig. 3) were generated, the simultaneously executed inferencial process on both of them produced STELLE/position (Fig. 4.1) or — depending on the search procedure — ORGANIS/organize (Fig. 4.2) which both are to be found instantiated in the peace of discourse. Thus, reducing the three sentences to a string of lexical items (lexemes) only, and underlining those of them (Tab. 3) whose occurrence had been predicted by the LD-algorithm, will reveal the capacity of *semantic dispositions* to provide knowledge based relevant *expectations* a cognitive system has to derive in order to decide whether or not a piece of discourse may be called *coherent*.

5. To conclude with, it should be stressed that the quantitative algorithmic analysis of usage regularities of lexical items in pragmatically homogeneous corpora of discourse is a tentative step towards the abstract representation of vague word meanings/world knowledge in a stereotype format constituting the system of semantic space. Operating on that distance relational data structure, the DDS-procedure allows for a dynamic, aspect-dependent, target-oriented, and, as such, contents-driven method for the induction of a relevance relation among these stereotypes which appear to be conveyed basically by natural language discourse dealing with specified subject domains.

For the modelling of cognitive functions, the DDS-procedure may help to simu-

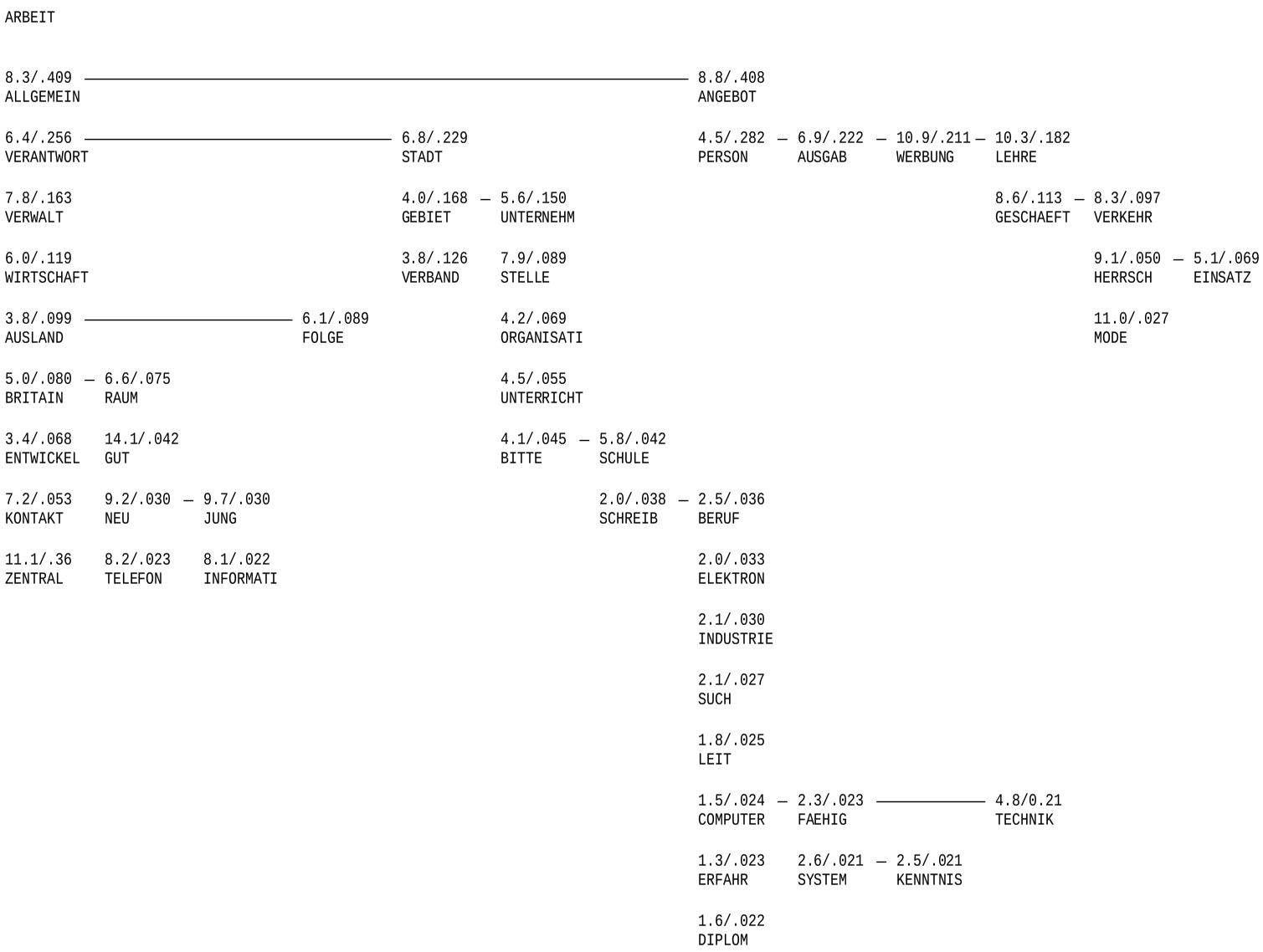
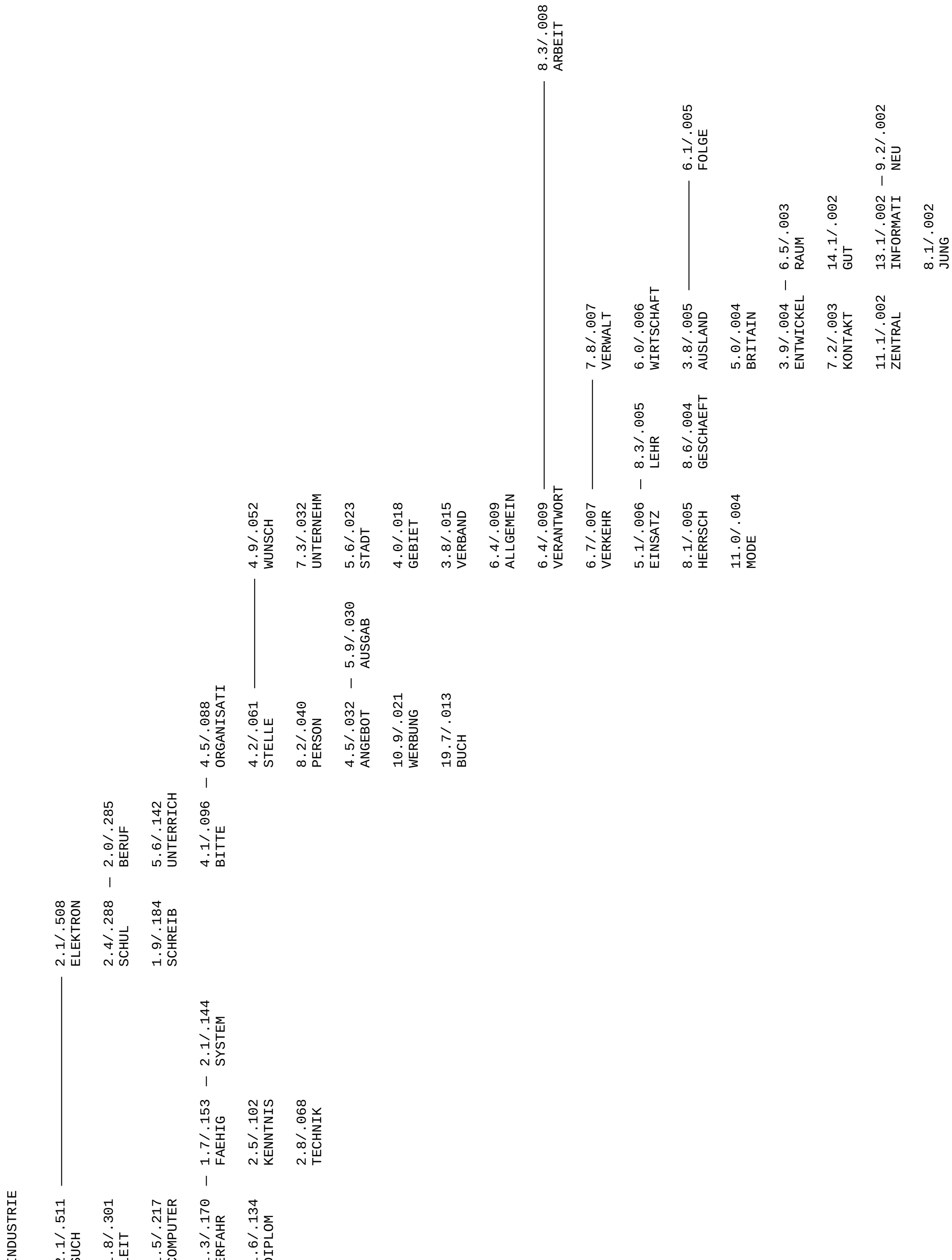

ARBEIT
8.3/.409
ALLGEMEIN
8.8/.408
ANGEBOT
6.4/.256
VERANTWORT
6.8/.229
STADT
4.5/.282
PERSON
6.9/.222
AUSGAB
10.9/.211
WERBUNG
10.3/.182
LEHRE
7.8/.163
VERWALT
4.0/.168
GEBIET
5.6/.150
UNTERNEHM
8.6/.113
GESCHAEFT
8.3/.097
VERKEHR
6.0/.119
WIRTSCHAFT
3.8/.126
VERBAND
7.9/.089
STELLE
9.1/.050
HERRSCH
5.1/.069
EINSATZ
3.8/.099
AUSLAND
6.1/.089
FOLGE
4.2/.069
ORGANISATI
11.0/.027
MODE
5.0/.080
BRITAIN
6.6/.075
RAUM
4.5/.055
UNTERRICHT
3.4/.068
ENTWICKEL
14.1/.042
GUT
4.1/.045
BITTE
5.8/.042
SCHULE
7.2/.053
KONTAKT
9.2/.030
NEU
9.7/.030
JUNG
2.0/.038
SCHREIB
2.5/.036
BERUF
11.1/.36
ZENTRAL
8.2/.023
TELEFON
8.1/.022
INFORMATI
2.0/.033
ELEKTRON
2.1/.030
INDUSTRIE
2.1/.027
SUCH
1.8/.025
LEIT
1.5/.024
COMPUTER
2.3/.023
FAEHIG
4.8/0.21
TECHNIK
1.3/.023
ERFAHR
2.6/.021
SYSTEM
2.5/.021
KENNTNIS
1.6/.022
DIPLOM

Figure 2



INDUSTRIE
2.1/.511 SUCH
2.1/.508 ELEKTRON
1.8/.301 LEIT
2.4/.288 SCHUL
2.0/.285 BERUF
1.5/.217 COMPUTER
1.9/.184 SCHREIB
5.6/.142 UNTERRICH
1.3/.170 ERFAHR
1.7/.153 FAEHIG
2.1/.144 SYSTEM
4.1/.096 BITTE
4.5/.088 ORGANISATI
1.6/.134 DIPLOM
2.5/.102 KENNTNIS
4.2/.061 STELLE
4.9/.052 WUNSCH
2.8/.068 TECHNIK
8.2/.040 PERSON
7.3/.032 UNTERNEHM
4.5/.032 ANGEBOT
5.9/.030 AUSGAB
5.6/.023 STADT
10.9/.021 WERBUNG
4.0/.018 GEBIET
19.7/.013 BUCH
3.8/.015 VERBAND
6.4/.009 ALLGEMEIN
6.4/.009 VERANTWORT
8.3/.008 ARBEIT
6.7/.007 VERKEHR
7.8/.007 VERWALT
5.1/.006 EINSATZ
8.3/.005 LEHR
6.0/.006 WIRTSCHAFT
8.1/.005 HERRSCH
8.6/.004 GESCHAEFT
3.8/.005 AUSLAND
6.1/.005 FOLGE
11.0/.004 MODE
5.0/.004 BRITAIN
3.9/.004 ENTWICKEL
6.5/.003 RAUM
7.2/.003 KONTAKT
14.1/.002 GUT
11.1/.002 ZENTRAL
13.1/.002 INFORMATI
9.2/.002 NEU
8.1/.002 JUNG

Figure 3

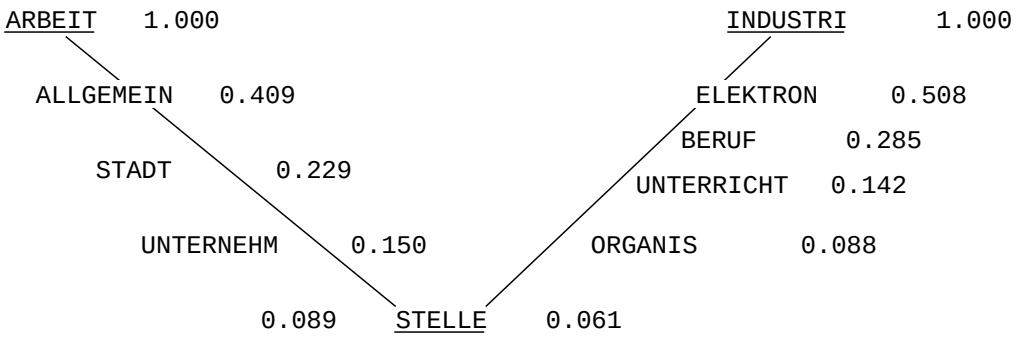


Figure 4.1: Inference-path of BF/DF-search on DDS-tree

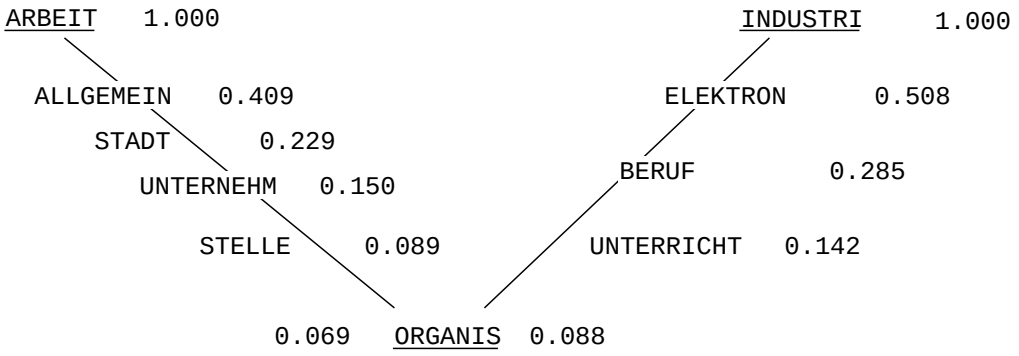


Figure 4.2: Inference-path of MC-search on DDS-tree

late selective and reordering processes operating on related word meanings and/or world knowledge structures to organise *relevant* fragments of them in hierarchies of *aspect-dependency*. Their generation serves to induce paths between related conceptual meaning representations and evaluates them for possible *activation* which might spread across *semantic space*, submitting relevant portions of it to associatively guided search and retrieval as well as inference and reasoning operations.

In natural language understanding, the problem of tacid knowledge and implied information is gaining increasing importance for the construction of intentional and/or interpretative *expectations* by way of connotative default values either prior to the generation of output strings and/or after identifying input items for semantic mapping. It appears that these functions may eventually render the procedural approach a valuable tool not only in the cognitive sciences but also in textlinguistic research where phenomena of textual coherence could possibly soon be analysed and explained as operational results of processes of language comprehension in general.

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