

THE DEMO

By Mikel Rouse and Ben Neill

Libretto by Mikel Rouse

Extended excerpts from the original 1968 demo of
Douglas Engelbart used by permission from SRI
International

Scene One

DOUGLAS ENGELBART (DE): I hope you'll go along with this rather unusual setting and the fact that I remain seated when I get introduced and the fact that I'm going to come to you mostly through this medium here for the rest of the show and I should tell you that I'm backed up by quite a staff of people between here and Menlo Park where Stanford research is located some thirty miles south of here and uh if every one of us does our job well it'll all go very interesting, I think...

The research program that I am going to describe to you is quickly characterizable by saying if in your office you as an intellectual worker were supplied with a computer display backed up by a computer that was alive for you all day and was instantly responsible, or responsive, instantly responsive to every action you have, how much value could you derive from that?

Well this basically characterizes what we've been pursuing for many years in what we call the Augmented Human Intellect Research Center at Stanford Research Institute. Now the whole session is going to be devoted to trying to describe and present to you the nature of this program, but unfortunately, uh, or fortunately, the products of this program, the technology of it, lends itself well to an interesting way to portray it for you so *we're going to try our best to show you rather than tell you about this program.*

A very essential part of what we have developed technologically is what does come through this display to us and I'm going to start out without telling you very much about the program and just run through a little bit of the action that this provides us.

So in my office, I have a console like this, and there are 12 others that our computer supplies and we try nowadays to do our daily work on here. So this characterizes a way I

could sit here and look at a blank piece of paper, that's the way I start many projects. So with my system, that's a good start. I'll sit here and say I'd like to load that in (typing) so...sorry about that...

MENLO PARK (MP):

STATEMENT ONE: WORD WORD WORD WORD WORD WORD
STATEMENT TWO: WORD WORD WORD WORD WORD WORD
STATEMENT THREE: WORD WORD WORD WORD WORD WORD
STATEMENT FOUR: WORD WORD WORD WORD WORD WORD
STATEMENT FIVE: WORD WORD WORD WORD WORD WORD
STATEMENT SIX: WORD WORD WORD WORD WORD WORD

DE: So I have a statement with some entities, words, and I can do some operations on these. I can copy a word; cause of that word might copy after itself, in fact a pair of words I'd like to copy after itself and I can just do this a few times and get a bit of material there. And there are other entities like text, say after there I'd like to copy from that entity point to that point, and it'll copy it. Great, so I can get myself some material on my blank piece of paper and then I say well this is going to be more important than it looks... *this is going to be more important than it looks.*

DE & MP: WORD WORD WORD WORD WORD WORD
WORD WORD WORD WORD WORD WORD
WORD WORD WORD WORD WORD WORD
WORD WORD WORD WORD WORD WORD

Scene Two

DE: FILE SIZE
FILE OWNER
LAST WRITTEN
NAME DELIMITERS
STATEMENTS IN FILE
FILE BLOCKS

FILE SIZE
FILE OWNER
LAST WRITTEN
NAME DELIMITERS
STATEMENTS IN FILE
FILE BLOCKS

DE & MP: WORD WORD WORD WORD WORD WORD
WORD WORD WORD WORD WORD WORD
WORD WORD WORD WORD WORD WORD
WORD WORD WORD WORD WORD WORD

DE: COPY GROUP
COPY GROUP
COPY GROUP
COPY GROUP

REPLACE WORD
REPLACE WORD
INSERT CHARACTER
INSERT CHARACTER
INSERT CHARACTER

REPLACE CHARACTER
REPLACE CHARACTER
INSERT CHARACTER
REPLACE CHARACTER
REPLACE INVISIBLE

REPLACE INVISIBLE
DELETE CHARACTER

DELETE PLEX

STATEMENT ONE

STATEMENT ONE
STATEMNET ONE
STATEMENT ONE
STATEMENT ONE
STATEMENT ONE

So I'll say well I have this but I don't want them all to be statement ones, so I'll just replace the word there with a two and how bout that one with a three.

STATEMENT ONE
STATEMENT TWO
STATEMNET THREE
STATEMENT FOUR
STATEMENT FIVE
STATEMENT SIX

Just a place to forget how to count. So I can look and say alright, that's statements one two three and four, if I'd like to make them a little prettier, I can um hmm I can work and neaten them up a little, but that isn't what I always do oops. You can tell that I am not warmed up yet, I hope you can tell.

MP: WORD WORD WORD WORD WORD WORD
WORD WORD WORD WORD WORD WORD
WORD WORD WORD WORD WORD WORD
WORD WORD WORD WORD WORD WORD

DE: So, we've seen ways to work fairly fast with the entities of a statement, in a file, create a file, I can delete that file or mess it up considerably, like I'm going to say if I want to delete that word by accidentally hit that entity instead, watch what happens. It sort of replaces the whole thing, its nothing, in that case it happens you say alright I'll load that file...

LOAD FILE
DELETE FILE
DELETE FILE
LOAD FILE
DELETE FILE
DELETE FILE

...And it'll come back in as it was I last saved it telling me the date that I wrote it and unfortunately I didn't save enough.

Scene Three

Well I'm through with this example right now. Let me go to a file that I prepared just after my wife called me and said on the way home would you do a little shopping for me? So as soon as she said that, I uh got my system organized, and made a shopping list...

DE & MP:

SHOPLIST. 12/09/68

ORANGES

APPLES

BANANAS

SOUP

ASPIRIN

NEWSPAPER

LETTUCE

FRENCH BREAD

BEAN

TOMATO SOUP

PAPER TOWELS

NOODLES

1 ORANGES

2 APPLES

3 BANANAS

4 SOUP

5 ASPIRIN

6 NEWSPAPER

7 LETTUCE

8 FRENCH BREAD

10 TOMATO SOUP

11 PAPER TOWELS

12 NOODLES (ELBOW KIND)

23 ICE CREAM

24 CHARCOAL

25 LIGHT BULBS

26 NAILS

27 WHIPING CREAM

28 LIBRARY

29 OVERDUE - 2 BOOKS

30 HOLDING
31 7TH GRADE REFS.
32 DRAWING PAPER
33 PICK UP SHOES

1 ORANGES
2 APPLES
3 BANANAS
4 SOUP
5 ASPIRIN
6 NEWSPAPER
7 LETTUCE
8 FRENCH BREAD
9 BEAN SOUP
10 TOMATO SOUP
11 PAPER TOWELS
12 NOODLES

1 ORANGES
2 APPLES
3 BANANAS
4 CARROTS
5 SOUP
6 ASPIRIN
7 NEWSPAPER
8 LETTUCE
9 FRENCH BREAD
10 BEAN SOUP
11 TOMATO SOUP

1 ORANGES
2 APPLES
3 BANANAS
4 CARROTS
5 SOUP
6 NEWSPAPER
7 LETTUCE
8 FRENCH BREAD
9 BEAN SOUP
10 TOMATO SOUP
11 PAPER TOWELS
12 ASPIRIN
13 NOODLES (ELBOW KIND)
14 BEANS

15 SCOTCH TAPE
16 CHAPSTICK
17 MILK
18 FILM
19 BROOM

1 ORANGES
2 APPLES
3 BANANAS
4 CARROTS
5 SOUP
6 NEWSPAPER
7 LETTUCE
8 FRENCH BREAD
9 BEAN SOUP
10 TOMATO SOUP
11 PAPER TOWELS
12 ASPIRIN
13 NOODLES (ELBOW KIND)

DE: So let me jump back to the head of the list and I can do things like begin to reorganize it a little bit well I say after bananas, its more likely that I'll uh take the carrots there and so carrots move right up behind bananas and aspirin doesn't really belong there uh I think aspirin goes after paper towels in the order. Well pretty soon I would uh I would begin to have a lot of trouble keeping that straight so let me organize it by saying um just generally produce.

Alright I'm gonna try it again. I enter a statement it says, hey that's weird. I suspect that something is going wrong and I would call a programmer or the hardware man and tell him, I made it produce.

PRODUCE PRODUCE
PRODUCE PRODUCE

PRODUCE PRODUCE
PRODUCE PRODUCE

I really haven't warmed up to this thing yet, so I'll say well produce, I'll categorize things. Let me uh look at it that way and I'll say let me move a statement for produce by

carrots and I'd like to subcategorize it so it will, and there it is.

DE & MP:

PRODUCE

CARROTS

PRODUCE

CARROTS

THERE IT IS

PRODUCE

CARROTS

PRODUCE

CARROTS

THERE IT IS

PRODUCE

CARROTS

BANANAS

PRODUCE

CARROTS

BANANAS

ORANGES

PRODUCE

CARROTS

BANANAS

ORANGES

APPLES

2 PRODUCE

2A CARROTS

2B BANANAS

2C ORANGES

2D APPLES

DE: So I can begin categorizing things like that and if I looked at the numbers now I'd find that these items fit under there as a subset, and I realize I can categorize quite extensively, I could introduce a new thing under there that was uh something I just invented, a skinless banana, but I have to go there.

DE & MP:

2 PRODUCE

2A CARROTS

2B BANANAS

2B1 SKINLESS
2C ORANGES
2D APPLES

SKINLESS BANANA
SKINLESS BANANA
SKINLESS BANANA
SKINLESS BANANA

PRODUCE
CARROTS
PRODUCE
CARROTS
THERE IT IS
PRODUCE
CARROTS
PRODUCE
CARROTS
THERE IT IS

PRODUCE
CARROTS
BANANAS
PRODUCE
CARROTS
BANANAS
ORANGES
PRODUCE
CARROTS
BANANAS
ORANGES
APPLES

2 PRODUCE
2A CARROTS
2B BANANAS
2C ORANGES
2D APPLES

2 PRODUCE
2A CARROTS
2B BANANAS

2B1 SKINLESS
2C ORANGES
2D APPLES

SKINLESS BANANA
SKINLESS BANANA
SKINLESS BANANA
SKINLESS BANANA

DE: Well suppose I work for some time at this and then call up my wife to get the rest of the list, I'd eventually end up with a whole structure where I could say gee there are a lot of things, the market, shoe store I have to stop to. Let me see what I'm suppose to get in the market, produce, cans, cereals, what about cereals.

DE & MP:
ROUTE
MARKET
SHOE STORE
HARDWARE
ART SUPPLY
DRUG STORE
LIBRARY

ROUTE
MARKET
SHOESTORE

PRODUCE
CANS
CEREALS
COLD LOCKER

CEREALS
BREAD
NOODLES (ELBOW KIND)
FRENCH BREAD

PRODUCE
CANS
CEREALS
COLD LOCKER

PRODUCE PRODUCE PRODUCE

Scene Four

DE: But one interesting thing here that I haven't told you about is that when the numbers are on, I can do something like say instead of jump to identity and pointing to that and having it bring to the top, or jumping return back, I can say to jump to a name and go to 2A4, and it'll do it, or return. So I can jump to a location number just by giving it or if I wish, I can add it, add it as text in there and say jump to name, just point to that, and it'll go to a...did I say that?

JUMP TO RETURN
INSERT BRANCH
INSERT BRANCH

So I gave it the name, or that can go to it. I can give it the names of uh I don't want to go to that word... that one. I could say go to one, which is out of sight from here now and say jump to that, I'm at one, different views. So it's very easy to jump around and make cross-references.

JUMP TO IDENTITIY
JUMP TO IDENTITIY
JUMP TO RETURN
JUMP TO RETURN

JUMP TO NAME
JUMP TO NAME
JUMP TO NAME
JUMP TO RETURN
INSERT BRANCH

INSERT WORD
JUMP TO NAME
JUMP TO NAME
JUMP TO RETURN
JUMP TO NAME
JUMP TO RETURN

REPLACE WORD
JUMP TO NAME
JUMPT TO NAME
REPLACE WORD

INSERT CHARACTER

So I gave it the name, or that can go to it. I can give it the names of uh I don't want to go to that word... that one. I could say go to one, which is out of sight from here now and say jump to that, I'm at one, different views. So it's very easy to jump around and make cross-references. It turns out if I wish, I can also make a cross reference to something if I give it a label or a name such as you do when you're programming. I can call this alpha, aha.

DE & MP:

ALPHA

INSERT CHARACTER

JUMP TO NAME

JUMP TO NAME

INSERT CHARACTER

RESTORE

JUMPT TO NAME

JUMP TO NAME

JUMP TO RETURN

INSERT CHARCHTER

VIEW SET

INSERT CHARACTER

INSERT WORD

INSERT WORD

JUMP TO NAME

JUMP TO NAME

VIEW SET

INSERT WORD

JUMP TO WORD

DE: So look what else we can do in here, I've got this file, its structured. If I want to see what's in there I can walk down the hierarchy levels and see, or return. But there's another thing I can do. This route set up I have here, so here I'm afraid I'll need a different picture to view.

So here's where I drew, with a picture drawing capability, its a slight map if I start from work, and here's the route

I seem to have to go to pick up all the materials, and that's my plan for getting home tonight. But if I want to I can say the library, what am I supposed to pick up there? I can just point to that and oh, I see overdue books and all.

Well there was a statement there with that name on it. Go back, what if I, what am I supposed to pick up at the drugstore? Hmm I see, interesting. Alright, market? Oh I've already seen that, gee that's too much. Anyway, so we have this feature of structuring our material hierarchically being able to move around it very well. When we get a hierarchy such as I can show you here now..

Scene Five

And now I'd like to stop a minute, and make sure you understand we're shifting from illustrative material to the real working stuff, in case you wouldn't recognize it otherwise.

We had uh, we've used this tool to do our daily work and its, our system has been built, this time sharing system, for about six months now, its been working and in that time we've gone from getting one console to getting about six working now with twel... six more due with the rest of spring. This is our fourth computer in which we've had this kind of a system so we've learned a lot about the user features we want and how to be fairly skillful.

With this next step about learning how, when you're faced with having us in your office all day, as I now do in a very exciting sense, how do you put that to work for yourself? How do you organize your files, what kind of things do you do. So, to get going on this, let's switch away from the tool we have here and talk about some of the general features of the program, some of the ways its built and get back a little later to the nature of the uh our usage of it.

INTRODUCTION

OVERALL ABOUT PROGRAM
NLS AS AN 'INSTRUMENT'
CONTROL TECHNIQUES
NLS IMPLIMENTATION
USAGE ACTIVITIES
CREDITS

JUMP TO LINK
JUMP TO LINK

INTRODUCTION

OVERALL ABOUT PROGRAM
NLS AS AN 'INSTRUMENT'
Here's...this is another file and in this file I've prepared a chain of views and I'm using some of the tools I have it all set so I can move from one scene to another I could study them in the fashion I've shown you before, but it's

sort of fun to set up these chains and it represents to you the way in which we work too.

REPLACE CHARACTER
(CHAINPREPO TO
START OUT ON
PRESENTATION:
FREEZE
JUMP LINK ON

REPLACE CHARACTER
RESTORE
JUMP FILE LINK
REPLACE CHARACTER
RESTORE

INTRODUCTION

OVERALL ABOUT PROGRAM
NLS AS AN 'INSTRUMENT'
CONTROL TECHNIQUES
NLS IMPLIMENTATION

STANDARD
BUG ONLY
REPLACE CHARACTER
VIEW NAME
RESTORE

VIEW NAME
OVERALL ABOUT PROGRAM
REPLACE CHARACTER
PRESENTATION
RESTORE

So to do it I'm going to freeze a statement that's named A and I'm going to put on a certain parameter when I do it - and then I'm going to jump to a link - here's a link - that says you want to go to statement A but after the colon, all of this garbage, tells, a bunch of, abbreviated ways in which you'd like to control the view when you get there - many parameters as you'll notice so I'll just say I'll go to that one and I'm looking at Statement A.

BUG ONLY

STANDARD FOR
REPLACE CHARACTER
VIEW CHANGE
REPLACE CHARACTER
BUG ONLY FOR CHART OVERLAYS

INTRODUCTION

OVERALL ABOUT PROGRAM
REPLACE CHARACTER
FREEZE
JUMP LINK ON
JUMP LINK ON
REPLACE CHARACTER
FREEZE
JUMP LINK
REPLACE CHARACTER

FREEZE STATEMENT

LINK ON
JUMP LINK ON
JUMP LINK ON

Now it's telling me, this presentation is devoted to the AHIRC - the natural question is - what's that? That was another boo-boo I made, I left several statements frozen.

This statement I've asked to be frozen that was the setup operation, it's just going to stay there above that dotted line as the viewing part of my screen from there down jumps around on the links I have set up.

Scene Six

OK the first jump took me to this statement, saying alright Augmented Human Intellect Research Center's what AHIRC stands for. A hidden link will take me to the next one, telling me where it's located within SRI, it's an explicit organizational entity, and we call it group level.

THIS PRESENTATION IS DEVOTED TO THE AHIRC
LOCATED WITHIN STANFORD RESEARCH INSTITUTE
MENLO PARK, CALIF.
AS AN EXPLICIT ORGANIZATIONAL ENTITY
AT THE 'GROUP' LEVEL

(BUT IT IS NOT THE ONLY MAN-COMPUTER
WORK GOING ON AT SRI)

THIS PRESENTATION IS DEVOTED TO THE AHIRC
AS AN EXPLICIT ORGANIZATIONAL ENTITY
AT THE 'GROUP' LEVEL

(BUT IT IS NOT THE ONLY MAN-COMPUTER
WORK GOING ON AT SRI)

THIS PRESENTATION IS DEVOTED TO THE AHIRC

INVOLVING ABOUT 17 PEOPLE
TOGETHER WITH SPECIAL LABORATORY
FACILITIES

SPONSORED BY GOVERNMENT AGENCIES:

CURRENTLY: ARPA, NASA, AND RADC
ALSO, IN THE PAST: AFOSR AND ESD

THIS PRESENTATION IS DEVOTED TO THE AHIRC
A GOAL-ORIENTED PURSUIT FOR MANY YEARS
A GOAL-ORIENTED PURSUIT FOR MANY YEARS

--During these years there was only one of us.

THIS PRESENTATION IS DEVOTED TO THE AHIRC
A GOAL-ORIENTED PURSUIT FOR MANY YEARS

IMPROVE THE EFFECTIVENESS WITH WHICH

INDIVIDUALS AND ORGANIZATIONS WORK AT
INTELLECTUAL TASKS

BETTER SOLUTIONS
FASTER SOLUTIONS
MORE COMPLEX PROBLEMS; WITH
BETTER USE OF HUMAN CAPABILITIES

PURSUING THESE GOALS:

1 IMPROVE THE EFFECTIVENESS WITH WHICH
INDIVIDUALS AND ORGANIZATIONS WORK AT
INTELLECTUAL TASKS

2 DEVELOP A SYSTEM-ORIENTED DISCIPLINE
FOR DESIGNIN THE MEANS BY WHICH GREATER
EFFECTIVENESS IS ACHIEVED

BETTER SOLUTIONS
FASTER SOLUTIONS
MORE COMPLEX PROBLEMS; WITH
BETTER USE OF HUMAN CAPABILITIES

AS AN EXPLICIT ORGANIZATIONAL ENTITY
AT THE 'GROUP' LEVEL

Scene Seven

Alright there's another one hidden there that says the general approach, for us, empirical, we're pursuing this monstrous goal, monstrously difficult, to, by building and trying, empirically, and we're approaching it evolutionary-wise, because, we feel that it's a whole system problem...

DE & MP:

WE'RE PURSUING THIS MONSTROUS GOAL
MONSTROUSLY DIFFICULT

WE'RE APPROACHING IT EVOLUTIONARY-WISE, BECAUSE
WE FEEL THAT

WE'RE PURSUING THIS MONSTROUS GOAL
MONSTROUSLY DIFFICULT

WE'RE APPROACHING IT EVOLUTIONARY-WISE, BECAUSE
WE FEEL THAT

WE'RE PURSUING THIS MONSTROUS GOAL
MONSTROUSLY DIFFICULT

WE'RE APPROACHING IT EVOLUTIONARY-WISE, BECAUSE
WE FEEL THAT

IT'S A WHOLE SYSTEM PROBLEM
IN A LARGE SYSTEM LIKE THAT
WE NEED TO DO IT EVOLUTIONARY-WISE
BECAUSE WE CAN'T BE ANALYTIC ENOUGH

BOOTSTRAPPING: THE SPECIFIC EXPERIMENTAL
SYSTEM (BEING BUILT, TRIED AND EVOLVED)
BOOTSTRAPPING
BOOTSTRAPPING
BOOTSTRAPPING

WE'RE PURSUING THIS MONSTROUS GOAL
MONSTROUSLY DIFFICULT

WE'RE APPROACHING IT EVOLUTIONARY-WISE, BECAUSE
WE FEEL THAT

WE'RE PURSUING THIS MONSTROUS GOAL
MONSTROUSLY DIFFICULT

WE'RE APPROACHING IT EVOLUTIONARY-WISE, BECAUSE
WE FEEL THAT

WE'RE PURSUING THIS MONSTROUS GOAL
MONSTROUSLY DIFFICULT

WE'RE APPROACHING IT EVOLUTIONARY-WISE, BECAUSE
WE FEEL THAT...

COMPOSE, STUDY, MODIFY
BOOTSTRAPPING
BOOTSTRAPPING
BOOTSTRAPPING

Scene Eight

DE: I've finished that version, and to help you keep track of where we are and a little bit to help me too, we'll move that down. So having gone through these items I'd like to come in now and begin to tell you something about the implementation. So I'm going to open up, under here, and talk to you about the control techniques, control devices, control dialog and control metalanguage that we're using.

Ok to talk about control devices we'll use this overhead camera shot, where you can see the devices that I'm using. I use three and they're not all standard. We have a pointing device called a mouse, a standard keyboard, and a special keyset we have here. And we're going to go for a picture down in our laboratory in Menlo Park, and pipe it up, that'll show you from another point of view about how that mouse works -

Come in Menlo Park.

OK, there's Don Andrews' hand in Menlo Park, and in a second we'll see the screen that he's working, and the way the tracking spot moves in conjunction with movements of that mouse.

I don't know why we call it a mouse, sometimes I apologize, it started out that way and we never did change it.

Alright, as it moves up or down or sideways so does the tracking spot, and the principles of its operation are quite easy to see, if you'll turn it over Don? Can you hear me Don, would you turn it over and we'll see, right?

Its principle is that there are two wheels that roll on the surface, but since they are at right angles and kind of sharp edges, one'll roll and the other slide in one direction. Each of these wheels controls through a potentiometer with a voltage output sampled by an ADD converter, the numbers taken in by the computer, its sample

times as to what the horizontal and vertical complements are to be of where it should put the tracking spot.

And, as the mouse moves over the surface then each one of those wheels either slides sideways without rolling or rolls, in an amount that very closely duplicates, the particular component of horizontal or vertical in the net motion it makes. Alright, if you take a mouse and move it through some closed trajectory back to exactly the same point, usually the tracking spot won't come back to exactly the same place it was on the screen, and for that sense it wouldn't work well if you're trying to trace maps, or other figures and diagrams but the way we use it continuously and exclusively is to watch the screen and to follow it around and we use this merely as a device to move that tracking spot, and your eye on the tracking spot, you really don't care whether it follows exactly this or not.

In fact we've had it at times where our tracking device, you had to move in an arc, like that, to make the spot, the tracking spot go in a horizontal line, and people adjusted to it, and would go like that to go in a straight line, and wouldn't even know that they were doing it. Other features of the mouse are that it stays put, I can lift it and replace it without having the spot change so I can adjust where I want it for my comfort, and these control buttons on the top are used quite a bit and I'll show you a little bit later how some of those are used.

Now, the keyboard in the middle is essentially a standard typewriter keyboard except for a few special keys out on the side, the computer knows it instantly when you hit one and makes an appropriate response.

This device over here is unique to us, and we always have to justify and explain it, we'll do it in reverse order, we'll explain it first. It provides for you the one hand equivalent of what you can do with a keyboard. There are 5 keys and normally each finger sits on a key, and depressing

any one key at a time produces a character. And any two keys at a time, also, and in fact any combination of depressing, of which there are 31 combinations, so...

ORANGES
APPLES
BANANAS
SOUP
ASPIRIN
NEWSPAPER
LETTUCE
FRENCH BREAD
BEAN
TOMATO SOUP
PAPER TOWELS
NOODLES

It'll offer you a character, if I hit 'W', it'll say delete word. The arrow moves back and forth to give me feedback. My tracking spot changes; that gives me feedback. Now it tells me since it's an arrow that it's armed I can do something. We get a lot of feedback. Let me restore a view like this to show you this is more normally the way we work with feedback up here.

Or here I'm shown... it's not working... that's an echo register that normally gives you the last six characters that you use. The last six characters and left shifts continuously so you can look up at any time and see what have I just struck?

And that's very good feedback. Here are characters that show me the different viewing parameters...

PRODUCE
PRODUCE

They get large at times in which I can add, hit single strokes, and change those view parameters.

PRODUCE

PRODUCE

And each of those mean something to me. And they're being large at particular times tells me I can hit very quick abbreviation for changing the view. So I could say, alright, I'd like to go to produce...

PRODUCE

PRODUCE

...But I'd like to... with produce they get big, I'd like to say one branch only and, eh, and just that little...

PRODUCE

CARROTS

PRODUCE

CARROTS

THERE IT IS

PRODUCE

CARROTS

PRODUCE

CARROTS

THERE IT IS

And I see it... Or I can say I'd like to see just one line only... So these ways I move around, the way I get feedback up here, the way I use both hands to coordinate to tell the computer what command and what short literals I want are all carefully designed to go together to make the repertoire.

PRODUCE

CARROTS

PRODUCE

CARROTS

THERE IT IS

PRODUCE

CARROTS

PRODUCE

CARROTS

THERE IT IS

PRODUCE

CARROTS
BANANAS
ORANGES

Scene Nine

We've talked about the devices and now the nature of the dialog. The kind of feedback we get from the computer.

DE & MP:
CONTROL DEVICES
CONTROL DIALOG
CONTROL METALANGUAGE

DE: We've developed a very special language for talking with precision about these control, both the main functions and the control dialog for them.

DE & MP:
CONTROL DEVICES
CONTROL DIALOG
CONTROL METALANGUAGE

NLS IMPLEMENTATION
USAGE
ACTIVITIES

HARDWARE DESIGN
SOFTWARE
HARDWARE DESIGN
SOFTWARE

ILLEGAL
HARDWARE DESIGN
SOFTWARE

NLS
WORKSTATION CONTROLLER
DISPLAY SYSTEM
WORKSTATION CONTROLLER

CORE BANK CORE BANK
CORE BANK CORE BANK
DISC STORAGE DISC
DISC STORAGE DISC
DISPLAY SYSTEM 1
DISPLAY SYSTEM 2
INPUT CONTROLLER

CORE BANK CORE BANK CORE BANK
CORE BANK CORE BANK CORE BANK
CORE BANK CORE BANK CORE BANK
DRUM STORAGE DRUM STORAGE

CORE BANK CORE BANK CORE BANK
CORE BANK CORE BANK CORE BANK
DRUM STORAGE DRUM STORAGE

DE: We've taken advantage of that to put all of our control out here, a large 96 million character blank disk for giving backup storage for ourselves, our two display systems, each of which drive 6 displays, and all of which are refreshed out of core, and the input controller which samples the keyboards, the keysets, the mice of each station about 15 times a second, and our printer and the ARPA network coupling here, all come in through that same priority basis, so they can all be working full tilt, and we find that we get very low interference in CPU cycles being interrupted, or interfered with, something like a ratio, of maybe one to one and a half percent here that it can't get when it wants to, and this might be running 50, 60, 70 percent of the available memory cycles that it can handle.

Alright, the input controller stuffs it into core without ever interfering with the CPU's process and then just interrupts the time sharing system if there's something new and says hey take care of this user, and the display system reads out of core from a tree structure like set of links to uh cycle itself automatically and take all that material, output it to display something like 15 times a second without any interference from CPU requirements.

Alright, so that system's allowed us to have one time-sharing computer to take care of a lot of stations. Let me talk to you about the display systems, the other aspect of the thing's that we've built on here that are slightly unusual.

Alright for that I'd like to switch to Menlo park and get a

view from a camera there, and actually looking at the hardware, so these are the units that develop the displays, the computer constructs it right on a small, high resolution CRT which you're focusing in on right now, and in fact, that's the CRT whose camera on the right, looking at it, is generating the text view that is being piped down here on my console.

So as those are faded in and out between the two, you can just sort of compare them, so that's very nice, there's my mouse moving around in Menlo Park, my tracking spot. So our displays work with those being watched by commercial cameras - look at my black bug - commercial TV cameras, 875 line scanning rates so they're fairly high resolution look at that from there on out to the display station they're standard video microwave system. And if you backup the camera shot a little bit we'll see that we have a whole rack full of equipment here, serving 12 of them but you'll notice quite a lack of cameras mounted on, we seem to have stolen them all for this show... so we don't have several consoles that work right now because the cameras are mounted to give you these different special views,

Scene Ten

DE & MP:

HARDWARE DESIGN HARDWARE DESIGN
HARDWARE DESIGN HARDWARE DESIGN

HARDWARE DESIGN HARDWARE DESIGN
HARDWARE DESIGN HARDWARE DESIGN

WORKSTATION CONTROLLER
WORKSTATION CONTROLLER

DISPLAY SYSTEM DISPLAY
DISPLAY SYSTEM DISPLAY

HARDWARE DESIGN HARDWARE DESIGN
HARDWARE DESIGN HARDWARE DESIGN

WORKSTATION CONTROLLER
WORKSTATION CONTROLLER

DISPLAY SYSTEM DISPLAY
DISPLAY SYSTEM DISPLAY

DE: Well, turns out that that little CRT, its incremental cost, the video camera, the controller and a monitor total about 5,500 dollars which is cheaper than most fairly good resolution random deflection display monitors would be so we come out well on the price of the hardware, turns out that also that the cathode of the camera tube and, uh, in just black and white usage like this, you can back off the scanning current of it so that its a sticky cathode, so that actually it doesn't erase the image on it by each sweep it may take 3 or 4 scans, and so with something like a 15 cycle second refresh rate on those CRTs, the camera the one that's generating this as well as the one we looked at it with a few minutes ago, have short term storage in there, it's quite different from long persistence but it gives us the flicker free display here for quite a flickery display

there. This lets us use that display generation hardware for three to four times as many display stations as otherwise, you'll notice if we get just the text alone that there's a small effect by that bug smearing, but it's not that bad, and that comes from the memory. OK, so much for that.

I'd like now to have us bring in Jeff Rulifson from Menlo Park and we'll switch to his console, he's sitting at one just like this and working independently

DE: Hi Jeff

JEFF RULIFSON (JR): Hello

DE: We're not hearing you very well

JR: Oh you're not hearing me? How about now?

DE: That's fine

JR: Okay

DE: Alright, I'm sorry you can't see everybody here, but I can't very well either because of the lights so we're about even. Okay um, I'd like you to talk to them about the, the way the special languages have helped in making flexible design and study available for us of the user features, the functions and the repertoire of the commands as well as the um control dialogue for them and also, it'd be an interesting example here because programmers, you programmers are the ones who most intensely found use for working online as we're building up, show them how you structured the, your uh, system guide, okay?

JR: OK, uh, I think we can do that, uh we can get sort of a good feeling for the way the whole system is put together by looking through the system guide, the, the uh, file is one that system programmers sort of put together, to help them get around. NLS right now is getting to be a fairly large program,...

INTERMISSION

(Text and Code Libretto fade in and out over the 10 minute Intermission)

UTILITY - RECENT - DATA ENTRY
UTILITY - RECENT - DATA ENTRY
UTILITY - RECENT - DATA ENTRY
UTILITY - RECENT - DATA ENTRY

JUMP TO VECTOR LABEL
JUMP TO VECTOR LABEL

CODE DOCUMENTATION
COMMAND RESET
JUMP TO ORIGIN
JUMP TO IDENTITY

JUMP TO VECTOR LABEL
JUMP TO VECTOR LABEL

CODE DOCUMENTATION
NOTES
ROOM LEFT
360 PATCHES
JUMP TO LINK
JUMP TO LINK
JUMP TO LINK
DOCUMENTATION

(+ WC) BP AN ZAP CASE
 (A) GOTO QAQ, 1OCTL
 (B) DSP (< BREAK 1 STATEMENT).CASE
 (C) (EDIT) DSP:<COPY 1ES*).CASE
 (D) (EDIT) DSP:<DELETE 1ES*).CASE
 (E) DSP (<EXECUTE 1).CASE
 (F) (SPECIAL) DSP (< FREEZE STATEMENT)
 (I) (EDIT) DSP (< INSERT 1ES*) . CASE
 (J) 1 JUMP 1
 (K) -QMAIN.QUDID
 (L) GOTO QLQ.IOCTL
 (M) (EDIT) DSP (< MOVE 1ES*) . CASE
 (O) GOTO QOQ.IOCTL
 (P) (SPECIAL) DSP (<POINTER 1FIX) . CASE

```

(Q)  DSP(<VIEW SET1) *LTSPEC.PRMSPC

(M) (EDIT) DSP(<MOVE 1ES*) . CASE
(C)  S*=MC.EDIT DSP(* < MOVE
(D)  -QMD.VCTRL
(W)  S*=MW.EDIT DSP(* < MOVE WORD)
(V)  S*=MV.EDIT DSP(* < MOVE VISABLE)
(I)  S*=MI.EDIT DSP(* < MOVE
(T)  S*=MT.EDIT DSP(* < MOVE TEXT)
(S)  S*=MS.EDIT DSP(* < MOVE
(B)  S*=MB.EDIT DSP(* < MOVE BRANCH)
(P)  S*=MP.EDIT DSP(* < MOVE PLEX)
(G)  S*=MG.EDIT DSP(* < MOVE GROUP)
(CA) REPEAT OIE*)
      ENDCASE GOTO CAQN
(O)  GOTO QOQ.1OCTL
(P)  (SPECIAL) DSP( <POINTER 1FIX) . CASE

```

```

WORD
INVISABLE
INVISABLE
JUMP TO IDENTITIY
JUMP TO IDENTITIY

```

```

(W)  S*=MW.EDIT DSP(* < MOVE WORD)
E*=W.WORD
      +BUG2SPEC.PRMSPC -QMW.TXTEDT
(V)  S*=MV.EDIT DSP(* < MOVE VISABLE)
E*=V.VISABLE
      + BUG2SPEC.PRMSPC -QMW.TXTEDT
(I)  S*=MI.EDIT DSP(* < MOVE
INVISABLE) E*=I.INVISABLE
      + BUG2SPEC.PRMSPC -QMW.TXTEDT
(T)  S*=MT.EDIT DSP(* <MOVE TEXT)
E*=T.TEXT
      + BUG2SPEC.PRMSPC -QMW.TXTEDT

```

```

WORD
MAIN CONTROL
NOTES

```

JUMP TO ORIGIN
UTILITY RECENT
CODE
DOCUMENTATION
NOTES
TEXT EDIT EDIT
TEXT EDIT EDIT

I CONTROL ROUTINES CALLED FROM MAIN CONTROL I
I COPY I
I DELETE I
I INSERT I
I MOVE I
I REPLACE I
I SHIFT CASE I
I POINTER SPECIFICATION I

END OF TXTEDT

.HED=*TEXT EDIT MOL CODE : I < NOLIST>;

(TXSD) PROCEDURE

PREFIX FOR GENERATED LABELS: 'TXL' ;

PREFEX FOR TEMPORARIES: 'TET' ;

CALL RERROR ENDP.

I OCOL I

(+QMW) +WDR2[B1.P1-4] +WDR[B2,P5-B]

+MVWDVG[B1.B2.P1-B]

(+WDR) (A1,A2,A3,A4,A5)

:P C(A1) >CH SLD 1A3+A3

(SP 1A5 C(A1) <CH SLD 1A2+A2 1A4/

1A5 C(A1) <CH (SP/.EMPTY) 1A2+A2

1A4) :

RETURN

3F (MNCTRL0 MAIN CONTROL

3F1 CODE (NLS, MNGTRL, :XBJHNZ)

3F2 DOCUMENTATION

3F2A (TREE, SPLR, :XJHNZ)

RETURN
RETURN
RETURN
RETURN
RETURN
RETURN
RETURN
RETURN...

JR: The MOL is, a in a sense its a high level language in it, it has phrase structure and good control constructs like if statements and while statements but its also very very close to machine language, 940 machine language, people talk about the actual registers of the machine and you talked about doing indirect addressing, this language has helped us uh, write the kind of fast type code that we want, that we have to have to operate in the time sharing system and at the same time it's given us a lot of flexibility uh it's also the phrase structure of the MOL, its designed to sort of mesh with the live structure of NOLs... NLS, so here I've got a while statement, so to see what's in that while statement... (FADE OUT)

(FADE IN) One of the uh, besides the sort of program organizational benefits that we get by designing all the special purpose languages we've been able to design a syntax of these languages so that they fit with our linking structure and the conventions that we've set up and the aids we've built to help us and NLS itself to move around between them. Um, one of the ways we've managed to implement all of these languages is, by designing a compiler compiler which uh which we call tree meta... (FADE OUT)

(FADE IN) The meanings of, of the commands by working in our high level language but we're also able to go in and just change the compilers as quickly as we have to, to accommodate all sorts of new hardware features and experimenting that we do like that. See, in a system guide

file, there were three sections. The first one served the program structure... More notes that programmers leave around about bugs, things that are wrong with our system right now, hmm I've got my blank line off... how did I, well, anyway, uh one of the interesting things that NLS does just an advantage of being online is it keeps track of who you are and what you're doing all the time, so on these statements.. (FADE OUT)

Scene Eleven

DE: WELL JEFF, HOW BOUT KIND OF GOING BACK TO THAT PLACE IN THE CONTROL META LANGUAGE WHERE YOU START DOWN THE DIALOGUE PROTOCOL A PERSON WOULD USE

JR: OK, UH RIGHT OVER HERE IN MAIN CONTROL

DE: YEAH, AND OFF TO ANOTHER FILE WHERE WE'RE LOOKING AT REAL CODE NOW, AND THERE'S A BRANCH OVER, DOWN THERE

JR: YEAH, THESE UH TOP BRANCHES ARE ALL SUBROUTINES THAT ARE PRETTY MEANINGLESS AND THIS WC MEANS WHAT CASE, AND ITS, WHAT'S THE PERSON GOING TO ASK FOR

DE: SO OPEN THAT ONE LEVEL DOWN NOW, RIGHT, NOW ALL THOSE THINGS IN PARENTHESIS THAT IN NLS ARE THE NAMES OF THOSE STATEMENTS, ARE ACTUALLY IN THE PROGRAMMING LANGUAGE THAT WORKS HERE, THE WAY IT'S IDENTIFIED THAT'S THE CHARACTER A USER HITS, IF HE HITS A D FOR INSTANCE

JR: A D HERE FOR DELETE

DE: RIGHT THERE, ALRIGHT IF HE HITS THE D THAT LINE TELLS YOU WHAT THE RESPONSE IS SUPPOSE TO BE, WHAT THE COMPUTER'S SUPPOSE TO DISPLAY, CERTAIN MATERIAL ON TOP OF THE SCREEN, AND THEN ITS SUPPOSE TO WAIT, UNTIL THE USER DOES THE NEXT THING, WHY DON'T YOU TRIM IT TO ONE LINE?

JR: UH, YEAH I WAS GOING TO DO THA...WHY DOESN'T MY BRANCH ONLY WORK? OH THAT'S ALL THAT BRANCH (LAUGHS) OH OK

DE: HIT EBT, WELL, ITS EASY

JR: OKAY

DE: ITS EASY, WELL, I DON'T WANT TO INSULT YOU BY SAYING THAT ITS EASY TO GET A NEW VIEW (LAUGHS) THE UH DOWN THERE TO SAY ALRIGHT, THEN IF HE'S HIT A D AND IT SETS UP WHAT IT SAYS THERE YOU CAN OPEN UP ONE LEVEL BELOW IT AND THATS THE NEXT BLOCK DOWN IN THIS SPECIAL LANGUAGE AND YOU SEE WELL IF AFTER THE D HE HITS SOMETHING ELSE LIKE A W, THEN IT GOES ON FROM THERE TO SAY WHAT IT IS THAT THE COMPUTER'S SUPPOSE TO DO IN RESPONSE. SO THIS LANGUAGE HERE IN ITS HIERARCHICAL STRUCTURE RESEMBLING THE BRANCHING TREE OF CHOICES USING USER MAKES SPECIFY AT EVERY POINT WHAT THE COMPUTER DOES AND FEEDBACK IN THE OPTIONAL CHOICES AND DOWN IN THE END THEN SPECIFYING THE ACTUAL FUNCTION LIKE DELETING A WORD, WHAT'S THE WORD? AND WHAT DO YOU MEAN BY DELETE? FOR WHAT'S A WORD

THAT'S SPECIFIED OFF IN THE SUBROUTINE THAT HE SHOWED YOU IN
A SPECIAL LANGUAGE TO FIND IN THERE WHAT A WORD IS. AND IT
DOESN'T TAKE A LOT OF PROGRAMMING SKILL TO LEARN HOW TO READ
THESE LANGUAGES BECAUSE THEY'RE AT THE CONCEPT LEVEL ALMOST
AT WHERE THE USER WANTS TO WORK. AND SO FOR US IN OUR
EXPERIMENTAL ENVIRONMENT, OUR USERS ARE BEGINNING TO LEARN
THIS SO THAT WE CAN LOOK AT THAT TO FIND OUT HOW THE SYSTEM
WORKS AND NOT SOMEBODY'S UH ENGLISH TEXT TRANSLATION ON
SPECIFIC, THOUGH MAYBE... JEFF YOU DID A GREAT PRESENTATION,
ESPECIALLY THE LAST PART
JR: THANK YOU, THANKS
DE: THANKS VERY MUCH

Scene Twelve

DE & MP:

HARDWARE SOFTWARE
IMPLIMENTATION
HARDWARE INTRODUCTION
NLS IMPLEMENTATION
OVERALL ABOUT PROGRAM
NLS AS AN 'INSTRUMENT'
CONTROL TECHNIQUES
NLS IMPLEMENTATION

USAGE
ACTIVITIES
CREDITS

INTRODUCTION
OVERALL ABOUT PROGRAM
NLS AS AN 'INSTRUMENT'
CONTROL TECHNIQUES
NLS IMPLEMENTATION

USAGE
ACTIVITIES
CREDITS
MOVE STATEMENT
INTRODUCTION
OVERALL ABOUT PROGRAM
APPLICATION EXAMPLES
TWO PERSON COLLABORATION

APPLICATION EXAMPLES
 USER DOCUMENTATION
 PAPER STUDYING OR MODIFYING
 PRINTOUT-DIRECTIVE GUIDE
 JOINT-FILE USAGE, MESSAGES
 OPEN-HOUSE DUTY ROSTER
 HARDWARE-DESIGN DOCUMENTATION,
 SYSTEM ANALYSIS RECORDS

DEFINITIONS

COMMAND TABLES

DEFINITIONS

DE: You want to find out the definition of a lot of terms. Here's sort of a glossary. Well, lets do the thing called 'freeze a statement'...

DE & MP:

FREEZE STATEMENT

THE FOLLOWING STATEMENT

(TABLES) BRANCH BUG CHARACTER CHORD FILE

FILENAME SCHAR GROUP HEAD INVISIBLE KEYSSET

KEYWORD LABEL

TABLES BRANCH

BUG CHARACTER CHORD FILE

FILENAME SCHAR GROUP HEAD INVISIBLE KEYSSET

BRANCH BUG CHARACTER CHORD FILE

FILENAME SCHAR GROUP HEAD INVISIBLE KEYSSET

KEYSET

(MOUSE) THE DEVICE AT THE RIGHT-HAND SIDE OF

THE KEYBOARD. WHEN IT IS ROLLED AROUND ON THE TABLETOP, IT

CAUSES THE BUG TO MOVE

CENTER BUTTON

THE MOUSE BUTTON

THE MOUSE BUTTON

CENTER BUTTON

RIGHT-HAND BUTTON

LEFT-HAND BUTTON

THE MOUSE BUTTON

THE MOUSE BUTTON

USER DOCUMENTATION

PAPER STUDYING OR MODIFYING

PRINTOUT-DIRECTIVE GUIDE

JOINT-FILE USAGE, MESSAGES

ABSTRACT
INTRODUCTION
THE USER SYSTEM
SERVICE CENTER SOFTWARE
BASIC FACILITY
WORK STATIONS
STRUCTURES OF FILES

FILE STUDYING
THE COMPUTER
THE 'NORMAL' VIEW BEGINNING AT THE GIVEN
LOCATION IS LIKE A FRAME CUT OUT FROM A
LONG SCROLL
SET OF STATEMENTS IS PRINTED IN
SEQUENTIAL ORDER

THIS PAPER DESCRIBES A MULTISPONSOR RESEARCH
FOR IT'S LABORATORY FACILITY

FREEZE STATEMENT
FREEZE STATEMENT

DE: And these things up in here, these three letters and equals, are special directives we embed in our text so when the output processor does it, it puts in things like headers like this says make the header on every page be D.C. Engelbart abstract, that's the prescribed form, the number between lines double space it, all these others have characteristics to get right justifications page numbers; all kinds of control on there. Alright so much for paper writing...

Scene Thirteen

Well, print out directives... I feel a little rushed for time..

JOINT FILE USAGE IS SOMETHING THAT IS VERY POWERFUL HERE, I WENT OFF TO A FILE THAT WE WERE WORKING ON, AS WE WERE GETTING READY THE EARLY PARTS OF THIS PRESENTATION, AND IT WAS A MESSAGE, IT WAS SOMETHING THAT THREE OF US USED A LOT BETWEEN US TO COORDINATE THE PLANNING, ASK CONTINGENCY PLANS, THE SPECIAL NEEDS OF NLS FOR THE FALL JOINT AND THINGS LIKE THAT, WE DEVELOPED A MESSAGE TECHNIQUE SO WE COULD LEAVE MESSAGES FOR EACH OTHER,

UNDER THERE ARE USAGE CONVENTIONS AND LET ME JUST TELL YOU ABOUT THAT, UNDERNEATH HERE WE'D DIRECT MESSAGES TO EACH OTHER THAT WE CAN UNFOLD AND SEE, BUT MANY TIMES, YOU WOULDN'T WANT DIRECT MESSAGES AS MUCH AS YOU'D LIKE TO JUST GO THROUGH AND LEAVE A MESSAGE FOR SOMEBODY. SO WE WORKED OUT THAT THE CONVENTIONS WOULD BE, WHERE'S AN EXAMPLE, THE EXAM...

THE CONVENTION WE'RE GOING TO USE IS THAT WE WOULD SEND A MESSAGE TO A GUY,

If I wanted to send Bill English WKE a message I would, put that in the file, WKE DCE with that pound sign in between. So any statement that's marked like that means there's a message to him from me.

IF I WANT TO, I CAN ALSO SAY IT WAS FOR DAVE EVANS, LIKE THAT. SO THAT'S FROM ME TO BOTH OF THEM. ALRIGHT, WE HAVE THIS THING WE CALL A CONTENT ANALYZER, JEFF MENTIONED IT BRIEFLY WHICH WE CAN WRITE EXPRESSIONS IN A LANGUAGE, LET'S JUST COME DOWN HERE AND LOOK. HERE'S A LITTLE EXPRESSION IN A LANGUAGE WHICH MEANS I'M GOING TO LOOK FOR MR. XXX, A MESSAGE FROM HIM. ALRIGHT, WHAT IF I SAY I WANT THAT XXX TO BE DCE THAT SAYS SOMEPLACE IN THERE I WANT TO FIND A POUND SIGN AND DCE, SO WITH OUR LITTLE COMPILER WE SAY FROM THERE, COMPILE IT, IT COMES BACK AND SAYS I DID IT OK AND I CAN SAY

ALRIGHT, ONLY SHOW ME THE STATEMENTS THAT PASS THE TEST,

SOMEPLACE IN THEM THEY HAVE THAT STRING, THERE THEY ARE. SO IN EVERY ONE OF THOSE, THAT'S FROM DCE, DCE GO DOWN THERE AND LOOK FOR IT. THIS ONE OVER HERE, THIS IS TO ANYBODY FROM DCE. THEN I CAN SAY, WELL TURN OFF THAT FILTER, HOW ABOUT FOR SO AND SO. SO I CAN SAY ALRIGHT, THIS IS FOR WKE, A MESSAGE FOR BILL. THE REST OF THIS PATTERN HERE SAYS IT'S GOT TO BE FOLLOWED BY ANY NUMBER OF COMMAS AND LETTER TRIPLETS FOLLOWED BY A POUND SIGN OR IT DOESN'T GO. WELL LETS COMPILE THAT AND SEE. OH, IT MAY HAVE PASSED THE TEST ALRIGHT...

PATTERN

XXX XXX

AND I CAN USE ANOTHER THING I CALL MARKERS I HAVEN'T TOLD YOU ABOUT LATELY, BEFORE, YOU NOTICE THAT MANY TIMES WHEN I'M DOING SOMETHING TO OPERATE ON SOME ENTITY I USE THIS BUG TO POINT DIRECTLY. WELL IT SO HAPPENS WE HAVE A FEATURE WE CALL MARKERS SUCH THAT ANY PLACE IN A GIVEN FILE I CAN PLACE A MARKER ON A CHARACTER AND GIVE IT UP TO A THREE LETTER NAME.

DAE,WKE,JFRKDIA PPPPPP

DAE,WKE,JFRKDIA PPPPPP

WKEKDAE PPPPPP

DUMMY FRONT

DUMMY FRONT

DUMMY FRONT

DUMMY FRONT

THEN AT ANY TIME IN ANY COMMAND WHERE ITS APPROPRIATE TO POINT AND PUSH THIS RIGHT HAND BUTTON TO SAY SELECT, I CAN HOLD THE BUTTON DOWN AND ENTER THAT NAME AND LET THE BUTTON UP AND INSTEAD OF IT TAKING THE CHARACTER I'M POINTING AT WITH THIS BUG, IT TAKES THE COINED, IT TAKES THE CHARACTER

FOR AN OPERAND THAT I HAD NAMED, THAT I PUT THAT MARKER ON A NAME, SO OFF SOME PLACE I HAVE MARKERS ON PATTERNS THAT I'VE ALREADY SET UP FOR OTE, OPEN HOUSE TUESDAY EVENING AND SUCH. SO I CAN SAY EXECUTE COMPILER FROM HERE AND I CAN TYPE IN OPEN HOUSE WEDNESDAY AFTERNOON, OWA AND SAY EXECUTE IT, AND IT SAYS I DID. I SAY, ALRIGHT LET'S SEE WHAT YOU'VE GOT. OPEN HOUSE WEDNESDAY AFTERNOON, THESE ARE THE PEOPLE THAT ARE GOING TO BE THERE, OH WHAT ABOUT OPEN HOUSE WEDNESDA.. ER TUESDAY EVENING, OTE EXECUTE, OPEN HOUSE TUESDAY EVENING. SO THESE KIND OF PATTERN MATCHERS AND MARKERS AND FREEZING STATEMENTS AND JUMPING ON THINGS GIVE US A GREAT DEAL OF POWER JUMPING AROUND...

DESTROYING THE MESSAGE
DESTROYING THE MESSAGE
DESTROYING THE MESSAGE
DESTROYING THE MESSAGE
DESTROYING THE MESSAGE
DESTROYING THE MESSAGE
DESTROYING THE MESSAGE

Scene Fourteen

I've had to disable slightly because this seems to be hung up in the wrong place. I'll have to run by the keyboard and that's a real bag. I'm so used to working with one hand and this that I can hardly remember what to do with a keyboard.

Anyway, I want to go back to a file. The other guys at the other end of the time sharing system are gonna go in and see why and I hope some hardware guys are too...

And I can use another thing I call markers I haven't told you about lately, before, you notice that many times when I'm doing something to operate on some entity I use this bug to point directly. Well it so happens we have a feature we call markers such that any place in a given file I can place a marker on a character and give it up to a three letter name, then at any time in any command where its appropriate to point and push this right hand button to say select, I can hold the button down and enter that name and let the button up and instead of it taking the character I'm pointing at with this bug, it takes the coined, it takes the character for an operand that I had named, that I put that marker on a name, so off some place I have markers on patterns that I've already set up for OTE, open house Tuesday evening and such.

So I can say execute compiler from here and I can type in open house Wednesday afternoon, OWA and say execute it, and it says I did. I say, alright let's see what you've got. Open house Wednesday afternoon, these are the people that are going to be there, oh what about open house Wednesda.. Er Tuesday evening, OTE execute, open house Tuesday evening. So these kind of pattern matchers and markers and freezing statements and jumping on things give us a great deal of power jumping around...

MAKE UP PATTERN PATTERN

MAKE UP PATTERN

DE & MP:

WE'RE PURSUING THIS MONSTROUS GOAL
MONSTROUSLY DIFFICULT

WE'RE APPROACHING IT EVOLUTIONARY-WISE, BECAUSE
WE FEEL THAT

WE'RE PURSUING THIS MONSTROUS GOAL
MONSTROUSLY DIFFICULT

WE'RE APPROACHING IT EVOLUTIONARY-WISE, BECAUSE
DE:

MAKE UP PATTERN PATTERN

MAKE UP PATTERN

MAKE UP PATTERN PATTERN

MAKE UP PATTERN

MAKE UP PATTERN PATTERN

MAKE UP PATTERN

MAKE UP PATTERN PATTERN

MAKE UP PATTERN

DE & MP:

BOOTSTRAPPING BOOTSTRAPPING BOOTSTRAPPING
BOOTSTRAPPING BOOTSTRAPPING BOOTSTRAPPING
BOOTSTRAPPING BOOTSTRAPPING BOOTSTRAPPING

DE:

MAKE UP PATTERN PATTERN

MAKE UP PATTERN

MAKE UP PATTERN PATTERN

MAKE UP PATTERN

MAKE UP PATTERN PATTERN

MAKE UP PATTERN

MAKE UP PATTERN PATTERN

MAKE UP PATTERN

Open house Wednesday afternoon, OWA and say execute it, and
it says I did. I say, alright let's see what you've got.
Open house Wednesday afternoon, these are the people that
are going to be there, oh what about open house Wednesda..
er Tuesday evening, OTE execute, open house Tuesday evening.
So these kind of pattern matchers and markers and freezing

statements and jumping on things give us a great deal of power jumping around...

DE & MP:

WE'RE APPROACHING IT EVOLUTIONARY-WISE, BECAUSE WE FEEL THAT

DE: Alright, there are other things to show here...

DE & MP:

INTERMEDIATE BUFFER REGISTER

INTERMEDIATE BUFFER REGISTER

INTERMEDIATE BUFFER REGISTER

INTERMEDIATE BUFFER REGISTER

INTERMEDIATE BUFFER REGISTER

INTERMEDIATE BUFFER REGISTER

24-BIT STORAGE

24-BIT

24-BIT STORAGE

24-BIT

24-BIT STORAGE

24-BIT

INTERMEDIATE BUFFER REGISTER

INTERMEDIATE BUFFER REGISTER

INTERMEDIATE BUFFER REGISTER

24-BIT STORAGE

24-BIT

24-BIT STORAGE

24-BIT STORAGE

24-BIT

24-BIT STORAGE

INTERMEDIATE BUFFER REGISTER

INTERMEDIATE BUFFER REGISTER

INTERMEDIATE BUFFER REGISTER

INTERMEDIATE BUFFER REGISTER

INTERMEDIATE BUFFER REGISTER

INTERMEDIATE BUFFER REGISTER

TWO-PERSON COLLABORATION
INFORMATION RETREIVAL

DE: So I'm going to establish a collaborative mode between me and another terminal, Bill Paxton's at a terminal back at SRI, and the first thing I do to do that of course is to say hey, I'm going to uh oops, to call this command, we have to go into the executive mode and set executivity to a special level, oops and then continue with NLS so a free..

DE & MP:

USER DOCUMENTATION
PAPER STUDYING OR MODIFYING
PRINTOUT-DIRECTIVE GUIDE
JOINT-FILE USAGE, MESSAGES
OPEN-HOUSE DUTY ROSTER
HARDWARE-DESIGN DOCUMENTATION
SYSTEM ANALYSIS RECORDS

Scene Fifteen

DE: demonstration of some of the versatility, alright special command I'd like to link to Bill and uh I don't know if he's at his terminal right now so I have to ask for somebody to connect me to him audibly so Bill will you come in through this intercom?

BILL PAXTON (BP): Hello Doug

DE: Hi (laughs) Alright I need to know what terminal you're on Bill

BP: 13

DE & MP:

USER DOCUMENTATION
PAPER STUDYING OR MODIFYING
PRINTOUT-DIRECTIVE GUIDE
JOINT-FILE USAGE, MESSAGES
OPEN-HOUSE DUTY ROSTER
HARDWARE-DESIGN DOCUMENTATION
SYSTEM ANALYSIS RECORDS

DE: Alright, I'd like to have him see my text so this special thing if I label 13 will switch over, so on his display he sees my text so I'll execute it and sure enough it does. But what's that, running around? Well if he's looking at my text he'd like to have something to say about it, so we put on a marker, a tracking spot that he controls so he is sitting at Menlo Park looking at this text and he can point to it but we've carefully reserved for me the right to control and operate on this, so my bug is more powerful than yours. But we can have an argument, yeah. That's what they call a bug fight.

DE & MP:

USER DOCUMENTATION
PAPER STUDYING OR MODIFYING
PRINTOUT-DIRECTIVE GUIDE
JOINT-FILE USAGE, MESSAGES
OPEN-HOUSE DUTY ROSTER

HARDWARE-DESIGN DOCUMENTATION
SYSTEM ANALYSIS RECORDS

DE: So, alright so in case you haven't been listening Bill, we've been going through lots of examples and setting up and collaboration here so we can go on into information retrieval and we've set up now audio coupling and we're both looking at the same display and that would be handy to work we can talk to each other and point and maybe later I can hand you the chalk on this blackboard like saying hey maybe you control it but lets stay this mode now and add another feature that is available through the kind of display we have.

DE & MP:

TWO-PERSON COLLABORATION
INFORMATION RETREIVAL
TWO-PERSON COLLABORATION
INFORMATION RETREIVAL

DE: I'd like to see you while I'm working on it so before I can do that, I have to set up my display in a certain way, set it up so that I see it over like that, that leaves a corner up there and I say now computer do the automatic switching that'll bring in a camera picture from the camera monitor on his console such that the camera monitor on mine is. Hi Bill, that's great now we're connected audio, you can see my work, you can point at it and I can see your face and we can talk. So let's do some collaborating... you're silent...

BP: What do you want me to say?

DE: There's nobody here but a large audience Bill...

BP: Alright...

DE: So, let's eh, let's go talk about information retrieval and there are a lot of things I've been showing them and jumping around and finding your way relating back to the portrayal I gave about NLS as an instrument on complex data

structures and show them how we can get around and find things. I showed them the content analyzers to help locate things. OK, let's... you had a file kinda classifying retrieval stuff. Why don't we switch to it?

Scene Sixteen

DE & MP:

'HOT' RETRIEVAL -- KNOWN DESTINATION
'COLD' RETRIEVAL -- UNKNOWN DESTINATION

'HOT' RETRIEVAL -- KNOWN DESTINATION
'COLD' RETRIEVAL -- UNKNOWN DESTINATION

JUMP TO IDENTITY
JUMP TO NAME
JUMP TO LINK
JUMP TO IDENTITY
JUMP TO NAME
JUMP TO LINK

(DE): I HOPE YOU'LL GO ALONG WITH THIS RATHER UNUSUAL SETTING AND THE FACT THAT I REMAIN SEATED WHEN I GET INTRODUCED AND THE FACT THAT I'M GOING TO COME TO YOU MOSTLY THROUGH THIS MEDIUM HERE FOR THE REST OF THE SHOW AND I SHOULD TELL YOU THAT I'M BACKED UP BY QUITE A STAFF OF PEOPLE BETWEEN HERE AND MENLO PARK WHERE STANFORD RESEARCH IS LOCATED SOME THIRTY MILES SOUTH OF HERE AND UH IF EVERY ONE OF US DOES OUR JOB WELL IT'LL ALL GO VERY INTERESTING, I THINK...

DE & MP:

INTRODUCTION
OVERALL ABOUT PROGRAM
NLS AS AN 'INSTRUMENT'
CONTROL TECHNIQUES
NLS IMPLEMENTATION

USAGE
ACTIVITIES
CREDITS
MOVE STATEMENT
INTRODUCTION
OVERALL ABOUT PROGRAM
APPLICATION EXAMPLES

DE: THE RESEARCH PROGRAM THAT I AM GOING TO DESCRIBE TO YOU IS QUICKLY CHARACTERIZABLE BY SAYING IF IN YOUR OFFICE YOU AS AN INTELLECTUAL WORKER WERE SUPPLIED WITH A COMPUTER DISPLAY BACKED UP BY A COMPUTER THAT WAS ALIVE FOR YOU ALL DAY AND WAS INSTANTLY RESPONSIBLE, OR RESPONSIVE, INSTANTLY RESPONSIVE TO EVERY ACTION YOU HAVE, HOW MUCH VALUE COULD YOU DERIVE FROM THAT?

DE & MP:

HARDWARE SOFTWARE

IMPLIMENTATION

HARDWARE INTRODUCTION

NLS IMPLEMENTATION

OVERALL ABOUT PROGRAM

NLS AS AN 'INSTRUMENT'

CONTROL TECHNIQUES

NLS IMPLEMENTATION

USAGE

ACTIVITIES

CREDITS

INTRODUCTION

OVERALL ABOUT PROGRAM

NLS AS AN 'INSTRUMENT'

CONTROL TECHNIQUES

NLS IMPLEMENTATION

USAGE

ACTIVITIES

CREDITS

MOVE STATEMENT

INTRODUCTION

OVERALL ABOUT PROGRAM

APPLICATION EXAMPLES

TWO PERSON COLLABORATION

DE: WELL THIS BASICALLY CHARACTERIZES WHAT WE'VE BEEN

PURSuing FOR MANY YEARS IN WHAT WE CALL THE AUGMENTED HUMAN INTELLECT RESEARCH CENTER AT STANFORD RESEARCH INSTITUTE. NOW THE WHOLE SESSION IS GOING TO BE DEVOTED TO TRYING TO DESCRIBE AND PRESENT TO YOU THE NATURE OF THIS PROGRAM, BUT UNFORTUNATELY, UH, OR FORTUNATELY, THE PRODUCTS OF THIS PROGRAM, THE TECHNOLOGY OF IT, LENDS ITSELF WELL TO AN INTERESTING WAY TO PORTRAY IT FOR YOU SO *WE'RE GOING TO TRY OUR BEST TO SHOW YOU RATHER THAN TELL YOU ABOUT THIS PROGRAM.*

DE & MP:

FREEZE STATEMENT

THE FOLLOWING STATEMENT

(TABLES) BRANCH BUG CHARACTER CHORD FILE
FILENAME SCHAR GROUP HEAD INVISIBLE KEYSSET
KEYWORD LABEL
TABLES BRANCH
BUG CHARACTER CHORD FILE

FILENAME SCHAR GROUP HEAD INVISIBLE KEYSSET
BRANCH BUG CHARACTER CHORD FILE
FILENAME SCHAR GROUP HEAD INVISIBLE KEYSSET
KEYSET

(MOUSE) THE DEVICE AT THE RIGHT-HAND SIDE OF THE KEYBOARD. WHEN IT IS ROLLED AROUND ON THE TABLETOP, IT CAUSES THE BUG TO MOVE

CENTER BUTTON

THE MOUSE BUTTON

THE MOUSE BUTTON

CENTER BUTTON

RIGHT-HAND BUTTON

LEFT-HAND BUTTON

THE MOUSE BUTTON

THE MOUSE BUTTON

USER DOCUMENTATION

PAPER STUDYING OR MODIFYING

PRINTOUT-DIRECTIVE GUIDE

JOINT-FILE USAGE, MESSAGES

DE:

WORD WORD

WORD WORD WORD

WORD STATEMENT ONE

STATEMENT ONE...

Scene Seventeen

DE & MP:

OVERLAY INDEX & DEBUG
FORKS AND FOR STARTING
DOCUMENTATION INDEX
CATALOG FOR NLS
FILE HANDLING
INPUT/OUTPUT
INITIALIZATION
FEEDBACK
STRUCTURE

FILE HANDLING

RANDOM FILE
FILE BLOCK REFERENCING
FILE CONTROL
FILE STATUS BLOCK
WORKING COPY OF FILE

FILE HANDLING

RANDOM FILE
FILE COPYING
FILE BLOCK REFERENCING
FILE CONTROL
FILE STATUS BLOCK
WORKING COPY OF FILE

OVERLAY INDEX & DEBUG
FORKS AND FOR STARTING
DOCUMENTATION INDEX
CATALOG FOR NLS
FILE HANDLING
INPUT/OUTPUT
INITIALIZATION
FEEDBACK
STRUCTURE

BP: Still on?

DE: Yes. We hear you.

BP: So who, somebody hung up on us

DE: How do you say go ahead with a mouse?

DE & MP:

WORKING COPY OF FILE

FILE HANDLING

RANDOM FILE

FILE COPYING

FILE BLOCK REFERENCING

FILE CONTROL

FILE STATUS BLOCK

WORKING COPY OF FILE

OVERLAY INDEX & DEBUG

FORKS AND FOR STARTING

DOCUMENTATION INDEX

CATALOG FOR NLS

FILE HANDLING

INPUT/OUTPUT

INITIALIZATION

FEEDBACK

STRUCTURE

FILE HANDLING

RANDOM FILE

FILE COPYING

FILE BLOCK REFERENCING

FILE CONTROL

FILE STATUS BLOCK

WORKING COPY OF FILE

FILE HANDLING

RANDOM FILE

FILE COPYING

FILE BLOCK REFERENCING

FILE CONTROL

FILE STATUS BLOCK

WORKING COPY OF FILE

DE:

WE'RE PURSUING THIS MONSTROUS GOAL
MONSTROUSLY DIFFICULT
WE'RE APPROACHING IT EVOLUTIONARY-WISE, BECAUSE
WE FEEL THAT
WE'RE PURSUING THIS MONSTROUS GOAL
MONSTROUSLY DIFFICULT

DE & MP:

ANDREWS UTILITY
ANDREWS UTILITY
ANDREWS UTILITY
ANDREWS UTILITY
ANDREWS UTILITY
ANDREWS UTILITY

DE:

BOOTSTRAPPING BOOTSTRAPPING BOOTSTRAPPING
BOOTSTRAPPING BOOTSTRAPPING BOOTSTRAPPING
BOOTSTRAPPING BOOTSTRAPPING BOOTSTRAPPING

DE & MP:

SERVICE SYSTEM DEVELOPMENT
USER-SYSTEM DEVELOPMENT
MANAGEMENT SYSTEM

SERVICE SYSTEM DEVELOPMENT
USER-SYSTEM DEVELOPMENT
MANAGEMENT SYSTEM
MANAGEMENT SYSTEM
MANAGEMENT SYSTEM
MANAGEMENT SYSTEM

SERVICE SYSTEM DEVELOPMENT
USER-SYSTEM DEVELOPMENT
MANAGEMENT SYSTEM

WORD WORD WORD WORD WORD WORD
WORD WORD WORD WORD WORD WORD
WORD WORD WORD WORD WORD WORD
WORD WORD WORD WORD WORD WORD

MANAGEMENT SYSTEM
MANAGEMENT SYSTEM

SERVICE SYSTEM DEVELOPMENT
USER-SYSTEM DEVELOPMENT
MANAGEMENT SYSTEM

WORD WORD WORD WORD WORD WORD
WORD WORD WORD WORD WORD WORD
WORD WORD WORD WORD WORD WORD
WORD WORD WORD WORD WORD WORD

OUR PRODUCT
OUR PRODUCT
OUR PRODUCT
OUR PRODUCT

Scene Eighteen

DE: Well, it's uh, we're about providing a sample augmentation system, the one we use and not only that it's an augmentation system that's provided to augment computer system development, and beyond that we're also hoping that we're developing quite a few design principles for developing augmentation systems and these I hope are transferable things.

I'd like to close and give you some description of the support we've gotten from the different people to produce this and acknowledge that, and uh back in Menlo park we've got quite a team of people surrounded by quite a bit of equipment that have been busy listening to us and trying to control and switch and these monitors up there where all the displays went, the cameras went for what's on the use, the displays go here so that they can monitor the different signals and switch and send us what one we want.

Alright and I particularly want to give appreciation to Bill English who has not only designed all of the hardware, or you know has been responsible for all of the hardware and software development that gives us our services for all of these years, but in the last few months put together the considerable network of, of intercoms and video switching and controls and mixers they've borrowed and stolen that would provide this show to make it come off like that.

To the supporting staff Ed van de Viet, Martin Hardy, Roger Bates, John Farbodough, Steve Paavola who just worked very very hard to make all of this work out, technically, Dave Evans in coordinating this and then managing the open house we're going to have, Don Andrews, Jeff Rulifson, Bill Paxton for preparing and presenting their material there, and beyond us too we've gotten a great deal of support from SRI, with general preparations support.

Steward Brand from Portola Institute has volunteered a good amount of time to help us he was in that picture of people there, John Dusterberry in Ames Research lab was very kind saving our life by offering us the loan of this Eidophor projector, that's the machine that's projecting this video image up on the screen we were just bowled over about what

sort of a display we could provide of what we're doing and we very much appreciate the loan of that.

And Gene Warren from TNT Communications who handled this, we retained him to come and help us be sure it worked and he's just been a tremendous spark plug, running around fixing the paging system for us and whatnot and Tasker Instruments, and he's done a lot of extra work lately, the telephone company, the telephone company has done a great deal beyond, beyond what they needed to do too to fix us up once they found out what kind of wild thing we're trying and their video men yesterday were trying to help us out with the phone circuits and all kinds of extra things.

A very, a very interesting credit to bring up next, is Herman Miller Research Company, this is an affiliate of Herman Miller Furniture Company and uh why are they connected with a computer show? Well, they've been bringing out some new office furnishings, and we've been very much interested in developing the whole environment for people working in a different way and that means walls, desk surfaces, console and everything, we got so attracted to their line that they started working to help us equip offices and stuff like that and one of their designers Jack Kelly came one day to spend a day working with us about our ideas, about control consoles as being separated from display consoles and ended up making this, on a chair, that I can get up, move around, sit down, swivel, and lock, rock, lean back and work very relaxed.

So I think this is a very exciting stage, we've just gotten it and in our open house we have uh a full office that is equipped like this with this kind of a console that we're very excited about, that we invite you to come to, and, without being formal I'd like to really say that I'm backed up by a really very tremendous team in these 17 guys who caught the spirit of putting on this show tremendously and have just done an overwhelming job with putting it all together, and have been backing me all these years and this wild dream of doing this sort of thing and they're all catching fire and I, I want to just tell them all right now.

I owe them a lot and a very final credit goes to my wife and daughters who are out here to whom I'd like to dedicate this whole presentation because of what they've put up with

over these years, with a husband that dedicated to in a monomaniacal way to something very wild and uh so this whole presentation is dedicated to you, four people there and I thank all the rest of you very much for coming to the dedication ceremonies.

The End