Bill Budge

PINBALL CONSTRUCTION SET™

After all, the world is a construction set of sorts. You grab this and you add that and you make stuff. In a sense, Budge is just taking this process to a certain point and passing it on. He's sculpting this beam of electrons, putting them through the arcane phases of machine language and then handing them to you in the more familiar forms of screwdrivers, hammers, and magnifying glasses.

Icons, he calls them. "They're symbols. Not just symbols for things in the world, but placeholders for the vast hunks of programming behind it all. They make the game accessible, make it *feel* like a construction set."

Move the flippers here. Put a bumper in the mouth of that corridor.

Then shoot a ball through and wonder. With each flicker of light, waves of Budge code flood this way and that. Logic gates traffic bits by the thousands. You don't see it. You don't want to see it. You don't have to see it.

Budge smiles. "In a way, I'm just saving you a lot of time. You can read the manual for a few minutes, go over to the parts box, and get started. Right away, it works. You're doing it.

"*That's* what makes this thing a toy."
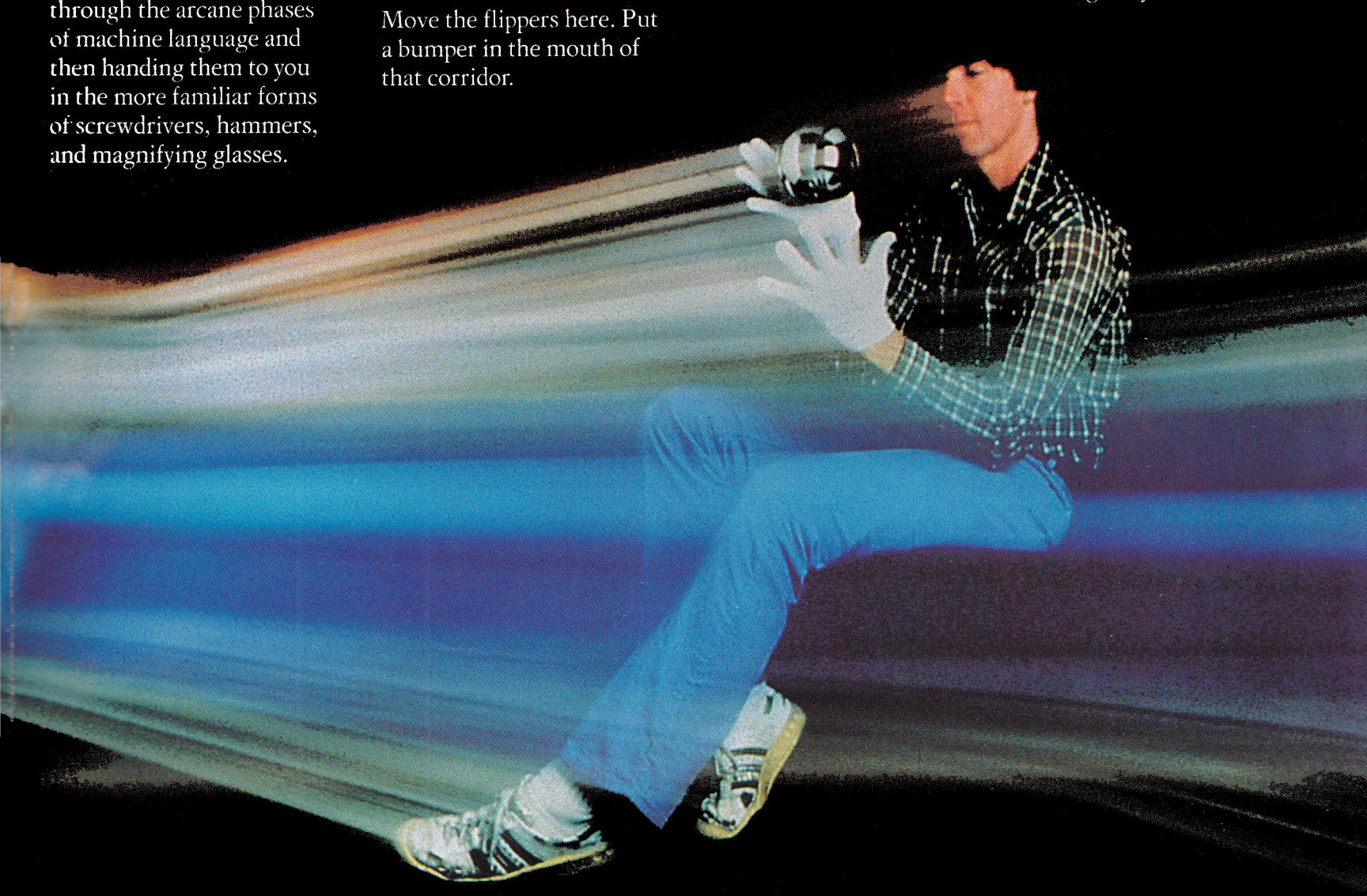
Bill Budge

PINBALL CONSTRUCTION SET ™

User's Guide

Icon Commands

To activate a command, touch it with the hand and press the joystick button once.

	Icon Name	Use	See p.#
	hand	to drag parts onto and around the board and to activate the other icons	2
	arrow, scissors and hammer	to create and change solid shapes made with polygons (the parts on line 2 of the parts box)	6
	paintbrush and colors	to change the color of the border and of polygons	4
	play	to play one turn in a game under construction	2
	magnifier	to paint details, decorate the board and create attractive game titles and signatures	4
	world	to increase and decrease gravity, ball speed and bounce, and bumper kick	8
	AND gate	to set and change score values and sounds for targets and for bonus conditions	8
	disk	to save and load games (finished and unfinished)	3

Basic Play Information	Apple	Atari	
to play a single ball	activate play icon	same	*Note:* Atari owners may also plug in two joysticks, one in port 1, the other in port 2, or a pair of paddles in port 1. Then left flipper and launching ball can be controlled with the button on the joystick in port 1 (or on left paddle) and right flipper with the button on the joystick in port 2 (or on right paddle). When using paddles, the launcher setting cannot be changed from its preset value.
to play full games	activate disk icon, then choose PLAY GAME	same	
to get parts box back	ESC	SELECT	
to cock spring	move joystick up and down	same	
to launch ball into play	the joystick button	joystick left or button	
left flipper	the joystick button	joystick left or button	
right flipper	second joystick button	joystick right	
select no. of players	space bar	OPTION	
turn off sound	Control-S	turn monitor down	

Pinball Construction Set gives you complete control over the game of pinball. You can quickly and easily move parts around, change the scores and the sounds for all the targets, create bonuses to shoot for, decide how heavy to make the ball and how fast and lively to make the game, even reshape and repaint the board and the parts.   **T**here are 5 complete, ready to play Demo games on your PCS disk. Each is a great place to start playing *plus* a great place to look for ideas about how to build good pinball games of your own.   **Y**ou build games by using a joystick-controlled hand. You use it to drag parts from the parts box on to the board and to point to and turn on the other powers at your PCS command.   **T**he chart to the left describes which power goes with each of the symbols (called *icons*) and there's a chart at the end of this guide describing each of the parts in the parts box. In between is a tour of the full range of your PCS commands along with some interesting things to think about while you play, change and build pinball games.   **I**f you're already afraid you're going to die if you have to read one more word without playing some pinball, look at the "Basic Play" information on the left, then skip ahead to "Loading and Playing a Demo Game" on the next page. (If you haven't already loaded the disk into your computer, do so now. Start it up as you would any other disk.)
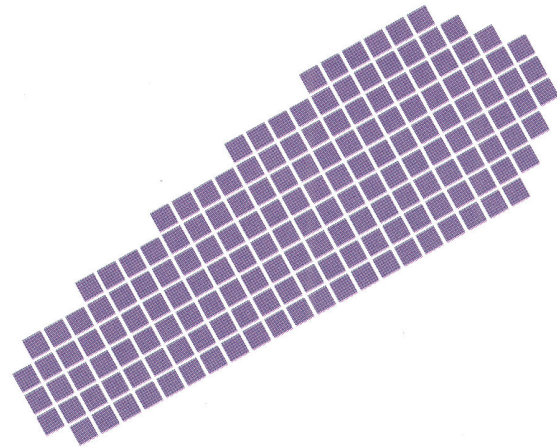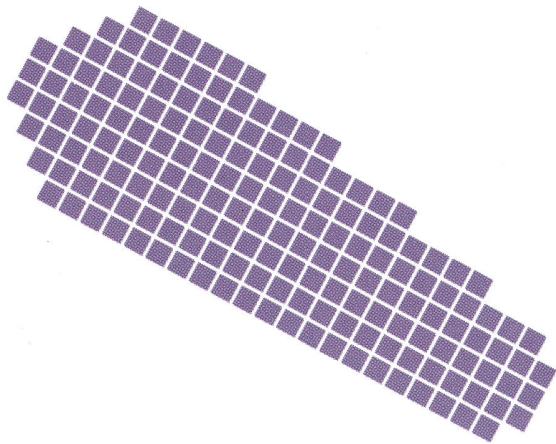
Building Games

*The **hand** is used to build games by dragging parts onto and off of the board. It's also used to activate the other commands.*

The hand—which shows up in the upper left hand corner of the screen whenever you first turn your PCS on—is one of the most powerful game changing and constructing tools under your PCS command. You control the hand with your joystick. Go ahead. Try it. Move the hand around the screen to get a feel for how to make it go where you want.

Now move the hand over so that the index finger touches one of the pinball machine parts pictured just to the right of the empty game board—one of the flippers maybe, in the top row, or one of the round bumpers in the third one. Next, hold the button down on your joystick (either button will work if you're using an Apple) and while you're holding it down, "drag" the part out onto the board with your computer hand. When you want to let go just release the button.

Drag a few more parts onto the board. Be sure to put both a left and a right flipper toward the bottom in the center (where flippers usually go), and a ball somewhere near the top. If you're unsure what some of the parts are, look in the **Parts Inventory Guide** at the end of this manual. If you change your mind about a part just drag it off the board and let go.

When you're ready to put the ball in play, move your hand to the ball-and-flipper picture in the middle of the column on the far right of the display and press the joystick button once (don't hold it down this time). For instructions on how to use your flippers and how to put the ball in play again, study the chart on the inside front cover. Practice with your flippers and with moving back and forth between "play" and "construct."
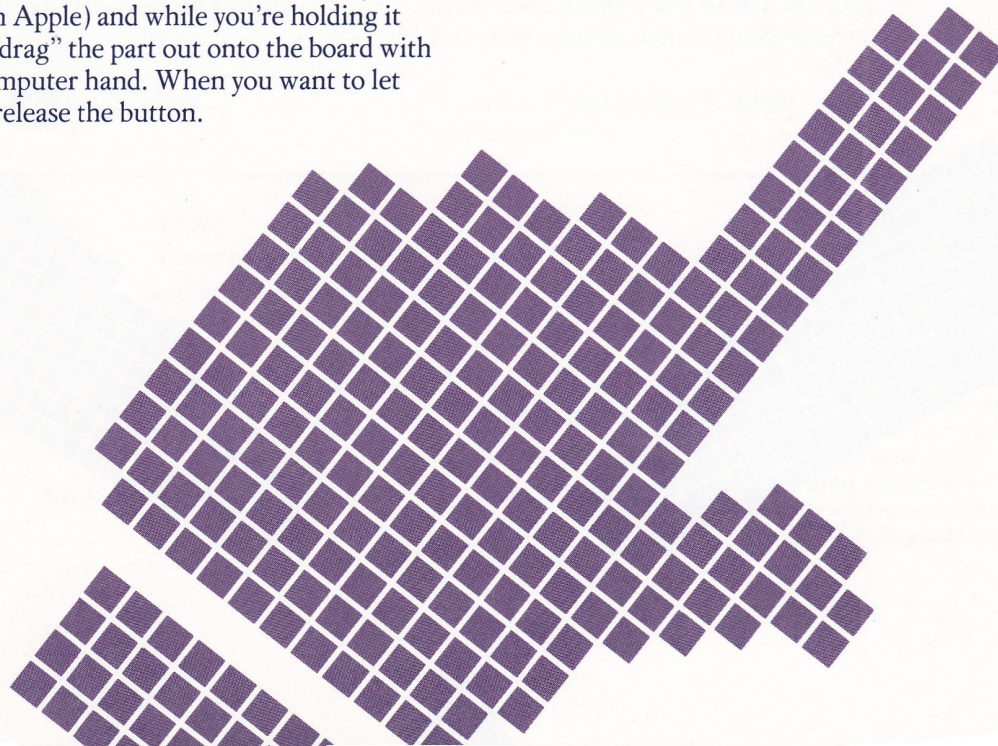
Loading and Playing a Demo Game

Your PCS disk comes with 5 ready to play games which you can play and modify and play anew to your heart's content.

The pictures in the right hand column of the display are called icons. Move the hand down now till it touches the **disk icon** (it's on the bottom) and press the joystick button. When the new display is in place, move the hand to the word LOAD and press the button again. Now type either DEMO1, 2, 3, 4 or 5 (don't leave a space between DEMO and the number) and press Return. When the words INSERT YOUR GAME DISK appear, press Return again. Once the game has finished loading, put the hand on PLAY GAME, press the joystick button and play to your heart's content—or at least until you're ready to load a different game or try out some of the other PCS commands. Then press ESC on your Apple or SELECT on your Atari and either repeat the loading steps or read on for more wonders still.
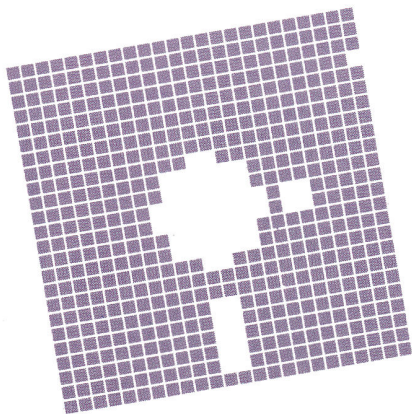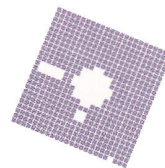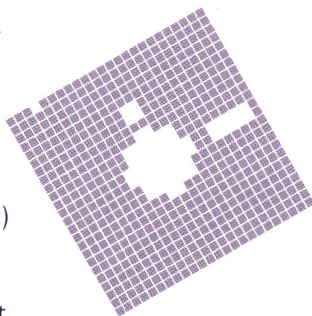
The material on the next few pages uses DEMO1 often as an example. If this is your first time through this guide, you will probably find it helpful to load DEMO1 before reading on.

Choosing Colors

*The **paintbrush** icon makes instantly changing the color of the game board border and the polygons as easy as pressing a button.*

Activate the paintbrush (it's 5th from the top) then move it down to one of the colors just beneath it and press the joystick button again. Now move the paintbrush into the black area in DEMO1 and press the button once more. Presto. Instant border color change. And you can change the color in the other two green shapes just as easily. Simply move the paintbrush inside each of them and press the button again.

If you try using the paintbrush to change the color of the two slingshots you'll discover that it doesn't work there. In fact, except for polygons (the parts on line 2 of the parts box), the paintbrush icon has no effect on ready made parts. But watch what happens if you drag one of the slingshots slowly across the board. See it alternate between two colors? Thanks to some oddness about high resolution graphics on your computer, you can choose between those two colors by deciding where to put a piece.

And what if you want a third color for a ready made part? For that you need the power in the magnifier icon, described in the next section.

Painting Details

*The **magnifier** icon lets you draw designs on the board, decorate parts and create fancy titles and signatures to give your games more personality.*

Activate the magnifier icon (it's just below the "play" one) and your hand will turn into a paintbrush. Now take the brush up, and using it like a hand, grab the small square in the upper left hand corner of the board and drag it around. Pull it across one of the bumpers near the top of DEMO1 while watching the large square to the right of the board.

The image in the large square is 7 times the size of the one in the small square. And whatever you do to the image in the large square is immediately reflected in the image in the small one. Try it. First place the small square on top of one of the bumpers. (There are three ways to move the square around: drag it; move the paintbrush to where you'd like the square to be and press the joystick button; put the paintbrush on an edge or corner of the large square, then press the joystick button and hold it down.)

Now place the paintbrush on one of the white rectangles in the large square and press the joystick button. Press it again to bring back the rectangle you just erased. Press it once more and this time hold it down and move the
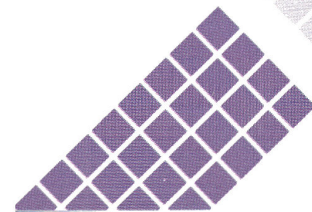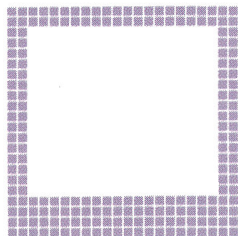
paintbrush around in the large square, erasing rectangles as you go. Now take the paintbrush down, use the joystick button to pick up a new color, go back into the large square and paint with the new color by holding down the joystick button as you move the paintbrush around.

Don't worry about messing up. If you don't like your new design you can always drag the bumper off the board, erase the leftover paint smudge with the magnifier paintbrush, then drag a new bumper on in its place. (Use QUIT to get the parts box back. To learn how to take unusual advantage of paint "smudges," see **Special Effects**, page 12.).

Because the high resolution graphics in your computer are a bit strange you will often be surprised at first by what happens when you try to draw new designs and erase old ones. Just be patient and you can usually solve the problem to your satisfaction. Sometimes the grid (just to the left of "quit") can be helpful. To turn it on, touch it with the paintbrush and press the joystick button. Do the same to turn it off. (The black and white symbol—for use when you don't have a color monitor—turns on and off in this same way.)

The magnifier can also be used to paint in the area above the large square, to the right of the board—a perfect place to use a fancy script to give your pinball games names. (It's like the part of a real pinball machine—the part called the "back glass"—where the score is kept.) For ideas about how to decorate your boards and create fancy back glass designs, study the other Demo games on your PCS disk, especially the higher numbered ones.
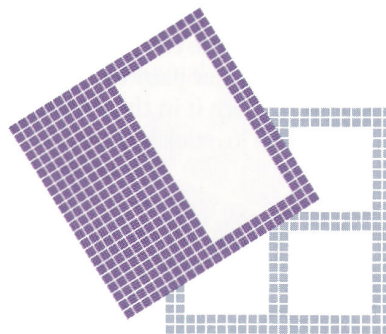
If you get tired of constructing and want to play for awhile, then come back and pick up where you left off, follow the instructions for saving your work on page 11.
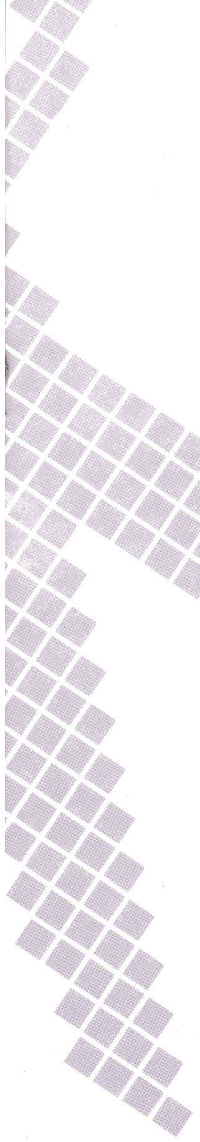
Creating New Shapes

*The **arrow, scissors** and **hammer** icons let you start with ready made polygons from the parts box to create the shapes and pathways you want in your games.*

One of the most powerful and spectacular PCS command sets makes use of the arrow, scissors and hammer icons near the top of the icon column, and the polygons. Use the hand to drag the square polygon onto the board. (You'll notice that only the corners of the square actually come out onto the playing surface.) Now get the regular paintbrush, pick up a color with it, place it in the center of the square and press the joystick button. Presto, a solid square.
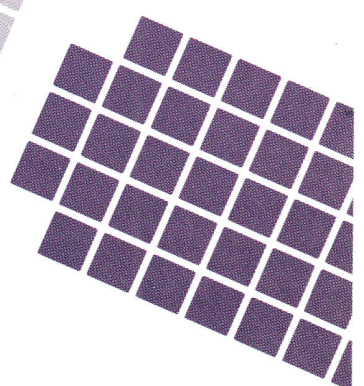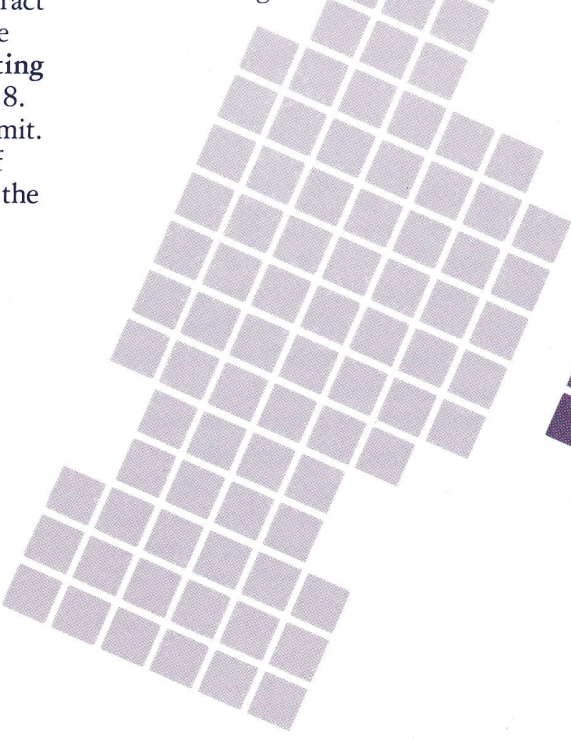
You can use the arrow, hammer and scissors to reshape your square into more interesting and useful forms. For instance, activate the arrow and then use it to drag one of the corners of your square to a new location. Don't like that shape? Drag another corner somewhere else. (You can also reshape your game board border by dragging around the "corners" that show up in it when you activate the arrow. Don't be afraid of mistakes. You can always go back to the disk icon and reload the game.)
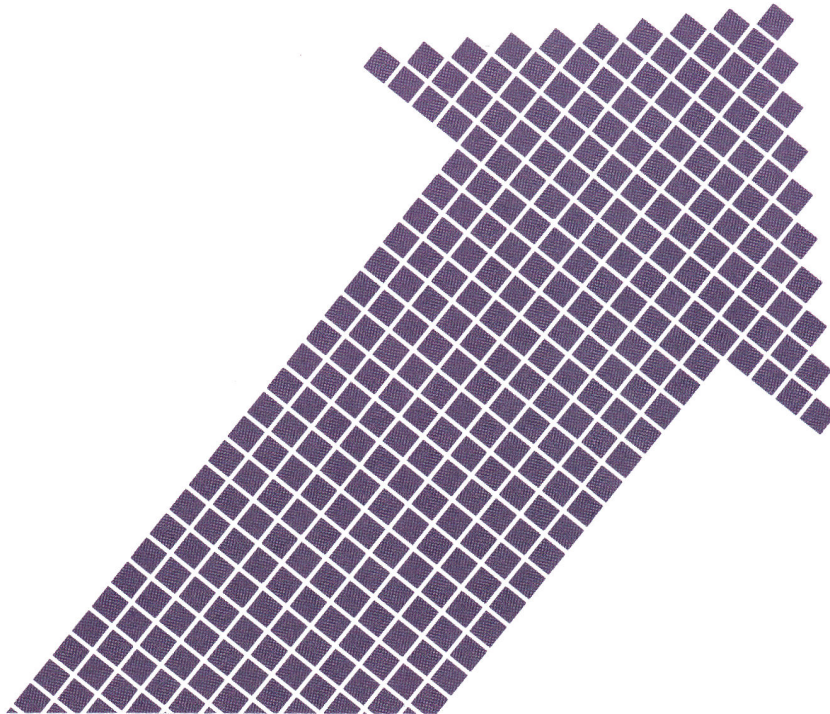
Tired of working with a shape with 4 corners? Go get the scissors, touch them to a corner and press the joystick button to create an instant triangle. Want more corners so you can make a shape with some curve to it? Go get the hammer, put it between two "corners" and press the joystick button. Repeat the process until you have enough "corners" to make the shape you're interested in. (For fast shaping, use the hammer to move "corners" as well as to add them.)

There's really only one rule: don't overlap or twist shapes. Doing so makes the ball interact strangely with the shape and may interfere with the wiring tools described in the **Setting Sound and Score Values** section on page 8. Otherwise your imagination's your only limit. And remember, if things should get out of hand, not to worry. Just drag the mess off the board with the hand and start over with a new square.

The straight vertical lines and jagged diagonal ones next to the square in the parts box are also polygons, just very skinny ones. Stretching one out to make something like the long ball chute on DEMO1 can be tricky if you forget that the line is a polygon, easy if you remember. Sometimes it's easiest if you draw the line you want with the first corner you move. You can then move the second corner out to the side as if you were making a fatter shape, bring it up till it's level with its mate, and finally move it back till the line's back to its original width.

Setting Gravity, Bounce, Kick and Speed

Setting Sound and Score Values

*A pinball player's dream, the **world** icon lets you change how heavy the ball is, how fast it moves, and how much kick and bounce you have in your game.*

Activating the world icon (just below the magnifier) causes the parts box to be replaced with four gauges, each with its own marker. Using the hand to drag markers up and down decreases and increases the force or condition the scale represents. Try it. Move the gravity marker to the bottom of its scale then select QUIT and go back and try out a ball. Can't get it in play because it's too heavy? Reactivate the world icon, decrease gravity a notch, then try again.

Do the same with the other settings trying them in different combinations. *Gravity* determines how heavy the ball is; *speed*, how fast it moves; *kick*, how strong the bumpers are and *elasticity* how "bouncy" the sides, flippers and any shapes you've fashioned are. Experiment until you find the combination you want—the one that "feels" best or plays hardest, whatever you like most at the moment, then use QUIT. And if you later change your mind, just go in and set new values to suit your new mood or interest.
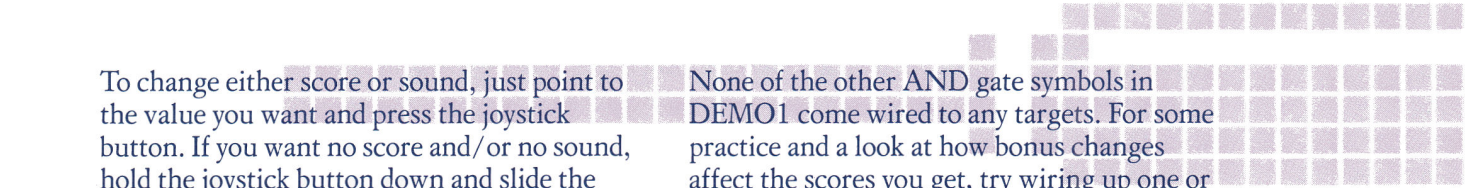
*The **AND gate** icon lets you decide on the score and sound for each target, bumper, etc. and it lets you wire pieces together to create special bonuses to aim for.*

The AND gate icon is located just above the disk icon. To a computer designer, an AND gate is an arrangement of switches that will let electricity flow through only if all the switches in the gate are on. In your PCS, the AND gate icon lets you hook targets together so that a bonus is awarded only after all the targets have been hit and turned on. It also lets you change the sound and score for each individual target, bumper, etc. on the game board.

Activate the AND gate icon with DEMO1 loaded. Move the hand out onto the new display, touch one of the bumpers and press the joystick button. The sound you hear (sound no. 1, as the white square in the note list shows) is made each time the ball hits the bumper. And, as the score list shows, each ball strike scores 10 points.
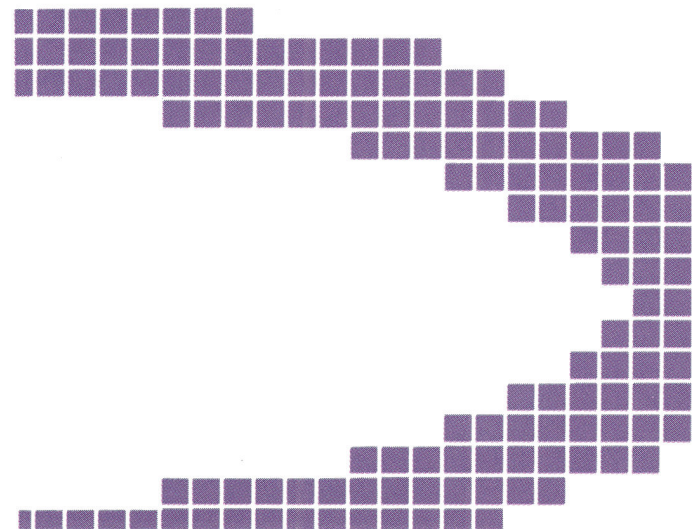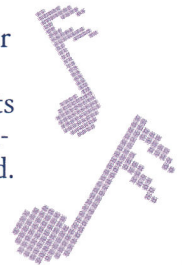
To change either score or sound, just point to the value you want and press the joystick button. If you want no score and/or no sound, hold the joystick button down and slide the marker off the bottom of the list. To find out what the default values for the other targets are and to change them if you like, touch each in turn and press the joystick button. ("Default value" is a useful computer term which means "what the value is unless you do something to change it.")

Bonuses are created by turning on AND gates with the hand and using the screwdriver and pliers to connect and disconnect wires between targets and the AND gate symbols. (As many as three targets can be attached to each symbol.) Move the hand up now to the top AND gate symbol in DEMO1 and press the joystick button. The wiring diagram you now see on the display means "each time you turn on *both* of the bottom rollover targets, you get a bonus of 10,000 points." To change matters so you get the bonus just for turning on the left rollover, go get the pliers, touch them to the right target and press the joystick button. To reconnect the wire, go get the screwdriver, touch the right target and press the joystick button again.

None of the other AND gate symbols in DEMO1 come wired to any targets. For some practice and a look at how bonus changes affect the scores you get, try wiring up one or two of them and playing a little. You might, for instance, connect gate 2 to the drop target and assign it a bonus of 5000 points which can be earned only by turning off all four of the target segments. Or you could connect the three bumpers at the top so that hitting all three produces a bonus of say 1000 points. And see what happens to scores if you keep the same wiring patterns but change the value of each.

For some interesting bonus creating ideas, use the AND gate icon to explore the wiring in the other 4 Demo games on your PCS disk, playing and changing as you go, thinking all the while about what sorts of scoring patterns you like best.

One final note. When you wire targets to an AND gate, they visibly turn on when hit and stay on until their fellow targets are hit as well, or until the game ends. In a multi-player game, each player's bonus target status is kept separately, so no one gets to luck out by hitting the last target after you had worked so hard to hit the first 2. And BonusX goes back to 1 at the end of every ball. (It never goes higher than 5 for any ball.)
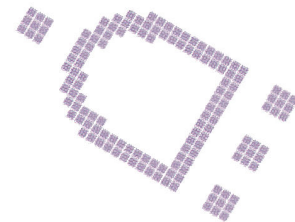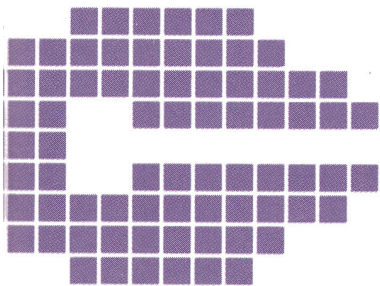
It doesn't take very many pinball games for most people to realize that learning to control the flippers to keep the ball in play is very important. Some keep playing long enough to learn to *aim* the ball in addition to keeping it in play, so they can go for the highest bonuses and avoid bad angles and traps. And pinball game designers keep that in mind when they create new games. They look for ways to put good bonuses near dangerous targets to challenge skillful players, all the while paying attention to whatever will make the game attractive and exciting to the eyes and ears. Look, for instance, at DEMO3. As wired there's a high bonus for the rollover targets at the top of the channel on the left. Try playing for awhile, doing your best to use the right flipper to send the ball up that leftmost channel to collect the big bonus. (If you've never learned to catch the ball on your flippers so you can control it, find people who know how, watch them play, then practice what you've seen.) It shouldn't take too long to discover that if you miss the channel and hit the knife edge target next to it, you lose the ball out the left side almost 100% of the time. It's a pattern experienced pinball players will recognize instantly and painfully, remembering all the quarters they spent learning to avoid "quick out" traps on particular machines. There are interesting points in the other Demo games as well. DEMO2 for instance has a very clean and pretty design but a little play will uncover places where the ball gets hung up, repeating the same pattern over and over until you take action to end "play" and return to "construct." Finding and getting rid of those traps provides a good chance to think about the relationship between angles and good and bad arrangements of bumpers and surfaces. And as you find other things you don't like in the Demo games—like the gate the ball sometimes gets stuck in on DEMO1, or the target it can get lodged behind on DEMO3—experiment with better placements and add to your insight about what details to pay attention to in building your own games. The possibilities are endless. DEMO4 makes it easy to keep the ball in play and produces high scores, an arrangement some players will love. Others will hate it, preferring instead a simple, low scoring but challenging game like DEMO1 because it has more flipper action in it. You can fashion interesting shapes like the semi-circle in DEMO3, add features like the ball hopper in that same game, create games within games like the little one in the top left of DEMO2 and much more. For a good sourcebook of pinball design ideas, look in your library or bookstore for *Pinball!* by Roger C. Sharpe (Dutton paperback, 1977), and *Pinball Wizardry* by Robert Polin and Michael Rain (Prentice-Hall, 1979). And keep your eyes open. Arcade games haven't replaced all the pinball machines yet. You never know when you might run across a terrific inspiration for a new game to build.

Saving and Loading Your Work

Activating the disk icon (on the bottom) gives you the power to load and play the five Demo games that come on your PCS disk. It also lets you use one of your own disks to save games you're working on and games you've finished so you can play them whenever you like. And finally it lets you use a "Make Game" command to create game disks your friends can use even if they don't have a PCS disk of their own. (Of course, once they've seen yours, they'll probably want one.)

To load or save a game, activate the disk icon, point to the command you want and press the joystick button, use your keyboard to type in the game's name, then press Return. If you're loading a Demo game, ignore the INSERT YOUR GAME DISK message and press Return again. Otherwise do as the message says first. (Note: Don't forget that blank disks must be initialized—by following the instructions that came with your disk drive—before they are used for the first time.)

If you want to play the game you loaded, activate the "Play Game" command, reinsert the PCS disk when the prompt tells you to and press Return once more. If instead you want to work on the game, use ESC or SELECT to get the parts box back.

Games saved with the "Save" command take up very little space on your disk—you can get more than 40 to a side. On the other hand, games saved with "Make Game" take up more than 10 times as much room because all the program instructions that simulate the ball and its interactions with the game board and parts must be saved as well. When you use "Make Game" to create game disks for your friends, tell them to start playing by booting a DOS disk and loading their game disk.

For the Apple II, boot a DOS 3.3 System Master and type "BRUN" followed by the name of the game. For Atari, boot Atari DOS II version 2.0 S and load the file by name. (When using "Make Game" on Atari, it's easier if you save games on a self-booting DOS disk).

One word of advice. Even when you use the "Make Game" command, it's a good idea to use "Save" as well to save a template for your game. Then if you later find a glitch or want to change a target value, etc., you need only reload your template with your PCS disk, make your changes, then use "Make Game" to remake the game under its original name.

Special Effects · Pinball Games for Computers Only

Some of the game effects you can create with your PCS could never exist in the world outside your display screen. For instance you can revive your interest in a game you've mastered simply by changing the world settings to make the ball play heavier, faster, etc. Or you can quickly rewire targets to reward players for aiming the ball in new directions.

Here's a definite first from PCS. The games you build with MAKE GAME or PLAY GAME are 5 ball (or 5 "turn") games for up to four players. Real pinball machines give you just one ball each turn, but computer pinball can give you as many as you want. Just design the game with more than one ball on the playfield and you will get the extra balls every turn.

For still more spectacular effects, try the following. Load a demo game then get a ball and put it on the playing surface above one of the bumpers. Next get the magnifier and remove all the paint from the bumper. Now put the ball in play. Surprised to discover that the bumper's still there even though the paint's gone? For an even bigger surprise, get the parts box back and try to drag the invisible bumper off the board. Now put the ball in play again. This time, even though it looks like the bumper's there, the ball falls right through.

Invisible ball eaters, ball eaters that only you know are fake—the possibilities are fiendishly plentiful. Got other ideas? Terrific. Just drag what you need onto the board and try them out. Maybe the most wonderful thing of all about PCS is that you can always drag the failures off the board into never never land and start over. Happy creating.

Parts Box Inventory

Note: The default values for sound and score are shown. To change values, see p. 8. You can have as many as 128 parts on the board at once.

| Part Name	Use/Behavior	Sound	Score
flippers	To put and keep the ball in play.	—	—
ball	The only indispensible part in the game.	—	—
polygons	Used to make shapes with elasticity (bounce) instead of kick. The amount of elasticity can be set with the *world* icon.	—	—
bumpers	They "kick" the ball away, regardless of where they're hit. The amount of kick can be set with the *world* icon.	1	10
slingshot	They kick the ball away only on the long side and act like polygons on the other two sides.	2	20
kickers	They kick the ball away only on the ends and act like polygons on the sides.	3	30
launcher	To put the ball into play. Can be cocked by moving the joystick up and down.	—	—
drop target	When all four segments have been hit and turned off, the whole target will turn on again. In a multiplayer game, target status is kept separately for each player.	5	50
ball hopper	Catches and holds the first two balls, turns all the balls loose when the third one comes in. In MAKE GAME or PLAY GAME, if a ball is caught, another ball is put in play (your turn is not over). In a multi-player game, status is kept separately for each player.	5	50
ball eater	Viciously vanishes the ball from the face of the cosmos. Next player, please.	1	50
spinner	Spins merrily when the ball passes through yielding points on every revolution.	1	10
magnet	Grabs at the ball, putting a twist into its movement.	—	—
lanes	Guideposts used to make pathways for the ball (see DEMO2).	—	—
gates	The one on the left will let the ball go through on the way up but not on the way down. The one on the right lets it go through from left to right but not from right to left.	—	—
rollover	Tallies a score when the ball passes over. If wired to a bonus, will turn on when hit and stay on until the bonus is earned or the game ends.	4	40
knife edge target	Tallies a score when the ball bounces off. Same bonus characteristics as rollover.	5	50

Dedication	I would like to thank Pete Rowe and Ted Cohn for providing the BUGBYTER debugger and numerous assembler/editors, Andy Hertzfeld and Burrell Smith for ideas and encouragement, and Jim Nitchals for helping. —Bill Budge

Parts Box and Icon Commands

flippers
ball
hand
arrow
scissors
polygons
hammer
paintbrush
bumpers
slingshots
kickers
launcher
colors
drop targets
spinner
ball eater
magnet
play
ball hopper
magnifier
gates
world
lanes
AND gate
rollovers
disk
knife edge
targets

The Magnifying Glass.

"The whole game started here. There was nothing else. No pinball. Nothing. Just this thing that magnified parts of a video screen."
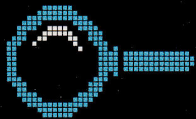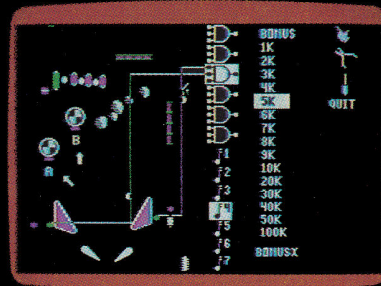
The World Functions.

"You can move these little rheostats and change the way the world works. That's something software can do. It's a way of getting control you don't otherwise have."
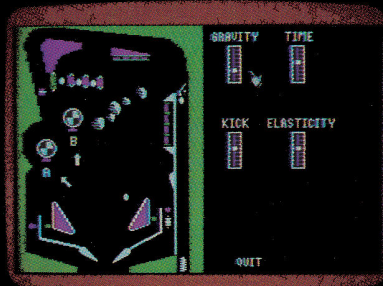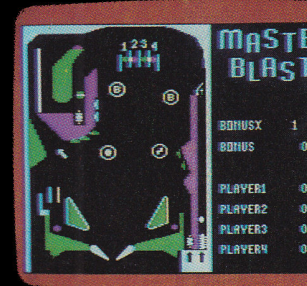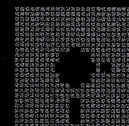
The Logic Diagram.

"This is like being underneath the board, looking up at the wiring. You want to change the scoring or the music, you get your screwdriver and pliers and you come down here."

Master Blaster.

"I sat down and built t[...] about half an hour. Y[...] could make a better o[...] you spent the time. M[...]"

Power. Pure, sheer and unadulterated. A nearly telepathic link between you and the machine. Here is the promise made good. Here is the reason why you bought a computer in the first place. It's been the best program ever written for an 8-bit machine. Boot the disk and find out why.

If you love bumpers (so do we), litter the board with them. Pump up their point value. Impress your friends.

This is your hand inside the machine. It works through your joystick. It moves and changes things. It does everything but walk the dog.

Want to change the laws of physics? Be our guest. Liven up the ball. Customize gravity. Thumb your nose at Newton.

The magnifying you enlarge and pixel on the scre you see what the does.

This alley's killing your score? Plug it up. Nothing says this game has to be difficult.

You've probably lost a lot of quarters wondering why there was only one pair of flippers. Well, there are a lot more where these came from. Help yourself.

There are five ready-made games on the disk. Use them for a quick pinball fix when you don't have time to make your own.

Here's where you can into the logic flow an shake things up. Cha scoring. Change the r Make strange things

ELECTRONIC ARTS