

# THE ARCADE MACHINE



*Create your own arcade games.  
No programming knowledge necessary!*

**Broderbund Software**

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## I. Introduction

If you have ever wished that you could design and program your own fast action arcade game but been stopped because you didn't have the programming background, then the Brøderbund Arcade Machine was built for you! It will still take patience, hard work and a creative eye, but YOU DON'T HAVE TO KNOW HOW TO PROGRAM!

Even better, you are going to be able to learn each part of arcade game design and try it out in a completed arcade game instantly! Try your hand at animation and see it on the screen two seconds later! The Arcade Machine was designed as a teaching tool, and quick feedback was assigned highest priority. Ten minutes after you finish reading this manual you will be able to play an arcade game that has elements of your own unique design.

The Arcade Machine will guide you step by step through the process of designing and producing your own computer arcade game. As you gain familiarity with the different options available to you and the variety of ways in which they may be used, your ability to create more and more complex and original games will grow as well.

AM comes with five sample games on the flip side of the disk, as well as a test game that loads into memory when you start to use the program. As you practice using the different parts of the Arcade Machine, you may find it useful to try modifying parts of the test game or the other samples rather than designing a game from scratch. Once you are comfortable with all of the functions, of course, there is nothing to keep you from creating something entirely new and different.

AM does have some limitations—it is not entirely free-form. However, it is extraordinarily flexible and will permit the creation of a truly astonishing variety of very different games.

Let's get started. Take the Arcade Machine disk, place it in your disk drive and turn on your computer. We're ready to begin!

## II. The Main Menu

After the title page comes up, press any key and AM will jump straight into a sample game. You can play this for a bit, using paddles or joystick, until you are ready to get on with the real stuff. Or use the keyboard if you like. Type B (for Bottom tank) and you will find that you can control the tank's movement by pressing the K for left, the L to stop, and the semi-colon (;) for right movement. You fire with the space bar.\*

When you're all ready to begin with the serious stuff, press RETURN. You will see the following:

### \*\* MAIN MENU \*\*

- (1) SHAPE CREATOR
- (2) PATH CREATOR
- (3) GAME OPTIONS
- (4) LEVEL OPTIONS
- (5) BKGD/TITLE CREATOR
- (6) LOAD/SAVE GAME
- (7) CREATE GAME DISK
- (8) RUN GAME

This menu calls all of the principal programs in the game creator. You can almost always return to this menu if you get lost by pressing RETURN repeatedly.

One of the first and most important functions on the menu is listed at the very end. You can test your efforts at almost any point by typing '8' to run the game (pressing RETURN is equally effective). Running the game does not create a disk or data or do anything at all permanent. It just lets you see how things are progressing. It's perfectly safe. In fact, try it right now, and then press RETURN to get back to the main menu.

We're going to start by taking the test game and modifying it part by part to learn how the various features of the Arcade Machine work. After each modification you will be able to return to this main menu and examine your progress by running the modified game.

\*For future reference, two player games are also possible and one or both players can play on the keyboard. 'B' toggles the bottom tank between keyboard and paddle. 'T' toggles the top tank. The top tank's control keys are: 'A' for left, 'S' to stop, 'D' for right, and 'F' to fire.

## III. The Shape Creator

Type '1' to call up the first routine on the main menu, the Shape Creator. The Shape Creator will permit you to design and animate all of the moving objects in your game. It also allows you to decide how many shapes you are going to use and what size they will be. Your computer screen should now look like this:

### \*\* SHAPE CREATOR \*\*

- (1) CREATE/EDIT SHAPES
- (2) BLOCK/OBJECT STATUS
- (3) RETURN TO MAIN MENU

If you type '3' right now or press RETURN you will flip back to the main menu. Press '1' instead and you should see something like this:

ARCADE MACHINE OBJECT SET-UP			
BLOCK 1 (SML)	BLOCK 2 (SML)	BLOCK 3 (SML)	BLOCK 4 (SML)
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6

- (1) SHAPES
- (2) EXPLOSIONS
- (3) TANKS
- (4) TANK EXPLOSION
- (5) RETURN TO MENU

'Shapes' are the objects that aren't controlled by the players. We might just as easily have called them the 'aliens' or the 'enemy'. Instead we just called them 'shapes.' 'Explosions' refers to what happens when a 'shape' and a missile try to occupy the same space at the same time. 'Tanks' are the objects controlled by you, the game player. (It's plural because the Arcade Machine can generate either one- or two-player games).

Each arcade game you create can include as many as 24 different enemy shapes on the screen. These shapes are organized in four groups, called blocks, for ease of reference. Each block can consist of 6 small objects, or 3 medium-

sized objects, or 2 large objects, and that is why the top half of your TV screen now has four columns (one for each block) on it, each with six numbers in it. As you can see, in the parentheses under each block heading, the blocks are set to small size, and each has 6 objects. (The fourth block is not being used). If you go back to the sample game and look at it, you will see that there are 18 (6 objects times 3 blocks) aliens marching around on the screen. Let's take a look at one of the shapes in Block 1. Press '1' to indicate that we want to edit a shape. The screen will then say:

BLOCK NUMBER (1-4)

Answer by typing '1'. The next prompt is:

SHAPE NUMBER (1-6)

Type '1' again.

The screen will clear and then seven little numbered images will appear at the top of the screen. At the bottom you will see a rectangle filled with a pattern of white dots. If you look at the white dots from a distance, you may notice that they represent an enlargement of the first of the seven images.

It is important that you understand why there are seven images of an alien on the screen right now, even though we are examining only one 'shape' in one block of shapes. Animation is created by rapidly substituting one picture for another and allowing the eye to blur the images together into one continuous motion. The easiest way to animate a shape on the Apple is to substitute nearly identical images of a shape for one another as an object moves across the screen. Therefore, you will have an opportunity to create seven slightly different images of the same object and the arcade game will display them one after another as an object moves on the screen.

It is actually the horizontal position of the shape that determines which of the seven images is drawn. If the object is plotted starting on the first vertical line of the screen, then the first image is used; if it is plotted starting on the fifth vertical line, then the fifth image is used. After the seventh image has been used, it starts over again with the first image, of course.

If you examine the seven images closely you may notice that some of them differ slightly from one another—if you recognize the shape from the sample game, you may remember that some part of the object wiggled as it crossed

the screen. Or go back and look at it if you like (you will find yourself watching the test game if you press RETURN five times in a row); you should be able to find your way back here when you're done.

Now let's erase the existing shape and try drawing one of our own. Type 'E.' At the bottom of the screen it should say:

ERASE? (1-8) OR 9-ALL

The big rectangle at the bottom of the screen is considered image '8.' However, since we want to erase everything, type '9.' All of the images will disappear. Only the flashing cursor in the rectangle remains.

You can move the cursor with the I-J-K-M diamond on the keyboard, and you can plot a dot in any position by pressing the 'F' key. Pressing 'D' will erase an unwanted dot. Try drawing a horizontal line. It should appear as part of all seven images as well as in the rectangle at the bottom. Move down a line or two and draw another horizontal line, plotting only every other dot. Color! Drop another couple of lines and draw a horizontal line offset one dot from the colored line you just drew. You should get a completely different color. Dots plotted side by side look white. However, when you plot every other dot, you get color. Occasionally one or several of your dots may appear washed out and lacking intensity. Try moving one dot to the right of the washed out dot and press 'D' in the blank space. For highly mystical technical reasons this may make your colored dot brighter.

The Apple has two sets of colors. They are:

Set One	Set Two
Black1	Black2
Green	Orange
Violet	Blue
White1	White2

The two whites look almost identical (as do the blacks). To switch to the alternate color set, type 'C' and then continue to plot. To change back to the original color set, type 'C' again. You can draw shapes in four colors, plus white and black, which is all your Apple has to offer.

Now erase all of those lines and get down to some serious work. Let's start by working on a very simple flip-flop two image shape. Press the keys 2, 4, and 6. These digits will disappear from the screen, and when we start to draw, we'll only be drawing to images 1, 3, 5 and 7. Now draw your best little alien. (If

you want to practice on paper first, there is a worksheet provided that has just the right number of horizontal and vertical lines.)

When you're done, press all of the keys from 1 through 7. The numbers that were on will go off, and the ones that were off will go on. You can erase all of the dots in the rectangle by typing 'E8' or you can use them as a reference as you draw the second image of your shape. Be sure to make some part of it different from the first image. If you put arms on your alien, draw them in a 'down' position in the first set of images and in an 'up' position in the second set.

Another command that may prove useful is T for Transfer. You can transfer any of the eight images to any other image by typing 'T', then the source image, then the destination image.

Let's go see how we're doing. Press RETURN and the following line will appear:

SAVE SHAPE TO MEMORY? (Y/N)

If you are so disappointed in your efforts that you want to throw all of your work away, type 'N'. If you have already saved your work previously and just want to admire it, you can also type 'N' or RETURN when you leave. If you are saving it for the first time, type 'Y'. Next you will see:

SHAPE NUMBER? (1-6)

This is where you decide which of the six shapes in the block you want to replace with your new shape. Since we are using only shapes #1 & 2 in the demo program, type either 1 or 2. Then press RETURN three times. There's your shape, in with all the others, wiggling across the screen.

Let's digress for a moment to discuss the difference between shapes and objects. Each block can store up to six different shapes in memory. Each block ALSO controls up to six different objects on the screen. Think of the shapes as masks and objects as actors. Each actor, before he goes onto the stage, must select a mask to wear. There are multiple copies of each mask so, if they like, all six of the actors in a block could choose to wear the same mask, in which case the other five masks would just sit in the dressing room drawer, gathering dust and waiting for their moment to strut and fret upon the stage.

Therefore, we can, if we choose, replace ALL of the objects in this block with the shape that you just drew. Return to the Shape Creator in the usual

manner, requesting your shape to be displayed upon the editor. When all seven images are on the screen in front of you once again, press W. W is the command to Write a shape, and you can write it to any of the shapes in the block. Transfer your shape to both 1 and 2 by typing W1, W2. Then go take another look at the game. Not bad, eh?

Caution: The "W" command erases and replaces in memory any shape that is addressed. It does not automatically put your shape into play. (Remember that only Shapes 1 & 2 in Blocks 1, 2, & 3 are used in the sample game, so write to Shape 1 or 2 in order to affect the sample game).

This diagram shows how shapes are used in the sample program:

Block 3		(1)	(2)			
Block 2	(1)	(2)	(1)	(2)	(1)	(2)
Block 1	(1)	(2)	(1)	(2)	(1)	(2)

Shapes are represented in parentheses by their corresponding number, i.e., the bottom row consists of Shapes 1 & 2 from Block 1.

One last thing. Our sample shape only used two images and flip-flopped between them. However, if you like, all seven images can be different, so very complex animation is possible. You will even learn later how to link shapes together so that more than 7 images can be displayed through use of the Mutate command in the Path Creator.

Part 1 of the Shape Creator permits you to draw shapes, explosions and tanks. Although we have only talked about drawing shapes so far, drawing explosions or tanks is not very different. The same commands are available to you.

There are a few small differences. If you decide to draw explosions you will be asked: EXPLOSIONS? (S,M,L). If the alien shapes are small (as all of ours have been to date), then type S. The computer actually keeps in memory three sets of explosions, one for each size object. If your game uses only small objects, then the medium sized and large explosions are never used (although you can feel free to edit them if you like). Each size has two shapes and during an explosion flips rapidly between them.

The explosion animation differs from the animation produced in the Shapes in Blocks 1 through 4. Because an explosion does not move on the screen but remains in one place, its motion is caused by flip-flopping between two images rather than running through a progression of 7 images as in the case of

Shapes. Your explosion then will only include two images from any of your 7 pairs:

Shape #1 ...	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Shape #2 ...	(1)	(2)	(3)	(4)	(5)	(6)	(7)

You can actually produce 7 different looking explosions for each shape size. Which pair is used will depend on where your shape is at the time it is hit.

If you are drawing tanks, you will be asked: TANK? (T)OP OR (B)OTTOM? If you are creating a two player game, then you will have to create a tank for each player.

Part 2 of the Shape Creator is called 'BLOCK/OBJECT STATUS'. Let's enter this part of the program by typing a '2' from the Shape Creator menu. The top part of the screen will look like this:

\*\* ARCADE MACHINE OBJECT SETUP \*\*  
LEVEL 1

BLOCK1	BLOCK2	BLOCK3	BLOCK4
(SML)	(SML)	(SML)	(SML)
1 ON	1 ON	1 ON	1 OFF
2 ON	2 ON	2 ON	2 OFF
3 ON	3 ON	3 ON	3 OFF
4 ON	4 ON	4 ON	4 OFF
5 ON	5 ON	5 ON	5 OFF
6 ON	6 ON	6 ON	6 OFF

(L)EVEL, (B)LK STATUS, (O)BJECT ON/OFF

With this function, you can determine just how many and which objects you want to use in each of the five levels of your game. You can use as many or as few of the objects as you like in each level. Pressing 'L' permits you to display the current setup for the level you want and then change it if you like.

If you press 'B', you can change the size of the objects in one of the blocks or turn on/off the entire block. The only shapes that come in different sizes are the alien shapes (and the explosions that go with them). To change a block of shapes, type B. You will then see:

BLOCK NUMBER? (1-4)

Type the number of the block you want to affect (try typing a 1 this time). Next you will be asked:

BLOCK ON? (Y/N)

If you look at the top of the screen, you will see that the first three blocks are all turned on right now. The fourth block is turned off. Just to see what happens, why don't you turn Block one off and then run back to the game and see what is missing (this is one way to find out which six objects were included in Block 1). Then come back here and turn the block back on. The program will then ask you:

SIZE? (S,M,L)

Right now Block 1 contains 6 small objects. Just as an experiment, type L. The column of numbers under Block 1 will shorten to just two numbers. As you recall, a block of data can be interpreted as six little objects, three medium objects, or two large objects. If you want to see what your two large objects look like, hit RETURN until you come to the game. Not very impressive, are they? You will have to go to Function 1: Create/edit Shapes and draw a couple of new shapes, large size, to clean up what you see on the screen. (And even then the 2 shapes would be positioned too close to one another to look good on the screen. You would have to modify their starting positions which we'll get to in Chapter VI). So remember, you can't change the size of your shape after you've drawn it.

It might be a good idea, before continuing, to boot Arcade Machine again. We have played around with the shapes some, and the sample game probably isn't what it once was.

That's about all there is to the Shape Creator. Even if you never used another part of the Arcade Machine, this section could permit endless studies of computer graphic design and animation technique. But we're sure you won't want to stop here...

#### IV. The Path Creator

The second function on the Main Menu is called The Path Creator. Type '2' from the Main Menu and you will enter the Path Editor. You will see two rectangles, one inside the other. In the center of the smaller rectangle you will see a small crosshair and, next to it, a little alien. Think of the smaller rectangle

as representing the entire TV screen. The position of the crosshair in relation to this rectangle is the same as the position of the alien in relation to the actual screen. To understand this, try the following experiment: Press **K** three times. Each time you press **K** the crosshair moves to the right. However, the little alien moves even further to the right. When the crosshair reaches the edge of the inside rectangle, the alien should be disappearing off the edge of the screen. The alien moves across the screen exactly as he's seen during the game. The crosshair, however, moves relative to the diagram.

What you are doing is constructing a path table. Keep pressing the **K** key until the crosshair and alien wrap around to their initial position (if you aren't sure where that is, keep your eye on the X and Y coordinates in the lower left-hand corner of the screen; when the X equals 118 you are almost back where you started, and you won't be able to get any closer until you learn some other commands, so consider that good enough for the time being).

To end your path table type **E** for End (actually, paths never end; they just start over again at the beginning—so the path table you just wrote would work just as well if you only pressed **K** once before ending it). Then press **RETURN** enough times to get to the game and watch the aliens follow the new path you laid out for them. Around and around... But we can do better than that! Back to the Path Creator!

Take a look at all that text at the bottom of the screen. The first thing you see is PATH NUMBER 1. You can create up to ten different path tables for your creatures to follow. Each path table can be up to 254 instructions long. This prompt is just to tell you which path table you are working on.

To the right of that you should see: PATH POINTER 1. The path pointer is designed to tell you how far along on your path the little alien on the screen is at that particular moment. Since your paths, with all their multitudes of instructions, can get very complex, it is important that you know exactly where you are at any particular moment (this is also the reason that your Arcade Machine comes with worksheets to help you lay out your paths—if you don't keep track of your efforts on paper, you may find it hard to find the precise spot where your path is fouling up).

To the right of the path pointer is: SPEED 1. It is not necessary that all of the creatures in your game move at the same speed, or even that a particular creature always move at the same speed. SPEED is an index. A speed index of "1" means that a creature on this path is going about the same speed as everyone else on all of the other paths. On the other hand, an index of "3" means that anything on this path will be moving a lot faster than shapes moving on part of a path that has a speed rating of "1". (If you give all of your paths a speed rating of 3, however, everything will move at exactly the same speed, and that speed will be precisely the same as if you had given all of the

paths a speed rating of 1—the numbers mean speed RELATIVE to the other objects on other paths.)

On the bottom line are four more important pieces of information. The X and Y values give you precise information about the location of your shape on the screen. The way they work is this: the X value tells you how far you are from the left side of the screen. An X value of 1 means that you are on the left edge. A value of 240 means that you are on the right edge. The Y tells you how far from the top of the screen you are. Again, these numbers run from 1 to 240.

The path table you just wrote, however, didn't say "Start at coordinate 120,120 and then go right 3 times." All it really said was, "Starting wherever you happen to be at the moment, go right three times." That's why all of the aliens moved to the right (since they were all on the same path) but moved in formation, not on top of one another (since they all started from a different spot). We will talk about setting up the starting positions of your objects a little later. Right now let's just talk about how to move them.

To the right of the X and Y values at the bottom of the screen you will find the word LENGTH, followed by the number 14. LENGTH can be set to any value between 1 and 14. This represents the number of dots in a particular direction that a shape will move each time we press a direction key. For example, when we pressed **K**, the alien took 14 steps to the right, since **K** is the direction key for right.

There are eight direction keys. At the bottom righthand corner of the screen is a two letter code representing the direction in which the shape is moving. If you call the direction toward the top of the screen North and toward the right East and so forth, the eight points of the compass are represented by the following keys:

Northwest <b>U</b>	North <b>I</b>	Northeast <b>O</b>
West <b>J</b>		<b>K</b> East
<b>N</b> Southwest	<b>M</b> South	Southeast

Try the following test. Re-enter the path creator (if you are in it right now, exit by pressing **RETURN** and then enter again). Now try to design a path that takes the shape in a circle, eventually returning to the point where it starts. Don't forget to type **E** to end the path. Then exit and take a look at the game. That's not so hard, is it?

If you would like to examine your path table step by step, there is a procedure for single stepping through it. Return to the path creator and press the right arrow. Each time you press it, the path pointer will advance by 1 and the little alien will move in the manner indicated by the next command in the path table. If you would like to back up, you can use the left arrow. So if you made a mistake somewhere in the path table, you can step through it until you find the error and then enter the correct instructions from that point.

In addition to the command keys we have described so far, each of the ten numerical keys has a function. Here is a description of each:

'1' SET PATH NUMBER (1-10) – You can create up to 10 different paths. Use this to change the number of the path on which you wish to work. It is a good idea not to use PATH #1 for one of your permanent paths, since the program is automatically set to PATH #1 every time you enter the PATH NUMBER function.

'2' SET PATH POINTER (1-254) – This allows you to jump directly to any point in a path table (much faster than pressing the arrow keys repeatedly to get there). However, the computer will not know the correct X and Y coordinate for the alien if you move to a point in your table this way; you will have to enter the information manually.

'3' SET X & Y COORDINATES (1-240,1-240) – You can use this command to set the coordinates of the alien on the screen; a setting of 120,120 will put the shape back in the middle of the rectangle. This will not affect your actual path positions during game play, but is useful for aligning paths during set-up.

'4' SET LENGTH (1-14) – Typing 1 will permit you to set the length of movement each directional keystroke will take you. Initially this is set to 14. If you type K, for example, the alien shape will move 14 spaces to the right. (You will find that moving up and down always goes in multiples of 2; therefore if length is set to 14 and you move one keystroke downwards, the Y coordinate will change by 28. There's a reason for this. We just can't remember what it is.)

These four commands are editing commands. However, the next six digits actually insert commands into your path table, which are acted upon whenever an object following that path reaches the point where you inserted them.

'5' DROP BOMB – If you type 5, a marker will be left in your path. Whenever an object strikes that marker it will release a

bomb. Whenever you give a DROP BOMB command you must follow it with a direction. Here are your choices:

Northwest U	North I	Northeast O
Randomly north J	K Randomly south	,
N Southwest	M South	Southeast

You can drop bombs 'up' because it is possible to construct two-player games where one of the player's tanks is at the top of the screen. If you type '5K', then each time an object reaches that point in the path table, it will release a bomb in a random downward direction.

'6' SET SPEED (1-3) – You may wish objects to speed up at some point on a path. This command will permit you to make some parts of a path slow (1) and others faster (2 and 3). Remember, however, that these speeds are not absolutes but only in relation to the other objects, so if you gave all parts of all paths a rating of 3, objects would move no faster than if you gave them all identical ratings of 1.

'7' SHAPE CHANGE – When an object strikes this marker it mutates to the next higher numbered shape in its block. For example, if it was shape #1, it will mutate to shape #2 (if it was shape #6 it will mutate back to shape #1).

'8' JUMP TO ANOTHER PATH TABLE – This command must be followed by the number of the path to which the objects are expected to jump. When the jump occurs, the objects will jump to the beginning of the path table jumped to. If you then want to return to the former path table, inserting a CTRL-R will cause a RETURN to the exact point of departure, plus 1. So, for example, if the tenth command in Path #1 is JUMP TO PATH 2, then the next command that shape will execute will be the first command in Path 2. If Path 2 contains a CTRL-R (RETURN) command, when the shape hits that command it will return to the eleventh command in Path #1 and continue on from there.

'9' DELAY (1-30) – This is an extremely valuable command. It permits an object to wait in one place while other objects perform up to 30 additional instructions. This can be particularly

useful if you want one object to break away from a pack, perform some independent actions, and then return to its previous position in the pack. Timing the return to the exact position in the pack can be a little difficult, and this command makes it much easier. Each cycle in the delay corresponds to 1 unit in length, so that if Object 1 has a delay of 10 cycles, Object 2 can move a length of 10 units in the same amount of time (or 10 lengths of 1 unit, etc.).

'0' JUMP ON TANK POSITION – This is what is known as a conditional jump. When an object is given this command, it compares its position on the screen with the tank at the bottom of the screen. If it is to the left of the tank, command will pass to the same position on the next higher numbered path table; if it is to the right, it will stay on the same path table.

If you learn no other commands, you can still write perfectly good path tables with these. However, the Arcade Machine does include a number of other commands designed to make your job easier. Here they are:

**S - SAVE** If you are working on a complicated path, you will often want to run the test game to see how the path looks. It can be a nuisance getting back to the exact place where you left off. If you press S right before exiting the Path Creator, your current position will be stored in memory and can be retrieved when you are ready to continue work. (Warning: if you load in another function from the Main Menu, your place in the Path Creator will be lost.)

**R - RETRIEVE** If you press R as soon as you enter the Path Creator, it will recall which path number, path pointer, x, y coordinates, and length you saved (see previous command, S - SAVE).

**C - CLEAR PATH** Pressing C will fill an entire path with End statements. This permits you to build the path bit by bit without the bother of adding an End statement every time you go to test your effort and then deleting it upon return.

**W - WHICH?** If you want to work on the motions of one of your objects, this command will bring in the X,Y coordinate, path number and starting path pointer position of any object in any block at any game level.

**CTRL-T - TRANSFER** If you want to transfer all or part of any path table to another path table or another point in the same path table, this command will permit you to do so. (CTRL stands for the Control key on the left side of the keyboard. If you hold the CTRL key down and then press T, as you would with the shift key on a typewriter, you have typed CTRL-T.)

**ESC** - The ESCape key allows you to see the full graphics screen by removing the text window at the bottom of the screen. You can restore the text data by pressing ESC a second time.

**CTRL-I - INSERT** This command shifts each higher numbered instruction above the path pointer up one position. Pointer 10 becomes Pointer 11 etc. with Pointer 254 becoming Pointer 255 (nonexistent and hence lost), permitting you to insert an instruction. You must type CTRL-I before each command that you intend to insert. Remember that this command will move EVERYTHING in the path table after the path pointer, which can be a real nuisance if you have charted out your path usage very carefully. If you add to a path without using the INSERT command you will simply replace the previous command at the same pointer. Remember that if you replace or insert a command you may cause drift. (See explanation of drift at end of this chapter.)

**CTRL-D DELETE** This command works in a similar fashion. Each higher numbered instruction above the path pointer is shifted down one position. The command at the path pointer is lost. This may be confusing at first. Look at the following diagram representing the bottom portion of the screen in the PATH CREATOR section:

Path Number 1	Path Pointer 4	Speed 1
Bomb Released So		
X, Y (120, 120)	Length 14	Direction So

This does not mean that the command "Bomb Released So(uth)" is at Path Pointer 4, but rather that "Bomb Released So" is executed by Path Pointer 3 and Path Pointer 4 awaits your next command. To delete Bomb Released So you must step back to Path Pointer 3 with the left arrow, then press CTRL D.

**CTRL-F - FIND** This command allows you to find quickly the first occurrence of a command in a path table. You can only search for the six numerical commands. For example, if you typed CTRL-F5, the Path Creator would search forward until it found the first DROP BOMB command in the path table. (If it encounters an END statement before it finds the command you are looking for, it will stop.)

**B - BLANK BACKGROUND** If you have drawn a background, it will ordinarily appear while you work on your path tables. This permits you to see how your shapes will interact with the background as they move. If you want to turn the background off while you work on your shapes, however, just press B.

The Path Creator is probably the most complicated part of the Arcade

Machine. However, it is also the most flexible and powerful part. After you get used to using the commands, you should have little difficulty with the Path Creator if you keep in mind several things.

First of all, the paths that you create are RELATIVE paths – that is, they indicate where you should go relative to wherever you are at the moment. If you start three objects on the same path but from different starting positions, they will move in formation. If your path is a circle, each object will move in a circle, BUT IT WILL NOT BE THE SAME CIRCLE. If you want the three objects to follow one another around in a circle, you will have to design a path that goes through the starting positions of each shape and then start each shape at a different point on that path.

There are two concepts here that we have not discussed yet. The first is the STARTING POSITION of each object, which we will cover in Chapter VI, Part 3. This refers to the X,Y coordinate where each object begins its journey. The second is the STARTING PATH POSITION of each object, discussed in Part 5 of Chapter V. It is not necessary that each object start receiving commands at the beginning of a path table. One might start with the first command, another with the sixth, and the third with the eleventh. This, in fact, is how you get shapes to follow one another about.

One of those items that we mentioned briefly but which we probably should stress is that when objects come to the end of a path table, they start over again at the beginning of that path. As a result, it is usually advisable to end path tables at the same X,Y coordinate where they began. Otherwise, you may get a gradual drift of objects across the screen. As an example, go to the Path Creator and type K until the X,Y coordinates wrap around to 118, 120. Then type M to move downward and then E to end the path. Try running the game. As you can see, each time the objects circle the screen, they also move downward and in little time, the game gets completely unplayable. You can use this drift factor in your games if you like, of course, but you should be aware of why it happens.

Finally, the reason that a Path Table worksheet is included at the end of this book is that it is crucial that the actions of objects on different paths be properly coordinated. This is far easier to do on a sheet of paper which graphically displays all of the activity on all of the paths than it is on the computer, which can only deal with one path at a time. Therefore, we suggest that you use a copy machine to make copies of that sheet (or make up a scheme that's more to your liking) so that you can track the activities of ALL of your objects simultaneously.

## V. Game Options

The third function on the Main Menu is called Game Options. This function is actually a collection of five small utilities that allow you to set up a variety of substantially different games. When you type '3' from the Main Menu you will see the following Game Options Menu:

### \*\* GAME OPTIONS \*\*

- (1) GAME OPTIONS
- (2) SOUND
- (3) SET SCORES
- (4) PATH POINTER START VALUES
- (5) MUTATE OPTION
- (6) RETURN TO MAIN MENU

Now press '1'. The following screen will appear:

- (1) NUMBER OF PLAYERS? ONE
- (2) NUMBER OF TANKS TO START GAME? 3
- (3) TIME LIMIT? NO
- (4) BOMB/MISSILE COLLISION SCORE? 0
- (5) GAME DELAY? 0
- (6) BOUNCING BOMBS? NO
- (7) EXPLODING OBJECT OPTION? NO
- (8) NUMBER OF BARRIERS. 1
- (9) RANDOM OBJECT BOMBING? 0

PLEASE CHOOSE (RETURN TO EXIT)

Let's go through them one at a time. Press '1' to change the number of players from one to two. Press '1' again, and the word "Special" will appear after the option. The special one player option permits the bottom tank to move vertically as well as horizontally (the top tank cannot be used in this configuration). If keyboard mode is being used, K moves left, O moves up, L moves down and ; (semi-colon) moves right. The E key will fire up and the D key will fire down.

If you press '1' a third time, this option will cycle back from "Special" mode to "One player" mode.

You may set the number of tanks (extra players) that each player begins the game with. That number can vary from 1 to 9.

Number three permits you to add a new feature to the game—a time limit. If you answer this yes, you will be asked the number of seconds and may respond with any number between 1 and 6,000. The larger the number, the longer the time before the game automatically ends. Roughly fifteen seconds before a game ends, the "SHIPS" sign at the top of the game screen will begin to flash.

If you want to award points for successfully shooting down bombs, you will turn on number four. The score awarded can vary from 0 to 990 points (ten times the number you type in, since the ones column on the scores is a dummy).

Number five can be used to slow a game down. If you have finished your game and decide that it just plays too quickly, add a delay number here between 0 and 100. The larger the number, the slower the game will play.

Number six permits an option in which falling bombs bounce off the side of the screen, off horizontal background objects drawn with WHITE1, and off vertical background objects drawn in WHITE2 (although the vertical lines have to be at least seven dots thick). See Chapter 7 for discussion about drawing background objects in color.

Number seven causes all alien shapes to explode when they hit the bottom of the screen. You may want to create a game in which you try to prevent shapes from reaching the bottom of the screen. This option permits you to reward or punish the player for failing to catch the falling shapes.

Number eight refers to the number of Invader-like barriers that you would like to set up at the bottom of the screen. This number can vary from 1 to 3. (You actually turn the barriers option on and off in Function 4: Level Options.)

Number nine provides for random downward bombing, an alternative to placing 'bomb' instructions in the path tables. When this option is set to 0, it is turned off. You can turn it on by changing the setting to a number from 1 (frequent bombs) to 8 (very few random bombs).

The second menu item under the GAME OPTIONS function is SOUND. This item permits you to create your own sound effects for various events during the game. If you type '2' to enter this option, you will see the following screen:

\*\* GAME SOUNDS \*\*

- (1) MISSILE BEING FIRED
- (2) BOMB BEING RELEASED
- (3) TANK EXPLODING
- (4) OBJECT EXPLODING
- (5) BOMB/MISSILE COLLISION
- (6) RETURN TO MENU

Choose the sound effect that you would like to modify by typing a number from 1 to 5. The screen will clear and you will see something like this:

DURATION — →	1	2	3	4	5	6	7
PITCH — →	8	4	8	8	0	0	0
CYCLES — →	8	2	8	2	0	0	0
PLEASE CHOOSE (D, P, C) (RETURN TO EXIT)							

Type D to modify duration and you will be prompted to enter 7 numbers, each ranging from 0 to 20. A 0 in pitch or duration will end the cycle. A 1 is very short, 20 is long. This 7 note sequence represents a single sound effect. You can modify pitch in the same manner. The example above will produce a warbling effect.

Cycles can vary from 1 to 4. This means the number of times the effect is repeated each time it is called. You will find that a high cycle number and long durations can produce sound effects that interfere substantially with the game, so try to keep them reasonably short. Again, here as elsewhere, the key to success lies in experimentation. Try all sorts of combinations and keep records on the ones that you like.

The third menu item under GAME OPTIONS is SET SCORES. This routine permits you to decide how many points to give for the destruction of each shape in each block. When you type '3' you will see:

\*\* SHAPE SCORES \*\*

	BLOCK1 (SML)	BLOCK2 (SML)	BLOCK3 (SML)	BLOCK4 (SML)
#1	0	0	0	0
#2	0	0	0	0
#3	0	0	0	0
#4	0	0	0	0
#5	0	0	0	0
#6	0	0	0	0

(B)LK, SHAPE (1-6), RETURN TO EXIT

Pressing B permits you to select the block you wish to work on. You then type the shape number and enter the number of points you wish to award to a player for hitting that shape. Points run from -99 to 99. The actual scoring is whatever number you choose times ten. If you want to make an object immune to missiles, give it a point value of zero. During game play, the game will move on the next level once all positive numbered shapes have been destroyed. Shapes with negative scores can still be left on the screen.

Note, incidentally, that scores are attached to SHAPES, not to OBJECTS. This gives you a great deal more flexibility—in effect, you can change the point value of an Object merely by mutating it to another Shape.

The fourth function under GAME OPTIONS is one that we alluded to in Section 4, the Path Creator. Press '5' and you will see:

\*\* PATH POINTER START VALUES \*\*  
(LEVEL 1)

	BLOCK1 (SML)	BLOCK2 (SML)	BLOCK3 (SML)	BLOCK4 (SML)
#1	1	1	1	1
#2	1	1	1	1
#3	1	1	1	1
#4	1	1	1	1
#5	1	1	1	1
#6	1	1	1	1

(B)LK, (L)EVEL, SHAPE (1-6)

This table refers to the point in their path table at which each object will start to take its instructions. In the example above, each object starts with the first instruction. If, however, one were designing a winding path in which objects followed one another, each object might start at a different path pointer number.

Note also the reference to LEVEL 1. All games are designed to have 5 levels, although all levels may be identical. You may design your game so that each level is substantially different. One way to do that is to use different parts of the path tables for different levels in the game. Other ways of making levels different are explored in the fourth function of the Main Menu, called LEVEL OPTIONS.

The final function under GAME OPTIONS is the MUTATE OPTION. Press '5' and you will see:

\*\* OBJECT STATUS FOR MUTATE OPTION \*\*

	BLOCK 1 (SML)	BLOCK 2 (SML)	BLOCK 3 (SML)	BLOCK 4 (SML)
#1	NO	NO	NO	NO
#2	NO	NO	NO	NO
#3	NO	NO	NO	NO
#4	NO	NO	NO	NO
#5	NO	NO	NO	NO
#6	NO	NO	NO	NO

(B)LOCK, OBJECT (1-6)

This function permits you to make some of the objects in your game mutable while others are not. If the mutate option for the Level you are playing is turned ON (see Level Options: Function 2), then all those objects whose Mutate Status is YES will mutate when hit by a missile. Those objects which are Shape 1 will become Shape 2, Shape 2 will become Shape 3 and so forth. However, once objects reach the highest numbered shape in their block, they will explode the next time a missile strikes them (note that this differs from the Shape Change function in the Path Creator – Shape 6 would become Shape 1 when it hit a shape change marker).

## VI. LEVEL OPTIONS

When you press '4' from the Main Menu the following screen will appear:

\*\* LEVEL OPTIONS \*\*

- (1) LEVEL OPTIONS
- (2) MISCELLANEOUS
- (3) EDIT PATH DATA
- (4) SET LEVEL POINTERS
- (5) RETURN TO MAIN MENU

These largely unrelated utilities are grouped together because they can be used to make the five levels of your game different from one another

(although they can be used for a good many other purposes as well). Let's take a look at the first one. Press '1'. The screen will clear and then fill with this:

(0) STAR MOVEMENT	2	2	2	2	2
(1) STAR SPEED	2	2	2	2	2
(2) STAR DENSITY	1	1	1	1	1
(3) TANK SPEED	2	2	2	2	2
(4) TANK SCORE	10	10	10	10	10
(5) TANK ACCURACY	1	1	1	1	1
(6) BOT L. LIMIT	1	1	1	1	1
(7) BOT R. LIMIT	124	124	124	124	124
(8) TOP L. LIMIT	1	1	1	1	1
(9) TOP R. LIMIT	124	124	124	124	124
(A) MISSILE SPEED	4	4	4	4	4
(B) MISSILE TYPE	2	2	2	2	2
(C) MISSILE NUMBER	1	1	1	1	1
(D) MISSILE DRIFT	1	1	1	1	1
(E) BOMB SPEED	1	1	1	1	1
(F) BOMB TYPE	1	1	1	1	1
(G) LRG. SHP. ACC.	1	1	1	1	1
(H) MED. SHP. ACC.	1	1	1	1	1
(I) SML. SHP. ACC.	1	1	1	1	1

PLEASE CHOOSE <RETURN> TO EXIT

The numbers following these eighteen variables represent their current settings for each of the five levels of the game. To alter any one of them, type the number or letter preceding the description and then enter five values, one for each level. Although many of the descriptions may be self-explanatory, here is a brief expansion on the purpose of each:

(0) STAR MOVEMENT If you type 0, a new line will appear at the bottom of the screen:

1-NO STARS      2-SCROLL      3-STATIONARY

You may use stars whether or not you choose to add a background to your game. If you choose stationary stars, they will all stay in one place and

flicker. If you choose scrolling stars, they will always move from the top of the screen downwards.

(1) STAR SPEED Varies from 1 (slow) to 3 (fast)

(2) STAR DENSITY Varies from 1 (crowded) to 3 (very few)

(3) TANK SPEED (1-3) One is slow, three fast

(4) TANK SCORE In a two player game, this is the score you get when you hit the opposing player. Can be set from 1 to 99 (which represents 10 to 990, as usual).

(5) TANK ACCURACY How direct a hit is necessary to destroy a tank. One means that a flank hit counts. At 3 a direct center hit is necessary.

(6)-(9) These are the left and right limits for the two tanks. One is the left margin, 124 is the right. If you want to restrict tank mobility to a smaller part of the screen, adjust these numbers. In the "Special" one player mode the top tanks limits will become the vertical limits.

(A) MISSILE SPEED (1-4) One is slowest, four fastest. Missiles are the projectiles fired by the tanks, not the ones fired by the alien shapes.

(B) MISSILE TYPE (1-4) There are four standard types. Pick your favorite.

(C) MISSILE NUMBER (1-8) This determines how many missiles can be on the screen at one time. The larger this number, the easier it is to destroy alien shapes.

(D) MISSILE DRIFT (1-3) If you select steerable missiles in the MISCELLANEOUS function of LEVEL OPTIONS, then the missiles you fire will drift in the same direction you were moving. One means little drift, three means a lot.

(E) BOMB SPEED (1-3) One is slow, three fast.

(F) BOMB TYPE (1-4) Pick the type you like. Same choice as in MISSILE types.

(G)-(H) These settings, like item 5, determine how accurate a shot is needed to destroy a shape. A setting of 1 means that a glancing blow will destroy the shape. A setting of 3 requires a direct center hit and makes the game much harder.

If you would like to test each level of your game after making modifications you can press RETURN until you are in game play. Pressing any of the numbered keys from 1 to 5 will then immediately jump you to that level of play.

The second section under LEVEL OPTIONS is called MISCELLANEOUS, and rightly so. Here you have a chance to add a number of unusual features to your game if you wish. Type '2' and you will see:

(1) SHOULD SCORE INCREASE WITH LEVEL?

YYYYY

(2) SHOULD OBJECTS SPEED UP AT THE END?

NNNNN

(3) SHOULD OBJECTS MUTATE WHEN HIT?

NNNNN

(4) FREE TANK AT EACH LEVEL?

NNNNN

(5) STEERABLE MISSILES?

NNNNN

(6) SHOULD MISSILES STOP AT WHITE1?

NNNNN

(7) SMART BOMBS?

NNNNN

(8) BARRIERS FOR BOTTOM TANK?

NNNNN

PLEASE CHOOSE                    RETURN TO EXIT

Each Yes/No question has a setting for each of the five game levels. This is what these flag questions will do:

(1) If this switch is set to Yes, then the score for hitting each alien will be multiplied times the level number. In other words, if you get 20 points for hitting an alien in Level 1, you will get 40 points for hitting it in Level 2 and 60 points for hitting it in Level 3. Negative scores are also multiplied.

(2) If this setting is Yes, then the fewer aliens there are on the screen, the faster they will move.

(3) This is a Mutate command with a difference. If this flag is set to Yes, each mutable object will mutate to the next higher shape number until it reaches the top number (6 for small shapes, 3 for medium and 2 for large). Then if it is hit once more, it will explode. Whether or not a specific object is designed to mutate is set in Game Options, Function 5.

(4) Provides both players with a free tank at the beginning of each game level.

(5) If this flag is set to Yes, the tank controls will also control missiles after they have been fired, allowing them to be guided toward their targets.

(6) If this is set to Yes, missiles will be stopped by any white barriers on the screen. The barriers offered in Section V:GAME OPTIONS can be gradually eaten through unless this is set to Yes. White areas drawn as part of your background cannot be destroyed by missiles – either they will pass harmlessly through them (if this flag is set to No) or they will be stopped (if this flag is set to Yes).

(7) If you want to make the game very difficult, turning this flag on turns all the bombs into smart bombs.

(8) This item allows you to include barriers at the bottom of the screen on some or all levels. It will put a hole near the bottom of any background you draw using the Background Creator.

The third function in the LEVEL OPTIONS menu is EDIT PATH DATA. When you press '3' the following screen will appear (don't panic):

12345 ARCADE MACHINE LEVEL 1 DATA

	BLK1		BLK2		BLK3		BLK4	
OBJ. #1	79 1	85 1	79 1	75 1	87 1	65 1	79 1	95 1
OBJ. #2	87 2	85 1	87 2	85 1	95 2	65 1	87 2	95 1
OBJ. #3	95 1	85 1	95 1	75 1	103 1	65 1	95 3	95 1
OBJ. #4	103 2	85 1	103 2	75 1	111 2	65 1	103 4	95 1
OBJ. #5	111 1	85 1	111 1	85 1	95 5	55 1	111 5	95 1
OBJ. #6	119 2	85 1	119 2	85 1	103 6	55 1	119 6	95 1

(L)EVEL, (B)LK, OBJECT (1-6)

Each object in each block has four numbers associated with it. These numbers are arranged in a square. For example, the first object in Block 1 is associated with the following block of numbers:

79 85  
1 1

Just look for the intersection of the rows next to OBJECT #1 and the columns beneath BLOCK 1. The top two numbers stand for the starting position of Object 1 in Block 1 (the X and Y coordinates, as we called them earlier). Directly below the X coordinate is the number of the shape to be drawn to that object, and below the Y coordinate is the number of the starting path table for that object. This entire screenful of numbers is composed of rectangles of the following form:

X coord Shape #	Y coord Path #
--------------------	-------------------

You can ignore the numbers underneath Block 4 in the sample game. Since that block isn't being used, these numbers are irrelevant. However, if you examine the X and Y coordinates of the six objects in Block 1, you will see that all of the Y coordinates are the same, but that each of the X coordinates differs from the ones on either side of it by 8. This means that the six objects in Block 1 will all start in a row on the screen, spaced 8 dots apart.

If you look at the lower left-hand corner of each rectangle of numbers for these six objects, you will see that half of them are Shape #1 and half are Shape #2. Take a quick look at the test game if you want to refresh your memory about how this works. And finally, note that all six are on the same path, Path #1. This means that when one Object moves left, they all move left; when one moves down, they all move down. They do not follow one another – they are in the same position in the same path table, just moving from different starting positions.

What you are looking at is the display of the Level 1 Path Data. If you would like to see the path data for the other four levels, you can do so. Look at the prompt line at the bottom of the screen. If looks like this:

(L)EVEL, (B)LK, OBJECT (1-6)

If you type **L** for Level, you will be prompted to enter a number from 1 to 5. Then the screen will clear and new data will be displayed. Don't be surprised if it looks exactly like the data you just saw. In the test game, all five levels are exactly the same. When playing the game, you move on to the next level each time you destroy all of the alien shapes on the screen with positive point values.

Now let's try modifying a little of the data. Press **B**. You will note that the Block marker at the top of the screen jumped one column to the right. Continue to press **B** until Block 1 is marked once again. Then type any number from 1 to 6. That number will be replaced by an arrow on the left side of the screen and a new prompt line will appear at the bottom of the screen:

X(1-240),Y(1-240),SHAPE(1-6),PATH(1-10)  
?

You must now type in 4 numbers, separated by commas. They are the X coordinate, the Y coordinate, the Shape number and the Path number. The acceptable range for each number is listed in the parentheses in the prompt line. If you don't want to change anything, just retype the four numbers from the rectangle alongside whatever object number you chose. If you would like to try a little experiment, leave all of the numbers the same except the Y coordinate. Add 20 to that when you retype it. Then exit to the test game and see what your change has done. With a little experimentation you should be able to change all of these numbers with predictable results.

This is, however, one of the few places where you CANNOT press **RETURN** to back out of a situation. Once you see the four number prompt line at the bottom of the screen, you must enter four numbers. If you accidentally typed in nonsense numbers and want to restore everything to its original, dull but predictable pattern, just turn off the computer and re-boot the program. The test game is never permanently changed.

Now take a look at the upper left corner of the screen. You should see five digits there: 12345. This shows which levels you are currently WRITING to. It is designed to permit you to write identical data to all five levels if you wish. Say, for example, that you wanted the test game to be used as levels 2,3 and 5 in your finished game but you wanted to create an entirely different game for levels 1 and 4. You would want to be able to turn off writing to levels 2,3 and 5. To do this, hold down the shift key and then press these three numbers. The appropriate numbers in the upper left corner will turn off, leav-

ing only the 1 and the 4 lit. This means that any data you now enter will only be written to Levels 1 and 4. Let's try it.

Change all six objects in Block 1 by adding 20 to the Y coordinate. In other words, change the 85 to a 105 but leave the other three numbers the same. Then press **RETURN** until you are playing the test game. The bottom row of shapes should be positioned even lower on the screen. Play the game until you have destroyed all of the aliens. **LEVEL 2** will appear on the screen and then another batch of aliens. This time the bottom row of aliens will be in its original position.

**EDIT PATH DATA** looks very complicated at first, and it is very important. But it actually is pretty simple to manipulate, once you get used to it. You will have to use copies of the special graph paper provided at the end of this manual to plot out the starting position of each shape and the paths they will take. But then this section of the Arcade Machine will provide quick access to all the starting information on all of your shapes.

The final section in **LEVEL OPTIONS** is (4) **SET LEVEL POINTERS**. When you type 4 you will see:

LEVEL POINTERS 1 1 1 1 1

LEVEL 1 (1-254)

?

This section is designed to permit you to move the aliens in different ways at each of the five levels of the game. As you recall, the Arcade Machine permits you to construct up to 10 different path tables, each up to 254 instructions long. As a practical matter, most of your path tables will not be anywhere near that long. Therefore, this option allows you to divide each path into 5 separate mini-paths, one for each level of the game. You do this by selecting a different starting point in the paths for each level. For example, type in the following 5 numbers so the screen looks like this:

LEVEL POINTERS 1 51 101 151 201

LEVEL 5 (1-254)

The aliens in the test game all use Path #1. Path #1 consists of 7 instructions—move right (3 times), move left (3 times), end. We have now modified the game so that when you get to Level 2, the computer is going to look to Position #51 in Path #1 for instructions on how to move the aliens. We had better put something there. Go back to the path editor and move the path pointer to 51 (type '2' '51' to do this). Then enter a short path (different from the back and forth path that starts at path pointer #1). When you are finished, try the game and see if the aliens don't follow your new mini-path when you get to Level 2.

There is one complexity here that you should be aware of. Function 4 under GAME OPTIONS was called PATH POINTER START VALUES. That section allowed you to set a different starting position in the path table for each of your aliens. These start values are actually an OFFSET. In other words, they are added to the Level Pointer to determine the starting instruction for a particular alien. Thus, in our example above, if a particular shape was given a PATH POINTER START VALUE of 4, then on Level 1 it would start by executing the fourth instruction in the path; however, at Level 2, it would begin at instruction number 54, and so forth.

## VII. Background and Title Creator

Function 5 on the Main Menu is entitled BKGD/TITLE CREATOR. This is a screen drawing program that allows you to design both the backdrop for your game and a title page to be used when you finally assemble your own game disk. Press '5' and you will see:

### \*\* BACKGROUND/TITLE CREATOR \*\*

- (1) CREATE BACKGROUND
- (2) CREATE TITLE PAGE
- (3) RETURN TO MAIN MENU

You may work on your background throughout the game development process, leaving to work on other sections and returning to this one without fear of losing your work. However, you should not design your title page until all other aspects of your game have been finished. TITLE PAGE CREATION MUST ALWAYS BE THE FINAL STEP BEFORE YOU CREATE YOUR GAME DISK. The reason for this is that the title page sits on the high resolution page and will be erased by any routine that makes use of this page, such as the Shape Creator or the Path Creator.

Press '1' to enter the background drawing routine. The screen will clear. On the top part of the screen you will see a crosshair. In the window at the bottom of the screen, you will see:

XO = 140  
YO = 120

X = 140  
Y = 120

COLOR = WHITE1  
INSTRUCTIONS = ESC  
PRESS RETURN WHEN DONE

For a quick summary of all of the commands, press the ESC key in the upper left part of the keyboard. All drawing is done with the crosshair, which can be moved around the screen in two ways—by keyboard control or by using a joystick or paddles. To move the crosshair with the keyboard, use the diamond made up of the I-J-K-M keys to move in the four directions. The crosshair will hop nine dots in a particular direction each time you press one of these four keys. If you would like it to move in smaller jumps, just press one of the keys from 1 to 8 to set the size of the hop. Note that the X and Y values displayed at the bottom of the screen change each time you move the crosshair. The screen is composed of dots: 280 dots wide and 192 dots high (although the top eight lines of the screen are restricted). The X value tells the horizontal position of the crosshair. The Y value tells the vertical position.

If you prefer to use the joystick or paddles to control the crosshair, press CTRL-P. To revert to keyboard control, press CTRL-P again.

Stay in keyboard mode for the time being. Press the space bar. A small dot should appear in the center of the crosshair and the values of X0 and Y0 will be reset to the current values of X and Y. X and Y are the coordinates of the crosshair. X0 and Y0 are used to keep track of the values of X and Y the last time you pressed the space bar.

Now move the crosshair up and to the right. Type CTRL-L (for Line). A line will be drawn from the first position to the next. Move the crosshair again and then type CTRL-L once more. The line will be drawn from the first coordinate (X0,Y0) to the current coordinate (X,Y). To set a new starting point, press the space bar again.

You can draw lines in this mode, by setting end points, or you can place the crosshair in continuous draw mode by pressing the 'l' key. Now the cursor will leave a trail behind it wherever it goes. To return to point mode, press 'l'.

If you would like to change the color of the lines you are drawing, press 'C' (for Color). Then type a number from 0 to 7. The colors are:

- |            |            |
|------------|------------|
| 0 - Black1 | 4 - Black2 |
| 1 - Green  | 5 - Orange |
| 2 - Violet | 6 - Blue   |
| 3 - White1 | 7 - White2 |

Your current color will appear in the window at the bottom, on the righthand side. You will notice that it is difficult to draw vertical lines or near vertical lines, particularly in color. You will also note that certain colors do not do well when they are close together. Generally speaking, all of the colors in column 1 can be placed close together, as can all of the colors in column 2, but you can expect some difficulties if you mix the colors of one column (other than black and white) with the colors of the other.

WHITE1 and WHITE2 have a special function in the Arcade Machine. Function 1.6 under Game Options permits you to select BOUNCING BOMBS. With this option turned on, bombs will bounce off the sides of the screen. They will also reverse their vertical direction if they strike a background object drawn in WHITE1 and will reverse their horizontal direction if they strike a background object drawn in WHITE2. In other words, if you draw a box on the screen whose top and bottom are WHITE1 and whose sides are WHITE2 and if an object releases a bomb inside that box, the bomb will bounce around forever.

There is one qualification to this rule, quite a complicated one. In order for the AM to recognize these colors, the entire screen byte must be drawn in the same color. A screen byte is a horizontal row of seven dots, starting at an X coordinate which is a multiple of 7, plus 1 (in other words 1, 8, 15, 22, and so forth). This isn't much of a problem when you are drawing horizontal lines, since most of the middle part of a line is bound to be OK and only the bits at the end are a concern. But if you are trying to draw a vertical wall, it will have to be at least seven dots wide, and it will have to fill a whole column of screen bytes. This means that your vertical lines will have to be very thick for the bouncing bombs function to work with them.

If you have a joystick and would like to try your hand at freestyle drawing, press CTRL-P to get in joystick/paddle mode and then press the ';' key. If you find total freestyle too hard to control, press '.' to return to point mode. You can then use the Paddle 0 button to set X0,Y0 values and the Paddle 1 button to draw lines (same as CTRL-L). Holding Paddle 1 button down while moving the crosshair can produce some very interesting results too.

You will find that the horizontal control with joystick/paddle is a little tricky—at first the crosshair won't seem to go all the way to the right side of the screen. If you press the right arrow, however, you will be able to draw in the last 14 columns. Pressing the left arrow permits you to draw all the way to the lefthand margin again.

To set a background color, choose a color (press 'C', then 1-7) then just press CTRL-B. If you want to return to a completely black screen, set color to black and then press CTRL-B.

You can add circles, triangles and rectangles to your pictures fairly easily. For circles, move to the center and press the space bar or Button 0. Then move the crosshair to a point on the outer edge of the circle and press 'O' (or to create a filled circle, press CTRL-O). You may break the drawing process at any time by hitting any key.

In like manner you may draw triangles ('T' or 'CTRL-T') and rectangles ('R' or 'CTRL-R'). When drawing triangles you must first set two corners by pressing the space bar (or the Paddle 1 button if you are in paddle mode) when the cursor is positioned at each of them and then move the crosshair to the third. When drawing rectangles first set one corner by pressing the space bar or Paddle 1 button, then go to the diagonal corner and press 'R' or 'CTRL-R'.

If the text window at the bottom of the screen gets in your way, you can eliminate it by typing 'CTRL-F' (for Full screen). You can toggle the window back into view by pressing 'CTRL-F' a second time.

To shift into text mode, position the cursor approximately where you want your first letter of text to appear and then type the '@' key. A white block will appear where the text will print. You can toggle between upper and lower case with the ESC key, and you can change the color of the text by holding the shift key down and then typing one of the following keys:

- |            |            |
|------------|------------|
| 1 - Green  | 5 - Orange |
| 2 - Violet | 6 - Blue   |

Press '@' again to return to graphics mode. That's all there is to it!

## VIII. Load/Save Game

If you would like to load one of the five sample games that comes on the flip side of the Arcade Machine or if you would like to save some or all of your efforts to date, return to the Main Menu and press '6'. You will see:

\*\* LOAD/SAVE GAME \*\*

- (1) LOAD GAME
- (2) SAVE GAME
- (3) LOAD SHAPES
- (4) LOAD BACKGROUND
- (5) FORMAT GAME DISK
- (6) RETURN TO MAIN MENU

If you want to look at the names of the 5 games stored on the back of the Arcade Machine, press '1'. You will then see:

PLEASE TAKE OUT THE ARCADE MACHINE  
MASTER DISKETTE AND INSERT YOUR  
GAME DISKETTE.  
PRESS (Y) TO CONTINUE  
OR ANY OTHER KEY TO RETURN TO MENU.

Remove the Arcade Machine diskette, flip it over and put it back in the disk drive. When ready, press 'Y'. You will see a menu of five names, followed by the question, WHICH GAME DO YOU WANT? (1-5). If you press one of the keys from 1 to 5, the corresponding game will load into the computer's memory, taking the place of the sample game that loads into memory when you first turn on the Arcade Machine. If you decide that you don't want to load anything, just press RETURN.

Saving a game is no more difficult. If you have placed a new disk in the drive, the first thing you need to do is format it with Command 5. THIS WILL ERASE ANYTHING ON THE DISK, INCLUDING OLD ARCADE MACHINE GAMES.

Once you have a data disk prepared, press '2' and the list of games stored on the inserted disk will appear (or UNUSED if you haven't stored five games yet). Each game data disk can store 5 games on it. Below the list will appear the question: SAVE TO WHICH NUMBER? (1-5). Choose a number (or press RETURN if you decide that this was a big mistake) and the program will ask: DO YOU WANT TO CHANGE THE NAME? (Y/N). You can answer 'Y' for yes if you like and enter a name up to 30 characters in length.

Occasionally you want to pass shapes or backgrounds from one game to another. Options 3 and 4 permit you to take the shapes or background from one game and merge them with the one in memory. In this manner you can develop a library of shapes that can be passed from one game to the next.

When you are ready to return to the Main Menu, press RETURN. You will then see:

PLEASE TAKE OUT YOUR GAME DISKETTE  
AND INSERT THE ARCADE MACHINE  
MASTER DISKETTE.  
PRESS ANY KEY TO CONTINUE

Do as you are asked, and the Main Menu will reappear on the screen.

It is advisable to save your game regularly while you are creating it. After all, it is far better to have extra copies of partially completed games lying around than to lose it all because of an unfortunate power surge moments before completion.

There is one danger you should be aware of when you save games. The first time you try to load or save something to an AM data disk, the Arcade Machine turns on the disk drive and reads in the disk catalog. From then on that catalog is in the computer's memory, so if you switch data disks you may confuse your computer. If you need to switch data disks, be sure to exit to the Master Menu in between. This will cause the program to read in the new disk catalog.

## IX. Create Game Disk

This is what it's all about. If you like what you have done, have tested it a thousand different ways, and have decided that your creation deserves to be preserved for posterity, then it's time to create a game disk. Make sure that you've drawn all your shapes, designed all the paths, created your background and a title page (don't forget that title page!). Then put a new, blank disk in your drive and press '7'.

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Moments later you will have a complete, fast-boot, game disk of your own creation in your hands. Turn off the computer and insert your new game. Then turn it on and watch that title page come up. Then bring over your friends and sit them down to play... ALIEN MISTAKE! (or whatever you choose to call it).

Give your friends the disk. After all, there are new worlds to conquer, new games to make (and besides, you can always make another copy as long as you SAVED your game before you turned off the computer). And when you have finally written the most complex, graphically sophisticated game you will ever be able to write (until you learn to program), then send a copy to us. We are always looking for creative, artistic people. Even if you don't win one of the prizes in our ARCADE MACHINE CONTEST, we'll have your name in our files. And who knows what that might lead to.

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#### Controls for your game disk:

T - Toggles top tank between keyboard and paddle mode  
A - top tank move left  
S - top tank stop  
D - top tank move right  
F - top tank fire

B - Toggles bottom tank between keyboard and paddle mode  
K - bottom tank move left  
L - bottom tank stop  
; - bottom tank move right  
SPACE BAR - bottom tank fire

ESC - Freeze game. Repeated presses will single step through the game.

CTRL-S - Toggle sound ON/OFF

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## GLOSSARY

**BLOCK** - One of four areas of memory reserved to save SHAPES in. Each block can hold 6 small shapes, 3 medium sized shapes or 2 large shapes.

**BOMB** - Small destructive object fired by SHAPES at TANKS.

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**BOOT** - A computer term that means to load in a disk's operating system, usually by putting a disk in a disk drive and then turning on the computer.

**CTRL** - A key on the left side of the keyboard. To type a control code such as CTRL-I, you must first press the CTRL key and hold it down. Then, while the CTRL key is being held down, you must press the I key. In this manner it is similar to the shift key on an ordinary typewriter.

**CYCLES** - A counter describing the number of times something is to be repeated. In the Sound routines, if you set Cycles to 3, the sound you have created will be repeated three times.

**FORMAT** - What you have to do to a new disk before you can write any programs or data to it. The Arcade Machine has a FORMAT command in the Load/Save Game section. NEVER use this command unless the disk you intend to format is blank or has nothing on it that you want to save.

**IMAGE** - The term used in the Arcade Machine to describe each of the seven individual pictures which you must draw for each SHAPE. These pictures can be different and are flashed on the screen one after another whenever a shape moves horizontally across the screen. The differences in the images will animate the shape.

**LEVEL** - The term used for each of the five phases built into all games created on the Arcade Machine. The games are designed to move from one level to the next as soon as all of the shapes on a level have been destroyed. You may design games in which all levels are essentially the same or ones in which each level represents a substantially different game. You may examine each level of your game during testing by pressing a key from 1 to 5 to indicate the level at which you want to play.

**LEVEL POINTERS** - These are five numbers that tell your program at what point in each PATH TABLE to start receiving instructions to move your shapes, depending on which LEVEL is being played.

**MENU** - The word used to describe any list of options. The first list that you see when you BOOT the disk is usually called the Main Menu.

**MISSILE** - Small destructive object fired by TANKS at SHAPES.

**MUTATE-**

The term used when an OBJECT changes shape. There are two forms of mutation permitted in the Arcade Machine. One is caused by a marker in a PATH TABLE and never causes the destruction of the object that is mutating. The second occurs when a mutable object is struck by a missile, in which event it will mutate to the next numbered shape. However, if it is already the highest numbered shape in its block, it will explode.

**OBJECT-**

The term used to describe each of the individual items that can be moved about the screen on PATH TABLES. These items are distinguished from the objects controlled by the players with keyboard or paddles and which are called TANKS.

**PATH POINTER**—This is a number from 1 to 254 that tells you which of the 255 instructions in a PATH TABLE will be executed next.

**PATH POINTER START VALUE**—This is a number representing the first instruction in a PATH TABLE that a particular object will start with. It is not necessary for all objects to start with the same instruction, even if they are all using the same PATH TABLE.

**PATH TABLE**—One of ten lists of instructions stored in the computer's memory. These lists control the movement of OBJECTS about the screen as well as certain other functions of the objects, such as the positions at which they start bombing, change shape, or change speed.

**SHAPE-**

A series of seven pictures which can be displayed on the screen by any object; similar in this respect to an animated mask worn by an actor. The actor is an OBJECT; the mask is a SHAPE.

**SMART BOMBS**—Bombs which track the movement of a tank and which are very hard for a player to dodge.

**TANK-**

The object at the bottom or top of the screen which is controlled by the player. It does not use PATH TABLES at all but is controlled by the keyboard or by the paddles.

**WHITE2-**

One of the two shades of white that you can use in the Background Creator. Although it looks the same as WHITE1, the computer can tell them apart, and there are functions in the program that permit you to control whether or not bombs and missiles can penetrate background objects drawn in this color.

# THE ARCADE MACHINE CONTEST!

**GRAND PRIZE** - \$1,500 worth of hardware & software  
**RUNNER UP** - \$500 worth of hardware & software  
**MONTHLY PRIZE** - \$200 worth of hardware & software

Here's your chance to design games with your Brøderbund Software Arcade Machine . . . not just for fun, but for profit too! Enter our exciting Arcade Machine Game Design Contest and win prizes worth up to \$1,500!!

To enter simply send us your game (in data file form, not an autoboot game disk) along with the entry blank contained in your Arcade Machine package. You may enter as often as you like, but the first entry must be on your Brøderbund entry blank. Any subsequent entries should be sent in with your name, address, and phone number on a 3 x 5 card to "The Arcade Machine Contest."

Enter today! Starting January 31, 1983 and every month thereafter through June 30, 1983, we will select a finalist who will receive \$200 worth of prizes. These monthly winners will then be eligible for the Grand Prize and the Runner Up Prize to be awarded on July 31, 1983.

Remember, to enter just send us the completed official entry blank contained in your Arcade Machine package to:

"The Arcade Machine Contest"  
Brøderbund Software, Inc.  
1938 Fourth Street  
San Rafael, CA 94901

All entries must be received no later than June 30, 1983.

The contest is open to all purchasers of The Arcade Machine, worldwide, except employees of Brøderbund Software, Inc., and their immediate families. Contest entries cannot be returned, and become the property of Brøderbund Software, Inc. Entries may be included with demonstration programs sent out with The Arcade Machine.

Winners will be notified by mail. All prizes will be awarded. All taxes are the sole responsibility of the prize winners. Winners may be required to sign an affidavit of eligibility and release. Void wherever prohibited by law. All federal, state and local regulations apply.

# THE ARCADE MACHINE

By Chris Jochumson and Doug Carlston

You can use The Arcade Machine to generate copy-protected disks containing arcade games of your own design!

Your games will have the following features:

- Animated full-color monsters and other players designed and drawn by you (or selected from a medley of creatures on The Arcade Machine).
- Dramatic explosions and sound effects.
- Automatic scoring and high score features.
- Colorful title page with your title and name in large graphic letters (like Brøderbund games).
- One or two player options.
- Menu driven for easy use.

Your arcade games are created entirely in machine language for fast and smooth arcade-quality animation.

Requires 48K Apple II Plus or an Apple II with Applesoft in ROM or RAM and will run with a 16 sector controller.

This program is fully guaranteed. If it ever fails to boot, return the original disk to Brøderbund Software, Inc. for free replacement. If you have physically damaged the disk, please include five dollars for replacement.



## Brøderbund Software

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