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NEW REPORTS AND MEMOS

Knowledge Acquisition With A Machine Lexicon
Guo, C-M.
MCCS-88-131

This paper describes the construction of a machine lexicon and its use in acquiring general world knowledge from natural language text. Two types of text are identified, dictionary definition text and unrestricted general text. Knowledge acquisition from dictionary definition text helps to construct the lexicon, whereas knowledge acquisition from unrestricted general text expands the lexicon. Knowledge acquisition with the machine lexicon represented a continued process of learning, beginning with acquiring lexical and world and knowledge from dictionary definition text, continuing on to acquiring more knowledge from unrestricted general text.

A Survey Distributed Processing Models from a Computation Perspective
Balogh, I.L.
MCCS-88-133

Many distributed models of computations have been proposed over the years. On the surface they seem to be quite different from more traditional models, and often from each other. But do they offer a fundamentally different type of computation? Some of the more prominent models are investigated from this computational perspective. A brief description is given of each model, followed by a discussion of their capability with respect to each other and in relation to classical models of computation.

An Investigation Into The Minimum Structures of Programming Languages and Natural Languages
Hill, R.
MCCS-88-134

A phenomenon that is regarded as .UL theory based must have some foundation (namely, that theory), a grasp of which is necessary and sufficient to a grasp of the whole phenomenon in all of its manifestations. In other words, it must have some minimum structures on which the whole is grounded, so that analysis of any of those manifestations unravels into a tracing back to those structures, and nothing else.

If we look at language systems, we have, on the one hand, natural languages, the use of which is guided by the demands of the users, people. On the other, we have programming languages, the use of which is guided by the theory underlying them. Can their respective minimum structures shed light on each other?

Philosophy of Language and Artificial Intelligence
Wilks, Y.
MCCS-88-132

The paper surveys the relationship between AI and the philosophy of language. AI is normally described either as an engineering task, one of simulating certain interesting human functions (i.e., not arithmetic) with digital computers or, at a

higher level, as an attempt to explicate computationally the nature of intelligence. The history of practice in AI owes far more to the Leibnizian goal of a mechanical logic than to, say, robotics, the view of AI always taken by cartoonists. The point of view behind the survey is probably that of Wittgenstein's "Philosophy leaves everything as it is". One might extend that, with no greater respect for philosophy, as "Artificial intelligence leaves philosophy as it is", which is to say that no philosophical consequences follow from any piece of research in artificial intelligence and no particular philosophical assumptions are ended to carry out such research.

Form and Content in Semantics
Wilks, Y.
MCCS-88-137

This paper continues a long wail of intellectual complaints against the presumptions of certain kinds of formal semantics (the qualification is important) and their bad effects on those areas of artificial intelligence concerned with machine understanding of human language. The paper begins with a critical examination of Lifschitz's (out of McCarthy) use of epistemological adequacy. The paper then moves, rather more positively, to contrast forms of formal semantics with a possible alternative: commonsense semantics. Finally, as an in-between case of considerable interest, it examines various positions held by McDermott on these issues and concludes, reluctantly, that, although he has reversed himself on the issue, there was no time when he was right.

Belief Ascription, Metaphor, and Intensional Identification
Ballim, A., Wilks, Y. & Barnden, J.
MCCS-88-138

The purpose of this paper, and the mechanisms it describes, is the extension of *Viewgen*, an algorithm for belief ascription in a model of nested viewpoints of agents, to the areas of metaphor, intensional object identification and speech acts, and the addition to the basic "belief engine" of a relevance calculus. That system, summarized here, represents the beliefs of agents as partitioned sets of propositions known as environments. A general defense is given of partitioning approach to belief computation. Environments are convenient, even essential, for addressing important pragmatic issues of reasoning, and are the basis for an existing ascriptional-reasoning program, ViewGen. It is shown that belief ascription, metaphor generation, and intensional object identification can all be seen as processes that involve the amalgamation of a number of environments, and may be seen as manifestations of a single process.

Connectionist Parallel Machines and Turing Machines as Models of the Mind
Wilks, Y.
MCCS-86-79

The paper makes some initial remarks about whether or not connectionist parallel machines can be considered Turing machines and what the consequences, in principle, for AI's task of mental modeling might be. Since the application of much connectionist work is in natural language processing, the paper reviews some current work in that area and argues that, whether or not the processes used are genuinely different from conventional symbolic natural language processing, the arguments used by connectionists to support what they are doing do not in fact distinguish them very clearly from their symbolic predecessors.

The heart of the paper is a comparison and contrast between a current radical argument for connectionism and a radical argument against. It is not clear that the very same version of connectionism is defended by Smolensky as is attacked by Fodor, but since I do not bring the two arguments directly in

contact, that will not matter. My own inconclusive view is that the jury is still out, and that, in the meantime, while there is no convincing evidence to believe what Smolensky says, though one may respect it and be stimulated by it, neither should one reject the whole enterprise on the grounds Fodor gives. One can legitimately be, in a narrow and strict sense, an agnostic, without giving that word the force of active disbelief it is often made to carry.

Reference and Its Role in Computational Models of Mental Representations
Wilks, Y.
MCCS-85-30

This paper is written from a standpoint that still has considerable support within that part of the AI community concerned with modeling or simulating mental representations and processes, but which does not accord with the currently fashionable emphasis on the role of logic in those representations. I would characterize the position as "procedural intensionalist": not a very clear phrase, perhaps, but one which is intended to capture a set of claims that mental representations, in so far as they can be modeled by computer processes are a. symbolic; b. such that their semantics are to be given ultimately by procedures and not (except in a circumscribable set of cases) by sets of referents or by the standard semantics of predicate logic, and c. that semantic decomposition to some set of primitives, which may be domain dependent or (as some would argue) universal, plays a plausible role in the construction of those representations.

In this paper, I want indirectly to defend that club, of which I happen to be a member, by critically examining the recent claims of two writers concerning the role of reference in mental and computational representations. These two, Johnson-Laird (1981) and Smith (1982), are not from the extreme logicist camp; on the contrary, both of them distinguish themselves, in their quite different ways, from the claims of the sort associated with McCarthy and Hayes (1969), or, more recently, Barwise and Perry (1983), who assume that some variant of standard first order logic and its semantics is adequate for the description of meaning and knowledge.

Pronouns in Mind: Quasi-Indexicals and the "Language of Thought"
Wilks, Y., Ballim, A. and Dietrich, E.
MCCS-87-92

The paper examines the role of the natural-formal language distinction in connection with the **language of thought** (LOT) issue. In particular, it distinguishes a realist-uniform/attributist-uniform approach to LOT and seeks to link that distinction to the issue of whether artificial intelligence is fundamentally a science or engineering. In a second section, we examine a particular aspect of natural language in relation to LOT: pronouns/indexicals. The focus there is Rapaport's claims about indexicals in belief representations. We dispute these claims and argue that he confuses claims about English sentences and truth conditions, on the one hand, with claims about beliefs, on the other. In a final section we defend the representational capacity of the belief manipulation system of Wilks, Bien and Ballim against Rapaport's published criticisms.

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KIT-Report 59
A Constructive Version of GPSG for Machine Translation
Hauenschild, Christa, and Busemann, Stephan
February 1988, 25 p.
To appear in: Steiner, E.; Schmidt, P.; and Zelinsky-Wibbelt, C. (eds.): *From Syntax to Semantics-Insights From Machine Translation.*
Frances Pinter, London, 1988.

The paper discusses the applicability of generalized phrase structure grammar (GPSG) for machine translation (MT). After sketching the underlying conception of MT in general and defining the part that GPSG is to play within it, the paper concentrates on the problems raised by the claim that GPSG in its 1985 version is not amenable to computer implementation. It is shown that a straightforward implementation of the formalism would lead to a combinatorial explosion of the number of categories to be computed. Instead a constructive view of GPSG is adopted, which allows for grammatical structures in a direct manner but still under the control of the different GPSG devices, which have been redefined. The constructive version of GPSG forms the basis of the Berlin GPSG system, which is modularized according to the needs of MT. It is fully implemented for parsing and generation with one and the same grammar. Some aspects of using grammars bidirectionally are focused on as well as different ways of utilizing the GPSG formalism and their consequences.

KIT-Report 60
A Constructive View of GPSG or How to Make it Work
Busemann, Stephan, and Hauenschild, Christa
April 1988, 6 pp. To appear in:
Proceedings of the 12th Conference on Computational Linguistics (COLING), Budapest, 1988.

A straightforward implementation of generalized phrase structure grammar (GPSG) in its 1985 version would involve a vast overgeneration of categories and structures as well as processes to filter out everything but the admissible tree(s). We therefore argue for a constructive version of GPSG where information is gathered in subsequent steps to produce syntactic structures. As a result, we consider it necessary to incorporate procedural aspects into the formalism in order to use it as a linguistic basis for NL parsing and generation. The paper discusses the major implications of such a modified view of GPSG, thereby including a new proposal for handling agreement in a simple and sufficiently general manner.

KIT-Report 61
Using Constraints in a Constructive Version of GPSG
Weisweber, Wilhelm
April 1988, 6 pp. To appear in:
Proceedings of the 12th Conference on Computational Linguistics (COLING), Budapest, 1988.

Complex categories are characteristic of unification grammars as, for example, GPSG. They are sets of pairs of features and values and have crucial influence on the efficiency of the parsing algorithm. This is one problem from using complex categories; another one arises when using a constructive version of GPSG in which the feature values are propagated among the categories of a local tree. Namely that the application of admissibility conditions, i.e. linear precedence (LP) statements and feature co-occurrence restrictions (FCRs), to a local tree t is prevented because particular feature values of categories in t are not yet specified, but they will be instantiated later somewhere else in the complete tree. The paper describes the latter problem and will present a solution working with computation, evaluation and propagation of constraints within local trees. The constraint evaluation will reject local trees if the constraints of the subtrees of the daughters are violated.

KIT-Report 62
Discourse Structure-Some Implications for Machine Translation
Hauenschild, Christa
April 1988, 15 pp.
To appear in: *Proceedings of "New Directions in Machine Translation"*, International Conference, Budapest, 18–19 August 1988, organized by BSO/Research (Utrecht) and the John von Neumann Society (Budapest).

The paper discusses the importance of discourse structure for translation in general and for machine translation, regarded as a special case of translation. After some general remarks on the role of discourse structure for human and machine translation, the interrelation between the stipulation of invariants in translation and the interlingual approach is examined. As a kind of counter-evidence some language-particular ways of expressing the thematic structuring of a text are introduced, which leads us to an argumentation in favour of the transfer approach to translation. The conclusion is that both aspects of translation ought to be considered in machine translation, which yields an argumentation in favour of a "mixed approach".

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LILOG-Report 2
A Conceptual Model for Time
Studer, Rudi
December 1986, 20 pp.

For capturing static and dynamic aspects of an application domain on a conceptual level, THM-Nets based on a semantic data model and Petri net concepts have been proposed. In this paper THM-Nets are generalized to timed THM-Nets, thus providing modeling concepts for capturing physical and logical time aspects of a slice of reality. These modeling concepts are based on an appropriate notion of physical and logical time within the semantic data model THM.

LILOG-REPORT 3
Implementation Aspects of a Natural Language Understanding System in a PROLOG/DB Environment
Studer, Rudi, and Walter, Bernd
September 1986, 12 pp.

LILOG is a project for exploring linguistic and logic methods for an automatic understanding of German texts and for an adequate representation of the acquired knowledge. In order to maintain knowledge bases of realistic size, database technology will be used. This paper discusses some of the problems that occur when an existing database system (SQL/DS) is used for representing the various types of knowledge. Additionally, the design of a rapid prototype PROLOG/SQL system will be presented, which supports the exploration of various mapping and access schemes and considers the fact that the used knowledge representation methods will most certainly evolve during the course of the project.

LILOG-Report 6
Mathematical Logic and Artificial Intelligence
Schmitt, P. H.
January 1987, 17 pp.

This paper discusses some research topics of mutual interest in mathematical logic and artificial intelligence. Among the topics treated are mathematical theorem proving, modal logic, many-valued logic, reasoning under uncertainty and monotonic logic. While some issues are treated in detail for others only a selected guide to the literature is given.

LILOG-Report 7
The Semantics of Asserting and
Retracting Clauses to Logic Programs
Pletat, Udo, Beierle, Christoph
July 1987, 22 pp.

We discuss two approaches for defining the operational semantics of modifying logic programs by means of asserting and retracting clauses. The first approach defines a "logically clean" behavior for assert and retract. Logically clean means that this operational semantics for logic programs including asserts and retracts is equivalent to the model theoretic semantics of the logical skeleton of a program, i.e., where the asserts and retracts are removed. This is achieved by delaying the modification of the program due to the asserts and retracts passed during a proof after the successful evaluation of a goal. We contrast this clean semantics with the PROLOG style of modifying logic programs and discuss the reasons for losing the logical cleanness.

LILOG-Report 8
An Approach to Manage Large
Inheritance Networks
Studner, Rudi, Borner, Stefan
March 1987, 12 pp.

When developing large-scale knowledge-based systems, concepts are required for handling knowledge bases on external storage. In this paper we present an approach for managing structured inheritance networks in a database. Actually, we develop a representation of a KL-ONE-like formalism in an extended relational database system supporting non-first-normal-form relations. Of special importance is the handling of the general hierarchical structure provided by KL-ONE within the tree structure offered by non-first-normal-form relations.

LILOG-Report 12
On Structuring Domain-Specific
Knowledge
Wachsmuth, Ipke
March 1987, 15 pp.

This paper presents a proposal on how domain-specific knowledge of both conceptual and assertional nature can be structured. The aim is to devise a way that allows large amounts of domain-dependent knowledge to be used by a knowledge-based system while keeping the system manageable. The proposal grounds on findings from empirical research on the acquisition of domain-specific knowledge. It is presented abstractly in the form of principles that are to be understood as a specification rather than a symbol-level description for a representation scheme. The model comprised by these principles suggests domain-specific knowledge be organized in nested packets of knowledge elements. The central notions of "visible" and "reachable" knowledge are used to characterize static and dynamic access conditions.

LILOG-Report 13
Word Order and Focus Projection
Wesche, Birgit, Renz, Ingrid
April 1987, 20 pp.

One of the major problems that has to be confronted in a natural language system for German is its relatively free word order. If one takes into account, however, that word order is to a large extent motivated by pragmatic considerations the choices for placing the single constituents within a sentence narrow down considerably. A factor by which pragmatic aspects are reflected quite explicitly is stress. In this paper we will outline the regularities that result from the strong interaction of word order and stress in German, and show how these can be exploited even within an NL system which is based on written input only. Taking such an approach will have an impact on the encoding of lexical entries, on the formulation of syntactic rules, on parsing strategies, and it will, furthermore, support the component of semantic representation in that we will have a clearer insight as to which elements constitute the core message of a sentence.

LILOG-Report 20
Mental Images and Route Descriptions (in German)
Rehkamper, Kalus
August 1987, 10 pp.

Mental images are of great importance in the text comprehension of human beings. Text understanding computer systems which intend to meet the demands of cognitive adequacy must take this fact into account. Human beings use these images to represent knowledge. Thus images are-in addition to propositions-another way of gaining and representing knowledge. In this paper I want to show some of the new possibilities opened up by this second form of representation as well as the restrictions connected with it. Route descriptions form a class of texts which obviously require mental images for their generation and comprehension. During the generation of a route description the informant uses a cognitive map of a quasi-pictorial format, on which he locates his position, the destination and the route between them. To understand the following description the hearer must re-transform the verbal information into an appropriate format-presumably a combination of propositional and quasi-pictorial representation.

LILOG-Report 22
Chart Parsing of Unification-Based Grammars with ID/LP Rules
Seiffert, Roland
September 1987, 19 pp.

Earley-style chart parsers for unification-based grammars are now commonly used in implementations of formalisms like PATR-II and others. Some of the most essential extensions to the standard Earley algorithm are shown: the subsumption check for the insertion of new edges into the chart and the restriction of feature structures within the predictor step.

Graham et al. (1980) propose a method for the efficient encoding of all parse trees for context-free grammars. The representation of the parse forest provides efficient access to every single parse tree for a given sentence. This method is slightly extended for unification-based grammars. It is shown that the parse forest can be built at very little extra cost while the Earley chart is being constructed.

To combine the well-known advantages of the ID/LP formalism with the full power of unification-based grammars, Unification-ID/LP (UID/LP for short) grammars are defined. ULP acceptability of parse trees for UID/LP grammars can be decided for every complete analysis of an input sentence by checking every local tree in the analysis, just as it is the case for simple ID/LP grammars. The problems with UID/LP parsing that arise from allowing unrestricted unification in combination with constraining LP rules are discussed.

A parsing algorithm consisting of two steps is proposed. In the first step, an extension of the Earley/Shieber algorithm for unification grammars is used to build a chart with a representation of the parse forest for the input sentence. In the second step, every single parse tree is extracted from the forest and is checked for ULP acceptability.

LILOG-Report 23
At Ease with "at"
Wesche, Birgit
August 1987, 12 pp.

In representing the meaning of a preposition, the main question that arises is whether to assume a polysemous lexem or a number of homonyms according to the various senses the respective preposition can adopt. In this paper it will be shown that by taking a prototypical approach each preposition can be represented as one coherent concept. Exemplified by the concept of the English preposition "at"—distinguished by its diverse range of meanings such as spatial, temporal, causal, etc.—the systematic relation between the different senses will be illustrated. The argumentation is centered around the assumption of a prototypical concept, which in the case of "at"

is a spatial one. Departing from this prototype new senses develop successively, motivated by the fact that a certain domain is conceptualized similarly or analogously to an already existing concept of the respective preposition.

LILOG-Report 24
Representation and Accessibility of Discourse Referents
Bosch, Peter
September 1987, 23 pp.

Linguists and philosophers long looked upon definite reference as if it were entirely a matter of the descriptive content of referential expressions. In ordinary discourse, however, such information is usually insufficient to bring about unambiguous reference, certainly for pronouns with their extremely attenuate semantic content, but also for full NPs.

As a framework for the questions I want to discuss I shall adopt a proposal for a division in short-term working memory which was put forward by Sanford and Garrod (1981) (Section 1.1). Subsequently I shall amend this proposal to account for the role of the descriptive content of referential expressions in accessing the different memory registers. The remainder of Section 1 provides some linguistic evidence for this amended model. Section 2 discusses some problems which this model faces with regard to antecedentless pronouns (2.1) and contrastive reference (2.2) and leads up to the final version of our model for the relation between the representation and accessibility of focused referents, which I shall present in Section 2.2.

LILOG-Report 25
Text Understanding in LILOG-Sorts and Reference Objects
Rollinger, Clause, Studer, Rudi, Uszkoreit, Hans and Wachsmuth, Ipke
August 1987, 14 pp.

The main objective of the project LILOG (linguistic and logic methods) is to develop concepts and methods for understanding German texts and dialogs. "Understanding", in this context, refers to the construction of a semantic representation of a piece of text or of a dialog statement, that is a (partial) model of the situation described in the text. This representation is held in a computer memory and is used by the knowledge processing component, e.g., for extracting information to augment a knowledge base, or for answering questions about the text, etc. As a prerequisite, appropriate means for constructing such a model must be available in a permanent knowledge base. These means must be retrieved and applied to the actual situation by appropriate processes.

LILOG-Report 26
Computational Aspects of Three-valued Logic
Schmitt, P. H.
August 1987, 11 pp.

This paper investigates a three-valued logic L , that has been introduced in the study of natural language semantics. A complete proof system based on a three-valued analogon of negative resolution is presented. A subclass of L.sub.3 corresponding to Horn clauses in two-valued logic is defined. Its model theoretic properties are studied and it is shown to admit a PROLOG-style procedure.

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ACMC Research Report 01–0015
Implicature, Disjunction, and Non-monotonic Logic
Nute, Donald and Covington, Michael

Natural language utterances imply certain facts in the absence of which they would not be true; they also implicate additional facts in the absence of which the utterance would probably have been expressed another way. For example, "There are five books on the table" implies that there are five books and implicates that there are not more than five.

This paper presents a formal representation of one case of implicature (Pelletier's analysis of "or") using LDR1, a non-monotonic logic that was originally developed to encode generalizations that have exceptions.