

## HOW I LEARNED TO TALK TO COMPUTERS (AND TO GIRLS)

When I was about your age, my dad took me to the top of a high hill. Waving his hand toward the setting sun he said, "Across this vast wasteland..."

"It's a parking lot, Dad."

"Look harder, son. Ahem. Across this vast wasteland stands the Ancient Stronghold of the Osmosian..."

"It's a Walmart, Dad."

He sucked in a deep breath through his nose. I could tell he wasn't happy. I looked harder.

"Better," he smiled. Then he handed me a rubber finger tip. Said it would help with turning the pages.



WALMART

"Now where was I?" he said. "Ah, yes. The Osmosian Order of Plain English Programmers. Where the fires of The Once and Future Art are kindled in the hearts of the Chosen Few."

Then he turned, put his hands on my shoulders and looked deeply into my eyes. "You, my son, are one of those Chosen Few."

wow. Me, chosen! "Your wish is my command, m'Lord!" (I was starting to get into it.)

"Now don't forget to write," he said, handing me a blue pen and a yellow note pad. "Your mother will be worried about you." And with a quick hug, he was gone.

This is the pen, and this is the pad, and these are the letters I wrote.



yo, Mom!

You'll be glad to know I made it past the dragons and met an Osmosian Master named Old Ben just inside the Magic Gates.

He asked me if I had a computer at home with windows on it and I said I did. Then he said, "Excuse me a moment," picked up his cane, limped out to the parking lot Vast wasteland and spat on the ground.

When he came back he asked me if I could type with more than just my thumbs and I told him I could. He looked me up and down and then said, "Amazing."

Then he asked me if I was good at math. I was going to say yes but remembered you said it wasn't good to lie so I said no. And he said, "No problem. I'm not good at math either."

The Master had a wench by his side who was about my age. She was kind of cute but didn't look very bright.

She was scribbling on a pad of purple sticky notes. With a purple pen! Girls are so girly.

Old Ben said that if I had any letters to mail she'd put them in the box for me. I said, "Great. One less thing." The wench giggled.

Then the Master took us all the way to the very back of the ~~store~~ Stronghold to the Inner Sanctum. It would have been a long walk even if he wasn't limping the whole way.

When we got there we saw a big silver ~~door~~ Gate with a sign that said "Employees Osmosians Only." Old Ben gave it a shove with his cane and in we went.



Hello, Isaac's Mom!

Your son sure has a vivid imagination.

Old Ben is my grandfather and he taught me to program a couple of years ago.

He works as a greeter at the store and helps kids with computers in the break room -- the mysterious "Inner Sanctum"

-- Becky (the wench)



The name  
of this dragon is  
PRIDE.

The only light in the Inner Sanctum was the glow from an ancient desktop computer.

I couldn't see what was in the darkness beyond, but I could hear the fitful rumblings of ~~forttiffs~~ captured dragons sure enough.

I noticed the computer had two monitors but only one keyboard and only one mouse. When I pointed this out to Old Ben he said that Osmosians always program in pairs, Master and Padawan.

Then he told ME to sit by the keyboard, and the wench to sit by the mouse.

"Cool," I thought. "Who's the Master now?"

I was thirsty so I asked for some water. But Old Ben handed me a big Golden Key instead. He said it would open any lock in the whole Osmosian Empire.

Then he pointed one of his bony fingers at a slot on the computer and I stuck it in. The Key, I mean, not the finger.

After a while a window popped up. Ben said to do whatever I needed to do to see the files on the Key. It wasn't easy because, as you know, every version of windows is different. And the Master wouldn't help.

In fact, every time anybody mentioned "windows" he'd spit out a giant loogie. If the wench wasn't so fast with that five-gallon ~~bucket~~ urn the Inner Sanctum would have been a real mess.



I've enclosed  
a Golden Key with  
this letter in case you  
want to follow along with  
the lessons at home.

-- Becky

When I finally got the Golden Key opened up,  
I could only see two things on it:

1. Something called "my stuff" that looked like  
a folder. Old Ben said we'd deal with that  
later, once we got rid of windows (pa-tewie).

2. The other thing was called the CAL-4000.  
He said that CAL stood for "Compiler and  
Linker" (or something like that -- I was  
still thinking about how thirsty I was) and  
that the CAL was the heart and soul of the  
whole Osmosian Empire.

He said the CAL would not only make windows  
go away (pa-tewie) but could translate stuff  
we said in Plain English into bits and bytes the  
computer could understand. Then he said to  
double-click the CAL-4000 and when I did I  
forgot all about how thirsty I was.

I can't draw a picture of  
what you might see on  
Windows because,  
as your son says,  
everybody's version is  
different. Makes even me  
want to spit.

-- Becky

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4 items

c:\ (hard disk / flash drive)

d:\ (recovery)

e:\ (cd-rom / dvd drive)

f:\ (golden key)

I think  
ELEGANT  
is the word for it.

-- Becky

I forgot how thirsty I was because the circus that you see on the heads of all the computers in our village simply disappeared. And because I had never seen a computer with such a simple and honest face.

Check it out yourself -- that's the CAL in the background. (Ben showed me how to print the screen so I wouldn't have to write so much. I'm really starting to like the old guy.)

He said that in the CAL's world, there are no overlapping windows with gaudy frames. No misleading menu names. No screen-eating scroll bars where up means down. No toolbars, font bars or any other kind of bar. No goofy dialogs loaded with buttons and check boxes. And no tear-off palettes full of obscure icons.

"With Osmosians," he said, "less is more."



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4 items

c:\ (hard disk / flash drive)

d:\ (recovery)

e:\ (cd-rom / dvd drive)

f:\ (golden key)

Then he started tapping on the screen with the eraser end of a pencil.

"Alphabetical menus at the top," he said.

"And a place for messages (tap, tap) in the upper right corner."

"The middle of the screen (tappity, tap, tap) is where we work with our files. As you might expect, we call this the work Area."

"There are many work Areas, and the tabs at the bottom (tap, tap, tap) let us select which area we want to use at any given time. Though one is usually enough for a padawan."

And the wench giggled.

c:\ (hard disk / flash drive)  
 d:\ (recovery)  
 e:\ (cd-rom / dvd drive)  
 f:\ (golden key)

Your list will  
 be different, but that's  
 okay. The Golden Key is  
 the only thing we'll be  
 using.

"What's that list of goofy stuff IN the work  
 area," I asked.

"Those are the storage devices on this  
 machine that the CAL recognizes," he replied.  
 Then he took a deep breath in through his  
 nose like Dad does when he's not happy.

"Windows (pa-tewie) gives each device an  
 obscure name consisting of a letter, a colon,  
 and a backslash. The problem is you can't  
 count on the letters staying the same. They  
 change as you insert and remove devices (like  
 the Golden Key). But we're stuck with them.

I thought he was going to do some more  
 spitting, but instead he said, "Double-click  
 that Golden Key and let's move on."

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2 items

f:\my stuff\

f:\cal-4000.exe

When I opened up the Golden Key I saw the same two things that I had seen in Win—well, you know, the other place.

The Master said that the backslash on the end of "my stuff" meant there were more files inside.

And that the ".exe" on the end of the CAL meant that it was an "executable" file — something that the computer can actually understand and run.

He said that windows required the backslashes and the ".exe"s and the wench had to fetch the urn again.

He also said that I could see all the bits and bytes inside the CAL's brain just by opening it up (double-clicking it). So I did.

f:\

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00000000 4D 5A 00
00000010 00 00 00
00000020 00 00 00
00000030 00 00 00
00000040 00 00 00
00000050 00 00 00
00000060 00 00 00
00000070 00 00 00
00000080 00 00 00
00000090 00 00 00
000000A0 00 00 00
000000B0 00 00 00
000000C0 00 00 00
000000D0 00 00 00
000000E0 00 00 00
000000F0 00 00 00
00000100 50 45 00
00000110 00 00 00
00000120 E8 C9 01
00000130 00 20 00
00000140 04 00 00
00000150 00 90 00
00000160 00 00 10

```

Turns out CAL's brain is really complicated. It hurt my head just to look at it. You can see for yourself here in the background. And that's just the first 20 lines or so. Ben said there were about 50,000 lines in all.

He also said that the wench could scroll around CAL's head by pushing with the mouse while holding the right button.

And that I could jump around in there using the HOME, END, PAGE UP, and PAGE DOWN keys.

But I was feeling a little queasy, so I closed him up (Close is on the C menu).

And the wench giggled. which made me turn a little red. But still. C'mon. who wants to look inside someone else's brain all day?

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00 00 MZ.....
00 00 .....@.....
00 00 .....
00 00 .....
00 00 .....
00 00 .....

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"A little red"?  
More like a ripe tomato.  
But I shouldn't have  
laughed. It was rude.  
I brought him a bottle of  
water to make up for it.

-- Becky

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2 items

f:\my stuff\

f:\cal-4000.exe

So we were back to this screen and the Master said that it was time to see what was in the "my stuff" directory.

"Directory?" I asked.

"Directory, folder, container — whatever you want to call it," he said. "Directory is the official windows term." Pa-tewie.

Boy that wench was quick.

I double-clicked "my stuff".

f:\

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z 4 items

f:\my stuff\bible.txt

f:\my stuff\goal.exe

f:\my stuff\stuff the ancient masters have passed down to us so we don't have to start from scratch every time

f:\my stuff\stuff written by a padawan

There were four things in "my stuff" —

1. A file called "bible.txt" that Old Ben said was the whole Bible in the form of a text file. I didn't ask about the ".txt" on the end cause I was pretty sure it meant "text file" and because, well, y'know.

2. A file called "goal.exe". Since it had ".exe" on the end I figured somebody's brain was inside there all coded up in machine language and I made a mental note not to open it.

3. A file with a really long name that Old Ben told me was one of the most precious things in the whole Osmosian Empire. And...

4. A file called "stuff written by a padawan". The Master said that I would be writing my very own programs inside that very file before very long.

"But first," he said, "we need to know what we're aiming at."

my stuff\

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z 1 item

f:\my stuff\bible.txt

f:\my stuff\goal.exe

f:\my stuff\stuff the ancient masters have passed down to us so we don't have to start from scratch every time

f:\my stuff\stuff written by a padawan

Rename...

Reverse

Run

R

"Click that goal.exe," he said, and I flinched.

"A single-click," he said. We're not going to open it, we're going to run it. So click it, then select the Run command from the menu."

I clicked it — just once — and it turned a darker gray. I figured Run would be under R, and it was, so I selected it.

And I was amazed for the second time.

The R at the right of the RUN command is called a "keyboard shortcut."

If you hold the CTRL or ALT key and press R the CAL will execute the RUN command.

my stuff\

I can't show you what the screen looked like  
cause this program is for Osmosian Eyes Only.  
But it was awesome. It did 26 different  
things, one for each letter of the alphabet.  
Old Ben is kidding himself if he thinks I can  
write programs like that. Anyway, the wench  
and I played with it until somebody said  
something about pizza.

Tell Dad I'm having fun. The ~~ladies at the deli~~  
Kitchen Maids let us eat all the leftover  
stuff we want. And Old Ben had the wench  
fetch a sleeping bag from the ~~camping~~  
~~department~~ Storehouse so I could sleep in my  
own private ~~shelf~~ Cell near the Inner  
Sanctum. Tell Dad it's kind of like camping,  
but without the mosquitoes.

I'll write again tomorrow.

Isaac

"Osmosian Eyes Only."

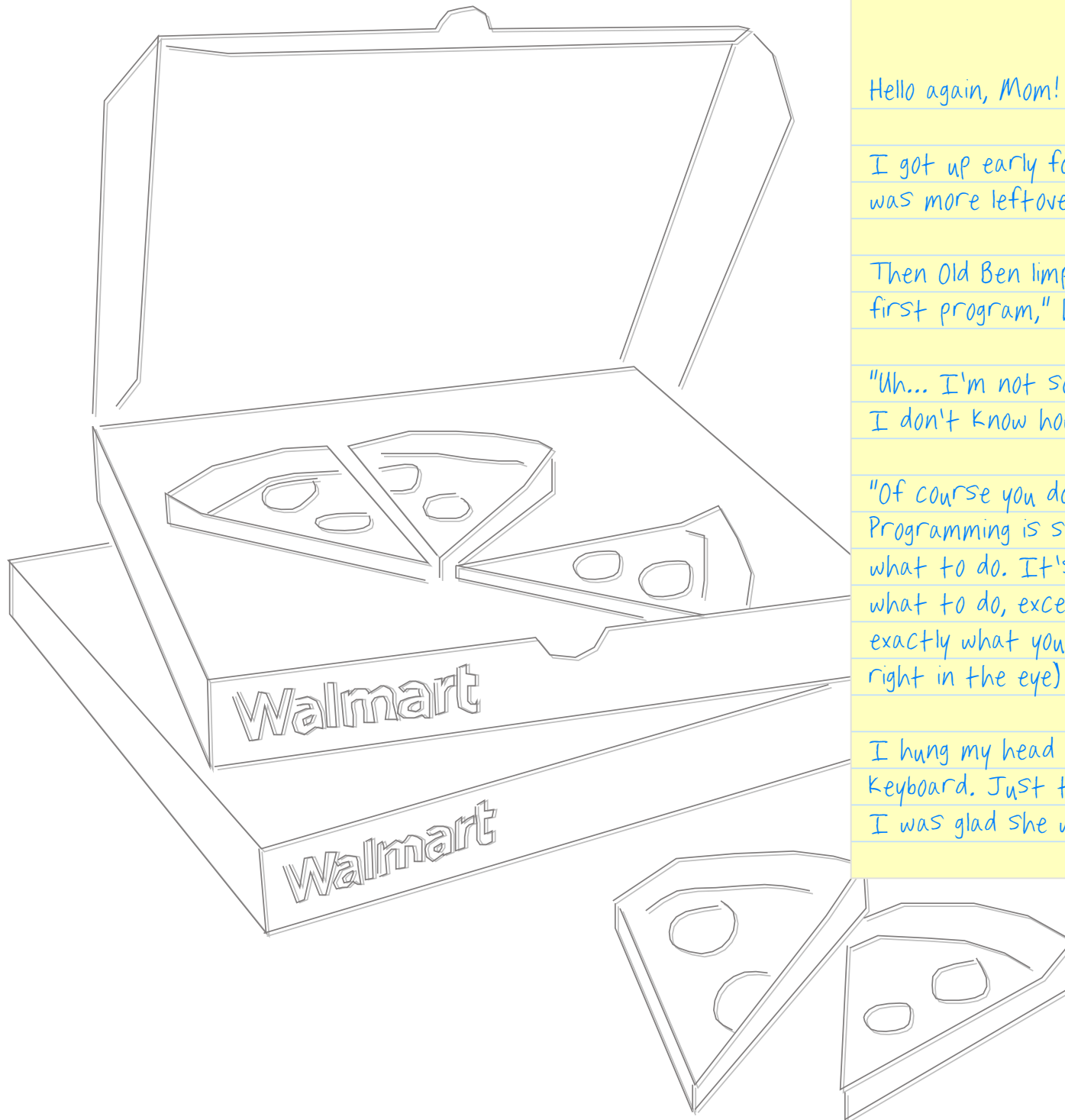
That's a good one.

Just run the "goal.exe"  
like he did and you'll see  
the whole thing.

It's pretty impressive.

-- Becky





Hello again, Mom!

I got up early for breakfast but all they had was more leftover pizza. It was great.

Then Old Ben limped in. "Time to write your first program," he said cheerfully.

"Uh... I'm not so sure about that, Master. I don't know how to write programs."

"Of course you do," he said with a sigh. Programming is simply telling the computer what to do. It's just like telling a person what to do, except the computer always does exactly what you tell it. And (he looked me right in the eye) it never whines."

I hung my head and sat down at the keyboard. Just then the wench came in. I was glad she was late.

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4:1

To do awesome stuff:  
Clear the screen.  
Wait for 3 seconds.

This time we opened up the file called "stuff written by a padawan". There was only one line in it. The Master said that all Osmosian programs start with that line because all Osmosian programs are awesome.

He said to add two more lines: one to clear the screen, and another to wait 3 seconds.

The Wench clicked the mouse and I figured that was my cue to start typing. You can see what I typed in the background. I was pretty sure it wouldn't work. But I told the Wench to select the Run command from the R menu anyway. She said it was quicker if I just held the CTRL key and hit R, so I did.

And it worked! The screen went black, stayed that way for 3 seconds, and then the CAL came back. Ben was right. It was awesome.

The Master said he had to pee.

The CAL is pretty good with basic English.

We could, for example, have said "erase" instead of "clear" or just "wait" place of "wait for".

But the CAL is fussy about punctuation. He wants colons and periods where they belong.

And he doesn't like numbers spelled out: he wants 3, not "three".

stuff written...

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z 4:1

To do awesome stuff:  
Clear the screen.  
Wait for 3 hours.

I didn't mention it before but the Master had to relieve himself a lot. And it took forever for him to do it. So I changed the line that said "wait for 3 seconds" to "wait for 3 hours," you know, just as a little joke.

But then, without really thinking, I hit CTRL-R and the screen went blank. And it stayed that way. And stayed that way. What's worse, the Wench giggled.

I hit some keys but nothing helped. I peeked out the Silver Gate and saw Old Ben limping our way. "What are we going to do?" I said.

"I thought you'd never ask. Hold the ALT key, press TAB, and let go. That will bring us back to the CAL. Then I'll execute the Stop command from the S menu and all will be well."

I could have kissed her.

Save S  
Save All  
Select All A  
Sort...  
Stop

Whenever your program gets stuck:  
ALT-TAB back to the  
CAL and select  
the Stop command.  
Don't forget the Stop  
command or your next  
Run won't work.

stuff written...

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

4:1

To do awesome stuff:

Clear the screen.

Wait for 300 grains of sand.

The CAL is pretty good  
with units of measure.  
He knows that 1 second  
and  
1000 milliseconds  
and  
100 grains of sand  
are all the same thing.

Old Ben came in. I don't know if he saw the word "hours" on the screen, but I think he did because he winked at the wench.

Then he pulled a tiny hour glass out of his pocket and set it on the table. Grains of sand started falling from the top to the bottom. After staring at it for a while he said, "I think we've got about 100 grains per second. See what the CAL does with that."

I had no idea what he meant, but the wench whispered in my ear and I changed the "3 hours" thing to "300 grains of sand." You can see the changes in the background here.

Then I hit CTRL-R and, to my surprise, it worked. Blank screen, 3 seconds, back again.

Awesome.

stuff written...

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

4:1

To do awesome stuff:  
Clear the screen.  
Wait until we hit the escape key.

The Master stroked his beard.

"I think it would be better," he said, "if we could keep the screen blank for as long as we want -- and get back to the CAL whenever we want. We can't do that with a timer."

I stroked my chin and nodded intelligently.

"Change that last line so the computer will wait until we hit the escape key," he said.

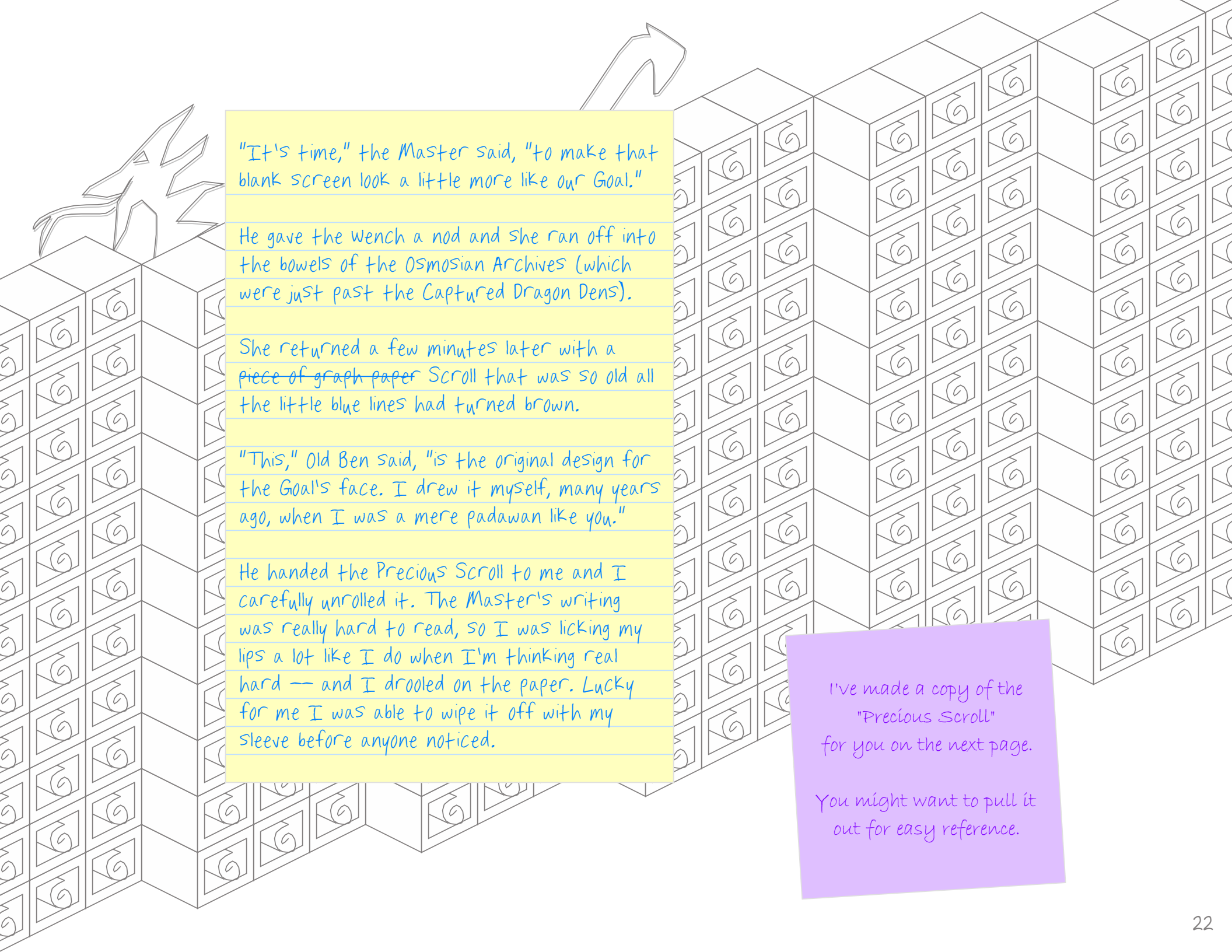
I thought that was a little wordy, but I typed it in anyway. I ran the program and the screen went blank. And stayed blank. Until I hit the ESC key which took us back to the CAL (the escape key on my keyboard was marked ESC).

"Sweet," I thought. "Who's in control now?"

"Wait for the escape key" also works (and is less wordy).

"Wait on that there key with the ESC on it" works if you can type with a southern accent.

stuff written...



"It's time," the Master said, "to make that blank screen look a little more like our Goal."

He gave the wench a nod and she ran off into the bowels of the Osmosian Archives (which were just past the Captured Dragon Dens).

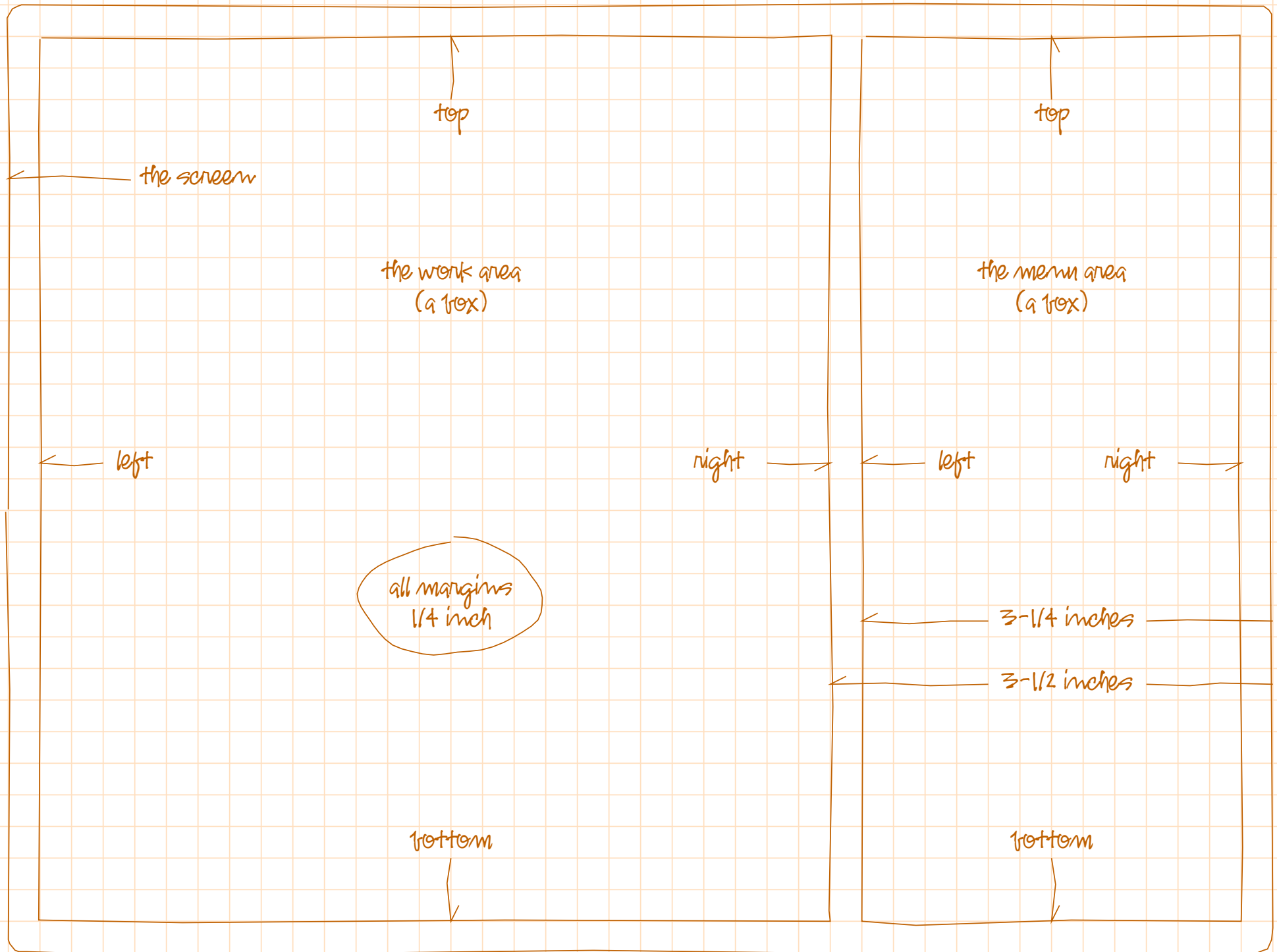
She returned a few minutes later with a ~~piece of graph paper~~ Scroll that was so old all the little blue lines had turned brown.

"This," Old Ben said, "is the original design for the Goal's face. I drew it myself, many years ago, when I was a mere padawan like you."

He handed the Precious Scroll to me and I carefully unrolled it. The Master's writing was really hard to read, so I was licking my lips a lot like I do when I'm thinking real hard — and I drooled on the paper. Lucky for me I was able to wipe it off with my sleeve before anyone noticed.

I've made a copy of the  
"Precious Scroll"  
for you on the next page.

You might want to pull it  
out for easy reference.



▶ The work area is a box.

To do awesome stuff:  
Clear the screen.

▶ Set up the work area.  
Wait until we hit the escape key.

I'm going to start  
marking new sentences  
with little lavender arrows  
so they'll be easier to spot.

You can thank me later.

"Let's start with the work Area," said the Master. Tell the CAL that the work area is a box right at the top of our file."

The wench clicked at the very top left of our text and I hit the ENTER key a couple of times to make some room. Then she clicked again, right at the top left (she was quick) and I typed what you see in the background.

"Now add another line," he said, "right after the one that clears the screen, telling the CAL to set up the work area."

The wench clicked at the end of the "clear the screen line," I hit ENTER, and I typed the sentence you now see there.

"Is that all there is to it?" I asked.

"Run it and let's see," he said.



Error in stuff written by a padawan. I don't know how to 'Set up [box]'.

M'kay

The work area is a box.

To do awesome stuff:

Clear the screen.

Set up the work area.

Wait until we hit the escape key.

So I ran the program and the CAL clucked and put up a big red error message right where the menus were supposed to be. You can see it for yourself above.

"Apparently that's NOT all there is to it," the Master chuckled.

"Ya think?"

"Let's look closer. 'Set up the work area' is highlighted, so that must be the sentence the CAL is having trouble with. But he clearly understands that the work area is a box because he said [box] in the message instead of 'work area'. So it seems we simply need to teach him how to set up the work area."

Then he told the wench to get rid of the error message, and she did.

You can dismiss error messages by clicking the "M'kay" button or by pressing the ESCAPE key.

stuff written...

The work area is a box.

To do awesome stuff:

Clear the screen.

Set up the work area.

Wait until we hit the escape key.

▶ To set up the work area:

▶ Put the screen's left plus 1/4 inch into the work area's left.

▶ Put the screen's top plus 1/4 inch into the work area's top.

▶ Put the screen's right minus 3-1/2 inches into the work area's right.

▶ Put the screen's bottom minus 1/4 inch into the work area's bottom.

In the CAL's world,  
an inch is an inch on  
all printers and on  
96 pixel-per-inch screens.  
If your screen is  
non-standard, your  
inches will be too.  
Sorry.

Old Ben got up and limped off toward the  
~~hardware department~~ Blacksmith's Shoppe.  
He returned with a hammer and some nails.

Then he snatched the Precious Scroll from  
the table and nailed it to the wall. (I guess  
drooling on it wasn't so bad after all.)

He took up his cane and with a lot of pointing  
and tap-tapping and long-winded explanations  
about how far this line was from that line, he  
had me type in the stuff you see at the left.

When I was done I ran the program, but all  
that happened was the screen went blank,  
and stayed blank, until I hit the escape key.

"Great," I said. "All that work for nothing."

"Patience, my padawan," he said, "Patience."

The work area is a box.

To do awesome stuff:

Clear the screen.

Set up the work area.

▶ Outline the work area with the gold pen.

▶ Refresh the screen.

Wait until we hit the escape key.

To set up the work area:

Put the screen's left plus  $1/4$  inch into the work area's left.

Put the screen's top plus  $1/4$  inch into the work area's top.

Put the screen's right minus  $3-1/2$  inches into the work area's right.

Put the screen's bottom minus  $1/4$  inch into the work area's bottom.

I groaned. "What's the point of typing all that stuff in if it doesn't do anything? And if it does do something, shouldn't we make sure it works before we get too much of it?"

He raised an eyebrow.

And then the wench said — get this — the WENCH said, "He's right, ~~Grampa~~ Master. You always say an Osmosian never writes more than a dozen sentences without testing."

"Out of the mouths of babes," he said. "Okay. We'll add a couple of lines so we can see some results. But we'll have to move them later. Tell the CAL to outline the work area with the gold pen right after the work area is set up. Then tell him to refresh the screen."

Type, type, run. It was awesome. But not as awesome as the wench thinking I was right.

The work area is a box.

To do awesome stuff:

Clear the screen.

Set up the work area.

Outline the work area with the gold pen.

Refresh the screen.

Wait until we hit the escape key.

To set up the work area:

Put the screen's left plus  $1/4$  inch into the work area's left.

Put the screen's top plus  $1/4$  inch into the work area's top.

Put the screen's right minus  $3-1/2$  inches into the work area's right.

Put the screen's bottom minus  $1/4$  inch into the work area's bottom.

"update the screen"  
also works.  
As does  
"Show it all"  
and  
"Reveal the canvas."

"Why do we have to say 'Refresh the screen' after we outline the work area?" I asked, and the wench ran for the ~~bucket~~ urn.

"If we draw directly on the screen," the Master said, "it blinks and flashes. Windows (pa-tewie) is bad at drawing on the screen."

"Oh," I said, a little sorry I asked.

He wiped his beard. "So we do all our drawing on a hidden canvas, like an artist, and when we're ready to show the world what we've got we turn the canvas around (so to speak) by saying, 'Refresh the screen.' "

"I get it," I said. "I bet a lot of people forget to say that and wonder why nothing is showing up on the screen."

"And that's a bet you'd win," he said.

The work area is a box.

The menu area is a box.

To do awesome stuff:

Clear the screen.

Set up the work area.

Set up the menu area.

Outline the work area with the gold pen.

Outline the menu area with the gold pen.

Refresh the screen.

Wait until we hit the escape key.

To set up the work area:

Put the screen's left plus  $1/4$  inch into the work area's left.

Put the screen's top plus  $1/4$  inch into the work area's top.

Put the screen's right minus  $3-1/2$  inches into the work area's right.

Put the screen's bottom minus  $1/4$  inch into the work area's bottom.

To set up the menu area:

Put the screen's right minus  $3-1/4$  inches into the menu area's left.

Put the screen's top plus  $1/4$  inch into the menu area's top.

Put the screen's right minus  $1/4$  inch into the menu area's right.

Put the screen's bottom minus  $1/4$  inch into the menu area's bottom.

I think  
he's starting to get it.

-- Becky

Old Ben tapped the screen. "Let's put a nice golden outline around the menu area as well."

"I know how to do that," I said (peeking at the wench out of the corner of my eye).

So I added a line near the top of the file to let the CAL know the menu area was a box. The Master pursed his lips and nodded.

And I added two lines to the awesome stuff: one to set up the menu area, and one to outline it. The Master nodded more deeply.

Finally, I added a routine with the details of the set-up at the bottom. That took a while because I had to keep getting up to look at the diagram on the wall.

Then I ran it. It worked! Unfortunately, the Master had nodded off. So I looked over at the wench — and she smiled. It worked!

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24:1

GEN 1:1 In the beginning God created the heaven and the earth.

GEN 1:2 And the earth was without form, and void; and darkness was upon th

GEN 1:3 And God said, Let there be light: and there was light.

GEN 1:4 And God saw the light, that it was good: and God divided the light fr

GEN 1:5 And God called the light Day, and the darkness he called Night. And th

GEN 1:6 And God said, Let there be a firmament in the midst of the waters, a

GEN 1:7 And God made the firmament, and divided the waters which were und

GEN 1:8 And God called the firmament Heaven. And the evening and the morn

GEN 1:9 And God said, Let the waters under the heaven be gathered togethe

GEN 1:10 And God called the dry land Earth; and the gathering together of t

GEN 1:11 And God said, Let the earth bring forth grass, the herb yielding see

GEN 1:12 And the earth brought forth grass, and herb yielding seed after his

GEN 1:13 And the evening and the morning were the third day.

GEN 1:14 And God said, Let there be lights in the firmament of the heaven to

GEN 1:15 And let them be for lights in the firmament of the heaven to give lig

GEN 1:16 And God made two great lights; the greater light to rule the day, ar

GEN 1:17 And God set them in the firmament of the heaven to give light upo

GEN 1:18 And to rule over the day and over the night, and to divide the light

GEN 1:19 And the evening and the morning were the fourth day.

GEN 1:20 And God said, Let the waters bring forth abundantly the moving cr

GEN 1:21 And God created great whales, and every living creature that move

GEN 1:22 And God blessed them, saying, Be fruitful, and multiply, and fill the v

GEN 1:23 And the evening and the morning were the fifth day.

The Master awoke and looked at the screen.  
"Good," he said. "Very good. I suppose you've  
noticed that our program is getting bigger."

I nodded.

"Twenty lines already. And we'll have hundreds  
before we're done."

I perked up. "Hundreds?"

"Yes, hundreds. So we're going to have to work  
on three editing skills before we continue."

"Okay."

"Click on another tab at the bottom of the  
screen. Open the Golden Key. Open "my stuff".  
Then open the "bible.txt".

I did. One click and three double-clicks.  
"Ready," I said.

stuff written...

bible.txt

A

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36:1

GEN 1:12 And the earth brought forth grass, and herb yielding seed after his

GEN 1:13 And the evening and the morning were the third day.

GEN 1:14 And God said, Let there be lights in the firmament of the heaven to

GEN 1:15 And let them be for lights in the firmament of the heaven to give lig

GEN 1:16 And God made two great lights; the greater light to rule the day, ar

GEN 1:17 And God set them in the firmament of the heaven to give light upo

GEN 1:18 And to rule over the day and over the night, and to divide the light

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GEN 1:22 And God blessed them, saying, Be fruitful, and multiply, and fill the v

GEN 1:23 And the evening and the morning were the fifth day.



GEN 1:24 And God said, Let the earth bring forth the living creature after his

GEN 1:25 And God made the beast of the earth after his kind, and cattle aft

GEN 1:26 And God said, Let us make man in our image, after our likeness: an

GEN 1:27 So God created man in his own image, in the image of God created

GEN 1:28 And God blessed them, and God said unto them, Be fruitful, and m

GEN 1:29 And God said, Behold, I have given you every herb bearing seed, wh

GEN 1:30 And to every beast of the earth, and to every fowl of the air, and t

GEN 1:31 And God saw every thing that he had made, and, behold, it was very

GEN 2:1 Thus the heavens and the earth were finished, and all the host of the

GEN 2:2 And on the seventh day God ended his work which he had made; and

GEN 2:3 And God blessed the seventh day, and sanctified it: because that in i

"The first of the three skills is used when you want to move a file around just a wee bit. It's called scrolling."

"But there aren't any scroll bars," I said.

"Correct. To scroll you simply press the right mouse button and push. Left, right, up, down, even slantways. Try it, you'll like it."

I did. The cursor changed into a little hand and I was able to push the whole Bible around.

"Now for practice," he said, "find the first word of Gen 2:17 and the last word of 1:26."

I did. The 2:17 one was easy; the 1:26 was a little harder. But after I highlighted the whole line by left-clicking at the far left and dragging down a little before scrolling it was easy to tell that I had the right verse.

stuff written...

bible.txt

REV 18:23 And the light of a candle shall shine no more at all in thee; and the  
 REV 18:24 And in her was found the blood of prophets, and of saints, and of  
 REV 19:1 And after these things I heard a great voice of much people in heav  
 REV 19:2 For true and righteous are his judgments: for he hath judged the gr  
 REV 19:3 And again they said, Alleluia And her smoke rose up for ever and ev  
 REV 19:4 And the four and twenty elders and the four beasts fell down and w  
 REV 19:5 And a voice came out of the throne, saying, Praise our God, all ye h  
 REV 19:6 And I heard as it were the voice of a great multitude, and as the vo  
 REV 19:7 Let us be glad and rejoice, and give honour to him: for the marriag  
 REV 19:8 And to her was granted that she should be arrayed in fine linen, clea  
 REV 19:9 And he saith unto me, Write, Blessed are they which are called unto t  
 REV 19:10 And I fell at his feet to worship him. And he said unto me, See thou  
 REV 19:11 And I saw heaven opened, and behold a white horse; and he that s  
 REV 19:12 His eyes were as a flame of fire, and on his head were many crown  
 REV 19:13 And he was clothed with a vesture dipped in blood: and his name is  
 REV 19:14 And the armies which were in heaven followed him upon white horse  
 REV 19:15 And out of his mouth goeth a sharp sword, that with it he should s  
 REV 19:16 And he hath on his vesture and on his thigh a name written, KING O  
 REV 19:17 And I saw an angel standing in the sun; and he cried with a loud vo  
 REV 19:18 That ye may eat the flesh of kings, and the flesh of captains, and  
 REV 19:19 And I saw the beast, and the kings of the earth, and their armies,  
 REV 19:20 And the beast was taken, and with him the false prophet that wroug  
 REV 19:21 And the remnant were slain with the sword of him that sat upon the

"The second skill," he said, "is jumping around  
 in a file. It's called paging. We use the HOME,  
 END, PAGE UP and PAGE DOWN keys for paging."

Then he droned on for a long time about the  
 caret (that little vertical line that shows  
 where the next thing you type will go) and the  
 CTRL and ALT keys (which are pretty much  
 the same to the CAL), blah, blah, blah. The  
 gist of it all was this:

HOME moves you to the start of a line  
 END moves you to the end of a line.  
 PAGE UP moves you one screen's worth up  
 PAGE DOWN one screen's worth down  
 CTRL HOME moves you to the top of the file  
 CTRL END moves you to end of the file

we practiced by looking for the last word in  
 Rev 19:4 and the first word in Genesis 5.



A B C D E F G H I J K L M N O P Q R S T U V W X Y Z Finding...

JOH 11:24 Martha saith unto him, I know that he shall rise again in the resurre  
 JOH 11:25 Jesus said unto her, I am the resurrection, and the life: he that be  
 JOH 11:26 And whosoever liveth and believeth in me shall never die. Believest  
 JOH 11:27 She saith unto him, Yea, Lord: I believe that thou art the Christ, th  
 JOH 11:28 And when she had so said, she went her way, and called Mary her si  
 JOH 11:29 As soon as she heard that, she arose quickly, and came unto him.  
 JOH 11:30 Now Jesus was not yet come into the town, but was in that place wh  
 JOH 11:31 The Jews then which were with her in the house, and comforted her  
 JOH 11:32 Then when Mary was come where Jesus was, and saw him, she fell d  
 JOH 11:33 When Jesus therefore saw her weeping, and the Jews also weeping  
 JOH 11:34 And said, Where have ye laid him? They said unto him, Lord, come  
 JOH 11:35 Jesus wept.  
 JOH 11:36 Then said the Jews, Behold how he loved him!  
 JOH 11:37 And some of them said, Could not this man, which opened the eyes  
 JOH 11:38 Jesus therefore again groaning in himself cometh to the grave. I  
 JOH 11:39 Jesus said, Take ye away the stone. Martha, the sister of him that  
 JOH 11:40 Jesus saith unto her, Said I not unto thee, that, if thou wouldest b  
 JOH 11:41 Then they took away the stone from the place where the dead was  
 JOH 11:42 And I knew that thou hearest me always: but because of the people  
 JOH 11:43 And when he thus had spoken, he cried with a loud voice, Lazarus,  
 JOH 11:44 And he that was dead came forth, bound hand and foot with grav  
 JOH 11:45 Then many of the Jews which came to Mary, and had seen the thing  
 JOH 11:46 But some of them went their ways to the Pharisees, and told them

"The third skill," he said, "is finding things in a file. It's called finding things in a file. You'll be using it a lot before long, so get good at it."

And then he droned on for a long time. What he meant to say was this:

1. Hold CTRL and hit HOME then F.
2. Type the thing you're looking for.
3. Use BACKSPACE if you make a mistake.
4. Use ESCAPE to end the search.
5. Use CTRL-N to find the next instance.

I tried it, looking for "Jesus wept."  
 CTRL-HOME put me at the top of the file.  
 CTRL-F put "Finding..." in the message box.  
 When I typed a J, the screen jumped to the first J in the Bible. When I typed E, it went to the first JE. Before long I was there.  
 I hit ESCAPE. Then I hit CTRL-N but there was only one verse that said that.

stuff written...

bible.txt

A B C D E F G

The triple dots  
( ... )represent lines of the  
program that  
we're not showing  
in the picture.

H I J K L M N O P Q R S T U V W X Y Z

24:1

...

To do awesome stuff:

Clear the screen.

Set up the work area.

Set up the menu area.

Outline the work area with the gold pen.

Outline the menu area with the gold pen.

▶ List the choices in the menu area using the gold pen.

Refresh the screen.

Wait until we hit the escape key.

...

To set up the menu area:

Put the screen's right minus 3-1/4 inches into the menu area's left.

Put the screen's top plus 1/4 inch into the menu area's top.

Put the screen's right minus 1/4 inch into the menu area's right.

Put the screen's bottom minus 1/4 inch into the menu area's bottom.

▶ Add "ALPHABET SOUP" to the choices.

▶ Add "QUIT" to the choices.

...

We spent the afternoon eating pizza and finding Bible verses. Then Ben said to close up the Bible and go back to our program tab.

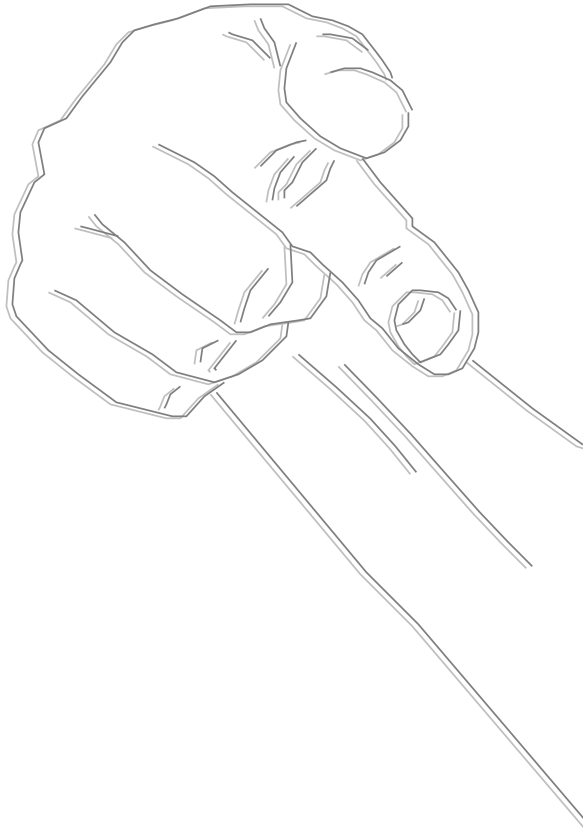
"We need to put some things for the user to choose in that menu area," he said. "Since the choices are always the same, we can simply add them to the set-up routine."

I scrolled the file up and got ready to type. He said just two choices would be enough for now, and that QUIT should be one of them. We let the wench choose the other one.

So I typed in the sentences you see at the left, and then scrolled back down because we needed to add a line in the awesome routine.

I ran it and it worked so I raised my arms and started chanting, "Programming Master of the Universe!" But nobody joined in.

stuff written...



My program was still running. "What's the matter?" I asked, pointing with both hands, my arms still raised. "There they are, ALPHABET SOUP and QUIT, right smack in the menu area, in pretty gold letters."

"Click on one," said the Master.

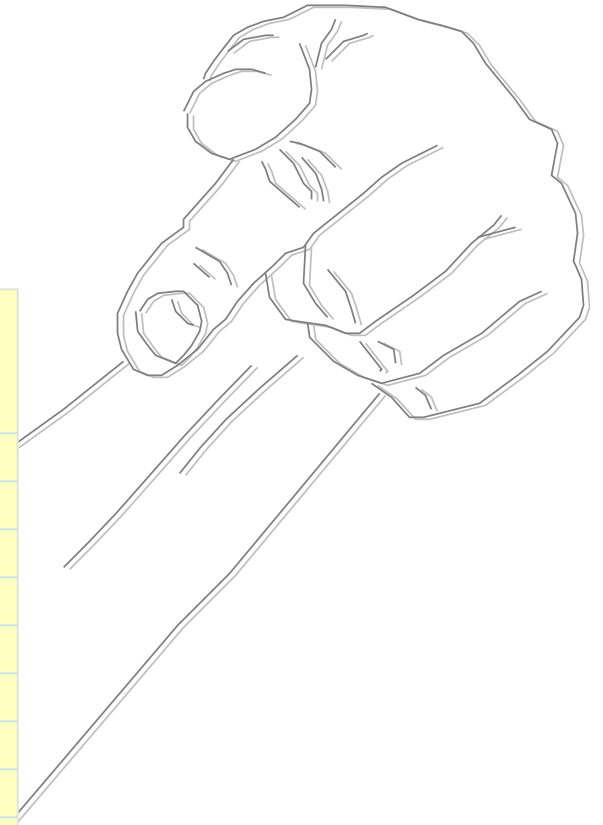
"Yeah," I said to the wench, "click on one."

She did. Nothing happened. She clicked again. Still nothing. She clicked a third time. Bupkis.

"Oh boy," I said, dropping my arms.

"Don't worry about it, son," he said. "So far we've only been working with outputs. Now we have to deal with inputs. But first we need to do a little clean up. Get back to the CAL."

I hit the escape key.



A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

24:1

...

To do awesome stuff:

Set up the work area.

Set up the menu area.

Wait until we hit the escape key.

...

▶ To show all our stuff:

▶ Clear the screen without refreshing it.

▶ Outline the work area with the gold pen.

▶ Outline the menu area with the gold pen.

▶ List the choices in the menu area using the gold pen.

▶ Refresh the screen.

▶ Draw only inside the work area from now on.

▶ Show the arrow cursor.

...

Programmers,  
like other writers,  
often re-arrange  
their sentences to make  
their work better.

"First," Old Ben said, "we need to move a few of those lines we added earlier for testing. Make a new routine to show all our stuff."

I did.

"Now take all the drawing stuff out of the awesome stuff and move it down there."

I selected the lines by dragging down at the far left, and moved them with cut and paste. Five of them. There wasn't much left in the awesome stuff when I was done.

"While you're at it, tell the CAL not to refresh the screen when he clears it since we do that later. And to only draw inside the work area from now on. And show the arrow cursor so we can see where the mouse is."

Done, done and done.

stuff written...

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24:1

...

To do awesome stuff:

Set up the work area.

Set up the menu area.

▶ Loop.

▶ Wait for some input.

▶ If the input is from Windows telling us the user has quit, break.

▶ If the input is from Windows telling us to show all our stuff, show all our stuff.

▶ If the input is a left click, handle the left click.

▶ Repeat.

...

▶ To handle a left click:

▶ Wait for the mouse's left button to come back up.

▶ Find a choice given the left click's spot.

▶ If the choice is "QUIT", tell Windows we're done.

...

"So far, so good," he said. "That's it for output. Now let's dump that escape key business and put in a loop for the input."

"A loop?"

"Yes, a loop. A handful of instructions that will run over and over until something happens to make the machine break out of the loop."

Then he had me type the loopy part in the awesome stuff in place of the line that used to wait for the escape key. Since two of the new lines said something about windows there was, as you can imagine, a lot of spitting.

He also had me add the routine you see at the left to handle any left clicks.

All in all, it was a lot of typing.

stuff written...

...

To do awesome stuff:

Set up the work area.

Set up the menu area.

Loop.

Wait for some input.

If the input is from Windows telling us that we're done, break.

If the input is from Windows telling us to show all our stuff, show all our stuff.

If the input is a left click, handle the left click.

Repeat.

...

To handle a left click:

Wait for the mouse's left button to come back up.

Find a choice given the left click's spot.

If the choice is "QUIT", tell Windows we're done.

...

I studied the program. I know that sounds weird, Mom, me studying without being forced to, but I wanted to see how it worked.

Most of it was pretty easy. We wait for input, then do something depending on what kind of input it is. Show all our stuff, or handle the user's clicks, no problem.

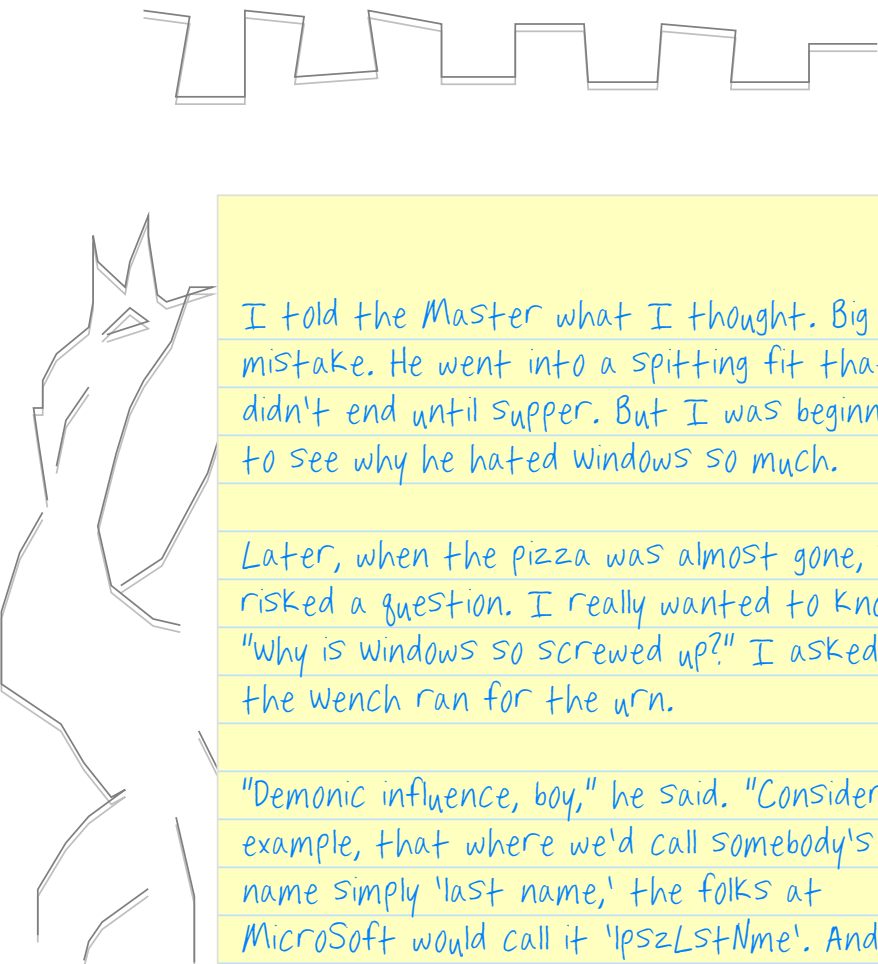
It was the quitting business that bugged me. It seemed real round-about. I mean, c'mon:

1. The user clicks on QUIT and windows tells us about it with a left-click message.

2. Then we tell windows that we're done.

3. Then windows tells us we're done (as if we didn't know) and we break out of the loop.


Goofy.



I told the Master what I thought. Big mistake. He went into a spitting fit that didn't end until supper. But I was beginning to see why he hated windows so much.

Later, when the pizza was almost gone, I risked a question. I really wanted to know. "Why is windows so screwed up?" I asked, and the wench ran for the urn.

"Demonic influence, boy," he said. "Consider, for example, that where we'd call somebody's last name simply 'last name,' the folks at MicroSoft would call it 'lpSzLstNme'. And then they'd reward the guy who came up with that way of naming things with piles of money. And he'd use that money to fund Richard Dawkins at Oxford. Charles Simonyi. Look him up. It won't say anything about demonic influence in the wikipedia, of course. But what else could make people act like that?"



Dragons, dragons everywhere we go.

Then Old Ben hobbled off and that was that.

I went back to the Sanctum and ran the program to make sure it worked. It did. I clicked QUIT and it quit. But I was feeling a little scared. Who knew programmers could actually be on the side of the dragons?

As you can imagine, Mom, I didn't sleep well. Especially with the rumbling of the ~~fork lifts~~ dragons all around my ~~shelf~~ cell.

My stomach was kind of upset, too. I smiled, though, when I saw that the wench had left the urn next to my cell. I was glad I didn't have to use it. But I'm thinking maybe I've been eating too much pizza.

Tell Dad I'm still having fun. I really want to stay and see what happens tomorrow...

Isaac

If your program won't quit, you'll have to use the ALT-TAB and STOP trick I showed Isaac on page 19 to get back to the CAL.





...

To handle a left click:

Wait for the mouse's left button to come back up.

Find a choice given the left click's spot.

▶ If the choice is "ALPHABET SOUP", cook up the soup.

If the choice is "QUIT", tell Windows we're done.

...

▶ To cook up the soup:

Hello again, Mom.

What a difference a little sleep makes!

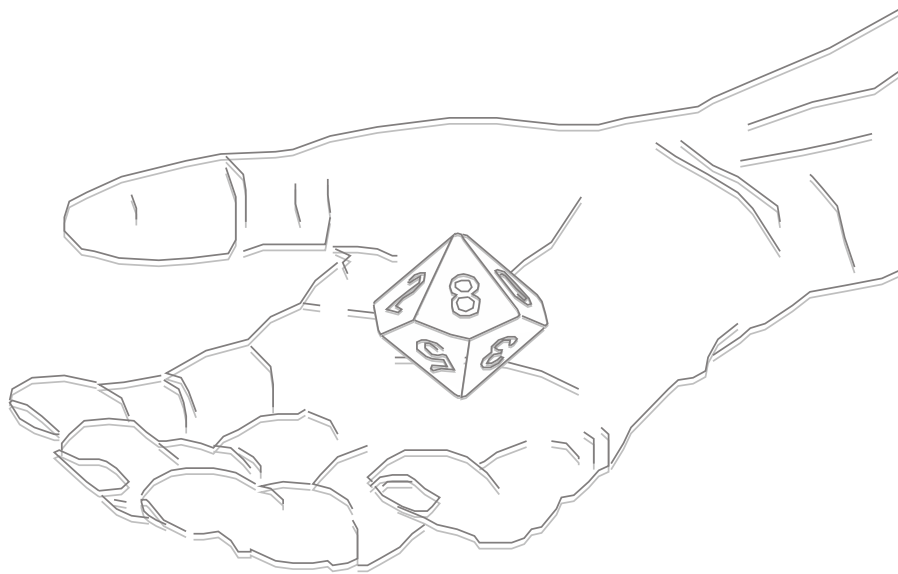
I awoke with a renewed determination to become a True Knight of the Osmosian Order.

So I had something different for breakfast (pizza ROLLS) and was sitting at the Keyboard ready to go when Ben tottered in.

"Let's make some soup," he said. And (believe it or not) I knew exactly what I should add to the left-click handling routine. It was like I was inspired or something. I even knew we'd need a new routine to actually cook up the soup — I added that in too.

But then I was just plain old me again, and I was stuck. I had no idea what to do next.

"Small beginnings," said the Master. "Despise them not." And he winked — at the wench!



Then he reached ~~into his pocket~~ up the flowing sleeve of his long black cloak and in his gnarly old hand there appeared the strangest dice (or die, or whatever you call just one of them) that I had ever seen.

"Cool," I said. "What's that?"

"It's a random number generator," he said. It picks numbers — but only God knows what it's going to pick. Try it."

I did. Sometimes God and I would pick the same number. But most of the time He was thinking something way different than I was. Nothing new there.

Then he said, "The CAL has one of these inside his head, only his has 4,294,967,296 sides. He uses it to pick numbers, letters, colors, spots on the screen, all kinds of things."

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

24:1

...

To cook up the soup:

- Start fresh.
- Loop.
- If the user clicks on the choices, break.
- Pick a letter of the alphabet.
- Pick a letter height between  $1/8$  inch and  $1/2$  inch.
- Use the fat pen.
- Pick a color.
- Pick a spot anywhere in the work area.
- Pick a heading.
- Write the letter.
- Refresh the screen.
- Add 1 to a count. If the count is 1000, break.
- Repeat.

...

Old Ben said that whenever we're drawing stuff we need to keep 5 things in mind:

1. Shape
2. Size
3. Color
4. Location
5. Orientation (which way something's facing)

He told me what to type and I typed. Then he pointed out how this routine let the CAL pick all of those things, using his own personal dice (or die, or whatever just one is called).

1. Pick a letter... (shape)
2. Pick a height, use the fat pen... (size)
3. Pick a color... (color, duh)
4. Pick a spot... (location)
5. Pick a heading... (orientation)

I'm pretty sure I wouldn't have noticed that on my own.

stuff written...

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

24:1

...

To cook up the soup:

Start fresh.

Loop.

If the user clicks on the choices, break.

Pick a letter of the alphabet.

Pick a letter height between  $1/8$  inch and  $1/2$  inch.

Use the fat pen.

Pick a color.

Pick a spot anywhere in the work area.

Pick a heading.

Write the letter.

Refresh the screen.

Add 1 to a count. If the count is 1000, break.

Repeat.

...

To start fresh:

Erase inside the work area.

Refresh the screen.

...

When I tried to run the program the CAL said he didn't know how to "start fresh". So we had to add in yet another routine. It's over there at the bottom.

I asked Ben why we didn't just put those two lines in with the rest of the soup and he said it would make the other 24 routines we still had to write shorter this way. I said it didn't seem like much of an improvement to me, and he said that was because I couldn't see as far as he could (which was funny cause Old Ben is nearly blind. Not that being blind is funny. But y'know.) He said the "start fresh" routine would get pretty big before we were done because it has to deal with all 5 of those things we talked about earlier. So I shrugged. Maybe he knows something I don't.

I ran it. It was sweet. And the wench showed me how to make million-dollar paintings with it (if I wasn't in a hurry).

10,000 instead of 1000  
will produce a  
Jackson Pollock painting  
(after a while).

But don't put commas in  
your numbers -- the CAL  
doesn't understand them.

stuff written...

...

To set up the menu area:

Put the screen's right minus 3-1/4 inches into the menu area's left.

Put the screen's top plus 1/4 inch into the menu area's top.

Put the screen's right minus 1/4 inch into the menu area's right.

Put the screen's bottom minus 1/4 inch into the menu area's bottom.

Add "ALPHABET SOUP" to the choices.

▶ Add "MOUSE DROPPINGS" to the choices.

Add "QUIT" to the choices.

...

To handle a left click:

Wait for the mouse's left button to come back up.

Find a choice given the left click's spot.

If the choice is "ALPHABET SOUP", cook up the soup.

▶ If the choice is "MOUSE DROPPINGS", draw mouse droppings.

If the choice is "QUIT", tell Windows we're done.

...

▶ To draw mouse droppings:

"Let's do another one," the wench said.

"Let's," he replied.

But I was way ahead of those two. I used that CTRL-HOME-F-start-typing thing to find where the choices were added to the menu area (I typed "soup" cause I knew it said "soup" right near where I wanted to be) and I added "MOUSE DROPPINGS" (one of my favorites) in between SOUP and QUIT.

Then I found the "handle a left click" routine and stuck a line in there as well. I was beginning to see a pattern. And I was definitely on a roll.

Finally, I started writing the routine that would actually draw the mouse droppings — but I got stuck. I was afraid the wench was going to giggle, but she just smiled and said, "I think you should turn the page."

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

24:1

...

To draw mouse droppings:

- ▶ Start fresh.
- ▶ Write "CLICK AND DRAG TO DRAW WITH THE MOUSE"
- ▶ with the gold pen at the bottom of the work area.
- ▶ Refresh the screen.
- ▶ Loop.
- ▶ If the user clicks in the choices, break.
- ▶ If the mouse's left button is not down, repeat.
- ▶ If the mouse's spot is not in the work area, repeat.
- ▶ Draw the mouse's spot with the green pen.
- ▶ Refresh the screen.
- ▶ Repeat.

...

"Children don't learn to speak by making up sentences on their own," the Master said. "They learn to speak by imitating the people around them who already know how to speak."

I had no idea why he would say that.

"And it's the same with writers. (Well, the good ones, anyway.) They learn to write by reading, reading, reading. And by imitating the writing of those they've read.

I was beginning to see where he was going.

"It's the same..."

"...with programming," I finished the thought. "Padawans don't learn to program by making stuff up on their own. They learn by imitating their Masters who know everything." What a relief! "Tell me what to type." And he did.

stuff written...

I ran the program and it worked just like the Osmosian Eyes Only Goal Program that I couldn't show you earlier. Awesome.

But all that work made me thirsty. The wench said she wasn't, so Old Ben and I limped off to get a drink. (What I mean is Old Ben limped and I tried to walk real slow without letting him know that I was trying to walk real slow so he wouldn't feel bad.)

When we got back I thought I saw a big red heart made out of mouse droppings on the screen — with "Isaac + Becky" inside it! But the wench hit QUIT when she heard us behind her so I wasn't sure.

What's funny though, Mom, is that when I looked at the mouse dropping routine in the program it said "red pen" where I was sure I had typed "green pen".



...

To set up the menu area:

Put the screen's right minus 3-1/4 inches into the menu area's left.

Put the screen's top plus 1/4 inch into the menu area's top.

Put the screen's right minus 1/4 inch into the menu area's right.

Put the screen's bottom minus 1/4 inch into the menu area's bottom.

Add "ALPHABET SOUP" to the choices.

Add "LOTS OF LITTLE LILACS" to the choices.

Add "MOUSE DROPPINGS" to the choices.

Add "QUIT" to the choices.

...

To handle a left click:

Wait for the mouse's left button to come back up.

Find a choice given the left click's spot.

If the choice is "ALPHABET SOUP", cook up the soup.

If the choice is "LOTS OF LITTLE LILACS", draw lots of little lilacs.

If the choice is "MOUSE DROPPINGS", draw mouse droppings.

If the choice is "QUIT", tell Windows we're done.

...

"Time for another program," the Master said. "Let's do LOTS OF LITTLE LILACS."

I was hoping for something a little more manly like the ILLUSIONS or the OSMOSIAN LOGO, but I figured we'd get there sooner or later. Probably later the way we're going.

"Do what you've got to do to put LOTS OF LITTLE LILACS on the menu," he said, and I did. I was getting pretty good at that part, even if I do say so myself. And I added a line to the left click handler, too. But it seemed kind of dumb to keep jumping around in the program so much.

"Why don't we just add all the choices right now and be done with them?" I asked.

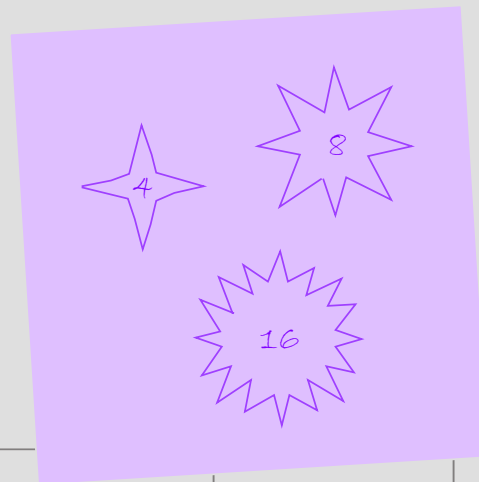
"Because," he said, with a very serious look on his face, "that would be too much like factory work. Factory work is bad for the soul."



...

- ▶ To draw lots of little lilacs:
- ▶ Start fresh.
- ▶ Pick a color.
- ▶ Loop.
- ▶ If the user clicks on the choices, break.
- ▶ Start anywhere in the work area.
- ▶ Pick a point count between 4 and 12.
- ▶ Pick a size between 1/32 inch and 1/16 inch.
- ▶ Pick a brightness between 10 percent and 90 percent.
- ▶ Draw a star with the point count and the size.
- ▶ Add 1 to a count.
- ▶ If the count is a multiple of 100, refresh the screen.
- ▶ If the count is less than 10000, repeat.

...



"Now where were we?" he mumbled. "Ah, yes. Getting LOTS OF LITTLE LILACS to work."

Then he told me what to type and I typed. At first I didn't know what a "point count" was but I looked over and saw the wench doodling different kinds of stars on her little purple pad and then it made sense.

It was cool when I ran it because every time I clicked LOTS OF LITTLE LILACS on the menu the flowers came out a different color. I mean there were different colors on the screen EVERY time but they were more different EACH time..."

"Shade and hue," he said, are the words you need. "Each time the colors are various shades of a particular, but different, hue."

What he said. I have to admit it looked kind of nice for something so girly.

...

To draw lots of little lilacs:

Start fresh.

Pick a color.

Loop.

If the user clicks on the choices, break.

Start anywhere in the work area.

Pick a point count between 4 and 12.

Pick a size between 1/32 inch and 1/16 inch.

Pick a brightness between 10 percent and 90 percent.

Draw a star with the point count and the size.

Add 1 to a count.

If the count is a multiple of 100, refresh the screen.

If the count is less than 10000, repeat.

...

I thought we were done with the lilacs when we got back to the CAL, but the Master got out his pencil and started tap-tap-tapping on the screen. And droning on like he does.

"Note," he said, "here (tap, tap) where the color is chosen outside of the loop. If we move that line inside the loop we'll get multi-colored lilacs every time. Try it."

I did and he was right. But I liked it better the other way, so I put it back.

"Note also (tap, tap) that we refresh the screen only every 100 times through the loop. Change that 100 to 1 and see what happens."

I did, and it was DOG SLOW. I think I would have done that ALT-TAB and STOP thing if the wench hadn't been sneaking me Skittles under the table. But I did put it back to 100 as soon as I got the chance.

...

To start fresh:

Erase inside the work area.

▶ Use small pointy letters.

▶ Use the skinny pen.

▶ Use the gold color.

▶ Start in the middle of the work area.

▶ Face North.

Refresh the screen.

...

These new lines are like  
pickles and onions at  
White Castle --  
they're the shape, size,  
color, location and  
orientation we'll get if we  
don't say exactly what we  
want somewhere else.

The Master was stroking his beard. "I'm afraid we have a little problem," he said. "Run the program again and do the lilacs."

I did. They were fine.

"Now do the alphabet soup."

That was fine too.

"Now do the lilacs again."

It seemed kind of silly, but I did it anyway. And WHOA! There WAS a problem. The lilacs were all fat and mushy.

"The soup routine," he explained, "left the CAL with the fat pen in his hand. I think it's time we beefed up our start fresh routine."

So I found it and we added five lines so we wouldn't have any more problems like that.

...

Add "ALPHABET SOUP" to the choices.

▶ Add "GEOMETRIC FIGURES" to the choices.

Add "LOTS OF LITTLE LILACS" to the choices.

Add "MOUSE DROPPINGS" to the choices.

Add "QUIT" to the choices.

...

If the choice is "ALPHABET SOUP", cook up the soup.

▶ If the choice is "GEOMETRIC FIGURES", draw the geometric figures.

If the choice is "LOTS OF LITTLE LILACS", draw lots of little lilacs.

If the choice is "MOUSE DROPPINGS", draw mouse droppings.

If the choice is "QUIT", tell Windows we're done.

...

A copy of this  
"Precious Scroll"  
is on the next page.

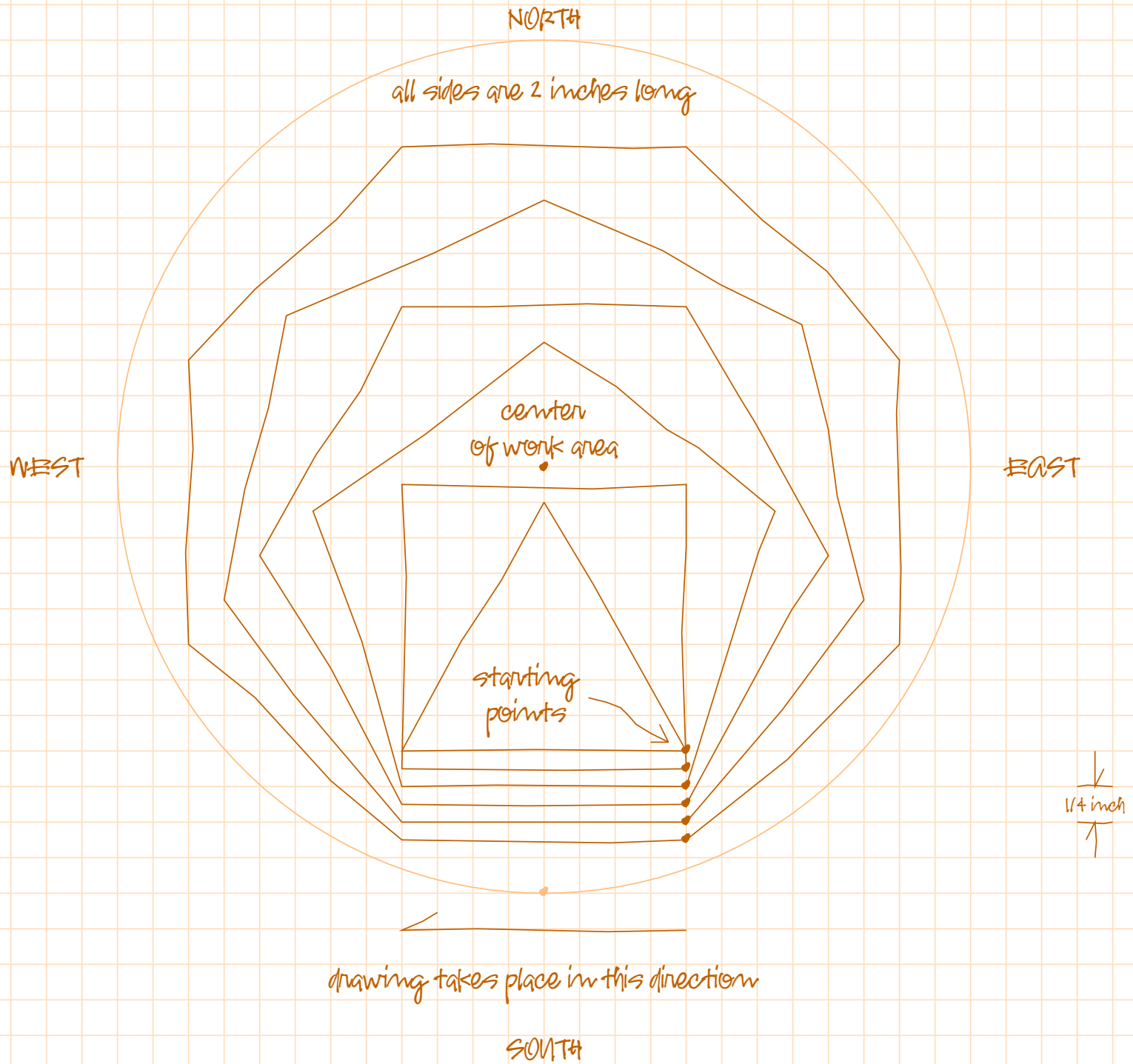
-- Becky

stuff written...

So I ran the program again, just to make sure everything was working. I did the SOUP and the DROPPINGS and the LILACS in every order I could think of. They all worked.

Then Old Ben nodded at the wench and she ran off to the Archives. He said it was time for us to do the GEOMETRIC FIGURES. I wasn't happy about that because I don't like geometry. But he waved his hand in front of my face and said in a mysterious voice, "This isn't the kind of geometry you have trouble with." And all of a sudden I felt better. Some kind of Osmosian mind trick, no doubt.

While we were waiting for the wench, I added GEOMETRIC FIGURES to the choices. And to the left-click handler. When she got back, she handed the Master a Precious Scroll and he nailed to the wall.



A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

24:1

...

- ▶ To draw the geometric figures:
- ▶ Start fresh.
- ▶ Put 2 inches into a side length.
- ▶ Put 3 into a side count.
- ▶ Start 1 inch to the right and 2 inches down from the work area's center.
- ▶ Loop.
- ▶ If the user clicks on the choices, break.
- ▶ Pick a rainbow color.
- ▶ Face west.
- ▶ Draw a geometric figure given the side count and the side length.
- ▶ Refresh the screen.
- ▶ Wait 1/4 second.
- ▶ Move down 1/8 inch.
- ▶ Add 1 to the side count.
- ▶ If the side count is 8 or less, repeat.

...

When the CAL sees  
"Rainbow Colors"  
he thinks of  
red, orange, yellow,  
green, blue and purple,  
in that order.

With a lot of tap-tapping on the diagram on the wall, Old Ben told me what to type in.

He pointed out that the side length (tap, tap) is always 2 inches, but the side count goes from 3 to 8 (tap, tap tap) — all the way from triangle to ~~stop sign~~ octagon.

He told me the little squares on the scroll were each 1/4 inch. Then he counted them (tap, tap) so I could see why our starting point was 1 inch to the right and 2 inches down from the work area's center.

Finally, he showed me how we needed to move down 1/8 inch after we drew each figure to get ready for the next one.

I ran it and it worked. No offense to Old Ben's mind tricks, but I was glad it was done. Reminded me too much of math class.

stuff written...

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

24:1

...

To draw the geometric figures:

Start fresh.

Put 2 inches into a side length.

Put 3 into a side count.

Start 1 inch to the right and 2 inches down from the work area's center.

Loop.

If the user clicks on the choices, break.

Pick a rainbow color.

Face west.

Draw a geometric figure given the side count and the side length.

Refresh the screen.

Wait 1/4 second.

Move down 1/8 inch.

Add 1 to the side count.

If the side count is 8 or less, repeat.

➤ Move 1 inch left and 3/8 inch down.

➤ Use the gold pen.

➤ Draw another geometric figure with 300 sides 1/16 inch long.

...

But it turned out that we weren't done.

"What kind of figure do you think we would get," he asked, "if we made the side length very small and the side count very large?"

"How should I know?" I said.

"Let's find out."

So we added 3 lines at the bottom of the routine. We had to move over and down a little because our side length was shorter and we didn't want to bump into our other figures. And we used the gold pen so it would look cool.

I ran it. A circle! "Hey," I said, "now my program is even better than the original!"

"It is. And that's something you can pass on to YOUR padawans some day."

stuff written...

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

24:1

...

Add "MOUSE DROPPINGS" to the choices.

Add "QUIT" to the choices.

▶ Add "WIPES" to the choices.

...

If the choice is "MOUSE DROPPINGS", draw mouse droppings.

If the choice is "QUIT", tell Windows we're done.

▶ If the choice is "WIPES", draw the wipes.

...

▶ To draw the wipes:

▶ Start fresh.

▶ Pick a solid color.

▶ Pick a number between 1 and 2.

▶ If the number is 1, wipe the work area with the solid color (left to right).

▶ If the number is 2, wipe the work area with the solid color (right to left).

...

"I like those nice bright colors," I said, trying to change the subject to anything but geometry. "How many colors are there?"

"Millions," he replied. "But before we can whip up a color wheel, we need to talk a little about compass points. And before we can draw our compass, we need to do some wipes. So let's start there. Add the WIPES to the choices. And to the left-click handler."

I did.

"You may have noticed that the WIPES sometimes go left to right, sometimes right to left. The CAL uses his random number generator to choose. This is what the choosing code looks like."

And he told me what to type.

stuff written...



A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

24:1

...

- ▶ To wipe a box with a color (left to right):
- ▶ Privatize the color.
- ▶ Start at the bottom left corner of the box facing north.
- ▶ Loop.
- ▶ If the user clicks on the choices, break.
- ▶ Draw a line as tall as the box using the color.
- ▶ Turn right. Move 1 pixel. Turn right.
- ▶ Draw another line as tall as the box using the color.
- ▶ Turn left. Move 1 pixel. Turn left.
- ▶ Darken the color about 1 percent.
- ▶ Refresh the screen.
- ▶ If we're still in the box, repeat.

...

- ▶ To wipe a box with a color (right to left):
- ▶ Privatize the color.
- ▶ Start at the bottom right corner of the box facing north.
- ▶ Loop.
- ▶ If the user clicks on the choices, break.

...

"There are a number of different ways to write up a wipe," he said. "We're going to do them as if we were a turtle crawling on the screen with a pen tied to our tail."

"Sure," I said, "that was my first thought." What on earth was he talking about?

Then he told me what to type and I typed. We did the left-to-right wipe first.

"The other wipe is similar," he said. "Copy this one and make the changes. I'll get you started but you can finish up on your own."

I did. I should say, we did. The wench helped a lot by double-clicking the "rights" and the "lefts" and all I had to do was switch 'em.

We ran it and it worked better than I thought it would. Tortoise beats hare again.



stuff written...

...

Add "QUIT" to the choices.

Add "WIPE" to the choices.

▶ Add "X MARKS THE SPOT" to the choices.

...

If the choice is "QUIT", tell Windows we're done.

If the choice is "WIPE", draw the wipes.

▶ If the choice is "X MARKS THE SPOT", draw the compass.

...

▶ To draw the compass:

▶ Start fresh.

▶ Center a box 6-1/2 inches by 6-1/2 inches in the work area.

▶ Wipe the box with the tan color (left to right).

▶ Write "X" with the black pen in the middle of the box.

...

"Now," he said, "we're ready to draw our compass. Add X MARKS THE SPOT to the choices. And to the left-click handler."

I did.

"The compass has a lot of parts," he said, "so we're going to draw it a little at a time."

"Okay."

"First, the background, which uses one of the wipe routines we just wrote up."

"Cool. Recycling."

"Then the X that marks the middle."

He talked and I typed. We ran it and it looked good. I really liked the wipe effect.

...

To draw the compass:

Start fresh.

Center a box 6-1/2 inches by 6-1/2 inches in the work area.

Wipe the box with the tan color (left to right).

Write "X" with the black pen in the middle of the box.

- Put 0 into a count.
- Loop.
- If the user clicks on the choices, break.
- Start in the middle of the work area. Move 1/4 inch.
- If the count is even, draw a long fancy arrow 1-3/4 inches long with the brown pen.
- If the count is odd, draw a short fancy arrow 1 inch long with the black pen.
- Turn right 1/16 of the way around.
- Refresh the screen.
- Wait for 10 grains of sand to fall.
- Add 1 to the count. If the count is less than 16, repeat.

...

"On to the fancy arrows," he said. "There are 16 of them. They all start 1/4 inch from the center. Half of them are long and brown. The other half are short and black."

"Yeah," I said. "I've seen it."

"Well then," he replied, "Let's type it in and see if it looks as you remember it."

And once again he talked and I typed. A lot. It was kind of tedious. But we got it done.

Then we ran it and it looked good. Real good.

"Now for the tedious part," he said.

"I thought that WAS the tedious part."

"Not quite," he said.

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Z

24:1

...

Start in the center of the box facing north minus 48 points.

Write "000...024...048...072...096...120...144...168...192...216...240...264...288...312...336...360..."

with the black pen 2-1/4 inches from the box's center.

Write "0/0.....1/8.....1/4.....3/8.....1/2.....5/8.....3/4.....7/8....."

with the brown pen 2-1/2 inches from the box's center.

Write ".N....NNE...N.E...ENE....E....ESE...S.E...SSE....S....SSW...S.W...WSW....W...WNW....N.W...NNW..."

with the black pen 2-3/4 inches from the box's center.

Refresh the screen.

...

The Master harumphed. "The English system of measurement is friendly because it's based on cutting things in half and people are naturally good at cutting things in half. You just put your nose in the middle."

I had no idea where he was going with this.

"Not hungry enough for a whole piece of cake? How about half a piece? You can't say things like that with the metric system. You'd have to ask for a TENTH of a piece of cake, which nobody would know how to cut."

Okay, I thought, he's got a point there. But what's this got to do with the compass?

"That's why, instead of using 360-degree circles that start at 3 o'clock and go around backwards (like they do in math classes), we use circles that start at noon and go around frontways for 384 points."

"I can see why we'd start at noon and go frontways," I said, "but why 384 points?"

"Because 384 can be divided in half seven times before we have to deal with fractions. Which gives us nice round numbers for north, south, east, west, and a whole bunch of in-betweens. Now add those labels to the compass and let me know how they look."

They looked good. Once I got them in there.

stuff written...