

XXV. COGNITIVE INFORMATION PROCESSING

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1. NATURAL LANGUAGE PROCESSING

National Science Foundation (Grant SED76-81985)

Jonathan Allen

The text-to-speech system for unrestricted English text has been unified in a current version called MITALK-79. A large effort was made to bring all components of the system up to date, and a one-week course was given in June 1979 to those people outside of M.I.T. who wished to understand or acquire the system. A license arrangement has been made, and several universities and companies are currently utilizing the software, demonstrating that the system can, in fact, be successfully

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exported. A set of notes was prepared for the summer course and these are now being edited to form a monograph that will soon be published.

As part of the conclusion of this project, a set of intelligibility and comprehension tests was made. These showed that the generated speech quality is acceptable for a wide range of applications, and that listeners can understand spoken paragraphs as well as the same material visually displayed. It is apparent, however, that synthetic speech generated by rule is still not completely natural, even though it may be highly intelligible. This happens because the synthesis-by-rule algorithms utilize a small number of robust cues to mark the various linguistic structures, whereas in human speech, a much richer variety of cues is redundantly produced. A major task is to understand how all of these correlates are produced together and, particularly, how they trade with one another. Equally important is the determination of how these correlates integrate to form percepts. In the coming year, we plan to focus on research which can reveal the nature of this integration metric, and how the perceptual mechanism dynamically weights the strength of the several cues and constraints. A model for speech recognition based on the determination of strong syllable structures, and subsequent lexical access based on these syllables, is currently under development. This model utilizes a principle of focused search, where selected sets of cues are actively examined based on local context so that passive template matching is avoided. The integrative process of perception is thus seen as a selective focus of attention on contextually relevant cues that have strong constraint strength in the immediate environment.

2. DIGITAL WIREPHOTO SYSTEM

Associated Press (Grant)

Donald E. Troxel, William F. Schreiber, Richard S. Damon,
John N. Ratzel, Jason Sara

Since August 1970, we have been developing a news picture (Wirephoto) distribution system that is entirely new for the Associated Press. It is being introduced in stages, in such a way that at least the present standard of quality and service will be maintained everywhere, with improvements spreading gradually to all

locations.

Pictures are stored under computer control. An editor can view any picture on a TV display in order to select, discard, edit, transmit, or store that image for later automatic dispatch. Editing may include cropping, enlarging, reducing, tone-scale enhancement, sharpening, combining, and addition of captions. No additional chemical photographic work will be required for any of these picture-processing operations.

Transmission over the "backbone" system linking AP bureaus and large metropolitan newspapers that have substantial computer facilities will be via high-speed digital links and will originate and terminate generally at computer-controlled digital storage devices. Transmission to subscribers will be analog or digital and at speeds and scanning standards appropriate to the existing transmission facilities. Complete control will be exercised by the New York network monitor. In the absence of manual interventions, transmission to all points among the bureaus, from point to point, and to regional networks, will be accomplished automatically.

We have implemented some of these procedures in the laboratory, using a PDP-11 computer (300-megabyte disk). The input may be a picture from the AP network, from a local analog transmitter, or from magnetic tape, and is stored on a disk. Pictures may be transmitted from the disk to comparable receiving points. Pictures stored on the disk may be viewed on a TV display utilizing a full-frame storage system. Editing facilities already in operation include cropping, enlarging or reducing, combining several pictures into one, addition of captions, and sharpening.

The multitask software operating system permits new picture-processing routines to be integrated easily, and we plan to keep incorporating additional picture-processing routines into the system.

We are particularly interested in picture-processing operations in which the processing depends on the local content of the picture. That is, the detailed parameters of a coding or enhancement scheme vary for different local areas. In this type of processing it is of prime importance to avoid artifacts such as contours outlining these local areas. We are also accelerating our interest in color picture processing, both from the viewpoint of coding for bandwidth compression and enhancement or manipulation.

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The Associated Press has now installed the computer-based image processing system in New York City. It is initially being used to coordinate the newsphoto transmissions between the domestic and international Wirephoto networks.

3. DATA PROCESSING FOR THE GRAPHIC ARTS

Providence Gravure, Inc. (Grant)

William F. Schreiber, Donald E. Troxel, Leonard Picard,
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The aim of this project is to explore the feasibility of digital processing and computer manipulation of graphic arts quality images which are intended to be duplicated on printing presses. Specific areas of investigation include data compression, tone-scale reproduction, enhancement, input/output hardware and software, and the economical storage and retrieval of very large amounts of pictorial data.

4. IMAGE PROCESSING FOR THE GRAPHIC ARTS

Taylor Publishing Company (Grant)

Donald E. Troxel, William F. Schreiber, Phuong-Quan Hoang, John N. Ratzel

Taylor Publishing Company is developing a computer-based system for producing printing plates for yearbooks and similar publications. This type of printing is characterized by a very large number of different pages, most containing many pictures, and by small runs compared with most other publishing. Thus the cost of plate preparation is a high proportion of the total production cost. The purpose of the MIT project is the development of an improved system for the input and processing of the graphical elements — pictures and other nontypographical matter — to be included in the final pages. The improved system is to feature lower cost, higher speed, and no loss of quality through the application of interactive computer techniques.

The work to be done at MIT consists of the design of a scanner station and its operating system. Physically, the station, which itself will be a satellite of the Taylor Publishing Company's publishing system, comprises a small computer with

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associated peripherals. These include a picture display, full-frame memory, disk memory, tablet and Autokon scanner. The operating system will permit the station operator, sitting in front of the computer console, to perform, interactively, the following operations:

1. Receive layout instructions for each page, from the central system, including location and size of graphical elements.
2. Scan pictures into the system using parameters derived from the layout information.
3. View scanned pictures on the display and perform aesthetic corrections, if required. View entire page on display to verify layout.
4. Organize graphical data in local memory as required by page layout and initiate data transfer to the central system.

The novel features of this system revolve around the use of a small computer, in combination with a graphics arts quality laser scanner and some special-purpose digital hardware, to permit input of graphic elements, aesthetic corrections, and the organization of data for each page according to layout information, all on an interactive basis, and in a cost-effective manner.

