

LABEL 00000000PRINTER00178193?USER=SITE ; EXECUTE LISTER /SMALL
IMPLEMENTERS MANUAL

LISTER /SMALL

JUNE 9 1977

SMALL TALK IMPLEMENTERS MANUAL

THIS DOCUMENT DESCRIBES THE IMPORTANT STRUCTURES AND
PROCEDURES FOR THE IMPLEMENTATION OF SMALLTALK DONE
AT UCSC IN 1977. WE HAVE RELIED HEAVILY ON THE READERS
FAMILIARITY WITH THE USERS MANUAL FOR THIS SMALLSTALK.

NEWLOW.*

MAJOR STRUCTURES

ALL OBJECTS ARE REPRESENTED IN ONE WORD. THE PARTS OF THIS WORD ARE: THE TYPE BITS, THE VALPTR BITS AND THE ACTIVE BIT. ONE BIT OF THE TYPE IS THE FAKO BIT, THE REST BEING THE JUMP BITS. ACTIVEP AND FAKOP ARE THE BOOLEAN FORMS. THE FAKO BIT IF ON INDICATES A SMALLTALK PROVIDED OBJECT. THE JUMP PART OF A FAKO IS USED AS AN INDEX FOR A CASE STATEMENT FOR PASSING CONTROL TO THE APPROPRIATE PIECE OF CODE. THE FOLLOWING FAKOS USE THE VALPTR FIELD AS FOLLOWS (ALL OTHER FAKOS MAKE NO USE OF VALPTR):

TYPE	VALPTR (INDEX TO...)
ATOM	CELL SPACE
NUMBER	NUMBER SPACE
VECTOR	VECTOR SPACE
STRING	STRING SPACE
COMMENT	STRING SPACE
FRAME	FRAME SPACE

CELLS (ATOMS)

THE FIELDS IN CELLS ARE :

- NAME INDEXES THE NAME IN STRING SPACE
- INSTPTR INDEXES THE VALUE OF THE CELL IN VECTOR SPACE
- ACD NAMES AN ACCESS CHAIN IN THE CONTEXT TREE
- FAKOJUMPS INDEX VARIOUS CASE STATEMENTS IN VECTOR, STRING, ATOM, AND BOOLEAN OBJECTS
- LINK INDEXES ANOTHER CELL IN THE SAME HASH BUCKET

NUMBERS

ARE A FULL WORD BURROUGHS FLOATING/INTEGER NUMBER

STRINGS

A STRING HAS THE FOLLOWING FIELDS:

- LENGTH THE NUMBER CHARACTERS IN THE STRING
- USE USE COUNT
- BLOCKLEN USED IN (DE)ALLOCATING STRINGS FOLLOWED BY THE CHARACTERS IN THE STRING

THE FOLLOWING ACCESSING FUNCTIONS ARE PROVIDED:

- POINTERTOSTRING(STRINGOBJECT) IS A POINTER TO THE CHARACTERS
- STRINGLENGTH(STRINGOBJECT) IS THE LENGTH OF THE STRING
- STRINGUSE(STRINGOBJECT) IS THE USE COUNT

VECTORS

A VECTOR HAS THE FOLLOWING FIELDS:

- LENGTH NUMBER OF OBJECTS IN THE VECTOR
- USE USE COUNT
- BLOCKLEN USED IN DE(ALLOCATING) VECTORS FOLLOWED BY THE OBJECTS IN THE VECTOR AND AN ENDOFVEC OBJECT.

VECTORLENGTH(VECTOROBJECT) IS THE LENGTH OF THE VECTOR.

FRAMES

MAJOR STRUCTURES

FRAMES FORM A SPAGHETTI STACK WITH THE FOLLOWING MODIFICATIONS:
THE CONTROL LINK HAS BEEN ELIMINATED (ITS FUNCTION IS IMPLICIT
IN THE CONTROL FLOW OF THE IMPLEMENTATION).
THE FRAME AND EXTENSION HAVE BEEN MERGED (THE EXT IS FIXED LENGTH
IN THIS IMPLEMENTATION).
A SHALLOW BINDING SCHEME IS USED.

THE FIELDS IN A FRAME ARE:

ALINK ACCESS LINK
VARS LINK LIST OF BINDERS USED FOR STORING BINDING INFORMATION
FUSE USE COUNT
MESSAGE MESSAGE VECTOR FOR THIS CONTEXT
WHO THE USER OBJECT WHICH THIS CONTEXT IS CURRENTLY EVALUATING
TOPWHO THE USER OBJECT FOR WHICH THE CONTEXT WAS CREATED
WHONAME INDEX OF CELL WHERE WHO CAME FROM IF THERE WAS SUCH A CELL

MESSAGE VECTORS

MESSAGE VECTOR WORDS ARE DIFFERENT FROM THE USUAL WORDS USED
TO REPRESENT VECTORS. THEY ARE USED MAINLY IN THE EVALUATOR.
THEY HAVE THE FOLLOWING TWO FIELDS:
BEGINNING INDEXES THE BEGINNING OF THE VECTOR
ENDING INDEXES THE FIRST ELEMENT NOT YET CONSUMED

BINDERS

BINDERS ARE USED TO STORE INFORMATION ABOUT A SET OF VARIABLE
BINDINGS. EACH BINDER IS FOR ONE SET OF EITHER LVARS, IVARS, OR
CVARS. THE FIELDS ARE:
KIND LVARS AND IVARS ARE REPRESENTED BY 0 AND CVARS BY THE
NUMBER OF IMPLICIT CVARS (6 CURRENTLY)
BUSE USE COUNT
BNEXT NEXT BINDER IN THE LINKED LIST OFF OF VARS
MODELVEC VECTOR OF CELL INDEXES OF BOUND CELLS
PREVVEC VECTOR OF THE VALUES OF THE CELLS BEFORE BINDING
CURRVEC VALUES BOUND TO THE CELLS (INCLUDES ALSO THE VALUES OF
THE IMPLICIT VARIABLE FOR CVARS)

USER OBJECTS

FAKO IS OFF
TYPE INDEX OF THE CELL WHOSE VALUE THIS OBJECT IS AN INSTANCE
OF
VALPTR INDEXES A VECTOR WHOSE ELEMENTS ARE MODEL AND VALUE
VECTORS FOR THE CVARS AND EACH OF THE IVARS FROM
THE DIFFERENT CLASSES OF WHICH THIS OBJECT IS AN INSTANCE
THE CVARS VALUES HAVE 6 IMPLICIT VALUES,
(THE LVARS MODEL, IVARS MODEL, CVARS MODEL, DEF VECTOR,
ISNEW VECTOR, AND INIT VECTOR) PLUS THE REST OF THE CVARS
VALUES.
SEE FIGURE 35.

OTHER GLOBAL VARIABLES

EXIT: IS USED FOR INDICATING ERROR CONDITIONS. (AND OTHER THINGS THAT ACT LIKE ERRORS.)

VEC: THE CURRENT MESSAGE VECTOR

RETURNVAL: USED FOR RETURNING A VALUE FROM A USER OBJECT

DONERETURNVAL: USED FOR RETURNING A VALUE FROM A DONE WITH

CONTINUEVAL: USED TO RETURN THE VAL TO CONTINUE WITH FROM AN ERROR

CONTINUEINC: USED TO MOVE THE MESSAGE POINTER FOR A CONTINUE FROM AN ERROR

CURACD: IS THE CURRENT ACCESS CHAIN DESCRIPTER

FILES: A SWITCH FILE OF TTY, PRINTER, 8 DISK FILES FOR THE USER, AND A DISK FILE USED BY FILOUT.

PFILE: INDEXES THE CURRENT PRINTFILE IN FILES

RFILE: INDEXES THE CURRENT READFILE IN FILES

OPENFILE: INDICATES WHETHER A FILE IS OPEN FOR READ, PRINT OR NOT OPEN (1, 2, OR 0 RESPECTIVELY). TTY IS A SPECIAL CASE BEING OPEN FOR BOTH READ AND PRINT.

PRINTIMAGE IS USED BY STRINGOF

PRINTBUFFER: USED BY PRINT, THERE IS A ROW OF BUFFER FOR EACH FILE

PRINTBUFLN: THE CURRENT LENGTH LEFT IN PRINTBUFFER

PBUFPT: POINTER TO PLACE TO BE PRINTED NEXT IN THE CURRENT PRINT BUFFER

PBUFLN: LENGTH LEFT IN CURRENT PRINT BUFFER

PBUF SIZE: NUMBER OF CHARACTERS PER LINE IN CURRENT PRINT FILE

PBUFWORD: NUMBER OF WORDS PER LINE IN CURRENT PRINTFILE

NOBREAKER: TRUE UNLESS A BREAK HAS BEEN INTERCEPTED DURING OUTPUT TO THE TTY

PRINTCHARARRAY: KEEPS CHARACTERS USED IN COMMON OUTPUT MESSAGES

CHARACTERTYPE, CHARTYPE: USED BY SCANNER

CURFRAME: INDEXES THE CURRENT CONTEXT FRAME

CURRCEL: IF CURRENT OBJECT WAS THE VALUE OF A CELL THEN CURRCEL IS AN INDEX TO THAT CELL

NEWCURRCEL: USED IN UPDATING CURRCEL

GLOBFRAME: FRAME CONTAINING GLOBAL VARIABLES

GLOBPTR: INDEXES THE LAST ALLOCATED GLOBAL VARIABLE IN VECTOR SPACE

CCELLS: ARRAY OF INDICES OF CELLS FOR THE IMPLICIT CLASS VARIABLES

ALLOCATION

CELLS ARE ALLOCATED AS A STACK (WITH NO POPS).
OTHER OBJECTS HAVE A USE COUNT TO INDICATE HOW MANY REFERENCES THERE
ARE TO THEM. IF THIS GOES TO ZERO THE OBJECT IS DEALLOCATED.
THE USE COUNTS ARE UPDATED BY THE USE OF REFUP AND REFDOWN PROCEDURES.
THERE IS A REFUP AND DOWN FOR EACH KIND OF DATA STRUCTURE FAKO AND
A GLOBAL PAIR FOR WHEN THE OBJECT COULD BE OF ANY TYPE.
NUMBERS, FRAMES, AND BINDERS ARE ALLOCATED BY USE OF A FREE LIST.
VECTORS AND STRING ARE ALLOCATED USING A BUDDY SYSTEM.
FOR VECTORS THE FREE LIST HEADS ARE KEPT IN A BLOCK OF SIZE 16 AT THE
BEGINNING OF VECTOR SPACE. INTERNALLY VECTORS ARE 2 WORDS
LONGER THAN THEY APPEAR TO THE USER. THE FIRST WORD CONTAINS THE
USE THE LENGTH AND THE BLOCKLEN AND THE LAST WORD IS AN ENDOFVEC OBJECT.
INTERNALLY MOST VECTOR INDEXES POINT TO THE SECOND WORD OF THE
VECTOR.
FOR STRINGS THE FIRST 4 CHARACTERS ARE USED FOR THE USE COUNT BLOCKLEN,
AND LENGTH.

SYMTABLE ISA HASH TABLE FOR CELLS, IT HAS LINKED LIST BUCKETS.

OTHER IMPORTANT PROCEDURES

SEE(CELL INDEX) IS A BOOLEAN PROCEDURE SAYING WHETHER THE NEXT ELEMENT IN VEC IS THE ATOM INDEXING THE SAME CELL.
GETNEXTVECTORELT(MESSAGE VECTOR) MOVES THE ENDING OF THE VECTOR TO THE NEXT NON-COMMENT UNLESS AT THE END OF THE VECTOR.

VECEVAL: USED TO EVALUATE A VECTOR.

SETUP: DOES SETUP FOR WHEN AN OBJECT TAKEN OUT OF A VECTOR IS GIVEN CONTROL. DOES THE IMPLICIT EVALUATION OF ATOMS AND VECTORS. ALSO THE CHECKING FOR THE ESCAPE COMMANDS /// AND DONE.

EVALPIECE: USED TO EVALUATE A PIECE.

EVALOBJECT: USED TO EVALUATE AN OBJECT. FAKOS AND USER OBJECTS ARE HANDLED SEPERATELY. JUMPTOFAKO IS JUST A LARGE CASE STATEMENT. TO EVALUATE A USER OBJECT FIRST A CONTEXT FRAME IS PUSHED AND THE DEF VECTOR IS EVALUATED. THEN IF THERE ARE FURTHER DEF VECTORS FROM HIGHER ORDER CLASSES OF THIS OBJECT THEY ARE EVALUATED IN TURN. THIS EVALUATION OF DEF VECTORS CONTINUES UNTIL EITHER A VALUE IS RETURNED BY ONE OF THE DEF VECTORS, AN ERROR OCCURES, OR THERE ARE NO MORE DEF VECTORS.

NEXT THE CONTEXT FRAME IS POPPED.

TRACING AND ERROR RESPONSE ARE ALSO DISPATCHED FROM EVALOBJECT.

PUSHFRAME: SETS UP A CONTEXT FRAME, INITIALIZING MESSAGE WHO, WHONAME, AND TOPWHO. IT BINDS THE VARIABLES FOR THE FRAME AND USES AN AUXILLIARY PROCEDURE PFBIND TO BIND THE VARIABLES FOR HIGHER ORDER CLASSES. IT ALSO EXTRACTS THE DEF VECTOR FOR EVALOBJECT.

POPFRAME: UNDOES THE WORK OF PUSHFRAME.

BIND: BINDS A SET OF VARIABLES. FOR EACH CELL IN THE MODEL VECTOR THE CURRENT VALUE OF THE CELL IS PUT IN THE PREVVEC AND THE NEW VALUE FROM THE VALUE VECTOR IS PUT IN THE CELL.

LBIND: IS BIND FOR LOCAL VARIABLE.

UNBIND: REVERSES THE EFFECT OF BIND. FOR EACH CELL IN THE MODEL VECTOR THE PREVIOUS VALUE IS RESTORED.

ADDGLOBAL: CREATES A NEW GLOBAL VARIABLE. GLOBAL VARIABLES ARE KEPT AS LOCAL VARIABLES IN THE GLOBAL CONTEXT FRAME. NEW VARIABLES ARE INITIALIZED TO HAVE THE VALUE "NO VALUE".

CELLFIX: GETS THE VALUE OF A CELL. IF IT IS AN IMPLICIT VARIABLE IMPLICITFIX IS CALLED. IF THE ACD FOR THE CELL IS NOT THE CURRENT ACD THEN THE ACCESS CHAIN FROM CURRFRAME IS SEARCHED UNTIL THE CURRENT VALUE OF THE CELL IS FOUND.

IMPLICITFIX: GET THE VALUE OF AN IMPLICIT VARIABLE FROM CURRFRAME.

IMPLICITASSIGN: ASSIGNS VALUES TO IMPLICIT VARIABLES. IT CHECKS THAT THE OBJECT IS A VECTOR AND CALLS FIXVARS IF NECESSARY.

FIXVARS: THE IVARS AND CVARS VECTORS ARE STORED IN TWO PLACES (IN THE VALUE VECTOR OF THE CVARS AND ALSO AS MODEL VECTORS IN THE OBJECT VECTOR) SO WHEN THEY ARE CHANGED BY ASSIGNMENT THE OTHER COPY MUST ALSO BE CHANGED. THIS IS WHAT FIXVARS DOES.

COPYSTUFF: IS USED WHEN THE CVARS OR IVARS ARE CHANGED TO PRESERVE AS MUCH AS POSSIBLE OF OLD BINDINGS.

ANEW: CREATES A NEW OBJECT.

IF THE NEW OBJECT IS TO BE ABLE TO ACT AS A CLASS CLASSIFY IS CALLED. THEN THE VECTOR OF MODEL AND VALUE VECTOR PAIRS IS BUILT UP AND THE ISNEW VECTORS ARE EVALUATED. THEN THE INIT VECTOR IS EVALUATED. THE PROPER CONTEXTS ARE BOUND FOR THESE EVALUATIONS. AN AUXILLIARY PROCEDURE EVALISNEW IS USED FOR DEALING WITH THE HIGHER ORDER ISNEWS.

CLASSIFY: PARSES THE WITH VECTOR IN THE MESSAGE TO ANEW AND BUILDS

OTHER IMPORTANT PROCEDURES
THE CVARS VALUE VECTOR.

OTHER

SINIT/SMALL: IS A FILE WHICH IS FILIN=ED DURRING INITIALIZATION,
IT MAY BE USED TO PRINT MESSAGES TO USERS GETTING ON TO SMALLTALK,
OR AUTO LOADING OF CLASSES ETC.

THE MINIMUM SET OF FILES THAT SHOULD BE ON THE DISK TO USE SMALLTALK
ARE:

OSMALL/SMALL
ERMSG5/SMALL
EDITOR/SMALL
SINIT/SMALL (IF USED)
THESE ALL SHOULD BE UNLOCKED.

THE FOLLOWING FILES ARE USEFULL AND SHOULD EXIST UNLOCKED ON
DISK IF POSSIBLE:

OLISTER/SMALL (FOR LISTING MANUALS)
MANUAL/SMALL (USERS MANUAL)
IMPMAN/SMALL (IMPLEMENTERS MANUAL)

LABEL 00000000PRINTER00178193?USER#SITE ; EXECUTE LISTER /SMALL

LISTER /SMALL