SUMMARIES IN ENGLISH

Benny Karpatschof and Steen Folke Larsen: Cognitive Research in Denmark
This paper has been prepared by a working group for the Danish Research Council for the Humanities as material for the council's future work in this area. In the paper is introduced the research field called cognitive science, which we propose should be translated to the Danish as »kognitionsforskning« (cognitive research). An attempt is made to define the characteristics and the content of this field, and the organisation of a national research program (in which the disciplines of the natural and technical sciences will be the partners of the humanities) is discussed.

Niels Ole Bernsen: Cognitive Science anno 1988
This paper presents characteristic features of the research programme of cognitive science and a distinction is made between research programme and research paradigms. Cognitive science is currently producing a reorganisation among several traditional scientific disciplines. This process has lead to controversies about, among other things, the research programme, the paradigms, and interdisciplinary collaboration. Comments are made on some of these controversies. Evidence is presented for the conclusion that, at least for the time being, cognitive science is developing in accordance with its research programme and a number of European, national, and global cognitive science initiatives are described.

Henning Boje Andersen: Modelling tacit knowledge
The widely accepted distinction between automatic and controlled processes is briefly reviewed, and it is stressed that several modern general framework theories of human cognitive performance share the dual architecture position underlying this distinction. A broad concept of tacit knowledge is presented in relation to characterisations of explicit and implicit knowledge. Two distinctions are made within the wider concept of tacit knowledge: between background knowledge and context knowledge; and between non-representational knowledge (perceptual and sensori-motor skills) and the knowledge imbedded in the global interconnectedness of knowledge structures. The paper concludes with some brief remarks on the prospects of modelling tacit knowledge.

Michael May: Cognitive Science and Artificial Intelligence between Logic and Psychology: A semiotic point of view.
The article presents a »meta-semiotic« perspective on cognitive science (CS) according to which the foundation of CS should be sought, neither in the psychological investigation of human intelligence nor in the »frankensteinian« construction of an artificial intelligence, but in the investigation of possible cognitive formations. Theoretical research in artificial intelligence would support such an investigation by analyzing the properties of computational models that can simulate these cognitive formations.

CS should take a special interest in the biological implementation of cognitive formations (in order to enhance the scientific understanding of the mental faculties), but I propose that it should be done on the background of theoretical research into different levels of constraints (logical, physical, biological etc.), that can help us recognize the different (natural or artificial) implementations of »intelligence« as realizations of abstract

possibilities relating to the reality of signs, tools, and models. The general properties of signs (as well as the general properties of signification and communication), the general properties of tools (as well as abstract machines), and the general properties of models (physical and mental), - is the subject of meta-semiotics.

CS is at present confronted by three fundamental problems: 1) to overcome the dichtomy between psychological and logical conceptions of cognition, 2) to reformulate the status of the phenomenal world in theories of cognition (the status of »naive« and commonsense theories), and 3) to restate the conflict between the paradigm of traditional AI and the paradigm of neural networks as an index of a reel theoretical problem, by formulating possible integrations of discrete and continuous models of symbolic and subsymbolic processes.

Hans Siggaard Jensen: Language and Cognition

The relationship between cognitive science, artificial intelligence and positions in the philosophy of language are investigated, especially departing from John Haugeland's analysis of the foundations of GOFAI (Good Old Fashioned AI). It is concluded that neither a pure formalist account like GOFAI with its representationalism, nor a purely rule-based account like the later Wittgensteins can account for the relationship between language and cognition, because language is an abstract entity that essentially involves semantics and intentionality, and is also situated in a sense that first J.L. Austin pointed to.

Henrik Prebensen: Natural Language Seminatics and Computers

This paper deals with *natural language (NL) semantics on the computer.* It presents two major theoretical viewpoints in linguistic semantics: *representational* and *denotational.* In linguistic theory, these two issues are mostly understood as mutually exclusive, as can be seen from Chomskyan and Montague Grammar. The paper discusses representational semantics in connection with the autonomous syntax approach of mainstream *transformational grammar,* denotational semantics in connection with the model-theoretic approach of *Montague grammar.* In the next step, I consider the implementation of model-theoretic NL comprehension systems on the computer. In the present context, they are viewed principally as a means to make experimental studies in the formalizations of NL. It is shown that the correct handling of referential NL terms in such systems can be achieved only if these systems combine methods and techniques from both types of semantics. Finally, the cognitive meaning of the concept of *computer understanding* is touched upon.

Kim Plunkett: Parallel distributed processing

After briefly reviewing the appealing psychological properties of PDP systems, an introduction to their historical roots and basic computational mechanisms are provided. A variety of network architectures are described including one-layered perceptrons, back propagation networks, Boltzmann machines and recurrent systems. Three PDP simulations are analysed: First, a model that purports to learn the past tense of English verbs; Second, a constraint satisfaction network which is able to interpret the alternative configurations of a Necker cube; Finally, a recurrent network which is able to decipher membership of grammatical classes from word-order information. The notion that PDP approaches provide a sub-symbolic account of cognitive processes, in contrast to the classical symbolic view, is examined. The article concludes with brief speculation concerning the explanatory power of PDP systems at the cognitive level of functioning.

Peter Holtse & Peter Molbæk Hansen: Speech Recognition and Speech Synthesis
This paper presents an overview of the principles and problems currently recognized in speech technology. It is argued that speech synthesis and general speech input/output recognition should be considered an integral part of computational linquistics and a model is presented which emphasizes fields of common interest to speech technology as well as to natural language processing in general.

Axel Larsen & Claus Bundesen: Visual recognition by template matching
A computational model of human visual recognition by comparison of stimulus patterns against memory representations is developed. Recognition is achieved by template matching (cross correlation). Invariance with respect to spatial position, size and orientation is obtained by coordinate transformations, and sensitivity to noise is reduced by Gaussian filtering. The model is implemented as a self-learning algorithm which is currently being tested with a sample of handwritten letters.

Klaus B. Bærentsen & John Paulin Hansen: Knowledge -acquisition and -modelling: A new work field for psychologists?
The acquisition, formalization and representation of expert knowledge in computer programs is a rapidly expanding field in the wake of computer technology developments. In the following it will be pointed out that this work to a large extent is based on theories of human cognition and applies psychological methods such as interview, observation, experiments and protocol analysis. Experiences from modelling of the knowledge and reasoning by machinists concerning the state of the process in a power plant show how these methods can be used in developing expert programs. This illustrates the fact that you do not have to be a computer expert to start working on such a project.

Flemming Vestergaard: Expert Systems! Who Knows?
A number of aspects of knowledge representation in expert systems are discussed. The aim is mainly to introduce to them, and as regards expert system technology the discussion is quite introductory, the perspective being more that of simple practice in the field than state-of-the-art applications. The main subject is how knowledge is embodied in expert systems, in particular with respect to explicitness and articulation. It is suggested that expert systems may embody knowledge in ways more similar to human knowledge representation than do conventional computer systems. Important reservations concerning this claim are also made.

Jørgen Aage Jensen and Thomas Nissen: Pedagogy Psychology Hypermedia
On the assumption that the phenomenon of hypermedia will have significant educational impact, the paper discusses the basis for deriving heuristics for hypermedia as a pedagogical »tool«. The paper is in three parts: the *issue,* a *(fictitious) example of a hypermedium,* and an *exposition of two paradigms of epistemology and pedagogy as the basis for use of hypermedia in education.*

A hypermedium is a domain specific collection of texts, pictures, graphics, film, and sound that, by named connections among fragments of the content, permits an organised, but non-sequential processing. This implies that the representation of knowledge does not require prior structuring according to particular sequential or hierarchical principles. The fundamental questions are, firstly, how to *structure the domain,* i.e. deciding which elements of the content that are to be connected and in what ways they are to be connected; and secondly, how *a personal goal orientation is sustained,* and confusion

avoided, in view of the complexity of possible directions and routes of exploration.

Answers to such questions must be based on general epistemological and pedagogical conceptions. The paper outlines two paradigms, one epistemological, and one pedagogical. Aspects of hypermedia potential are illustrated by these paradigms.