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RESEARCH ON KNOWLEDGE BASED PROGRAMMING

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LEVEL II

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TRIP REPORT

by

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TRIP REPORT

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November 1980

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The following document is a report on my recent visit to several European universities and research centers. In it I will attempt two things. First, to convey personal impressions about the centers and their specific research organization. Second, to state a few general and specific observations collected during my visit, regarding computer science areas where work done at these centers may have the highest potential impact.

General Observations

Computer science research in Europe is of a different nature than that of the United States. While computer science work in this country concentrates on the development of advanced technologies at the boundary of basic research, similar work in Europe concentrates more on providing solutions to the everyday computational problems faced by the production sector of society (industry, government, commerce). The main difference with research in the United States thus lies in emphasis and directionality.

The main emphasis of current research in the centers I visited is directed towards advanced software engineering tools (smart editors, sophisticated description languages), and computer-mediated smart communication systems both at the national level (government networking) and at the organizational level (office automation).

Visit Summaries

I visited INRIA, ONERA-CERT and IMAG in France, and PISA and CNR in Italy. I talked to several research groups and presented my research on self-described software engineering systems. Overall the reception of the work was very positive in all of these places. Many of them have manifested their own

interest in pursuing similar research paths, and if possible even building on top of the results obtained. In the following sections I will attempt to summarize individual visits in detail.

France

In my opinion France is, with England, the focus for the development of computer science in Europe. France excels over England in research on software tools and networking (telematics) and is establishing a leadership in the development of semiconductor technology. The general thrust of the field is in the direction of distributed systems, foundations of programming languages, man-machine interfaces, and software engineering.

There are three major government and public computer science research centers in France: INRIA (Institut National pour la Recherche en Informatique et Automatique), ONERA-CERT (Office National d'Etudes et Recherche Aeronautiques - Centre d'Etudes et Recherches de Toulouse) and IMAG (Informatique et Mathematiques Appliquees de Grenoble), located respectively in Paris, Toulouse and Grenoble.

The most important place in France for computer science research is INRIA at Rocquencourt. INRIA is a very big organization that acts as a central dissemination channel for research results all over France, and is the government organ for distribution and allocation of research funds in computer science. INRIA's main task in the French context is thus the creation of research directions and control of the development of computer science research in France. At INRIA I visited the software group, where I had the opportunity of talking to Drs. Kahn, Levy, Huet and Mme. Donzeau-Gouge, as well as meeting with some visiting scholars, among them Dr. MacQueen. We discussed the applicability of their work on knowledgeable editors (the MENTOR system for PASCAL programs) to programming environments like CHI, and the role that denotational semantics plays in the development of such tools. Drs. Kahn and Levy have worked on foundations of computation in parallel programs and the lambda-calculus. Dr. Huet has been very active in the study of foundations for program verification and omega-order logics. Dr. Kahn and Dr. Donzeau-Gouge have been instrumental in the development of MENTOR systems for the PDP-10, IRIS80 and other machines. Their experience in the design of their system has given me valuable insights into the research problems we face in designing display-oriented knowledgeable editors.

Other work of interest currently in progress at INRIA includes the development of ADA tools, work on networks (Reseau Cyclades, Distributed Systems), work on applications of microprocessors, relational data bases, optimization theory, abstract data type theories and pattern recognition. Of most interest in my opinion is their work on the foundations of programming languages and the potential use of their results in the development of new tools to alleviate the programming task. I believe that their activities in these fields should be more closely followed.

After INRIA I visited CERT-DERI and the Universite Paul Sabatier at Toulouse. The research of the CERT group on program specification and development is the closest to our own. The goal of this group is the development of a super-compiler based on advanced techniques for program specification. I met and exchanged ideas with several members of the group among them Profs. Lemaitre, Lemoine, Jacquart and Zanon. They gave me a very detailed overview of the methodology used in their project, which they call computer-assisted software design (CASD). Basically their idea is to develop a communication language in which to specify programming tasks and to produce a system which aids in the transformation of such language into code via a problem solving process. The details through which this transformation is carried out are still quite sketchy and tend to favor a theorem-proving approach for the problem solving component, and PROLOG as the target language. The work is still in the definitional stage, and they expect to enter into development mode at the beginning of 1981. In addition to the CERT group I met with Prof. Ernst from the Universite Paul Sabatier who described his work on data base organization. This work seems to follow closely, similar approaches developed at Berkeley by Prof. Stonebraker's group.

The last stop in France was at IMAG. There I met with the program specification group (Drs. Amy and Caplain) and talked to them about design of specification languages. Dr. Caplain is considered to be one of the experts in specification languages in France. He is also leading a small project at IMAG on the specification and synthesis of small operating systems like those used for control and navigation. In addition to his group, I had a chance to talk to people in the production automation center where they are starting robotics research under the direction of Prof. Latombe. One more project of interest is the POLYPHEME distributed data base schema currently being implemented under CYCLADES, a packet switched network.

Italy

Research in computer science in Italy is heavily oriented towards the development of software tools, and in general of small computer systems. The main tendency in the centers I visited is to shift emphasis towards office automation and to consider the office automation problem as encompassing the software development problem. Their next generation of computer systems will be small personal office computers. They are thus gearing basic research in this direction.

In Italy I talked at ISI (Istituto per la Scienza e Elaborazione de la Informazione) of the Universita de Pisa, and at CNR (Conzilio Nazionale della Richerca) also in Pisa. At ISI I met with Profs. Prini, Attardi and Simi. They have a long tradition of research in programming languages and programming language semantics. Currently they intend to start work in design systems as applied to programming and workflow in offices. They will be installing a network of personal computers (PERQs) to establish a center for research in design. Their plans for development of such a center are still in the definitional stage. They expect to start it by the middle of 1981 when their first PERQs are delivered. At CNR I talked to Dr. Aiello and her group. They are interested in programming tools and architectures for advanced programming languages. CNR is more oriented towards satisfying the computational needs of the scientific community and are more concerned with tools for making the machine accessible to laymen.