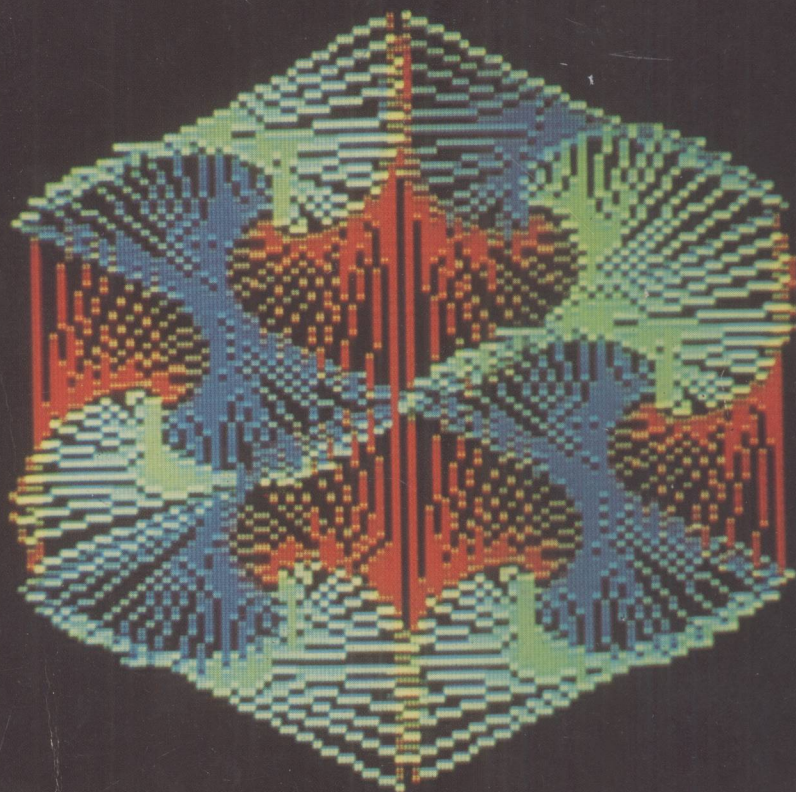


ATARI® SOUND AND GRAPHICS

A SELF-TEACHING GUIDE



HERB MOORE
JUDY LOWER
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To the Reader

Assuming no prior knowledge of computers, this book serves as your “road map” into the world of ATARI* Computer sound and color graphics. While exploring, you will learn to speak the most commonly used computer language in existence today: BASIC. It is a simple language to learn and most computers (large or small) can be programmed using BASIC.

ATARI Sound and Graphics emphasizes recreation and artistic expression. As you use this book you will not only learn a number of “useful” things about computers, but will also experience the pleasures of creating beautiful colors, shapes, and sounds with your ATARI Computer.

With this book you can easily learn to create exciting sound effects, some of which you may have already heard in various arcade games. And since the graphics capabilities of the ATARI 400 and ATARI 800 Computers are not only powerful but easily accessible, you will also find yourself creating colorful figures very quickly.

Later in the book you will get a taste of music theory and will create your own melodies and be able to see them play on the screen.

ATARI Sound and Graphics is meant to be used, along with the ATARI 400 or ATARI 800 Computer so you can try each new concept as it is presented. After all, seeing and hearing each new sound or color produced by the computer is the part that’s most fun. The fundamental grammar and logic of ATARI® BASIC is presented in a step-by-step fashion, with an emphasis on interaction and exploration with your computer. As you learn new concepts and techniques you will often be encouraged to apply them to your own artistic creations.

So whether you are a teacher wishing to prepare audio-visual aids for your classroom, an artist or musician seeking to explore the world of computer sound and graphics, or someone who just wants to play with the computer, this book and an ATARI 400 or ATARI 800 Computer will provide you with hours of pleasure and a great amount of useful knowledge.

Now take a look at “How to Use This Book,” and then go on to learn about ATARI Computer sound and graphics!

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How to Use This Book

With this book's self-instructional format, you'll be actively involved in learning BASIC for the ATARI Computer. The material in each chapter is presented in short sections, each of which teaches you something new about ATARI® BASIC and gives you a question or asks you to write a program. Correct answers are given following the dashed line. For the most effective learning we urge you to use a thick paper to keep the answers out of sight until you have written your answer.

You will learn best if you actually write out the answers and try the programs out on the computer. The questions are carefully designed to call your attention to important points in the examples and explanations, and to help you learn to apply what is being explained or demonstrated.

The Self-Test at the end of each chapter can be used as a review of the material covered in the chapter. You may test yourself immediately after reading the chapter. Or you may wish to read a chapter, take a break, and save the Self-Test as a review before you begin the next chapter. To go further in applying what you have learned, do the Challenges following the Self-Test. Answers are not given for the Challenges.

This is a self-contained book for learning ATARI Computer sound and graphics, but what you learn will be theoretical until you actually sit down at a computer terminal and apply your knowledge of the computer language and programming techniques. So we strongly recommend that you and this book get together with an ATARI computer.

Introduction

The language you will be learning in this book is ATARI® BASIC, a very simple form of an English-based language for computers. BASIC is understood by many computers. ATARI BASIC also has some special vocabulary for creating sound and color graphics.

As you use this book, keep in mind a few things about your interaction with your ATARI 400 or 800 Computer.

First, remember you are learning ways to tell your computer what you want it to do. You'll learn to speak a language the computer understands. Computer programmers of all skill levels think in terms of computer languages.

Second, although this book focuses mainly on sound and graphics, you will also learn many skills that will be valuable to you as you find other ways to use your ATARI 400 or 800 Computer.

You will learn many introductory programming techniques. Many of the sounds you will learn to create can be found in today's arcade games, and the graphics can be equally innovative—creations that are fun and exciting as you devise your own ways to use them. If you wish to learn more conventional music, we suggest you also consider the Music Composer® and the Video Easel®, programs for the ATARI Computer.

When you are learning to speak another language—such as Spanish or French—the more you practice and learn, the more you understand. The same is true with ATARI BASIC. As you begin to understand the machine more fully, you will find it easier to get the machine to do what you want it to do.

Remember also, if the machine doesn't understand you, it's not because of any lack of intelligence on your part. The computer has a very specific language, and if you start to speak another dialect or become too subtle, it can easily become confused.

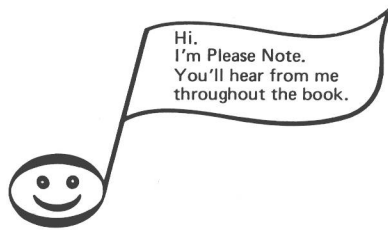
Be patient with your computer. And most of all, remember it's not the computer telling you what to do, but you telling the computer what to do!

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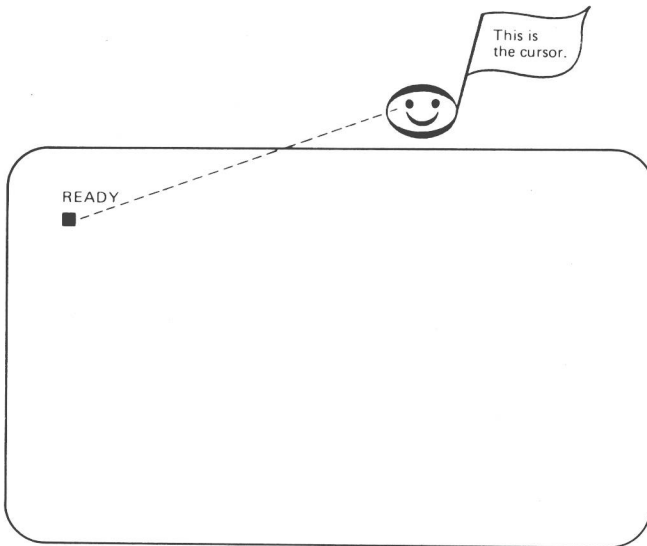
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CHAPTER ONE

Getting Started— The Sound Statement



When you turn on the ATARI* Computer,** you'll know that it is ready when the screen looks like this:



*Indicates trademark of Atari, Inc.

**This book does not try to tell you how to hook up the machine. That is explained very well in the *ATARI 400 or 800 Operators Manual* you received with your machine. It's easy to do, so we will assume your computer is "up and running."

You tell the computer what you want it to do by typing instructions, called commands.

The little square just below the word READY is called the cursor. As you type instructions, the cursor moves across the screen, so you'll know where the next letter will appear as you type it.

Before you begin, look at this diagram of the ATARI Computer's keyboard. Arrows point to two important keys (RETURN and SYSTEM RESET) you will learn to use in just a moment.



Now that you've looked over the keyboard, you're ready to give the machine a command. Type

SOUND Ø, 121, 1Ø, 8

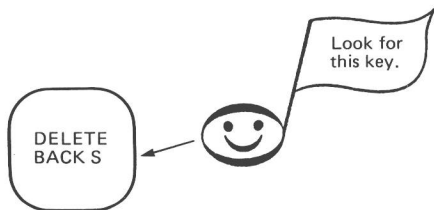
Be sure to type it exactly as you see it here. The computer is very particular about punctuation, so be sure to use a comma between numbers. It is also a very literal machine and is not able to guess what you mean; you must tell it exactly. Don't use substitutions such as the letter "o" for zero (Ø) or the letter "l" for the number 1, as you might on a conventional typewriter.

As you can see on your screen, the zeroes in the SOUND statement contain a slash mark (Ø), whereas the "o" in the SOUND does not. So remember that on the screen:

Ø is a zero
O is the letter "o"

What if, while typing your SOUND statement, you press a wrong number or spell "SUUND" or "SOUD," and realize you've made a mistake? It's easy to fix.

Just press the DELETE BACK S key near the upper right side of the



keyboard. This moves the cursor back (to the left) as many spaces as you want and erases the error. Then type the correct letters or numbers.

Okay, do you have a SOUND command that looks like this?

```
SOUND Ø, 121, 1Ø, 8
```

If you do, press the RETURN key and the machine will produce a single tone that is approximately the note middle C.

Can you hear it? Be sure the volume on your TV is turned up to a comfortable listening level.

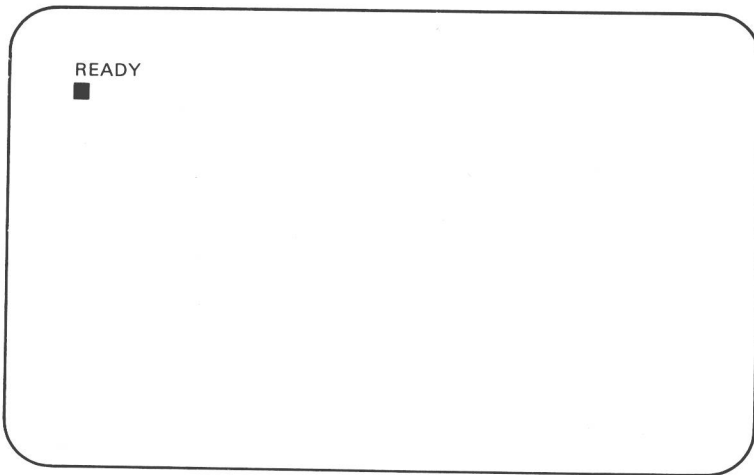
The tone will stay on. To stop the tone type:

```
END
```



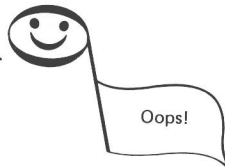
and press RETURN.

You can also stop it by pressing the SYSTEM RESET KEY (the yellow key at the upper right corner of the keyboard). When you do this, the sound stops and you see this again on the screen:



But what happens if you make a typing error in your SOUND statement and don't notice it? Suppose you put a period instead of a comma between 1Ø and 8, so it looks like this:

```
SOUND Ø, 121, 1Ø.8
```



If you do this and press the RETURN key, instead of a tone you'll get an ERROR message that looks something like this:

ERROR - SOUND 0,121,10.8

An ERROR Message is the machine's way of telling you it doesn't understand. Don't let an ERROR message upset you. The most advanced computer people get ERROR messages all the time. It only means that you have to find a different way to tell the machine what you want it to do.

Enough of ERRORS for the moment and back to the SOUND statement.

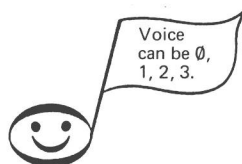
PARAMETERS

Each number separated by a comma in the SOUND statement can be changed to give the statement a different meaning. A number that affects the meaning of a statement is called a *parameter*. The SOUND statement in ATARI BASIC consists of four parameters.

Voice Parameter

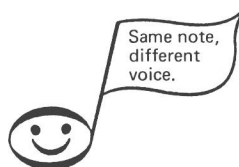
The first parameter in the SOUND statement you've been using is the *voice parameter*. Your ATARI Computer has four voices, just like a barbershop quartet. ATARI BASIC counts voices a little differently from people though. It numbers its four voices 0,1,2,3.

SOUND 0,121,10,10



Voice 1 can play the same note like this:

SOUND 1,121,10,10



Now you type a SOUND statement for voices 2 and 3 to play the same note.

You'll get a chance to combine the voices with different notes soon, but for the moment let's stick with the first voice. That's voice 0 (zero) in the ATARI BASIC's SOUND statement.

Note Parameter

The second parameter in your SOUND statement is the *note parameter*. To get a feel for the note parameter, try this exercise:

First type:

```
SOUND 0,243,10,8
```

and press the RETURN key.

You should hear a nice low note played by the computer.

Now type:

```
SOUND 0,60,10,8
```

and press the RETURN key.

Type END and press RETURN if you want to stop the sound.

By now you may have begun to realize that any time you give the computer a command, you must press the RETURN key to have the machine execute that command. So we'll stop telling you each time, although we will remind you occasionally.

Low numbers play high notes!
High numbers play low notes!



Using ATARI BASIC, you can play 256 different notes numbered from 0 to 255. When it comes to notes, not only does the computer start counting at zero, but it also counts backwards from the way we humans count. That is, it gives the highest notes the lowest numbers and the lowest notes the highest numbers. So 243 for the note parameter is a low note, while 26 is a high one.

Let's write a SOUND statement so the note parameter is a *variable* called N. That's simply a way of saying you can make N equal to different numbers, in this case numbers between 0 and 255 inclusive.

Now it looks like this:

```
SOUND 0,N,10,10
```

(The letter "N" here represents a number. You may substitute a number from 0 to 255 for N in this SOUND statement.)

Try different numbers for the variable N to get a feeling for some of the notes that your ATARI Computer can generate. Remember to use the RETURN key after each new command!

Tone Parameter

The third parameter in the SOUND statement is the *tone parameter*. “Tone” here is different from the tone control on your radio. To get the idea of some possible “tones” you can produce, try this.

First go back to the original SOUND statement:

```
SOUND 0, 121, 10, 10
```


This makes a nice “pure” musical tone.

But you can make a sound something like a motorcycle cruising down the highway by simply changing the value of the tone parameter to 4 instead of 10. If you do that, the SOUND statement will look like this:

```
SOUND 0, 121, 4, 10
```

You can make a variable out of the tone parameter in the same way you did with the note parameter. The statement would then take the following form:

```
SOUND 0, 121, T, 10
```



There are eight possible “tones” available in ATARI BASIC, indicated by even numbers from 0 to 14. There’s no particular reason for them being even numbers other than that’s the way the machine was designed.

If you use an odd number like:

```
SOUND 0, 121, 5, 10
```

it won’t make a sound.

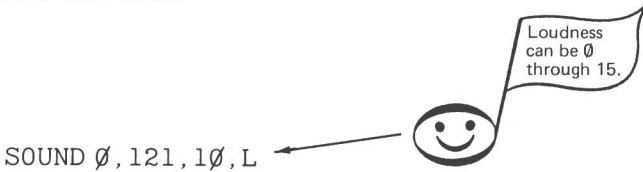
Note: 0 to 255

Tone: 0,2,4,6,8,10,12,14

Try different numbers for the variable “T” in the SOUND statement to see which ones you like. The values 10 and 14 should give you a very pure sounding tone. The other values give a variety of buzzing and scratching sounds. You’ll explore these later when you get into creating sound effects.

Loudness Parameter

The final parameter in the SOUND statement is the *loudness parameter*. It has sixteen possible values, numbered from 0 to 15. The lowest value, which is 0, makes no sound. Later, you will see how this can be used as a way to turn off a note.



The highest value of the loudness parameter is 15, the loudest tone. (Of course, all this depends on where you have the volume on your TV.)

First, try a value of 2 for “L” in this statement:

```
SOUND 0, 121, 10, 2
```

Then, try 15 for “L”:

```
SOUND 0, 121, 10, 15
```

Now try a few more values of your own choice to get a feeling for the loudness parameter.

You have now explored all four parameters of the SOUND statement.

Here’s a brief summary of what you’ve learned so far. This section may be helpful as a quick reference as you continue to explore on your own.

Defining each parameter as a variable, you can write the SOUND statement like this:

```
SOUND V, N, T, L*
```

V is for Voice Numbered 0 through 3.

(Four voices—Zero is the first voice)

N is for Note Numbered 0 through 255.

(0 is the highest pitch, 255 is the lowest)

T is for Tone Even numbers 0 through 14.

(Odd numbers won’t work—10 and 14 are “pure” tones)

L is for loudness Numbered 0 through 15.

(0 is the quietest, 15 is the loudest)

*You can use any name you wish for these variables. For example, in the ATARI 400/800 BASIC Reference Manual, Pitch is used for the parameter we’ve called Note, Distortion is used for what we’ve called Tone, and Volume is used for the fourth parameter where we’ve used the name Loudness. Use whatever variable names you like.

COMBINING VOICES

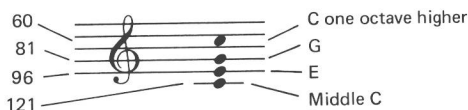
Suppose you want to hear two voices together. To do this, type one SOUND statement for voice 0, and then, without pressing SYSTEM RESET (but do press RETURN), type another statement for voice 1. For example, you might have:

```
SOUND 0,121,10,10
SOUND 1,60,10,10
```



Be sure the second statement is for voice 1 and not voice 0 again. This tells the machine to play middle C with the first voice and the note C an octave higher with the second voice. You can play up to four different voices at once in this way. You might have something like this:

```
SOUND 0,121,10,10-(middle C)
SOUND 1,96,10,10-(the note E)
SOUND 2,81,10,10-(the note G)
SOUND 3,60,10,10-(C one octave above middle C)
```



Remember, you can play any of 256 notes for the note variable. The following chart gives the number values for different notes in our western musical scale. You might want to make up some chords of your own before going on to the next section.

The diagram illustrates the relationship between piano keys and musical notes. The keyboard is shown with 60 keys, each labeled with a letter (C, D, E, F, G, A, B) and a sharp symbol (#). Arrows point from each key to a corresponding note on a musical staff. The staff is divided into two systems: the first system covers keys 29 to 57, and the second system covers keys 57 to 243. The notes on the staff are labeled with letters and sharp symbols, and the key numbers are listed below the staff. A 'Middle C' label with an arrow points to the 121st key (C4).

Key Number	Key Label	Note Label
29	C	C
31	B	B
33	A#	A#
35	A	A
37	G#	G#
40	G	G
42	F#	F#
45	F	F
47	E	E
50	D#	D#
53	D	D
57	C#	C#
59	C	C
61	B	B
64	A#	A#
68	A	A
72	G#	G#
76	G	G
83	F#	F#
85	F	F
91	E	E
96	D#	D#
102	D	D
108	C#	C#
114	C	C
121	B	B
128	A#	A#
136	A	A
144	G#	G#
153	G	G
162	F#	F#
173	F	F
182	E	E
193	D#	D#
204	D	D
217	C#	C#
230	C	C
243	B	B

EDITING

To change a parameter in the SOUND statement, you've learned to type the line over. For example, if you have:

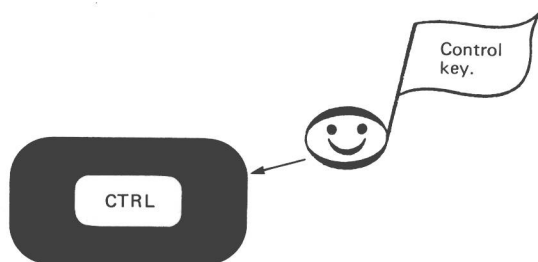
```
SOUND 0,121,10,10
```

You can change the note by typing:

```
SOUND 0,243,10,10
```

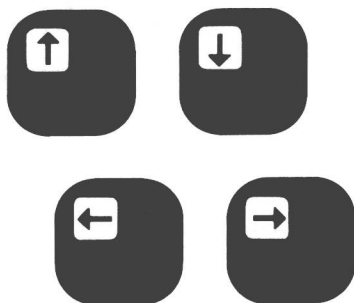
But if you want to change just one part of a statement, for example the note parameter, your ATARI Computer has a special "editing" feature to make it easy.

First, look on the left side of the keyboard and find the control key that looks like this:



Got it?

Okay, now on the other side of the keyboard are four keys with little arrows on them. They look like this:



Now enter a SOUND statement like:

```
SOUND 0,121,10,10
```

Once you've done that, hold down the control key, **CTRL** with one hand and while still holding it down, press the key with the arrow pointing
