Miscellany 12

This chapter will acquaint you with additional features of TUTOR and PLATO. See Appendix A for sources of additional information.

Other Terminal Capabilities

We have emphasized the keyboard and plasma display panel as the main input and output devices used in communicating with the student. Other devices which may be used include a projector of color photographs, a touch panel, a random-access audio playback device, and other specialized input-output devices. All of these terminal-associated devices are easily managed by TUTOR.

The plasma display panel is flat and transparent, which makes it possible to project photographs on the back, superimposing color photographs with plasma-panel text and line drawings. There exists a microfiche projector for the PLATO terminal which will project any of 256 color photos, with fractional-second access time to any of these 256 pictures. (A "microfiche" is a sheet of film carrying many tiny pictures.) Microfiches can be made from a set of ordinary 35mm slides. Students or teachers can insert the appropriate microfiche in the terminal for the subject to be studied. The -slide- command selects any of the 256 photos: "slide 173" will project the 173rd photo. Additional options on the

-slide- command permit the independent control of a shutter in the projector.

The touch panel is a device which puts a grid of 16 vertical and 16 horizontal infrared light beams just in front of the plasma panel. When a student points at the panel, he breaks a horizontal and vertical beam. The information as to which beams were broken is sent to the computer as a "key" and the lesson can use this information to move a cursor, choose a topic pointed at, etc.

We discussed in Chapter 8 how to know where the student touched the screen. Another way is to use the information in the system variable "key", which contains the last "key" input from the student, whether it came from the keyboard, the touch panel, or some other external input device. Here is a unit which will analyze the inputs:

```
unit    getkey
next    getkey
enable
pause
goto    (key $ars$ 8),x,keyset,touch,extin,x
write   Impossible!
unit    keyset
write   You pressed a key
        on the keyboard.
*
unit    touch
calc    x⇐(key $ars$ 4) $mask$ o17
        y⇐(key $mask$ o17)
write   You touched location
        x=⊲s,x⊳,y=⊲s,y⊳.
*
unit    extin
write   The external input
        was ⊲s,key $mask$ o377⊳
```

The -enable- command permits touch inputs as well as inputs from any device connected to the external input connector at the back of the PLATO terminal. (The external input device might be a temperature sensor, an analog-to-digital converter, etc.) Without an -enable- command these inputs are ignored. A -disable- command will also cause inputs to be ignored. The system variable "key" contains a 1∅-bit integer (see the section on bit manipulations in Chapter 9): the most significant or left-most two bits identify the source of the key (∅ for keyset, 1 for touch panel, 2 for external input), and the least significant or right-most eight bits contain the actual data (which keyset button, which touch panel beams, what external data). In the case of the touch panel, the eight data bits contain four bits of x and four bits of y to specify a position. A succession of external inputs can also be retrieved with a single -collect-command.

If an -enable- command is placed just after an -arrow-, touch inputs can be accepted. There is a -touch- judging command whose tag specifies a screen location (and optionally a spatial tolerance). The -or- command is particularly useful here:

```
.
.
arrow    2513
enable
touch    1215
or
answer   book
write    Yes, "libro" means book.
```

The student will get the same message whether he or she types "book" or points at a picture of a book displayed at location 1215. (The -or-command can be used to make synonomous any judging commands. The system variable "anscnt" will be the same for all judging commands linked by -or-.)

There is a random-access audio device which stores twenty minutes of speech, music, or other sounds. Segments as short as one-third second can be accessed in a fraction of a second, no matter where the segment is located on the twenty-minute magnetic disk. As with microfiche, students can change the disks themselves. There is a -play- command to choose a section of the disk to play music or talk to the student.

Other devices can be connected to the external output connector at the back of the PLATO terminal and controlled with the -ext- command. The -ext- command can send up to sixty 16-bit quantities per second to a device. Among the interesting devices using this capability is a "music box" that plays four-part harmony.

Student Response Data

A crucial aspect of TUTOR on the PLATO system is that student response data can be collected easily to aid authors in improving lessons. Detailed information can be collected: unanticipated "wrong" responses (which may have been correct but inadequately judged), requests for help, words not found in a -vocabs-, etc. Summary information can also be collected: amount of time spent in an area of a lesson, number of errors made, number of help requests, etc. These detailed and summary data provide an objective basis for revising lessons.

A -dataon- command in a lesson turns on the automatic data collection machinery. Students registered in courses with associated response data files will have their responses logged in their data files. When registering students in a course, specific data collection options can be chosen. For example, one might collect only responses judged "no" (unanticipated incorrect responses). Anticipated correct responses (judged "ok") and anticipated incorrect responses (judged "wrong") would not be logged. This is often done because the anticipated responses are precisely those for which the lesson is already replying in a detailed, appropriate manner to the student. Here we see the difference between judge "no" (unanticipated) and judge "wrong" (anticipated). In this connection, -wrong-, -wrongv-, and -wrongu- make a "wrong" judgment, whereas the -no- command makes a "no" judgment.

The -area- command is used to divide a lesson into sections, each of which will produce an area summary in the data file. Each time the student encounters another -area- command, a summary of the previous area is placed in the data file. The area summary includes student name, area name, amount of time spent in the area, number of -arrow-s, number of ok/wrong/no responses, number of helps requested and found, etc. This summary data makes possible a statistical treatment of lesson data which can pinpoint weak areas.

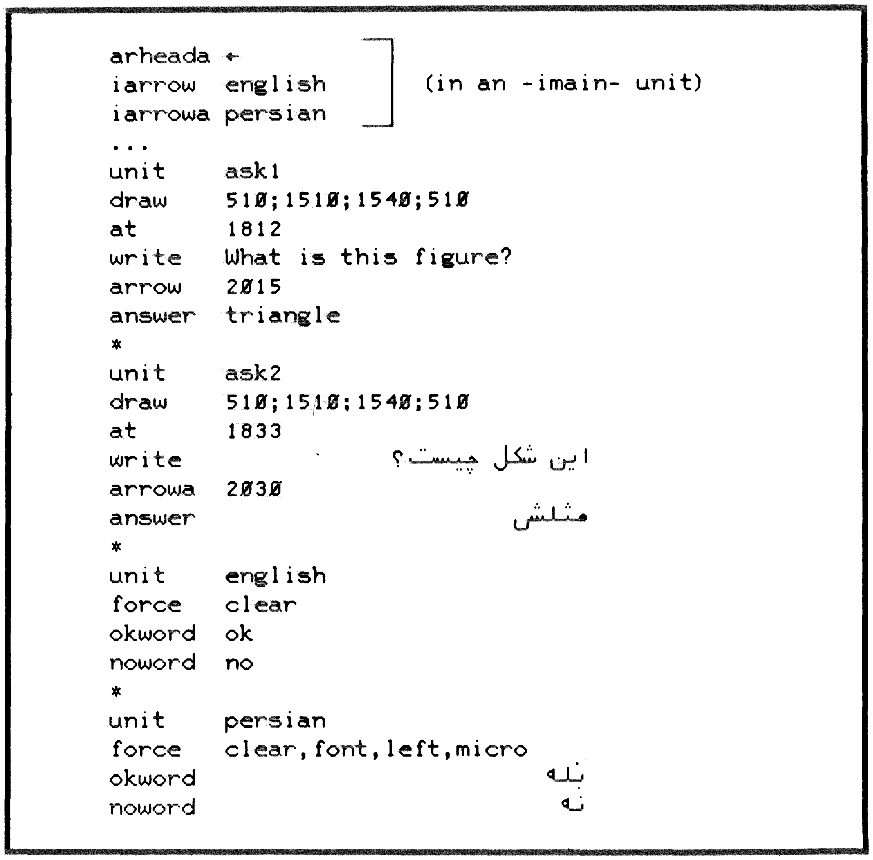
The -output- and -outputl- commands permit you to write your own information and messages into the datafile. This supplements the automatic data logging invoked with -dataon- and -area-.

While PLATO provides a standard mechanism for looking through data files (including sorting the data), you can also read back this information and process it yourself. For example, the -readd- command will read area summaries or -outputl- information from a datafile previously specified by a -readset- command.

Additional Tools for Teaching Foreign Languages

Usually in a lesson on a language such as Russian, which uses a special alphabet, the student will answer some questions in English and some questions in the foreign alphabet. The responses in the foreign alphabet require a "force font", or a "force font,left" for leftward-going languages such as Arabic, Hebrew, and Persian. Sometimes a "force micro" option will also be required in order to re-order the keyboard. Since there may be several things different about the two kinds of -arrow-s, it is convenient to have an alternate -arrow- command, which is named -arrowa-.

The -arrowa- command can cue the student differently, because you can alter the arrowhead displayed by -arrowa- by using the -arheada- command. The -arheada- command is similar to the -okword- and -noword- commands (the tag is what will be shown). Just as an -iarrow- unit is associated with the -arrow- command, so the -iarrowa- command can be used to specify a unit associated with the -arrowa- command. Here is a typical setup:



```
arheada ←          ┐
iarrow  english    │   (in an -imain- unit)
iarrowa persian    ┘
...
unit    ask1
draw    51Ø;151Ø;154Ø;51Ø
at      1812
write   What is this figure?
arrow   2Ø15
answer  triangle
*
unit    ask2
draw    51Ø;151Ø;154Ø;51Ø
at      1833
write                        این شکل چیست؟
arrowa  2Ø3Ø
answer                                مثلث
*
unit    english
force   clear
okword  ok
noword  no
*
unit    persian
force   clear,font,left,micro
okword                                 بله
noword                                  نه
```

Fig. 12-1.

Unit "ask2" has an -arrowa- command, which is associated with unit "persian", the unit named in the earlier -iarrowa- statement. Unit "persian" clears out any existing -force- options and sets up the appropriate typing conditions for the student. Unit "persian" also redefines the words to be shown for correct and incorrect responses. The -answer- command in unit "ask2" has the Persian for triangle. The student will see a "←" instead of a " ⩾" as a cue to give a response, thanks to the -arheada- command. On the other hand, the standard -arrow- command in unit "ask1" has associated with it the -iarrow- unit "english", which clears the -force- options and sets the "ok" and "no" words to English words.

While this machinery is particularly valuable in language lessons, it is also useful whenever your -arrow-s fall into two rather different categories. An example might be a physics lesson in which some -arrow-s require sentence responses and other -arrow-s require algebraic or numerical responses.

Some additional TUTOR commands which are particularly helpful in foreign language lessons include -change-, -getword-, -getloc-, -getmark-, and -compare-. As an example of the -change- command, the statement "change symbol comma to word" (which must be placed in the initial entry unit) will change the normal meaning of a comma as an ignorable punctuation mark, so that the comma will be treated as a separate word. This is useful when teaching punctuation, where you want to check specifically for commas. The -getword- command is similar to -storen- and is used to pull apart the student's response into separate words. The -getloc- command will tell you where a particular student word is on the screen, so that you could draw a box around that word. The -getmark- command gives you information on how TUTOR marked up the student's response, including whether a word was incorrect, misspelled, or out of word order. The -compare- command permits you to check a student's word against a stored list of words (in a common, for example), including spelling aspects.

Routers and -jumpout-

A lesson can be designated as a "router" which routes students through the many lessons making up a complete course. A router is associated with a course. Students registered in a course which uses a router will upon sign-in be sent first to the router, not to the lesson specified by the restart information. A typical router might ask the student, "Do you want to resume studying the lesson you last worked on?" If the student says yes, the router executes a "jumpout resume", which means "jumpout" of this lesson into the lesson mentioned in the tag, with "resume" having the special meaning "resume at the restart point". If the student does not want to resume, the router might offer the student an index of available lessons. Suppose the student chooses a lesson on the list whose name is "espnum". Then the router does a "jumpout espnum" to take the student to that lesson. (The -jumpout- command can be conditional.) Upon completion of lesson "espnum", (by "end lesson") the student is brought back into the router. If the lesson executed a -score- command, the router can use the corresponding value of system variable "lscore" to help decide how to route the student. The router might ask the student what he or she wants to do next, or the router might immediately take the student to an appropriate lesson.

Generally speaking, -jumpout- commands should be placed only in routers, not in instructional lessons. Following this practice insures that lessons can be plugged into routers on a modular basis. An exception exists in the case where one instructional package is spread over two or three physical lessons, in which case -jumpout- is used to connect the lessons.

A router can use up to fifty "router variables" (vr1 through vr5Ø) which are not affected by the instructional lessons. These can be used to keep track of which lessons have been completed, how many times they have been reviewed, how much time was spent in each lesson, etc.

Instructor Mode

Authors write and test lessons, and students study these lessons. Instructors choose lessons from the library of available lessons to make up a course for their students. Instructors also register students, monitor their progress, leave messages for the class or for individual students, etc. There is an "instructor mode" which makes it easy for instructors to do these things without knowing the TUTOR language. The instructor mode is based on a router coupled with a mechanism for setting up a roster of students. The options available through this router are sufficiently flexible to make it unnecessary in most cases to write specialized routers.

Special "terms"

Authors have a number of special "terms" to help them in curriculum development. If you press TERM and type "step", you can step through your lesson one command at a time. (A continued -calc- counts as one command.) This is extremely helpful in tracking down logical errors in a lesson. After each step, you can check the present value of student variables. There is also a -step- *command* which will throw the lesson into the step mode. The step features are operative only for authors testing their own lessons.

"TERM-cursor" provides you with a cursor which you can move around the screen using the "arrow" keys. Press "f" for fine grid or "g" for gross (coarse) grid. Also press "f" or "g" to update the display of the current cursor location. This facility is useful for deciding what changes to make in the positioning of displays on the screen.

"TERM-consult" notifies PLATO consultants of your request for help. When a consultant becomes available, he or she will talk to you by typing at the bottom of your screen. The consultant's screen has the same display you have on your screen. It is as though the consultant were looking over your shoulder as you demonstrate the problem. You can talk to the consultant by typing sentences at -arrow-s or by hitting TERM and typing. (If you press NEXT, and you have typed eight or fewer characters, your sentence will be taken as a -term- to look for in the lesson. Otherwise your line is erased so that you can type some more.) The consultants not only know TUTOR well but they have also had a great deal of experience in helping authors.

"TERM-talk" asks you for the name of the person you want to talk to, then pages that person if the person is presently working at a PLATO terminal. The person called accepts the call by hitting TERM and typing "talk". The two of you can then talk to each other at the bottom of the screen, but neither of you can see what is on the rest of the other person's screen. If you want the other person to see all of your screen, press shift-LAB, which puts you into a mode similar to TERM-consult.

"TERM-calc" provides a convenient one-line desk calculator at the bottom of the screen. Authors get normal, octal, and alphanumeric results. To avoid confusion, students who use TERM-calc are not shown the octal and alphanumeric displays.

Appendices

Appendix A. Where to get further information

Appendix B. List of TUTOR commands

Appendix C. List of built-in -calc- functions

Appendix A
Where to Get Further Information

The document "Summary of TUTOR Commands and System Variables" by Elaine Avner lists each TUTOR command, gives the basic form of the tag, and notes any restrictions such as maximum number of arguments or maximum length of names. Lesson "aids" available on PLATO provides detailed interactive descriptions of each command, as well as a wealth of other information useful to authors.

Lesson "notes" on PLATO provides a forum for discussing user problems. You can write notes to ask questions or to suggest new features that would be helpful in your work. You can read notes written by other users, including replies to your notes. Replies to programming questions generally appear within one day. (For faster service, use TERM-consult.) An extremely important section of "notes" is the list of announcements of new TUTOR features. Check this section regularly for announcements of new TUTOR capabilities. The announcements are followed within a few days by detailed descriptions in "aids".

Sometimes "notes" will announce a *change* in the TUTOR language involving an automatic conversion of existing lessons. For example, at one time there were several different commands (-line-, -liner-, -figure-, and -figuref-) which did what -draw- now does. When -draw- was implemented, all existing PLATO lessons were run through an automatic conversion routine to change the old commands into appropriate -draw- commands. It is probable that other such refinements will be made in the future. Therefore, be sure to read notes and aids regularly.

Appendix B
List of TUTOR Commands

Display

- at,atnm
- write
- writec
- erase
- eraseu
- size
- rotate
- mode
- charset
- lineset
- micro
- char
- plot
- show
- showa
- showe
- showo
- showt
- showz

- draw
- box
- vector
- circle
- circleb
- dot
- window

- rorigin
- rat,ratnm
- rdraw
- rbox
- rvector
- rcircle
- rdot

- gorigin
- axes
- bounds
- scalex
- scaley
- lscalex
- lscaley
- labelx
- labely
- markx
- marky
- gat,gatnm
- graph
- hbar
- vbar
- gdraw
- gbox
- gvector
- gcircle
- gdot
- polar
- delta
- funct

- slide
- play
- ext

Calculations

- calc
- calcc
- calcs
- define
- do
- exit
- doto
- goto
- branch
- transfr
- zero
- set

- randu
- setperm
- randp
- remove
- modperm

- pack,packc
- move
- search
- compute
- itoa
- clock
- name
- course
- date
- day
- find
- findall

- common
- comload
- storage
- stoload
- initial
- reserve
- release
- sort
- sorta

Sequencing

- unit
- entry
- nextnow
- next,next1
- back,back1
- help,help1
- data,data1
- lab,lab1
- term
- base
- end
- restart

- imain
- finish

- do
- join
- exit
- goto
- jump
- jumpout

- eraseu

- nextop,next1op
- backop,back1op
- helpop,help1op
- dataop,data1op
- labop,lab1op
- termop

Student Responses

- arrow,endarrow
- iarrow
- arrowa
- iarrowa
- long
- jkey
- copy,edit
- force

- answer,wrong
- answerc,wrongc
- concept,miscon
- vocabs,vocab
- list,endings
- ansv,wrongv
- ansu,wrongu
- exact,exactc
- touch,touchw
- ok,no,ignore
- ans
- match
- specs
- or

- storea
- storen
- store
- storeu

- judge
- join

- bump
- put,putd,putv
- loada

- okword,noword

- eraseu

- getword
- getloc
- getmark
- compare
- change

Other

- pause
- catchup
- time
- step
- keytype
- group
- collect

- inhibit
- enable
- disable

- dataon
- area
- output
- outputl
- readset
- readd

- dataset
- datain
- dataout

Additional TUTOR Commands Not Discussed in This Book

abort	abort normal updating of common or student record
add1	add one to a variable
allow	allow an instructional lesson to use router common
altfont	use alternate font for all writing
backgnd	run lesson at lower priority
chartst	check whether charset already loaded
close	like -loada- but takes one character per variable
dataoff	turn off student response data collection
delay	timed blank output for precise display timing
exactv	character string match to student response
foregnd	run lesson at normal (non-background) priority
iferror	specify unit to go to if -calc- error
lesson	sets "ldone" to inform router about lesson completion
open	like -storea- but stores one character per variable
press	presses a key for the student
readr	read a student record for data processing
record	record a message on audio device
route	specify router units for end of instructional lessons
routvar	set up router variables
stop	like -back- but for the STOP key
sub1	subtract one from a variable
tabset	set up tabs for TAB key
timel	set a time within a lesson
timer	router sets a time for a lesson to finish
use	use sections of another lesson to prepare this lesson

Appendix C
List of Built-in-Calc-Functions

sin(x)	sine
cos(x)	cosine
arctan(x)	arctangent

Angles are measured in radians. For example, sin(45) means sine of 45 radians, but sin (45°) means sine of 45 degrees (Ø.7Ø7). The degree sign (MICRO-o) converts to radians. Similarly, arctan(1) is .785 radians, which can be converted to degrees by dividing by 1°, the number of radians in one degree; arctan(1)/1° is 45. Using the degree sign after a number is equivalent to multiplying the number by (2π/36Ø). π (MICRO-p) is 3.14159. . . .

sqrt(x)	square root; can also be written $x^{1/2}$ or $x^{.5}$
log(x)	logarithm, base 1Ø
ln(x)	natural logarithm, base e
exp(x)	e^x
abs(x)	absolute value; abs(−7) is 7
round(x)	round to nearest integer; round(8.6) is 9
int(x)	integer part; int(8.6) is 8
frac(x)	fractional part; frac(8.6) is Ø.6
sign(x)	+1 if x>Ø, Ø if x=Ø, −1 if x<Ø
=,≠,<,>,≤,≥	produce logical values (true=−1,false=Ø)
not(x)	inverts logical values (true↔false)
x and y	true if both x and y are true
x or y	true if either x or y is true (or both)
x cls y	circular left shift x by y bit positions
x ars y	arithmetic right shift x by y bit positions
x $mask$ y	sets bits where both x and y have bits set
x $union$ y	sets bits where either x or y has bits set (or both)
x $diff$ y	sets bits where x and y differ (exclusive union)
bitcnt(x)	counts bits

The logical operators (=, ≠, <, >, ≤ and ≥) consider two quantities to be equal if they differ by less than one part in 1Ø^{11} (relative tolerance) or by an absolute difference of $1Ø^{-9}$. One consequence is that all numbers within $1Ø^{-9}$ of zero are considered equal. Similarly, "int" and "frac" round their arguments by $1Ø^{-9}$ so that int(3.999999999) is 4, not 3, and frac(3.999999999) is Ø, not 1. This is done because a value of 3.999999999 is usually due to roundoff errors made by the computer in attempting to calculate a result of 4.

System Variables

DISCUSSED IN THIS BOOK

anscnt
args
clock
formok
jcount
key
opcnt
spell
station
varcnt
vocab
where
wherex
wherey

NOT DISCUSSED IN THIS BOOK

baseu
capital
dataon
entire
error
errtype
extra
judged
ldone
lscore
lstatus
mainu
mode
nhelpop
ntries
order
phrase
size
user
wcount
zreturn

aarea
aarrows
ahelp
ahelpn
aok
aokist
asno
aterm
atermn
atime
auno

The third column consists of counters associated with the -area- command.

There are some additional system variables available for special purposes. See the on-line PLATO aids for information.

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