ARCHITECTURE MACHINATIONS

THIS WEEK

Tuesday, April 12,	@5:00-6:30pm	Benjamin Rockman of Adage will be here to discuss Adage 3D hardware in relation to MBY.
Thursday, April 14,	all day	Andy meets with Dave Evans at E&S, Salt Lake. Same discussion as above.
Friday, April 15,	@10:00-1:00pm	MBY final review.
Monday, April 18	@6:00-7:30pm	SID Open House (see inside for thin explanation).

AND BEYOND

Wednesday, April 20,	@5:00pm on	Elloit Schlam and Robert Dunn visit, ARO related.
Friday, April 22,	@11:00am-noon	Brown Boveri Company (the German branch) visit to see our NSF graphical input developments.
Wednesday, April 27,	@11:00am-noon	Siemens visits. More "Office 1990".
Saturday, May 7	all day	MIT's Open House for employees.

SID SYMPOSIUM by Nicholas Negropnote.

I have been asked by several people what our co-sponsorship of the SID Symposium really means. I don't actually know. However, I do know that we are having an open-house on Monday, April 18 6:00-7:00pm. Chris Herot has been asked to be the Master of Ceremonies. ABY will miss Guy, but have Peter Clay as a stand-in.

The week as a whole will bring many people to town, including Peter Brody (Westing-house), Bill Good (GE), and Elliot Schlam (Monmouth). Also, the exhibition should be of great interest to our hardware department.

I have asked Vernon Fowler, Chairman of the Symposium, to provide a small number of generalized entry tickets which we can circulate amongst ourselves. We should have every session covered. Please read over Machinations (Vol. III., No. 12) and give Margaret the names of those sessions you would like to attend. At the end of this week, we will see how many sessions are lacking in attendance and then do some coaxing. It would be nice to have next week's Machinations include a one or two paragraph review of each paper.

RAMTEK NEWS by Andy Lippman.

A new monitor is arriving from Ramtek! We are trading in the 19" Mitsubishi for the 13" version. This new monitor is better suited to our application, hopefully more reliable, and presents a better image. Expect it sometime this week.

The micro-assembler for the 8080 is almost up. It should be ready this week also.

The vidicon interface is undergoing some quality improvements. In our standard style, this means completely breaking it, then fixing it again, somewhat better than before. If you want to use it, please call. We are working on making it available for all applications. The image disk transfer program is in the works, and should be ready soon. As it stands now, it will store a 512 by 480 image with some grey values. I'm not sure how many yet. In the background is a program to digitize the image ten times faster. This involves a hardware mod to the Ramtek which is now possible with the MM80 here to debug it. Also, the copy lens has ar-rived. When the mounting adapter comes, in two weeks or so, we will be able to copy all the way down to one-to-one.

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MICRO-DEBUGGING FACILITY by Andy Lippman.

Through the good graces of the Ramtek Corporation, we now have an MM80 in-circuit
emulator for 8080 systems. It arrived last Tuesday. This device is an extremely
well designed and flexible debugging and simulation system for 8080 based software
and hardware.

It can operate in three modes. As a stand-alone system, it includes an editor, a
one-pass assembler, and a debug/monitor program with a dis-assembler. There is a
serial port that supports a variety of terminals. We have used it with the Carou-
sel. To use it in-circuit, there is a plug that interfaces to the target system
by plugging into the socket normally occupied by the 8080. Thus this box can be
used to emulate all of the functions of the microprocessor in that system, and can
single step through its operation (emulation), or run it in real time with some
debug features enabled.

The unit physically consists of a box, about the same size as a Summagraphics tab-
let controller, and can be carted around to work on any system that includes an
8080 for its controller.

The software is reasonably comprehensive and allows breakpointing, tracing, copy-
ing memory, and even memory testing. There is a self test feature (apparently a
feature of all Ramtek hardware) that tests the unit's internal functions every time
the system is reset or powered on. There is also provision for adding a PROM pro-
grammer.

Needless to say, this is the most desirable microprocessor debugging system avail-
able, and will probably be desired by all of the hackers and passers-by that happen
into the machine room. So, some rules of operation will be enforced. Bear in mind
that Ramtek gave this device to us to make it possible for us to implement certain
functions on the Ramtek 9300 that we have. Therefore, that is its highest priority
use. Here are the rest of the rules:

1) It must be borrowed from me by pre-arrangement, and must be returned to my office
    when it is not being used. It is as expensive and portable as an oscilloscope,
    and that is the order of care with which one must use it.

2) Prospective users must be trained and checked out in advance.

3) It should be used for some real purpose.

As time goes on, here is what will happen to the MM80. First, we will create a PASLA
driver (a tortuous task) so that we can store 8080 source and object files on the
fiel system and transmit them through the MM80 to the target system. We will also
be able to use the debugging system from an Imlac, or any magic console. There is
also an 8080 (fully compatible) two-pass assembler in development that should be up

ARCHITECTURE MACHINATIONS

A weekly newsletter of the Architecture Machine Group, Department of Architecture, M.I.T., Room 9-518, Trilla Ramage, editor.

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MICRO-DEBUGGING FACILITY continued.

within the week. Then we will be able to bypass the one-pass assembler in the MM80.
Eventually, if required, we will get a ROM blaster.

If you think you have a use for the MM80, please see me.

SUMMER UROP PROCEDURES

The following letter has been sent to me in my capacity as Departmental Coordinator.
I am reprinting it because it outlines the procedure for summer UROPers. I am re-
questing that all Architecture Machine participants have their proposals by 9:00am,
Friday, April 22nd.

In the past, we have been loose about the contents of the proposal versus what we
actually do. In contrast, this summer I need to find a real matching between pro-
posals and work. This is because we have less dollars than people eligible and
because the unknowns about NSF follow-on funds requires supporting areas that need
the most work. Priorities will be a function of Architecture Machine needs, de-
fined by those areas which are currently understaffed or in limbo.

TO: UROP Coordinators

FROM: Stan Hudson

RE: Summer 1977 UROP

        The knocking at your door is probably a student responding to
the announcement we ran in Tech Talk for the past two issues.

Summer UROP: First Call
  UROP will have a summer program again
this year. Eligibility will be limited to under-
graduates who are continuing ongoing UROP
projects. Support for research, personal
expenses or for overhead waiver will be
awarded according to the usual UROP pro-
posal procedures and negotiations. Such pro-
posals are now welcome, and should be sub-
mitted through the UROP coordinator of your
faculty supervisor's department. Award deci-
sions will be announced beginning April 25th,
continuing until we run out of money. Pro-
posals will receive priority according to the
date of receipt in the UROP office and accord-
ing to tangible evidence of faculty enthusiasm
for the proposed activity. If you apply for
UROP's own funds for all or part of your sum-
mer wages, remember that payment will be
limited to a maximum amount of $1500 total for
your UROP summer, at $3/hr. Probably you
should reread the How to Participate section of
the UROP Directory.

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SUMMER UROP PROCEDURES continued.

Proposal Review Criteria:

-- Good UROP track records by both the faculty supervisor
   and the undergraduate;
-- Evidence of faculty enthusiasm for the undertaking (a
   willingness to commit time - a financial contribution to
   the effort - a gleam in the eye...);
-- Project is ongoing: since Summer UROP is not a "summer
   job" program, we will look hard at requests concerning
   project activities born coincidentally at the end of March
   (when our "ongoing" criterion was publicized) and sched-
   uled to end in August;
-- Coordinator support;
-- Extent to which the student has previously benefited from
   our finances, with priority given to first timers;
-- Quality of the proposal: who, what, where, how, when, etc.

Types of Proposal Requests Welcome:

A. Materials and Supplies

   -- These are welcome anytime during the term and into
      the summer! (Hopefully, when wages are sought, any
      accompanying M&S request will be minimal.)

B. Wages

   -- Priority will be given to proposals seeking only a
      waiver of overhead from UROP. (Overhead is real
      money: it counts against UROP's budget. The
      proposal review criteria applied will be the same
      on overhead requests as on any other request.)
      There are no UROP restrictions on the maximum rate-
      of-pay or the total amount which a student may
      receive under an overhead waiver.

   -- Next priority will be given to proposals with a
      faculty contribution to the wages. UROP will
      match 1 for 1 1/2 up to a maximum of $600 from
      UROP for $900 from faculty. Faculty supervisors
      will automatically receive waiver of overhead on
      their matching wages of UROP projects. The wage
      rate, irrespective of experience or class year is
      $3.00/hour, i.e. the minimum UROP rate.

SUMMER UROP PROCEDURES continued.

> -- WHEN IN DOUBT BECAUSE FACULTY RESOURCES ARE TOO SHORT TO MEET OUR $900 THRESHOLD, HAVE THE STUDENT APPLY ANYWAY. WE'LL DO WHATEVER WE CAN TO MEET THESE SPECIAL CASES.

On Funds:

> -- We will try to expand summer UROP allocations to departments who have helped us save money during this past year. (Our ability to expand on any front, however, is suffering from the Economic Crunch, which has resulted in a greatly increased overall demand for UROP funds.)

> -- There is no such thing as "Department N's Share" of UROP funds.

> -- Balances in UROP accounts as of May 31, 1977 will be rescued and used to augment our Summer Program. (Overruns will be left to their owners.)

Off-Campus UROP:

> -- If undergraduates wish to continue their off-campus UROP project for summer pay, they should contact the UROP office to see if such an arrangement is possible with their organizations. Approximately 50% of the students in the past have been able to convert term-time off-campus UROP into wages for the summer.

> -- In the case of hospitals, non-profit agencies, and government organizations, a wages matching of 20% by the organization can be used with an 80% match from College Work Study monies. Contact us for information on this summer option (for needy students only).

> -- As usual, an active faculty supervisor/colleague is the central requirement for a student's off-campus undertaking to be considered UROP.

The CEP has requested that departments establish procedures for documenting all project-type work which will be used to waive Institute or departmental requirements. Students can check the UROP Directory's "How to Participate" section and departmental listings or they can contact the COC directly on x3-4781.

SOFTWARE SUPPORT FOR THE 85 PIXEL WINDOW by Christopher Herot.

In a recent marathon programming session, Bill Donelson and I brought the pixel window one step closer to being a generally usable device. It is now possible to set up the hardware with one subroutine call which allocates the available memory into an image with a specifiable aspect ratio and number of bits per pixel. The initial position of the screen on this image may be either centered or positioned in the upper left corner. In most cases, the size of the allocated image is significantly larger than the screen, requiring the use of scrolling to see each part of the image. The scrolling and zooming operations are each involed by subroutine call and are easy to use.

In addition to the standard pixel operations, lines can be drawn on the screen, with optional de-jaggying. The details of the de-jaggying algorithm will appear in a forthcoming article by WCD. Being able to zoom around and into a complex line drawing is rather exciting. We have a program to display Computervision REGEN files - some of them are so complex that they require an image larger than the standard 480 x 512 to display meaningfully, not to mention gobs of disk space and free storage to access.

The next step will be to rearrange the code so that it is compatible with the needs of most users. Some control blocks will be put into system-free storage or the Attachables' area, where they are immune to inter-loadmod interference. Others may be placed at the bottom of user core, where they can take advantage of the superior speed of the Interdata memory. When this reorganization is down, Larry Stead can begin embedding the algorithms in micro-code and things will begin to take off.

HOW TO GIVE YOUR 7/32 THE PERCEPTION OF A DOG by Paul Heckbert.

The following article describes a project started this semester in response to my plea to my IAP seminar for a student to write a gesture recognizer. It is intended to work with any type of input device such as tablets or TSDs. The Graphical Input Techniques Group will be interfacing it to its drawing system to achieve a gesture-driven editor. Paul is seeking input about the types of gestures which should be recognized, so those of you who are looking for gesture input should make your needs known.
                                                                    -CFH

Over the last month I have developed a simple gesture-recognition program called LEARN. The completed program is surprisingly "intelligent" - it recognizes approximately 80% of its gestures correctly. It does have many shortcomings, however, which render it far less perceptive than a human - nearer the perceptive ability of a dog, I would say.

HOW TO GIVE YOUR 7/32 THE PERCEPTION OF A DOG continued.

What LEARN does, briefly, is read the points of a stroke from a tablet (or light pen); munch on the data to reduce it to six parameters; compare those parameters with the parameters of known gestures; and then pick the known gesture which is "most similar" to the new gesture. The program then displays the name of the gesture with the best fit and a rating of the quality of the fit and pauses for the user to correct it, if necessary. It next goes back, reads another gesture, guesses its identity, and so on. After each gesture is guessed, the computer adjusts its stored data in a way that will (hopefully) improve its future guesses. To teach the program a new gesture, the user simply performs the gesture and gives it a name. From five to ten repetitions of the gesture are generally necessary before LEARN begins to recognize it. After about 20 repetitions, the program's recognition ability levels off at about 80% accuracy.

The number and type of parameters measured is of great importance. Presently my program uses six very simple parameters: the number of points read in, the total path length, the number of stops made by the pen, the average speed, the distance between beginning and ending points, and the ratio of the previous parameter and the path length. The information stored is the mean and standard deviation of each of the parameters for each type of gesture. As already mentioned, the parameters describing the new gesture are compared with the data for the known gestures and a guess is made. That guess is made by computing a rating of the quality of "fit" for each gesture and choosing the gesture with the lowest rating. The rating is computed with the formula:

$$\text{RATING} = \Sigma \text{ over all six parameters} \left[\frac{(\text{mean of previous gest.}) - (\text{param for new gest.})}{(\text{standard deviation of previous gestures})} \right]$$

I designed this rating function with two criteria in mind: (1) agreement between the new gesture and the mean of the old gestures should be rewarded with a small contribution, and (2) a parameter with a high standard deviation should be ignored. I believe my rating function meets both of these criteria.

In the formula for the rating function you can see that the performance of the program will improve as time goes on. For example: let's say you are teaching LEARN the gesture SQUARE, and the only gestures you have taught it so far are LINE and CIRCLE. The first time you draw a square, the program will undoubtedly guess that it is a circle because a square is much more like a circle than a line. You then type in "SQUARE", and draw another square. The program will still call it a CIRCLE because it is "unfamilar" with squares. LEARN will continue calling your squares CIRCLEs until enough examples of a square have been provided that the program "becomes familiar" with SQUARE. This point is reached when the means and the standard deviations of SQUARE are such that the rating of fit for SQUARE is below that of CIRCLE. As time goes on, the standard deviation of parameters like "path length" and "number of points" will grow while the standard deviation of the parameters "number of stopping points" and "distance between beginning and end" will decrease. The program learns that squareness is independent of size, and dependent only on number of corners and closedness.
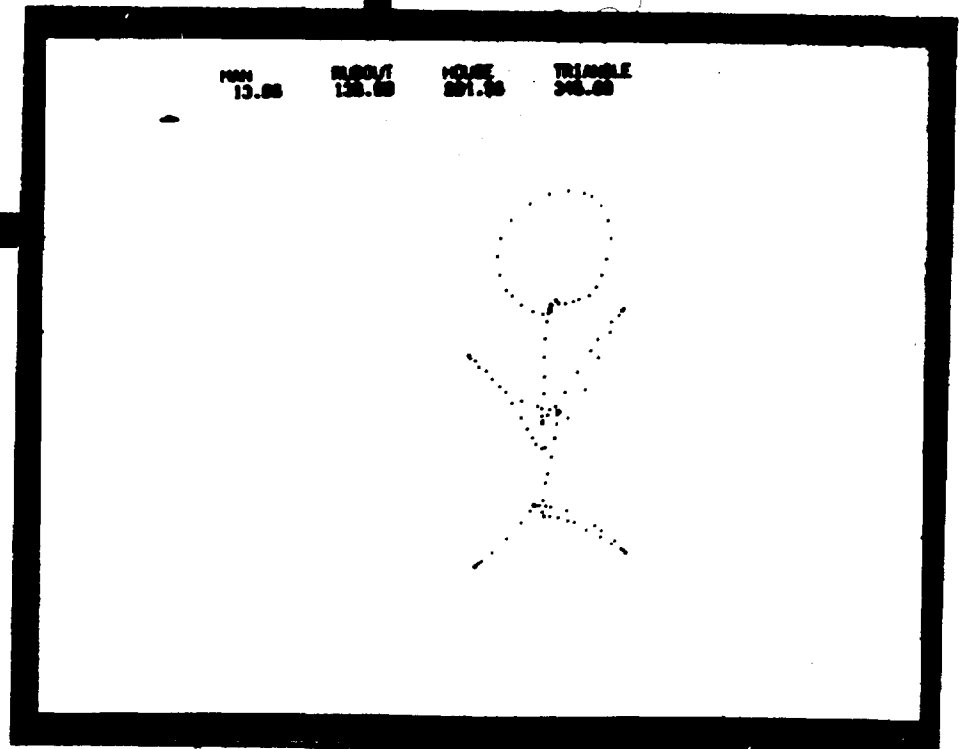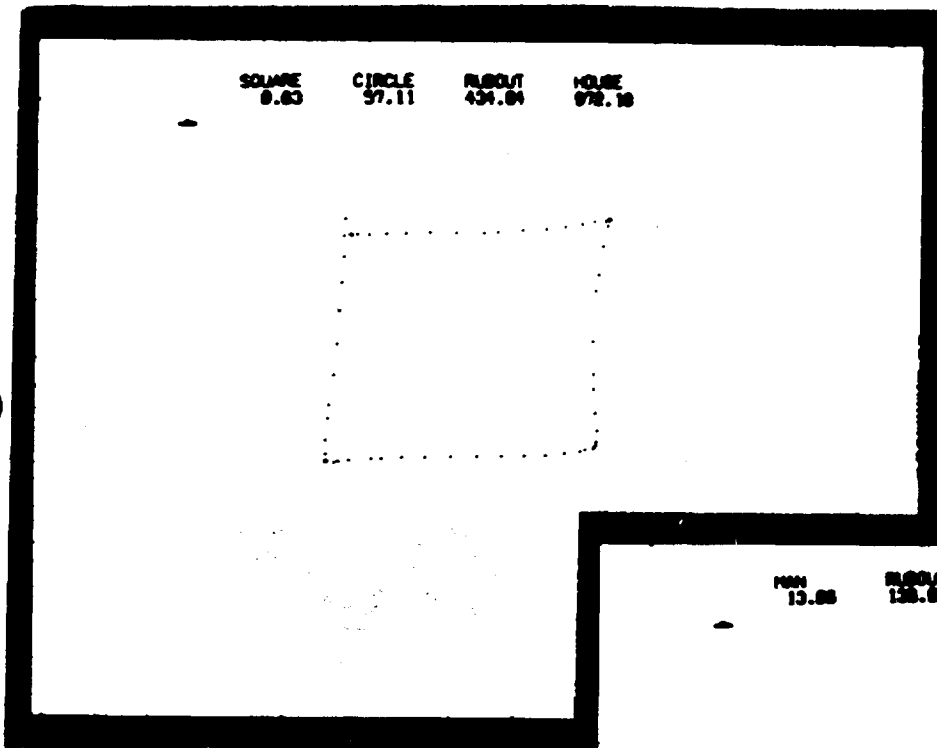
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HOW TO GIVE YOUR 7/32 THE PERCEPTION OF A DOG continued.

Considering that the program uses only six parameters and takes less than a second for guessing, I am surprised at its accuracy and universality. People have taught it to recognize such things as geometric shapes, parts of the body, signatures, and types of fruit. Some photos are shown below.

HOW TO GIVE YOUR 7/32 THE PERCEPTION OF A DOG continued.

For each gesture the four top candidates are printed with the ratings. The guess is
the leftmost candidate. (Remember, the lower the rating, the better.)

In theory LEARN could learn to recognize any type of gesture. In practice, hundreds
of parameters would need to be used, and the program would be too slow. I would aim
a bit lower below a man's intelligence, but above a dog's; more on the level of a
monkey.

AGING by Andy Lippman.

Nancy Burson (from NY) finally visited us, and we are now getting started on computer
simulated aging. Masterminding the project will be Nancy, via AT&T long lines, and
myself. Also working on it will be Craig Finseth (of Ramtek fame) and Tom Schneider
(of general fame). The aim of the project is to create a "mirror" that when you
look into it, reflects your visage at the ripe age of 70 years. First attempts at
implementing this will be finished by June.

One of the key characteristics of the project, and also one of the main reasons we
are interested in it, is that it purports to be a simple, closed-end task that gets
us into the area of manipulating picture data. So far at the lab, we have stayed
away from that. Generally, either we can do color manipulations, or hardware man-
ipulations, but we have left the bit map alone. There are exceptions to this, of
course, but in the areas of pictures, very few.

Here is an overview of the whole project:

1) It turns out that recognition of any facial characteristics and entities is a
    knotty problems on which many people have been working for years, with varying
    amounts of success. We are not going to enter that field yet, but rather will
    presume that their endeavors have been successful At the start, we will recog-
    nize facial characteristics by means of the tablet pen and a human operator.
    This frees us up to concentrate on the problems more directly related to aging.

2) Since we want to be able to demonstrate something by June, we will implement one
    of three possible image manipulations that, if we are lucky, will make a face
    look older. The first is not scene dependent, and consists of playing some con-
    trast enhancement games, and perhaps some image processing tricks to amplify
    certain features. This is of limited use now, but may be simple and useful later.

AGING continued.

The second is the interactive approach, and attempts to create an electronic make-up man's kit. We would program "aging" brushes that could be used with a system like PAINT, for example, that would draw in wrinkles and bags. To be learned here, are the bit manipulations necessary to create wrinkles, and so forth. The ultimate aim would be for the brush to be automatic.

The third approach is to try to pick out generally applicable features of older faces, store them in the machine, and interpolate between the young face and the generalized old one. We could stop at any age. The aim of this research is to determine if there are any general characteristics of aging that we can store and apply to any face. Necessary to do this task are some routines that may have more general application later. We will have to scale and warp the generalized older face to fit the young one, and we will have to develop interpolation routines to merge them (more on that in another article).

If there are any of you out there who want to join the merry gang of oldsters, or would like to pitch in with some comments when we meet about the project, don't hesitate to get in touch with me.

GRAPHIC NEWS by Christopher Herot.

Those of you who have been dismayed at the growth of your program when you call TABLET, need fret no longer. The new version of SDGLIB contains a new, improved tablet routine:

        call tablu(logical_unit,x,y,z).

It takes a logical unit as its first argument which can be set to 15 for the familiar usage. Otherwise, it is identical to TABLET but much, much smaller. Other new routines:

        call jaglu(lu,flag);   /* flag="1"b de-jaggies * /

        call lcolorlu(lu,color);   /* sets line color */

        call backglu(lu,color);   /* sets background color used by eraselu * /

DISK BACKUP SERVICE NOTE

Due to the extended weekend Dave Moosher will be out of town on April 18th & 19th. Therefore, no disk packs will be backed up that week. Also, the time usually reserved for his use will be available for general use.

AI SEMINAR ANNOUNCEMENT

Ira Goldstein will speak on Wednesday, April 13th at 3:00pm in the AI Playroom on the following topics:

THE PSYCHOLOGY OF COMPUTER COMMUNICATION,

INFORMATION THEORY FOR INTELLIGENT MECHANISMS,

THE EXPLANATION OF EXPERTISE,

THE EXPERTISE OF EXPLANATION, &

COMPLEXITIES OF COMPUTER COACHING.