THE HACKER'S DIET

How to lose weight and hair through stress and poor nutrition

by John Walker

Electronic Edition

The Hacker's Diet

How to lose weight and hair through stress and poor nutrition

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JOHN WALKER

Also by John Walker

THE AUTODESK FILE

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PREFACE

This is not a normal diet book, and I am not a normal diet book author.

I'm not a doctor. Nor am I a nutritionist, psychologist, sports hero, gourmet chef, or any of the other vocations that seem to qualify people to tell you how to lose weight.

I'm an engineer by training, a computer programmer by avocation, and an businessman through lack of alternatives. From grade school in the 1950's until 1988 I was fat—anywhere from 30 to 80 pounds overweight. This is a diet book by somebody who spent most of his life fat.

The absurdity of my situation finally struck home in 1987. "Look," I said to myself, "you founded one of the five biggest software companies in the world, Autodesk. You wrote large pieces of AutoCAD, the world standard for computer aided design. You've made in excess of fifty million dollars without dropping dead, going crazy, or winding up in jail. You've succeeded at some pretty difficult things, and you can't control your flippin' *weight*?"

Through all the years of struggling with my weight, the fad diets, the tedious and depressing history most fat people share, I had never, even once, approached controlling my weight the way I'd work on any other problem: a malfunctioning circuit, a buggy program, an ineffective department in my company.

As an engineer, I was trained to solve problems. As a software developer, I designed tools to help others solve their problems. As a businessman I survived and succeeded by managing problems. And yet, all that time, I hadn't looked at my own health as something to be investigated, managed, and eventually solved in the same way. I decided to do just that.

This book is a compilation of what I learned. Six months after I decided being fat was a problem to be solved, not a burden to be endured, I was no longer overweight. Since then, my weight hasn't varied by more than a few pounds. I'm hungry less often at 145 pounds

than I was at 215. I look better, feel great, and have more energy for the things I enjoy. I spend only a few minutes a day maintaining this happy situation. And I know I'll be able to control my weight from now on, because I have the tools I need, the will to use them, and the experience to know they work.

The tools are now in your hands.

Live long and prosper.

John Walker
Sausalito, California
January, 1991

1

INTRODUCTION

About losing weight

There's an old Wall Street tale: a tyro asks an old-timer, "How do you make money in the market." The wise man answers, "Nothing could be simpler: buy low, sell high." The beginner asks, "How can I learn to do that?" The sage responds, "Ahhhh... that takes a lifetime." Simple doesn't mean easy.

There is no magic secret to losing weight and keeping it off, just as there is no hidden key to instant wealth. Nonetheless, every year another crop of "magic diet" and "secrets of investing" books appear on already-creaking shelves. The human capacity to ignore inconvenient facts and avoid unpleasantness is immense. Success in any endeavour requires coming to terms with the true nature of the task at hand and, if the goal is worth the effort, getting on with it.

"How can I lose weight?" "Simple, *eat less food than your body burns*." "How can I learn to do that?" Read this book.

About this book

This book is about...

How to... It's a how-to book, but not a cookbook. Everybody's different, and no one diet is right for all. This book will help you find a diet plan that works *for you*.

...**lose weight**... Lose weight rapidly, and keep it off permanently. Losing weight isn't pleasant, and it's far better to get it over with quickly, and never have to do it again.

...**and hair**... Just kidding. Actually, it seems to me the life of a middle aged male is a race between hair falling out of its own accord and getting ripped out over stress and irritation. Women have

it harder—they have to rip it *all* out.

. . . **through stress**. . . Stress is an unavoidable consequence of living in our fast-paced, high-tech culture, yet few of us are willing to sacrifice its stimulation and excitement to recapture the placid and serene life of simpler times. Stress is a primary cause of overeating and weight gain. You'll learn how to break the cycle of stress-induced eating and how to actually turn stress into an ally in achieving your ideal weight.

. . . **and poor nutrition.** There is one, simple, unavoidable fact of dieting. To lose weight you have to eat less food than your body needs. Only by doing so can you cause your body to burn its reserves of fat and thereby shed excess weight. If nutrition is about meeting your body's needs, losing weight involves deliberately short-changing those needs—in a word, starving. This isn't a pleasant or inherently healthy process, but it's better than carrying around all that extra weight. You'll see how to reduce your food intake intelligently, so you don't end up with scurvy or something else unpleasant or embarrassing.

About you

This book is written for successful, intelligent, and motivated people who happen to be overweight. Whether you've always been overweight, have been on a roller coaster of dieting and regaining, or have just recently added some excess poundage, the key resources you need to achieve and maintain whatever weight and health goals you set for yourself are the same as you need to accomplish anything else worthwhile in life:

- An eye firmly fixed on the goal.
- Will power.
- A high tolerance for pain.

I don't mean this to be facetious; vaulting any of life's hurdles, whether success in school, business, sports, the arts, or personal relationships requires the will and the willingness to do what's necessary, recognising that the achievement will more than repay the investment of time and energy you make.

This is the very key to success in anything—to be able defer immediate gratification in pursuit of a more permanent and worthwhile future goal.

This is precisely what losing weight involves. If you're successful in the things that matter to you but overweight, all you need to lose that weight is to make accomplishing your weight and health goals *matter just as much*, then approach weight loss and control just like any other important project: by developing and carrying out a rational plan for success based on an understanding of what's involved in achieving it.

This book isn't written for people who are or wish to become obsessed with their health. I consider weight control and fitness like any other aspect of life that's important enough to do, but hardly my reason for being. It's like balancing the checkbook, going grocery shopping, or getting the car tuned up. The goal is to get the job done, and done right, as quickly as possible and with the minimum effort.

About me

I've been overweight most of my life.

In 1987, not yet forty years old, I achieved the material goals I'd been working for all my life. The company I founded, Autodesk, Inc., had achieved a commanding position in its industry, enriching me beyond the bounds of even my perfervid imagination. I'd handed the management over to willing and capable people and returned full-time to the work I love most, programming and writing. I'd moved to a beautiful house on a cliff overlooking the Pacific Ocean, shared with my intelligent, resourceful, and attractive wife.

What's wrong with this picture? Well, I was fat as a hawg and in lousy shape. I hadn't exercised since high school. I'd lost some weight once in the mid 1970s, but put it all back on in less than a year.

Life has a way of evening things out. And, I figured, dropping dead before forty would balance out a great deal of the success I'd clawed from the flinty soil of life. What a drag.

So, there was nothing for it but to shed all those pounds I'd packed on through the stressful years of starting, growing, and running a company. "If all you have is a hammer, everything looks like a nail." I'm an engineer. I decided to approach weight loss as an *engineering* problem.

I studied the human body the way I'd tackle a misbehaving electronic circuit or computer program: develop a model of how it works, identify the controls that affect it, and finally adjust those controls to set things aright.

It worked. In less than a year, totally under my own direction and without any drugs or gimmicks, I went from 215 pounds to 145 and

achieved physical fitness. Since then, I've kept my weight right where I want it with none of the yoyo swings I'd suffered in the past. All of this was accomplished in less than 15 minutes a day, and without any significant changes in the way I choose to live my life.

What's more, I came to *understand* the game of weight control. Confidence, founded in understanding and confirmed by success, makes maintaining an ideal weight far more likely. What I discovered was so simple, so obvious, yet so profound and useful I decided to make the tools that worked for me available to everybody. So I wrote this book.

I lost weight recently enough to remember clearly what dieting involves but long enough ago to be confident I have a way to avoid gaining it back. I understand what you've gone through trying to lose weight previously. I know what lies ahead. I've been there. It's worth it.

About the computer tools

I'm a computer freak, so the first thing I did when I started thinking about losing weight was develop a bunch of computer-based tools to help me understand, monitor, and control the process. Collecting the data, analysing it with a computer, then applying the insights I gained taught me more about losing and gaining weight, and how the body works in general than a lifetime of failed diets and a truckload of diet books. This book not only explains what I've learned, it describes how to use the tools to understand how your own body works.

The tools are all spreadsheets based on Microsoft Excel. Please refer to the **`README.DOC`** file which accompanies the tools for information about the hardware and software they require. In addition to the spreadsheets that let you plan, track, and chart your weight loss, many of the tables in this book are also supplied as Excel files so you can experiment with them and incorporate them into other health management tools. Each table in the text supplied in Excel form specifies the file name in computer type (for example, "**`WEIGHT.XLS`**") at the top of the table.

You don't need a computer to lose weight. Every technique in this book can be applied just as effectively with pencil and paper, in little additional time. The computer tools produce spiffier looking graphs, allow you to play around with the data in amusing ways, and let you experiment with "what-if" calculations without pencil pushing. If you have a computer, you'll appreciate the convenience it affords, but it won't determine whether you succeed or fail in losing weight.

Chapter 11 provides "Pencil and paper" methods equivalent to each computer-based calculation. In addition to making the techniques accessible to those without proper computers, these sections also explain how the spreadsheets work and are worth reading if you're interested in modifying them.

About pounds and inches

I usually use the metric system, but in this book I've stuck to English units throughout. Even scientists who work all day in metric units think of themselves as "five eleven, one-sixty." Metric units would only confuse U.S. readers and make the essential techniques in the book less accessible. I apologise to readers in more enlightened areas of the world. I've also conformed to the somewhat sloppy practice in most nutrition books of using "calorie" to mean what is more precisely termed "kilogram calorie" or "kcal"—the energy required to raise the temperature of one kilogram of water one degree Celsius. The "gram calorie," 1000 times smaller, is cumbersome when discussing the energy content of food. In Europe, food energy value is frequently given in kilojoules (kJ), the metric unit of energy. To convert kilojoules to kilogram calories ("food calories"), divide by 4.184.

The Excel spreadsheets allow you to specify whether weight is measured in pounds, kilograms, or stones; each spreadsheet which uses weight measurements contains a cell near the top which specifies the unit of weight. If set to 1 (as supplied), weights are in pounds. If you change the cell to 0, weights are in kilograms. If you set it to −1, weights are measured in stones. Also included is **`UNITS.XLS`**, an Excel worksheet providing conversion factors among all the odd English units encountered in connection with food (teaspoons per cup, for example), plus their metric system equivalents.

About time!

Enough tedious preliminaries—let's get on with it! The sooner you start, the sooner you can put the overweight, out of shape part of your life behind you.

You've probably already decided you don't want to be overweight. Otherwise, why read a diet book? You're about to learn what's involved in achieving your goal. Mastering and applying the tools for weight and health management in this book will allow you to succeed, probably within the next 12 months. By this time next year, then, having reduced a nagging lifelong problem to a few minutes a

day of minor effort, you'll look forward to many additional healthy years replete with all the joys life has to offer.

Part I

Engineering

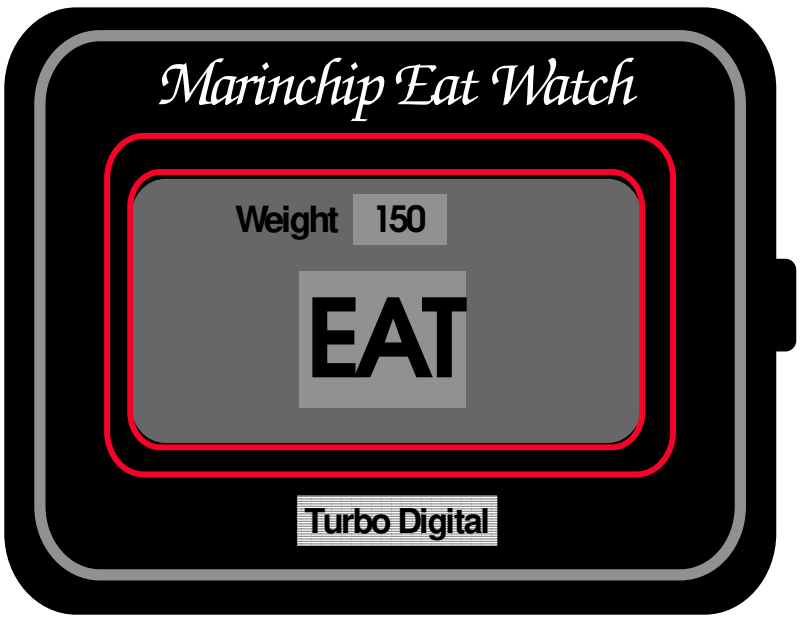
2

THE EAT WATCH

My hunger serves me instead of a clock.

—Jonathan Swift, *Polite Conversation*, 1738

Wouldn't it be great if you could visit your local purveyor of electronic marvels and purchase one of these?



You strap it on your wrist, set it for the weight you want to be, then rely on it to tell you when to eat and when to stop. Whenever it

says **EAT**, just chow down on anything you like until **EAT** goes out. Obviously the **EAT** indicator will stay on longer if you're munchin' cabbage instead of chugging München's finest beer.

As long as you heeded the Eat Watch, you'd attain and maintain whatever weight you set it to. If you ate the wrong foods or had your meals on an odd schedule you might be hungry, but you'd never be fat. And, with the eat watch guiding you, you'd rapidly find a meal schedule and makeup that banished hunger forever.

The eat watch wouldn't control you any more than a regular watch makes you get to work on time. You can ignore either, if you wish. You decide, based on the information from the watch, what to do.

Some people are born with a natural, built-in eat watch. You and I either don't have one, or else it's busted. But instead of moping about bemoaning our limitations, why not *get* an eat watch and be done with it?

You can't buy an eat watch in the store, at least not yet. But you can *make* one that works every bit as well. It isn't a gadget you wear on your wrist; it's a simple technique you can work with pencil and paper or with a personal computer. It tells you same thing: when to eat and when to stop eating. The eat watch you'll discover in this book is simple to work, easy to use, and highly effective in permanently controlling your weight.

The next few chapters lay the background for building an eat watch. The principles on which the eat watch is based are subtle and, although they've been used in engineering for decades, seldom are mentioned in conjunction with weight control. I'll explain them in detail. The road to understanding the eat watch is a long but interesting one. When we reach its end, you'll not only know how to use an eat watch, but how and why it works. Then you'll have the confidence, founded on knowledge, that your weight is totally and permanently under your control.

Food and feedback

If people didn't eat except when their bodies needed food, nobody would be overweight. What a wonderful world it would be! (Of course, there wouldn't be a market for diet books. . . .)

Hunger is supposed to tell us when it's time to eat, but in the modern world, we rarely rely on this message from our bodies. We eat certain meals on a given schedule, with family and friends. And, while hunger tells us when to eat, there isn't a corresponding signal that says we've had enough. Only when the scale begins to rack up extra pounds and

the belt seems to need another notch do we realise the cumulative effect of a little too much food every day.

As long as you aren't hungry, you're probably getting enough food, but how do you keep from eating too much? What's needed, along with food, is *feedback*—information that tells how you're doing—when to eat and when to stop: the message of the eat watch.

I believe one of the main reasons some people have trouble controlling their weight while others manage it effortlessly is that there's a broken feedback circuit in those of us who tend to overweight. Our bodies don't tell us "enough already!", while our slim and trim comrades, born with a built-in eat watch, always know when to hang up the nosebag.

But, hey—no problem! Back when we were all hunter-gatherers, people with crummy eyesight probably didn't live very long. It's hard to throw a spear when you can't even see the end of your arm. Along comes technology and zap!!!: eyeglasses fixed that problem once and for all. Actually, it's tilted the other way these days; if I weren't blind as a cinder block without my glasses, I'd probably have been sent to 'Nam.

So it is with the eat watch. If you weren't born with one, just get one, strap it on your wrist, and get on with life.

Motivation and manipulation

Controlling your weight provides an interesting window on the enigma of sentience, the distinction between mind and body. Weight control involves the body at the simplest level; eat more and gain weight, eat less and lose it. Yet the reasons we become overweight and the difficulties we have in losing weight often stem from the subtleties of psychology rather than the mechanics of mitochondria.

To control your weight, you need only eat the right amount. To eat the right amount, not just this month or next month, but for the rest of your life, you need not only the information—the display on the face of the eat watch—to know what's the "right amount"; you need an incentive to follow that guidance. Wearing a watch doesn't make you a punctual person, but it provides the information you need to be one, if that's your wish.

This incentive is the "motivation to control your weight," often simplistically deemed "will power." Where can you find this motivation, especially if you've tried diet after diet and failed time after time? This book will help you to find the motivation in the only place it can be found, within yourself, by laying out a program that makes the

steps to success easy and the thought of failure or backsliding difficult to contemplate.

This constitutes manipulation, but manipulation's OK as long as you're manipulating yourself. After all, in order to manipulate somebody you have to understand them, and who do you understand better than yourself? The goal is empowerment: the sudden realisation, "Hey, this isn't hard at all! I can do this!" It is such discoveries that give us the confidence and courage to go onward to greater challenges. The course of a life is often charted by such milestones of empowerment. Manipulation in the pursuit of empowerment is no vice.

Latent within you is the power to control your weight for the rest of your life. All you need to do is realise that your weight is under your conscious control. With that knowledge, you can peel off your excess weight and achieve physical fitness. Once you've accomplished those goals, you'll be in a position to make them central to your self-image.

Less than 12 months from now, new people you meet will be incapable of imagining you as overweight. Next year, you'll be able to run up four flights of stairs and scarcely notice the exertion. If, like me, you've been overweight most of your life, you're about to partake of a new and rich part of the human experience: the exultation of living in a healthy animal body.

Once you've experienced the joy, the confidence, and the feeling of power that success entails, you'll never consider giving it up—not even for that extra slice of pie.

Programmer, hack thyself

Recently, the word "hacker" has fallen into disrepute, coming to signify in the popular media the perpetrators of various forms of computer-aided crime. But most of the people who call themselves hackers, who have proudly borne that title since the 1950's, are not criminals—in fact many are among the intellectual and entrepreneurial elite of their generations.

The word "hacker" and the culture it connotes is too rich to sacrifice on the altar of the evening news. Bob Bickford, computer and video guru, defined the true essence of the hacker as "Any person who derives joy from discovering ways to circumvent limitations."

Indeed.... Well, what better limitations to circumvent than ones you've endured all your life? For the last few years, I've spent a weekend every Fall attending the "Hackers Conference": a gathering of computer folk who exult in seeing limitations transcended through

creativity. A commemorative T shirt is designed for each conference, so when you fill out your application, you have to say what size you wear. Hackers being hackers, it's inevitable that somebody will enter these data into a computer and analyse them.

The statistics are remarkable. We're talking megayards here; one wonders what the numbers would be if T-shirts came in Extra-Extra-Large, Jumbo, Gigantic, Colossal, Planetary, and Incipient Gravitational Collapse sizes as well as the usual S, M, L, and XL.

People who thrive on unscrewing the inscrutable—figuring out how complicated systems work and controlling them—sometimes fail to apply those very techniques to maintaining their own health. How strange to on the one hand excel at your life's work and on the other, XL in girth.

But not that strange, really. I've been there. For decades I believed controlling my weight was impossible, too painful to contemplate, or incompatible with the way I chose to live my life. I'd convinced myself that the only people who were physically fit were lawyers and other parasitic dweebs who, not forced to earn an honest living, had the time for hours of pumping various odd machines or jogging in the middle of the road while hard-working, decent folks were trying to get to work.

Most extraordinary things are done by ordinary people who never knew what they were attempting was "impossible." Hackers have seen this happen again and again; many of the most significant innovations in computing have been made by individuals or small groups, working alone, attempting tasks the mainstream considered impossible or not worth trying.

Once you possess the power to circumvent limitations, to control things most people consider immutable, you're liberated from the tyranny of events. You're no longer an observer; you're in command. You've become a hacker. This book is about one simple, humble thing: getting control of your weight and health. By circumventing the limitations that made you overweight in the first place and keep you that way, you're hacking the most complicated and subtle system in the world: your own human body. Weight control—what a hack! Once you realise you can hack your weight, who can imagine what you will turn to next?

Problems: managing, fixing, and solving

In every era, each culture defines itself in terms of the heroes it admires. That, in turn, determines the mindset and aspirations of the

generation whose values are formed during that time. For past generations explorers, military men, inventors, financiers, and statesmen have filled the role of hero. I believe that our time is the age of the manager. The MBA degree, a credential that qualifies one to administer by analysing and manipulating financial aggregates, has become the most prized ticket to advancement in the United States. The values managers regard most highly: competence, professionalism, punctuality, and communication skills have been enshrined as the path to success and adopted by millions.

The cult of management, for that is what it is, pervades the culture which is its host. In time, it will be seen to be as naive as the ephemeral enthusiasms that preceded and will, undoubtedly, supplant it in due course. But now, at the height of its hold, it's important to distinguish *managing* a problem from *fixing* it, for these are very different acts: one is a process, the other an event. *Solving* a problem often requires a bit of both.

Managing problems

"Management must manage" was the motto of Harold Geneen, who built ITT from an obscure international telephone company into the prototype of the multinational conglomerate. What Geneen meant by this is that the art of the manager is coming to terms with whatever situations develop in the course of running a business and choosing the course of action that makes the best of each.

The world of the manager is one of problems and opportunities. Problems are to be managed; one must understand the nature of the problem, amass resources adequate to deal with it, and "work the problem" on an ongoing basis. Opportunities are merely problems that promise to pay off after sufficient work.

Managers are not schooled in radical change. The elimination of entire industries and their replacement with others, the obsolescence of established products in periods measured in months, the consequences of continued exponential growth in technology are all foreign to the manager. Presented with a problem, an expert manager can quickly grasp its essence and begin to formulate a plan to manage the problem on an ongoing basis.

But what if the problem can be *fixed*? This is not the domain of the manager.

Fixing problems

Engineers, derided as "nerds" and "techies" in the age of management, are taught not to manage problems but to fix them. Faced with a problem, an engineer strives to determine its cause and find ways to make the problem go away, once and for all.

An engineer believes most problems have solutions. A solution might not be achievable in the short term, but he's sure somewhere, somehow, inside every problem there lurks a solution. The engineer isn't interested in building an organisation to cope with the problem. Instead, the engineer studies the problem in the hope of finding its root cause. Once that's known, a remedy may become apparent which eliminates the need to manage the problem, which no longer exists.

Most of the technological achievements of the modern world are built on billions of little fixes to billions of little problems, found through this process of engineering. And yet the engineer's faith in fixes often blinds him to the fact that many problems, especially those involving people, don't have the kind of complete, permanent solutions he seeks.

Solving problems

Many difficult and complicated problems require a combination of the skills of management and the insights of engineering. Yet often, the difficulty managers and engineers have in understanding each other's view of the world thwarts the melding of their skills to truly solve a problem. In isolation, a manager can feel rewarded watching the organisation he created to "work the problem" grow larger and more important. Rewardingly occupied too, is the engineer who finds "fix" after "fix," each revealing another aspect of the problem that requires yet another fix. Neither realises, in their absorption in doing what they love, that the problem is still there and continues to cause difficulties.

The development of the U.S. telephone network in the twentieth century provides an excellent example of how management and engineering can, together, solve problems. In the year 1900 there were about a million telephones in the country. By 1985 more than 135 million were installed. Building a system to connect every residence and business across a continent, providing service so reliable it becomes taken for granted, is one of the most outstanding management achievements of all time. Yet it never could have happened without continuing engineering developments to surmount obstacles which otherwise would have curtailed its growth: problems no amount of management, however competent, could have ameliorated alone.

Consider: in 1902 every thousand telephones required 22 operators. The Bell System employed 30,000 operators then, making connections among the 1.3 million telephones that existed. Had this ratio remained constant, the dream of a telephone in every house, on every desk in every business, would have remained only a dream for it would have required, by 1985, *three million* operators plugging and unplugging cables just to keep the phones working. About 3% of the entire labour force would be telephone operators. Even if that many could somehow be hired and trained, the salary costs would price phone service out of reach of most people.

No amount of management could overcome this limitation. But a series of incremental engineering fixes, starting with automated switchboards for human operators, then direct dial telephones, and finally direct worldwide dialing reduced the demand for operators to a level where universal telephone service became a reality. The managers wisely realised they needed an engineering fix, funded the search for one, and when it was found, managed the transition to the new system and its ongoing operation thereafter.

The engineers, likewise, realised that while they could fix a large part of the problem, they couldn't do it all. Had they sought to eliminate operators entirely, they would never have found a workable system. Instead, they automated what they could and relied on a well-managed organisation of human beings to handle the balance. Indeed, the number of operators employed by the Bell System has grown steadily over the years, reaching 160,000 by 1970. But the engineering fixes had, through time, reduced the requirement from 22 operators per thousand phones to about 1.7.

Weight: what's the connection?

Management in isolation struggles with constraints that can frequently be eliminated. Engineering in isolation seeks permanent fixes which sometimes don't exist and, even when found, often require an ongoing effort to put into place and maintain. Each needs the other to truly solve a problem. So it is with controlling your weight. First, you must *fix* the problem of not knowing when and how much to eat. As long as you lack that essential information, you'll never get anywhere. Then, you have to use that information to permanently *manage* your weight.

Diet books reflect the division between engineers and managers. When they focus on a "magic diet," they're seeking a quick fix. When they preach about "changing your whole lifestyle," they're counseling

endless coping with a broken system. This book presents an engineering fix to the underlying problem, then builds a management program upon it to truly solve the problem of being overweight.

What, me exercise?

There's a lot of nonsense floating around regarding exercise and weight control. The only way to lose weight is to eat less than your body burns. Period. Exercising causes your body to burn more, but few people have the time or inclination to exercise enough to make a big difference. An hour of jogging is worth about one Cheese Whopper. Now, are you going to really spend an hour on the road every day just to burn off that extra burger?

You don't exercise to lose weight (although it certainly helps). You exercise because *you'll live longer* and *you'll feel better*. When I started to control my weight, I had no intention of getting into exercise at all. As the pounds peeled off and I felt better and better, I decided to design an exercise plan built on the same principles that made the diet plan succeed.

This exercise plan is presented for your consideration in chapter 6. Even if you're dead set against the very concept of physical exertion, please read the introduction to that chapter. Like me, you've probably always thought of exercise as wasted time—precious minutes squandered in unpleasant activities. I think you'll find, as I did, that exercise actually *increases* the time you'll have to accomplish whatever matters in your life.

If you buy that argument, give the exercise plan a shot. Like the diet plan, it's calculated to motivate you to succeed, manipulate you to keep you going, and provide the feedback you need to let you know how far you've come. If you follow the plan carefully, you'll never be in pain, be exhausted, or ever spend more than 15 minutes a day on it.

3

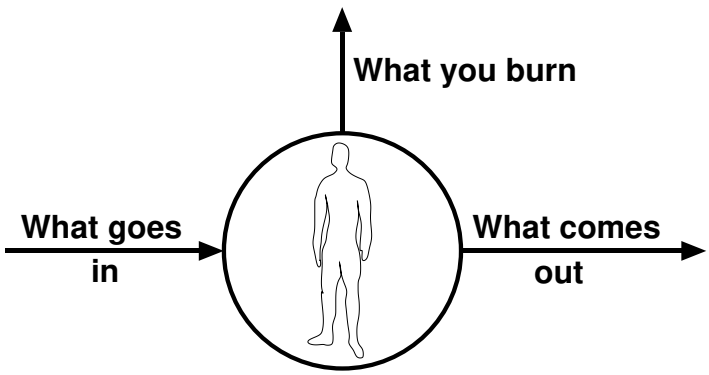
THE RUBBER BAG

> What a piece of work is man! how noble in reason! how infinite in faculty! in form and moving how express and admirable! in action how like an angel! in apprehension how like a god! the beauty of the world! the paragon of animals!
>
> —Shakespeare, *Hamlet*, Act II, Scene II

> Man is but a bubble, or bladder of the water.
>
> —Desiderius Erasmus, *Adagia* (1508)

The truth, I suspect, lies somewhere between these extremes. Nonetheless, when it comes to gaining and losing weight, the human body is remarkably akin to a rubber bag. Fad diets and gimmick nutritional plans obscure this simple yet essential fact of weight control: if you eat more calories than you burn, you gain weight; if you eat fewer calories than you burn, you lose weight.

Here's your body, reduced to a rubber bag.



What goes in

"What goes in" is everything you eat and drink. Humans, like bears and raccoons, are omnivores—we can eat just about anything, and as long as we get a reasonable variety, we'll be O.K. You don't see a 'coon stalking away from an overturned garbage can because the contents are low in calcium, nor a bear turning up his nose on finding the sandwiches in your picnic basket aren't made with the latest trendy low-sodium lecithin-enriched oat bran bread. There's no reason you should be obsessive about food either. Since we're efficient food processing machines, it's possible to reduce all the complexity of food so a single number that gives the total energy the body can extract from it—the calorie. The essential thing you need to know about what goes in is the total number of calories you eat in a day. All the rest are minor details.

What you burn

"What you burn" is the number of calories your body uses to provide the energy for everything you do, from heartbeats and breathing to running a marathon. The daily calorie requirement varies quite a bit from person to person depending on size, shape, basic metabolic rate, and degree of physical activity. A rough estimate of calories per day can be obtained by multiplying the ideal weight for your height and body type by a number based on your level of physical activity, ranging from 11 for a pure couch potato to 17 for a person engaged in heavy physical labour or strenuous exercise on a daily basis.

The following tables give estimates of the calories burned per day for men and women at their ideal weight, based on height and body type. The lower number is based on a level of activity characteristic of an office worker who does not exercise, and the high number assumes a moderate degree of physical activity, either as part of your work or through an exercise program. No table like this can be precise—use these numbers only as general guidelines. As you gain control over your weight, you'll determine precisely how many calories you burn every day.

Daily calories burned: Men

Height		Frame		
Feet	Inches	Small	Medium	Large
5	1	1427–1784	1542–1928	1652–2065
5	2	1471–1839	1580–1975	1695–2119
5	3	1516–1894	1619–2024	1741–2176
5	4	1561–1951	1660–2075	1787–2234
5	5	1606–2008	1704–2129	1834–2293
5	6	1653–2066	1749–2186	1883–2354
5	7	1700–2125	1796–2245	1933–2417
5	8	1748–2185	1845–2306	1985–2481
5	9	1796–2245	1895–2369	2037–2547
5	10	1845–2306	1948–2435	2091–2614
5	11	1895–2368	2003–2503	2146–2683
6	0	1945–2431	2059–2574	2203–2753
6	1	1996–2495	2118–2647	2260–2825
6	2	2047–2559	2178–2723	2319–2899
6	3	2099–2624	2240–2800	2379–2974
6	4	2152–2690	2304–2881	2441–3051

Daily calories burned: Women

Height		Frame		
Feet	Inches	Small	Medium	Large
4	8	1171–1464	1244–1555	1365–1707
4	9	1202–1502	1281–1601	1401–1752
4	10	1234–1542	1319–1649	1439–1798
4	11	1269–1586	1358–1698	1478–1847
5	0	1305–1631	1399–1749	1518–1898
5	1	1344–1680	1441–1801	1560–1950
5	2	1384–1730	1484–1855	1604–2005
5	3	1427–1784	1528–1910	1649–2061
5	4	1472–1840	1574–1967	1695–2119
5	5	1518–1898	1620–2025	1744–2180
5	6	1567–1959	1668–2085	1793–2242
5	7	1618–2023	1718–2147	1845–2306
5	8	1671–2089	1768–2210	1897–2372
5	9	1726–2157	1820–2275	1952–2440
5	10	1783–2228	1873–2341	2008–2510
5	11	1842–2302	1927–2409	2065–2582
6	0	1903–2378	1982–2478	2124–2655

Height in these tables is your barefoot height. "Frame" is a measure of the robustness of your skeleton; people vary in this regard from the extremes of "fragile wisp" to "hulkin' bruiser." If you aren't sure where you fall on that scale, don't sweat it. As you can see from the table, the variation based on your level of activity and other factors accounts for almost as much as your frame size.

The odds are the number of calories you burn every day will fall within the range given in these tables based on your sex, height, and build. This number is of surpassing importance to anybody interested in controlling his or her weight, yet few people are aware of how many calories they burn every day.

What comes out

This isn't a glamorous topic, but it's worth considering briefly to complete our understanding of the rubber bag. Every day, you put in some quantity of food and drink. For the most part, your body efficiently disassembles these complex substances into their molecular constituents and makes them available to power the cells of your body. As in any chemical process, there's a residue of waste, and your body excretes this in the well-known ways.

As an omnivore, your body is very efficient. You can use all kinds of odd stuff as food. Conversely, the substances your body can't use—the discard pile of the chemical card game of metabolism—are genuinely nasty stuff; the sooner you're rid of them the better.

Unfortunately, as you bring your weight down to your personal optimum level, the reduced quantity of food you're eating and the odious chemicals released as you burn up excess fat create a tendency for these poisons to stay inside the rubber bag. Means to ameliorate this situation will be discussed, tastefully I hope, later on.

Inside the rubber bag

Intake, burning, and excretion determine, in large part, how you look, how you feel, and how many years you'll live. They do this because, through simple arithmetic, they control the contents of the rubber bag. Living, as we do, inside the bag, it's worth understanding how we're affected by these processes, then using that understanding to gain control of them.

Assume you eat just enough every day to meet the needs of your body. What goes in is broken down into the molecules to power your

body and the result precisely equals what you burn. The residue, what comes out, is discarded to make room for the next day's food.

This is the condition of stable weight. *The entire purpose of this book is to allow you to attain this state.* Regrettably, many of us have spent most of our lives oscillating between the following two situations.

Too much goes in

You eat too much. "How could I have finished that entire pizza?" "Those doughnuts cried out, 'Eat me!' ". When what goes in exceeds what you burn, your body has left-over nutrients floating around in the bloodstream.

We evolved in a world where the normal conditions of life were hunger and cold. On those rare occasions the body enjoyed a feast it, like the prudent squirrel, made provisions for the hard times that would surely follow.

Fat cells are the body's equivalent of a piggy bank. Fat cells sit on the banks of the bloodstream and, whenever they see excess food, snatch it out and build molecules of fat to stuff in their little cellular storehouse. Each fat cell is, in essence, a little rubber bag: when it sees too much food it snarfs it up and expands.

When this goes on, the larger rubber bag expands: you gain weight.

Too little goes in

You skip a meal, or decide that a scoop of cottage cheese is a wiser choice for lunch that a double beef bozoburger with bacon, guacamole, and cheese.

Before long, the energy-distributing molecules in your bloodstream start to become scarce. Your body starts slowing down to adjust to the situation. You may feel cold, since less energy is available to be burned. Your stomach starts sending telegrams to central control, "Hey, what happened to lunch?"

As the bloodstream becomes depleted in energy, the fat cells notice this and respond; now's the time to draw down the reserves. Perhaps the boss is stalking a mammoth and doesn't have time to scarf up some fruit and berries along the way (or maybe Monday Night Football's gone into overtime and the fridge is forgotten in the heat of the moment—the world of the fat cell is a simple one, hardly cognizant of such modern problems). Individual fat cells begin to tap their storehouses and release energy into the bloodstream to ameliorate the shortfall.

When this goes on, the rubber bag contracts: you lose weight.

Seizing control

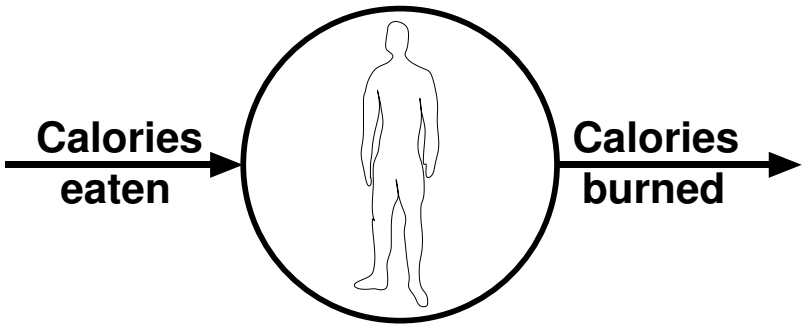
Understanding how a system works is the first step in controlling it. Thinking of yourself as a rubber bag may not be glamorous, but it casts the realities of weight control in stark contrast, dispelling the myths and misconceptions that collect around the subject. Compared to most systems engineers design, this one is pretty simple. Let's look at how to control it.

The first step is identifying *what we want to control*. Well, that's obvious: the goal is **control our weight**. Our weight is just the contents of the rubber bag.

So, what are the *inputs to the system*? Again, simple. There's only one input: *how much we eat*, measured in calories per day.

What are the *outputs from the system*? Almost as simple: **how much we burn**, again measured in calories per day, and **what comes out**. But since what comes out is for all intents and purposes simply the discarded waste products from processing what's been eaten and, in any case isn't subject to control, we can ignore it.

Thus we've simplified the rubber bag even further, to the following system:



Now we're getting somewhere! Calories in—calories out: both readily calculated. You get calories in by adding up the calories of everything you eat in a day: good old "calorie counting." Calories out, the calories you burn in a day, can be initially estimated based on your sex, height, and frame size using the tables on pages 22 and 23. Later, you'll be able to refine this estimate as you monitor your weight.

To determine whether you'll gain or lose weight—whether the rubber bag will grow or shrink—just take the number of calories in, what you

eat, and subtract the number of calories you burn. If the number's positive, you're eating too much and the excess calories will stay in the bag; you'll gain weight. If the result is negative, you're burning more calories than you're putting in; the bag will shrink as the reserves stored in fat cells are drawn down to meet the body's energy needs; you'll lose weight.

To complete our understanding of the rubber bag, we need but one more fact: a number that relates an excess or shortfall in calories to pounds on the scale. That's given by the number of calories of energy stored in a pound of fat: about 3500 calories per pound. (Fat is really remarkable stuff when you think about it from the standpoint of biochemistry rather than belt size. Life has discovered, in fat, an extremely compact and efficient way to store energy. We often think of sugar as "pure calories," but a cup of sugar contains only 750 calories. A cup of lard, essentially pure fat, contains more than 1800 calories, almost *two and a half times* the content of sugar. Is it any wonder flaky pie crust is purgatory in a pan for anybody with a weight problem?)

If, over a period of time, the calories in the food you eat exceed the calories you burn by 3500, you'll put on about a pound. Conversely, if you reduce your food intake so that you burn 3500 calories more than you eat, you'll lose about a pound.

Please reread that last paragraph. It contains essentially everything there is to know about weight control. All the rest are tools, techniques, and details, important ones to be sure, but useless unless you first understand the system. Any tools that achieve the same end, balancing the calories you eat against the calories you burn, will have the same results. (You can dig a ditch with a pointed stick, a shovel, or a backhoe. The result is the same, but you can get the job done faster and with less effort by using the best tool. Still, don't confuse the shovel (the means) with the ditch (the objective), as most diet books tend to.)

Note the phrase "over a period of time," in connection with a calorie excess or deficit. One single event: eating a half gallon of ice cream by yourself, right from the box, at one sitting, or going 36 hours without eating as you drive the Cannonball, doesn't have the impact of a consistent calorie excess or deficiency over an extended period of time.

Once you understand these simple facts, the realities of weight control can be reduced to calculations you work out in your head or on the back of a napkin (a particularly appropriate place for them!). Assume you're male, 5'11" barefoot, with an average build. You burn in the

vicinity of 2200 calories a day. As long as you eat about that much every day, your weight will stay the same.

Suppose you start putting in an extra 250 calories a day. That sounds like a lot, but consider the following:

Savoury Snack	Calories
Ice cream cone	220
Doughnut, glazed	225
Oreo cookies, 5	250
Beer, 2 cans	300
Chocolate shake	375
Pecan pie (1/6 pie)	550

These little compensations for life's vicissitudes can add up. Indeed they do... to the tune of an extra 1750 calories per week based on a daily excess of 250 calories ($250 \times 7 = 1750$). The weekly surplus of 1750 calories equals half the calories in a pound of fat ($3500/2 = 1750$). As week gives way to week, you'll find you're gaining about half a pound a week. Two pounds per month. About 25 pounds a year, by which time none of your clothes will fit, you'll look awful, be depressed about the situation, and feel unable to get a handle on it unless you've grasped the simple arithmetic at the heart of the problem.

But consider the flip side of this calculation. Passing by any of the treats listed above, or its equivalent in other foods, hardly constitutes starvation or survival rations. And yet, simply by eating that little bit less every day for a year, you can subtract 25 pounds from your weight in the space of a single year (assuming you weren't gaining weight before).

We'll look at these kinds of calculations in more detail when it comes planning your weight loss, but first let's consider the two sides of the rubber bag, what you eat and what you burn, from the standpoint of the control you can exert over them.

Controlling what you burn

We all enjoy eating. The prospect of eating less seems inseparably coupled to going hungry. Many people in industrialised countries have no real experience with hunger other than when trying to lose weight. That connection only reinforces our disinclination to diet.

Ever resourceful, we seize on the other side of the ledger sheet. How can you increase what you burn? There are two basic ways. You can increase basal metabolism, the rate your body burns calories all the

time, or you can add physical activity to your life to consume some additional calories.

It'd be great if we all came with a knob in some convenient place that adjusted our metabolism to meet the challenges of fast food. Regrettably, evolution, not having the time as yet to come to terms with deep dish garbage pies with swimmers (thick crust "everything" pizza with shrimp and anchovies, for those unfamiliar with the delectation), has neglected to equip us with such a welcome refinement. Regular exercise increases the metabolism a little, but for the most part you have to play the metabolic hand you're dealt. Since a large portion of the calories burned go toward keeping your body at 98.6°F you could apply for a job at the South Pole or, failing that, move your desk into the meatlocker at a nearby supermarket. You'd burn calories at a prodigious pace, but somehow I doubt you're thrilled at the prospect.

How about exercise? "If only I were more active, I could eat as much as I want (in other words, the same way I do now), and lose weight." After all, everybody can point to friends that bound out of bed at the crack of dawn for a few furious rounds of tennis before breakfast, then dash off to play handball after work. These lean and lanky types all seem to say they just eat whatever they want and never worry about their weight.

It's a glorious idea to control your weight without changing the way you eat, but like so many attractive ideas, it doesn't work. But what about the sports fanatic? Ask him if he's ever had a weight problem. Odds are he'll say, "Of course not. I've always been in shape." People who have trouble with their weight are different from those who don't. That doesn't mean they're defective or inferior, no more than people who need eyeglasses to see clearly are lesser men than those born with 20/20 vision. In the next chapter we'll examine why some people never have a weight problem while others remain locked in a lifelong struggle with the scale. We'll see how weight problems can be solved just as effectively as eyeglasses or contact lenses fix imperfect vision. Here, the focus is purely on why weight control by exercise alone is an illusion.

The problem is a simple matter of numbers. Consider the 5'11" medium build male we discussed earlier. This individual burns around 2200 calories a day, roughly 100 calories an hour. If, overweight and fed up with being fat, he vows to exercise a full hour every day for the rest of his life, here's roughly how many extra calories he'll burn each day by taking up each of the following.

At first glance, this looks pretty good. After all, an hour of tennis, at 500 calories, represents almost a 25% increase in calories burned.

Activity	Calories/hour
Walking	300
Bicycling	300
Aerobics	400
Swimming	400
Tennis	500
Basketball	500
Jogging	700

Indeed, if you expend 500 extra calories a day while holding what you eat the same, you'll burn off 3500 calories and a pound of fat every week. Fifty-two pounds a year without ever dieting sounds like a perfect racquet, even if you don't enjoy the game.

Regrettably, there are several thorns in this rosy picture. First, consider the fundamental assumption that you're going to spend a full hour each and every day engaged continuously in a given activity. Where, precisely, is that hour going to fit into your day? Before breakfast? After work? When? And how will it fit into your weekend schedule? If, like most of us, you can barely find time for all the things you *have* to do, not to speak of the ones you'd like to get around to, seven hours a week is a big chunk of time to devote to anything.

Second, those calorie counts are for a full hour spent nonstop in each sport or exercise. While anybody can, after a while, get used to walking or bicycling nonstop for an hour (which, however, only uses up 300 calories), when's the last time you or anybody you know spent a full hour jogging, swimming, or playing basketball without a break? Even if you found the time and spent the months it would take to get into condition so you could, is this the way you'd want to spend one hour of every day for the rest of your life?

Once you start to make the inevitable compromises with reality: planning, instead, to work out three times a week, to spend 45 minutes each time rather than an hour, and so on, things begin to come apart on the calorie burning front. For if you do faithfully play 45 minutes of active tennis (in an hour session) every Monday, Wednesday, and Friday, that totals only 135 minutes a week: two and a quarter hours. At 500 calories an hour, that only adds 1125 calories per week to what you burn. Spread out over 7 days, that's equivalent to just 160 calories of food a day. In other words, you can achieve equivalent weight loss by reducing your daily food intake by items such as:

Foregone confection	Calories
Nonfat yogurt	150
Cream of mushroom soup, bowl	175
Bread, 2 slices	150
Beer, 1 can	150
Snickers bar	275
Cola with sugar, 1 can	145
Twinkie	160

Don't misunderstand me. I'm not suggesting exercise is unimportant. Exercise plays an *essential* role in maintaining your health, and in chapter 6 I'm going to climb on the soap box and try to convince you to start exercising this very day, following a program I've crafted to fit realistically into the lives of busy, harried people like ourselves—a program you're likely to stay with through the years as opposed to more ambitious schemes that end up abandoned after a few months.

Nor do I mean to imply that exercising won't help you lose weight. Far from it: exercise doesn't just burn calories, it also raises your general level of metabolism so you burn more calories even when you're resting and, in some people, it seems to suppress appetite. Adopting a comprehensive exercise plan, whether the one in this book or another of your choice, and making it part of your regular routine will certainly help you lose weight in addition to the numerous other benefits you'll accrue.

But don't delude yourself into thinking that exercise can do the whole job. For many of us, exercising just causes us to eat that little bit more that cancels out its benefits. The calories burned by exercising, even counting the secondary effects on metabolism, can be erased by even the slightest increases in food intake. No, we'll have to look at what goes in to achieve real and permanent control over weight.

So, exercise if you can and expect ample rewards, but don't exercise thinking that it, alone, will achieve your weight goal. Not only are you likely to be disappointed when the weight doesn't come off, you'll then be tempted to abandon the exercise program in disgust, compounding the problem. On the other hand, if you've sworn not to spend a single minute from now until the day you die engaged in any form of exercise (even knowing that your dying day may, through that very pledge, come sooner), you still needn't be overweight. You can manage your weight quite effectively using the program in this book without ever exercising. Is that a good idea? No it's not, but if you're determined to be out of shape you're better off at the right weight than 50 pounds too heavy *and* out of shape.

Controlling what goes in

What it all comes down to, of course, is this: if you want to lose weight, you have to eat less. Eat less. It sounds like a sentence handed down by a stern faced judge to a forlorn prisoner in the dock. "Look, eating is one of the few things in life that's pure, simple, pleasure. Now you're going to take that away and tell me I have to be hungry all the time?"

The stark reality is that permanent weight control requires permanent attention to what you eat. Life long, permanent attention. The monumental pile of nonsense, mysticism, and bad advice associated with dieting stems from the all-too-human tendency to deny this simple fact. But fact it is, and like most unpleasant facts, it's best faced squarely and treated as a challenge to be overcome.

Many people have little or no difficulty controlling their weight. Slim people aren't that way because they're willing to go hungry all the time. They're slim because they're eating the right amounts of food at the right times, putting in just the amount of food their bodies are burning. Because they're meeting their bodies' needs, they aren't hungry: the hunger signal goes off only when too little goes in. Even most overweight people maintain a constant weight without hunger. It's just that the weight they're at is way too high.

This book shows you how to join the ranks of the slim people. Thereafter, you need never be hungry again. As you'll see in the next chapter, people who never get overweight have a mechanism in their bodies that tells them when to eat and when to stop. We who have trouble with weight either seem to have that mechanism broken, or else we're eating too frequently or too much for other reasons; we're eating not because our bodies need the food but to satisfy psychological needs the exposition of which in various bubbleheaded psychobabble diet books has leveled vast forests.

I prefer to focus not on why people may tend to eat too much, but rather on how to stop doing it. Once they've stopped overeating, and in doing so cured their weight problem, they may find, as I did, that a lot of the other more subtle problems simply melt away, just as the fat did.

Another unpleasant fact of dieting it's worth facing up front is that while you don't need to go hungry to maintain your weight, you *will* need to go hungry in order to lose it. It's the rubber bag again. The only way those fat cells are going to be persuaded to dig into their reserves and start dumping them back into the bloodstream is by eating less food than's needed to fill the bloodstream with nutrients. When

you do that the hunger alarm is going to go off: "Hey! Up there! Not enough food down here! How about sending down some pizza?"

This is not at all pleasant, but it needn't be incapacitating. Further, you only have to put up with it for a limited amount of time and, with this plan, you'll be able to watch your progress, know how long you'll have to spend to achieve your ideal weight, and build ever-growing confidence in your ability to control your weight as you wish.

Many things in life are unpleasant. Most are far more irritating than the day to day process of losing weight, and few yield comparable benefits. Controlling your weight holds the key to a reward no amount of money, no degree of knowledge, no position of power or influence can bring: a longer life and better health to enjoy it more.

And as with many challenges, you can turn the discomfort of dieting into an advantage once you've succeeded. For what better motivation is there to maintain your weight than recalling how awful you felt when overweight and what you went through to shed that excess poundage?

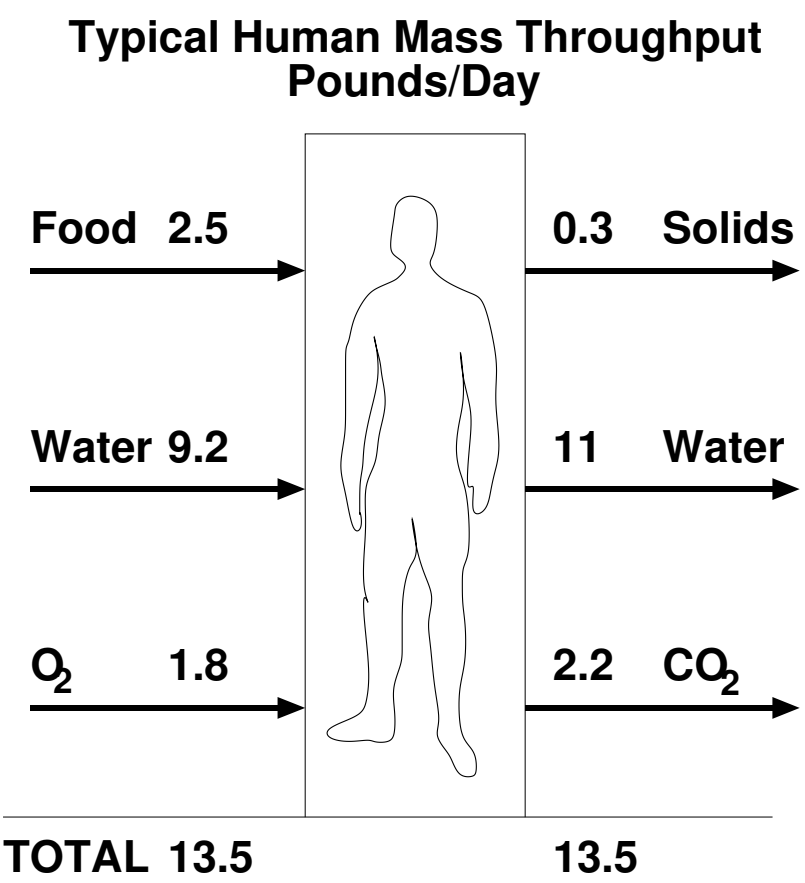
This isn't to imply that losing weight, even many pounds in a relatively short time, is akin to a stint in the Siberian Gulag. Cutting your food intake by 250 calories a day, the equivalent of foregoing french fries with your lunchtime burger or passing up your mid-afternoon "pick me up" candy bar, is enough to tilt the balance so you'll lose two pounds a month. Weighing the prospect of being 25 pounds lighter in a year against that little morsel of food each day shows how effectively you can manage major changes in your weight once you master the tools that allow you to make such decisions intelligently.

Input/Output

Keeping in mind that what you burn can be expressed simply as a number of calories, it's enlightening to look at what goes in and what comes out in somewhat more detail than you might have ever contemplated.

Consider this view of human as rubber bag presented at a NASA conference on the exploration of Mars.[1]

[1] "Mars Mission Life Support," by Dr. Penelope J. Boston, National Center for Atmospheric Research, in "The NASA Mars Conference," Duke B. Reiber, ed., Volume 71, Science and Technology Series, American Astronautical Society, San Diego, 1988.



From this all-inclusive perspective, which accounts for the oxygen in the air we breathe, moisture lost through the skin, and water generated by the reactions that break down the food we eat and reassemble it into the cells of our body, a human being, the "beauty of the world! the paragon of animals!" resembles a water pump more than the most intelligent known life form in the universe.

This is important information, not just to Mars mission planners or inveterate collectors of fascinating details, but to anybody interested in controlling their weight. Explained here are the reasons so many people misunderstand how their bodies react when they're trying to lose weight, why so many people become frustrated and abandon sincerely undertaken efforts to control their weight.

It's the water. On a day to day basis, the water you consume, whether directly in beverages or as part of the foods you eat, and the water you excrete in your various excursions to the hydraulic accom-

modations, dwarfs the weight of the food you eat and the solid waste you dispose of. To this extent: 68% of the mass you consume every day is water, and 81% of what goes out is likewise water. Startling, until you recall the human body is, by weight, about three quarters water. Average the percentages of water in and water out, and you get... 75%: three quarters.

Every day your body ingests plenty of water and disposes of even more. Most of the changes in weight you see from day to day on a scale reflect nothing more than how much water is in the rubber bag at the moment. Consider: if you pig out to the extent of three slices of pizza before bedtime every night for a whole month, you'll gain about four pounds as the lingering souvenir of your month of wild abandon. Yet even that extreme weight gain is less than half your daily intake and disposal of water.

Most of the changes in weight you see have nothing to do with how many calories you're eating or burning. Instead, all you're seeing is how many pounds of water happen to be inside the rubber bag at the moment. How many bleak mornings of dark despair endured by forlorn dieters who indulged in a bowl of salted popcorn at midnight then slaked their thirst with a large glass of water in the middle of the night, would have been taken in stride had only the implications of human being as water pump been fully comprehended?

Food fads

Attempting, for four decades or more, to remain rooted in the tenuous and shifting soil of reality tends to make one skeptical of suggestions of grand conspiracies by insiders pulling the strings that run the world. And yet, and yet....

It seems like every few months a new "scientific discovery" about food and health bursts upon the scene. How far do you go back? Remember...

- 100% polyunsaturated fat!
- With the iron that women need!
- High-fibre!
- Enriched with zinc!
- More calcium than the leading brand!
- Now with oat bran for your heart!

Fuzzy thinking

First, a legitimate researcher publishes a study in the New England Journal of Medicine that claims, heavily hedged and based on largely statistical evidence, to demonstrate a connection between a certain dietary component and some aspect of health, for example, a particular kind of fibre and serum cholesterol levels. That night, the evening news trumpets, "Researchers at the University of Sausalito have discovered a connection between peach fuzz and heart disease. In a study of 100 peach pickers and packers. . . ". Before you know it, the Sunday supplement's bulging with recipes for peach pie with fuzzy crust.

Meanwhile, the advertising engine is coming up to speed. Full page ads sponsored by the Georgia Peach Association proclaim, "Look for 'Fresh Georgia Peaches' on the bag. And remember, only Georgia peaches have *25% more fuzz*". Oat-this and oat-that breakfast cereals begin to vanish from the supermarket, displaced by the arrival of Peachies, Fuzz-chex, and Teenage Mutant *Fuzzy* Ninja Turtles. Soon, the whole supermarket looks like it's been sprayed with minoxodil. Whole grain cookies enriched with peach fuzz. Fuzz-tab supplements. Fuzzy toothpaste. "Fizzy fuzz" peach champagne.

Now everybody else tries to jump on the bandwagon. The Soybean Institute launches a new promotion to remind people that soybeans are the "hairy legume." Cheesemakers remind consumers "Cheese—so good for you it grows its own fuzz in the fridge." "The Fuzzy Way To Health," "Dr. Harry's Fuzz Diet," and "The Plantation Peach-Fuzz Cookbook" contend for space in the bookstore window, and their authors make the rounds of the talk shows.

The silliness builds to a crescendo of absurdity, around which time the medical journals start to publish papers such as "Peach Fuzz: No More Effective Than Sawdust" and "No Fuzz-Cholesterol Link In Rats." As the wave begins to recede, another article is published, "Possible Correlation Between Sesame Seed In Diet and Immune System Performance." And away we go again.

Food and fact

The rubber bag view of the body and considering only the calorie content of food is obviously oversimplified. There is a difference between eating a varied diet and chowing down on a cup of lard and sugar once a day. Programmers know this instinctively: they balance their daily menu among the four major food groups: caffeine, sugar, grease, and salt.

In reality, food satisfies two distinct needs of the body. The first is for energy. A substantial amount of energy is needed just to maintain a constant body temperature and keep the heart, lungs, and the rest of the body's mechanisms running. The energy consumed by a human body is comparable to a 100 watt light bulb. Food also supplies the raw materials the body uses to manufacture all the chemicals it needs, including those needed to build new cells.

From the standpoint of energy, almost any food will do; you can assume that all foods with the same calorie content are interchangeable. Eating the right mix of food only becomes important when you consider food as raw material. For the most part the body breaks food down into small molecules composed of carbon, hydrogen, oxygen, and nitrogen and then manufactures what it needs from these building blocks. However, certain structures in the body require other constituents. For example, iron is needed to form the hæmoglobin that carries oxygen in red blood cells, and calcium forms the matrix that strengthens bones. In addition, there are a number of complicated organic molecules our bodies require but cannot, for one reason or another, manufacture. These raw materials, minerals and vitamins, must be furnished or else the body begins to develop *deficiency diseases* such as scurvy and rickets.

If you eat a reasonable selection of food, varied within each meal as well as from meal to meal, it's extremely unlikely you'll come up short one of these crucial substances. (Vegetarians have to be careful, as some nutrients abundant in meat are present only in a limited number of plant foods: these considerations are discussed in detail in numerous books describing vegetarian diets, and I won't go into them here.)

The reason we focus entirely on calories when talking about weight control is that the energy-producing aspect of food is what determines whether you gain or lose weight. Unless your diet is wildly out of whack, which particular foods you eat has very little effect on your weight, compared to the calorie total. To lose weight, you have to eat less. When you eat less, you'll not only be putting less energy in the rubber bag, but also supplying less of the raw materials the body needs. It is, therefore, important to maintain a balanced diet as you lose weight.

Be reasonable. I think the main reason so many diet books are packed with information about food, special recipes, and the like is that it's a useful way to pad out the essential message of a diet book, "eat less food," into something thick enough to be visible on the shelf. As long as you vary what you eat and choose your foods from all around the supermarket, the probability you'll develop a deficiency

disease whilst dieting is extremely remote. If you supplement your food with a multivitamin every day (any one that provides 100% or more of the RDA of the big name nutrients is fine), you have even less cause for concern.

If you adopt the "Clam juice and brown rice quick-loss diet" from the supermarket tabloid, good luck. At least eat some peach fuzz along with it.

Summary

Human beings are the most intelligent form of life on Earth and, as far as we know, the only sentient beings in the Universe. From the neck down, however, we aren't much different from bears or raccoons—we're omnivores—we can eat just about anything and turn it into energy or, alas, if we eat too much, fat.

Notwithstanding our complexity, and regardless of our aspirations, at the most fundamental biological level we're not all that different from a rubber bag. Every day we take in some food and water, burn some amount of energy to sustain us, and dispose of the waste that's produced in the process. If we take in more than we burn and dispose of, the rubber bag expands: we get fat. If we burn and dispose of more than we take in, the rubber bag contracts: we lose weight.

From an engineering standpoint this is a simple system. We have virtually no control of what comes out; that's just the waste products of the factory. We have little effective control over what we burn: in theory our bodies are at our command but the constraints of modern life sorely limit the extent we can exercise.

Consequently, the only real control we have is over what goes in: what, when, and how much we eat. Weight control can be reduced to a very simple matter of arithmetic. Total the number of calories in the food you eat per day, averaged over a period of time. Take the number of calories you burn per day, roughly the same for everybody of your sex, height, build, and level of activity. Subtracting the calories burned from the calories eaten gives excess calories per day. This number times thirty is excess calories per month. A pound of fat is equivalent to about 3500 calories. If you eat 3500 calories more in a month than you burn, you'll gain a pound that month. If you burn 3500 calories more than you eat, you'll lose a pound. All the weight you gain or lose is the consequence of these simple numbers.

The most advanced racing engine is, basically, an air pump. Humans, notwithstanding our pretensions of transcendence are, at a comparable level, water pumps. Every day, the quantity of water we

take in and dispose of dwarfs the other physical interactions with our environment. This means that day to day weight figures primarily measure only how much water happens to be inside the rubber bag at the moment. They're of no use in managing one's health. Instead, it's necessary to extract the signal from the noise, the reality from the raw data. Learning how to do this and applying that information to controlling your weight will be discussed in chapter 5.

4

FOOD AND FEEDBACK

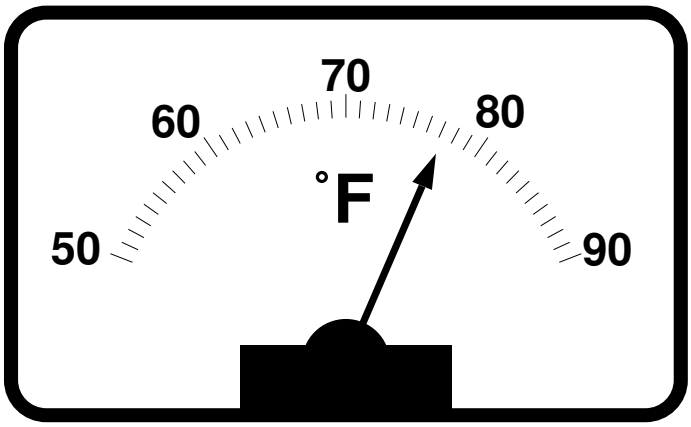
The purpose of computing is insight, not numbers.

—Richard W. Hamming, 1962

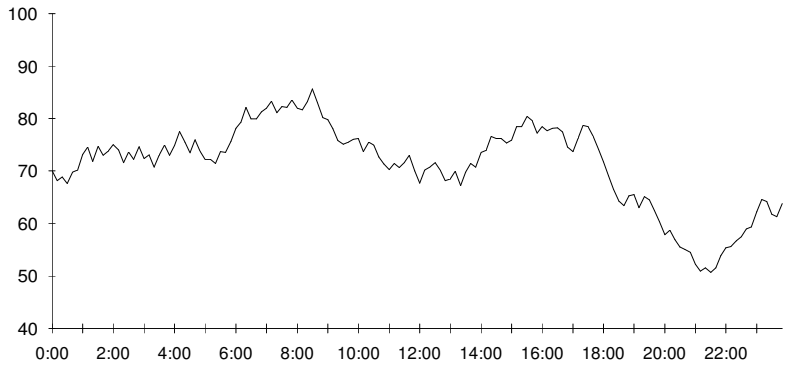
The rubber bag explains the mechanics gaining and losing weight. But why can some people control their weight effortlessly while others seem locked in a lifelong struggle against obesity? To understand this and find a path to permanent weight control, we must again step back from the daunting complexity of the human body and seek enlightenment from a much simpler model. Consider how a thermostat controls the temperature.

Measure the quantity

To control something, first we have to be able to measure it. To control temperature, start with a thermometer.

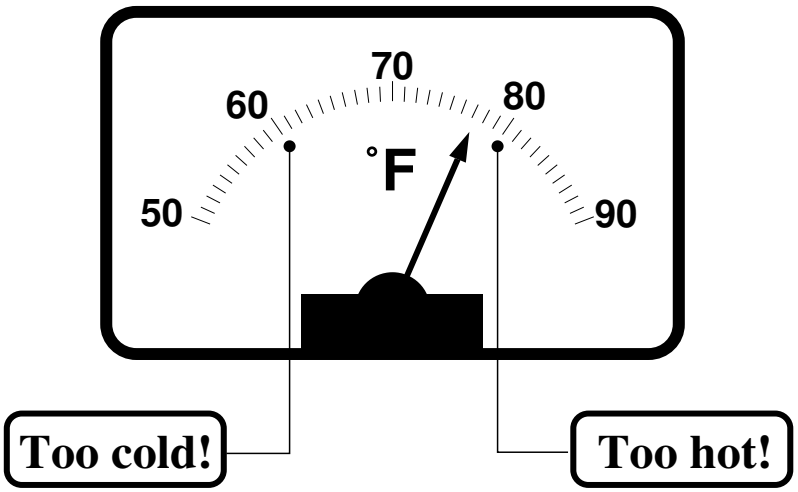


A thermometer tells precisely how miserable the weather is but doesn't do anything about it. Here's an example of the information the thermometer provides: the outside temperature over a day, plotted every 10 minutes.



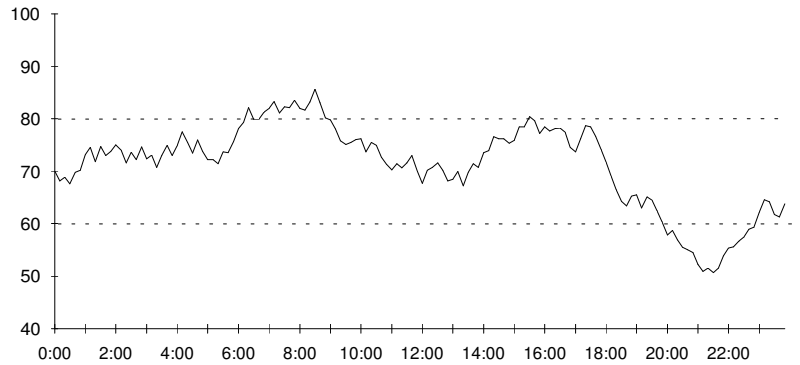
Determine the goal

The next step toward controlling something is choosing the objective, expressed in terms of the numbers we're measuring. Suppose we'd like to arrange things so the house never gets colder than 60° Fahrenheit nor warmer than 80°. We can modify the thermometer by adding electrical contacts at the 60 and 80 degree points on the scale, like this.



When the needle touches one of these contacts, it will close a circuit. The circuit remains closed as long as the temperature is outside the range of 60 to 80 degrees. We can wire this modified thermometer up to a pair of indicator lights. When the temperature drops below 60° the "**Too cold!**" light will come on, and when it exceeds 80°, the "**Too hot!**" indicator illuminates.

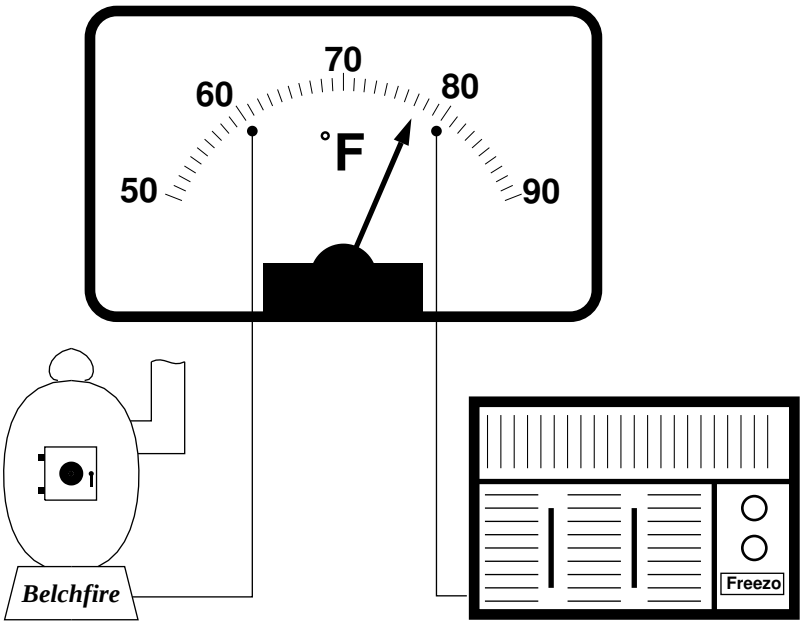
This apparatus monitors the temperature, detects when it's outside the range we're happy with, and lets us know what the problem is (too hot or too cold). We can think of this refinement as having drawn limit lines on the temperature graph, like this.



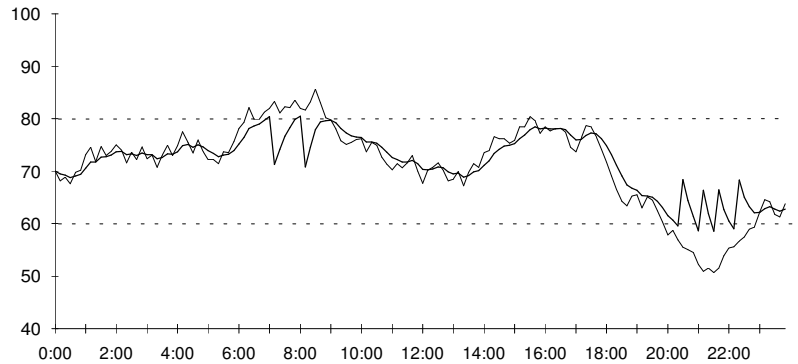
Whenever the temperature is above the top line, the **Too hot!** light will go on, and whenever it falls below the bottom line, **Too cold!** will be signaled.

Apply negative feedback

Whenever the "**Too cold!**" light comes on, we could stoke up the furnace, and when "**Too hot!**" was lit, crank up the air conditioner. But why get personally involved? We can wire the furnace and air conditioner right up to the thermometer in place of the blinkin' lights.



Whenever the temperature drops to 60 or below, the heater starts up and keeps on running until it's raised the temperature above 60, switching it off. When the needle hits 80, the air conditioner whirrs into action and wafts a welcome, cooling zephyr our way until the temperature falls back below that mark.

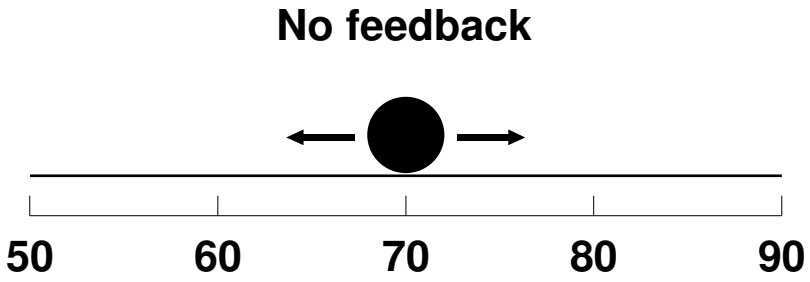


Finally, we've achieved control over the temperature. The heavy line on this chart is the indoor temperature. As long as the outside temperature stays between 60 and 80 degrees, the indoor temperature

follows it. As soon as the temperature begins to drift outside this range, the furnace or air conditioner pulls the temperature back toward the goal of 70°.

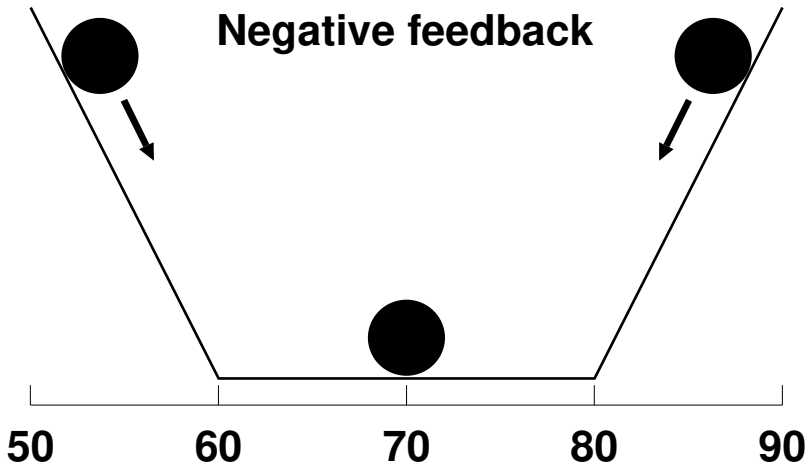
Engineers call this "negative feedback." The phrase is important, so let's pick it apart word by word. "Feedback" refers to the process by which the measurement (temperature) causes actions (starting the furnace or air conditioner) which, in turn, affect the quantity we're measuring (by heating or cooling the room). The feedback is "negative" because the action opposes the condition that triggers it. When it's too cold, the furnace heats up the place. When it's too hot, the air conditioner comes on and cools things off—negative feedback.

Another way of thinking about feedback is in terms of the constraints it places on the freedom of the system to change. Think of the temperature the thermostat is controlling as a ball rolling on a surface. As long as no feedback is applied, the ball is free to roll whenever it likes: the surface can be thought of as a completely flat plain, like this.



When it gets warmer outside, the ball, representing room temperature, gets pushed to the right, toward higher readings. When it cools off, the ball is dragged back to the left. In neither case does the ball "push back"; it moves totally at the whim of the weather.

Providing negative feedback with a thermostat changes the lay of the land. Instead of the temperature roaming freely like a ball on a flat surface, now it's confined within a valley.

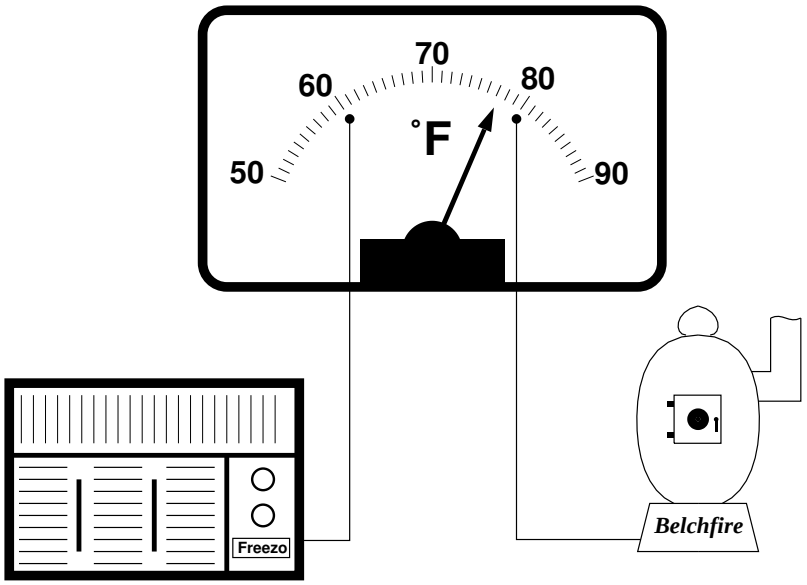


The flat floor of the valley represents temperatures between 60 and 80 degrees. Within this range the ball, representing the temperature, is free to follow the outside temperature as before. Once it reaches the point where the thermostat starts heating or cooling the room, however, it encounters a steep slope. As long as the heating or cooling capacity exceeds the rate heat can leak through the walls from outdoors, the temperature will remain confined to the desired range. This viewpoint makes the stability conferred by negative feedback self-evident.

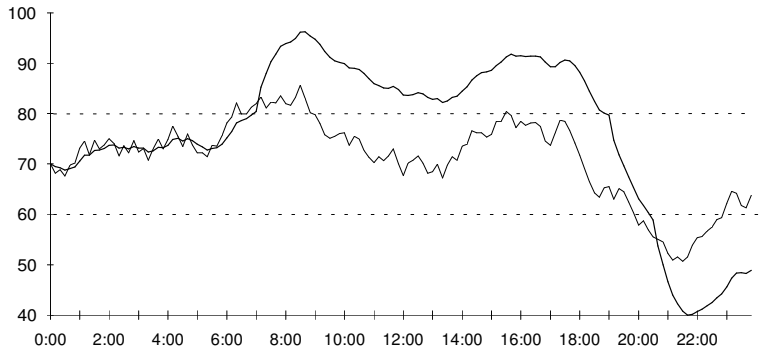
Negative feedback is at the heart of every stable, self-regulating system. If a company raises prices too high, people stop buying and soon the company cuts the price to increase sales. When there's plenty of rabbits, the wolves eat well, multiply, and before long more rabbits get eaten and they aren't so abundant. When your car starts veering into the left lane, you turn the wheel to the right. When you're feeling tired, you get more sleep. Negative feedback is ubiquitous, yet its profound consequences are often overlooked for this very reason. To understand them better, consider what happens when feedback goes bad.

Avoid positive feedback

Suppose the electrician or somebody like him makes a little boo-boo in hooking up the thermostat. Instead of the way we designed it, he wires it like this.

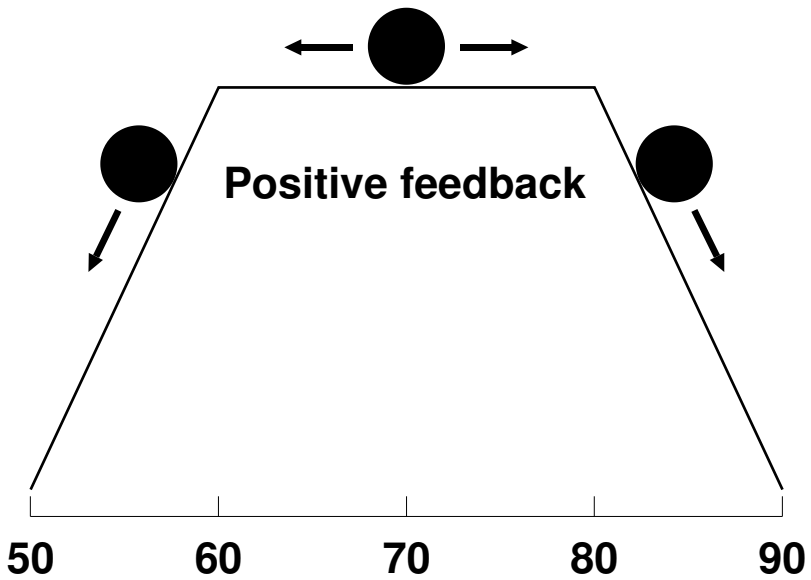


As long as the temperature stays between 60 and 80, everything will be fine. On the coast of Northern California where I'm writing this book, months may pass before the error is discovered. One bright October day, however, the temperature will creep up to the 80 mark. And then, all Hell breaks loose. With a *Whoomp*, the furnace lights off and starts doing its best to "remedy" the situation. Before long the house is transformed into a broiling pan, a blast furnace, a simulacrum of summer in New Jersey (albeit without the crummy bugs). Should a chilly July day drop the temperature below 60, the inverse scenario plays out. The air conditioner springs into action, commanded by positive feedback to create its own little polar ice cap in your living room. Mush!



Here's how the temperature behaves when the thermostat's wired for positive feedback. As long as the temperature remains between 60 and 80 degrees, all is well. As the sun rises, however, the temperature crosses the 80 degree mark and the furnace starts. This quickly pushes the temperature up near the century mark and the furnace continues to roar, compounding the problem, most of the day. Only in the evening does the rapidly falling outside temperature drag the indoor temperature below 80 degrees, finally shutting off the heat. Unfortunately, the temperature soon falls below 60 and the air conditioner starts. Temperatures plunge and finally hit 40. The only thing that keeps the temperature from rising to the point of ignition or falling until the air is liquefied is the finite capacity of the furnace to heat and the air conditioner to cool, plus leakage of heat to and from the outside.

Again, consider the temperature as a ball rolling over terrain. In the absence of feedback, the terrain was flat. Negative feedback confined the ball to a valley. With positive feedback the ball rests atop a hill:



As with negative feedback, the ball is free to roam within the flat region. Upon reaching the edge, however, rather than being pushed back as negative feedback would do, positive feedback forces it further outside the stable region. In other words, once the ball rolls off the flat crest of the hill, it rolls downhill faster and faster. The system can

be returned to the stable region only by pushing the ball uphill against the force of positive feedback.

When things shrug off the bonds of control and start to get weird, positive feedback is usually in the driver's seat. The very word "feedback" means, to many people, one of the most common examples of positive feedback: the deafening scream when a microphone picks up a sound from a speaker and sends it back to the speaker which emits it even louder, which is picked up by the microphone....

Positive feedback makes for humorous anecdotes. But the real world contains, sadly, many examples of positive feedback put in place by well-meaning politicians and businessmen who don't understand the consequences of crossing the wires between noble ends and expedient means. Consider the nuclear arms race. At the end of World War II, the United States and Britain realised they couldn't afford to match the Soviet army in Europe so they built nuclear bombs and threatened all-out destruction of the Soviet homeland in response to any aggression. The Soviets, faced with the ultimate threat, accelerated their own nuclear program in the belief that only by matching or surpassing the West could they deal on an equal basis. Once the Soviets tested their bomb, hysteria in the West was compounded—now they faced an adversary armed with the Bomb as well as a huge army. The only way to deter the Soviets from using their bomb was to build mo' bigger bombs. And so on, as fear fed on fear, technological developments like the ballistic missile spurred further developments and countermeasures by the other side, the whole process consumed a substantial fraction of all the world's wealth for decades. This tragedy of our age is, at its heart, a case of positive feedback, pure and simple. And like most examples of positive feedback it was stopped (if indeed it has ceased and not just gone on vacation), not by good will, not through mutual understanding and trust, not by the actions of diplomats and politicians, but by the application of stronger negative feedback. The negative feedback in the arms race was economic: the race grew to the point where it virtually bankrupted the participants who were, only then, compelled to slow down.

Once you begin to analyse things in terms of positive and negative feedback, you'll never see things quite the same.

Bang-bang vs. proportional control

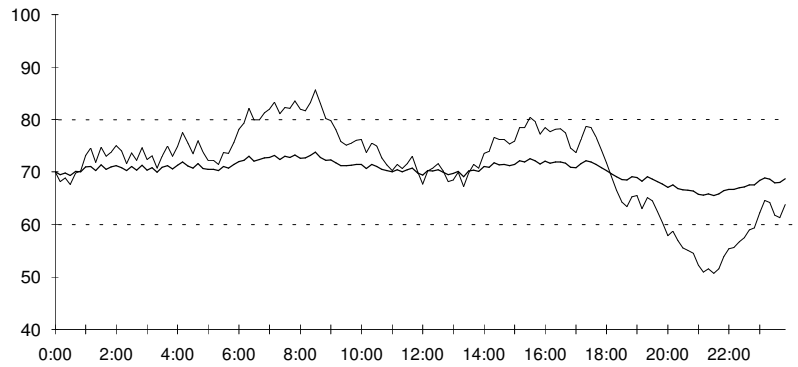
Our thermostat, regardless of whether it's wired for negative or positive feedback, applies an all or nothing form of control. When the temperature drops too low, the furnace comes on, Hell bent, to heat

up the place. When it gets too hot, the air conditioner's unleashed, flat out, to chill out the environs.

Engineers call this kind of control "*bang-bang*." When it gets too cold *bang*, the furnace comes on. As soon as the temperature rises above 60°, *bang* the furnace cuts off. Too hot? *Bang*, the air conditioner starts, and so on.

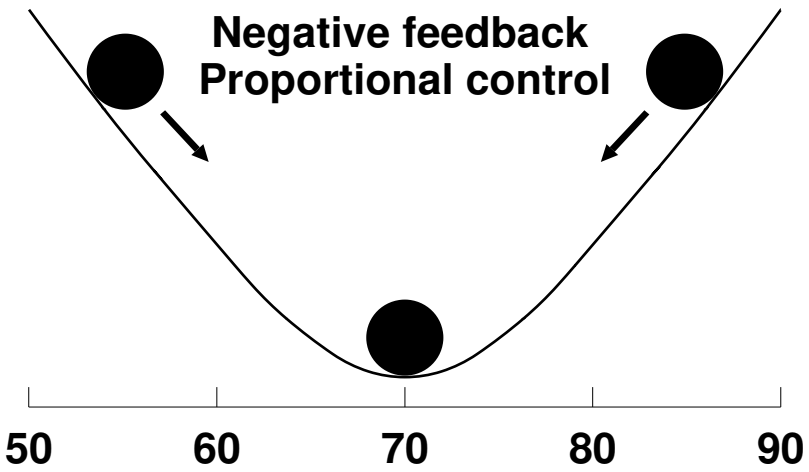
Take a closer look at the inside temperature in the chart on page 44. See how the temperature tends to oscillate between 70 degrees and the level where the thermostat kicks in? That's the signature of bang-bang control—since nothing happens until one of the limits is hit, the temperature varies freely between them. When the system exceeds a limit, it's hauled back within range, then allowed to drift again.

Bang-bang control keeps the temperature pretty much within the range from 60 to 80, but it allows the temperature to vary freely between the limits. Suppose instead of just switching the furnace and air conditioner on and off, we coupled the temperature reading to the gas valve on the furnace: the further the temperature falls below 70, the more heat the furnace generates. Likewise, as soon as the temperature rises above 70, the air conditioner starts, but we rig it to generate more and more cooling as the temperature rises. We'll end up with a system that behaves like this.



This is called *proportional control*. The action taken, the feedback, is *in proportion* to the degree the system diverges from the ideal point. Imagine you're driving down the road some lonely night. Proportional control is how you usually drive; every time you notice the car drifting a tiny bit to the left, you steer slightly to the right and vice versa. Bang-bang control would mean ignoring the steering wheel until the car crossed a lane marker line. Then you'd haul it in the opposite direction

until the car was no longer outside the lane: exciting, perhaps, but not recommended.



If bang-bang negative feedback keeps the temperature ball on the flat floor of a valley with steep sides (see the chart on page 46), proportional control confines it to the bottom of a smoothly sloped bowl. The slightest degree of motion away from the optimal point, the bottom of the bowl, causes the ball to roll upward. The further it deviates from the goal, the stronger the force applied to restore it—back to the bottom of the bowl. A chart of positive feedback with proportional control would simply flip the bowl upside down: the temperature would remain stable only as long as it stayed perched at the precise optimum point. To appreciate how quickly proportional positive feedback gets out of hand, try balancing a raw egg on top of a bowling ball.

Proportional control makes systems run smoother than bang-bang. Most biological systems are proportional, while many engineered and all too many political and social systems are bang-bang. As with negative and positive feedback, once you understand how proportional control lends stability to a system, while bang-bang tends to oscillate between the extremes, you'll recognise many examples of both kinds of control in everyday life.

Three possible outcomes

A wise engineer once said that all systems, regardless of composition, do one of three things: blow up, oscillate, or stay about the same. Once

you understand feedback, you know why this must be. If a system blows up, it is governed by positive feedback. If it stays about the same, negative feedback is on the job. If it oscillates, either negative or positive feedback can be in charge. You have to look more closely at the details.

Feedback doesn't explain everything, but it explains a great many things. Let us now turn to how and why these three forms of behaviour: stability, oscillation, and runaway growth, are literally embodied in human beings.

Three different people

"Enough with the thermostats, already!" you shriek, exasperated. "I'm not too *cold*, I'm too *fat!* What does all this have to do with losing weight?"

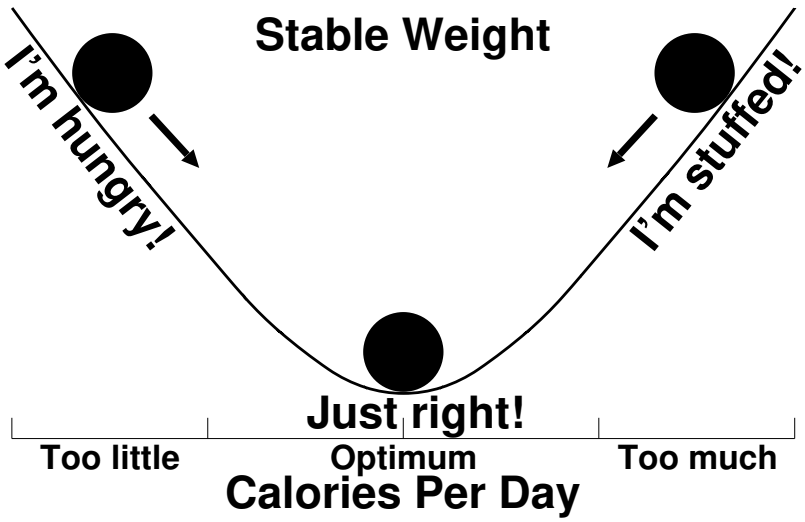
Patience, please. The problem isn't *losing* weight, it's *gaining* weight. If you hadn't already gained more weight than you're happy toting around, you wouldn't be reading a diet book. Anybody can lose weight... for a while. Many of us have lost weight on numerous occasions, only to put it right back on within a short time. The problem isn't weight loss, it's *weight control*, and the insights into feedback and control from the thermostat were necessary to allow us, finally, get a handle on our problems with weight.

It's time to stop talking about the weather and start doing something about what we weigh.

Skinny Stable Sam

Consider Skinny Sam, that exasperating acquaintance we all seem to have: the fellow who's never overweight, never out of shape, who chows down whenever he feels like and eats as much as he wants, who can't understand how anybody could have a weight problem. How does he do it?

Well, now we know. Sam is fortunate enough to possess a mechanism you and I lack: a proportional negative feedback linkage between his body's need for calories and his appetite for food. His feedback system works like this.



This graph is identical to the one describing a proportional control thermostat; compare it with the chart on page 51. The mechanism is identical, only the labels have been changed to reflect the incidents. Rather than temperature, what's being controlled is the number of calories of food eaten. Rather than switching on a furnace or air conditioner, control is accomplished through a signal called *appetite*. The effect is the same.

When Sam eats the same number of calories as he burns, the ball rests at the bottom of the bowl and his appetite is silent. If less food goes in than he burns, whether from skipping meals, eating less at each meal, or from the extra calories he burns up practicing wolverine juggling three times a week, the ball drifts to the left. As it does, his appetite begins to signal, subtly at first then with increasing stridency, the need for more food. Conversely, when too many working lunches become rounds of "eat fast or get the anchovies"; when Sunday afternoon touch football in the back yard is supplanted by Monday Night Football in front of the illuminatus, too many calories begin to push the ball to the right. "How can you *think* of food?", groans Sam. "You guys enjoy your burgers. All I want is a stalk of celery and a good night's sleep!"

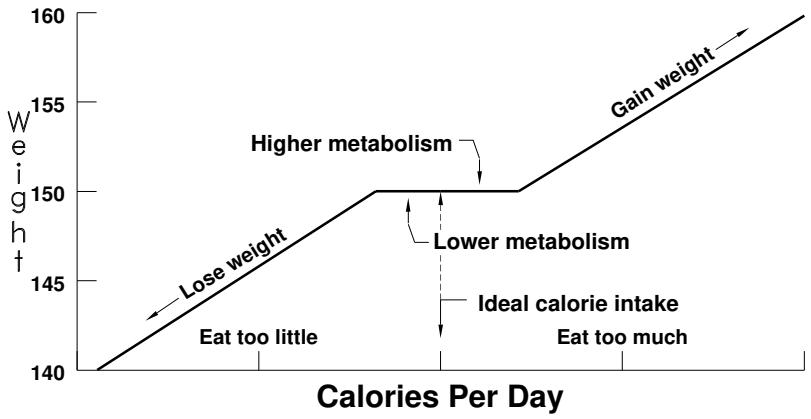
Calories and weight

To fully understand the difference between Skinny Stable Sam and ourselves, it's necessary to consider the rubber bag again. Sam's feedback

system connects *calories eaten* to *appetite*. It *does not* connect weight to appetite. Failing to appreciate this distinction has led millions of dieters to fail. Remember the rubber bag. For the most part it doesn't matter how much you weigh; whether you gain or lose weight depends only on the balance between calories eaten and calories burned.

One encouraging conclusion can be drawn from this: you won't be any more hungry at your optimal weight than at any weight above it. The rubber bag cares only about the *difference* between what goes in and what goes out. So don't assume that being thin dooms you to a life of endless hunger. You now understand enough of what's going on to see what utter, discouraging bilge that suggestion is.

Consider how Sam's body reacts when it gets too much or too little food. Assume Sam's normal weight is 150 pounds.



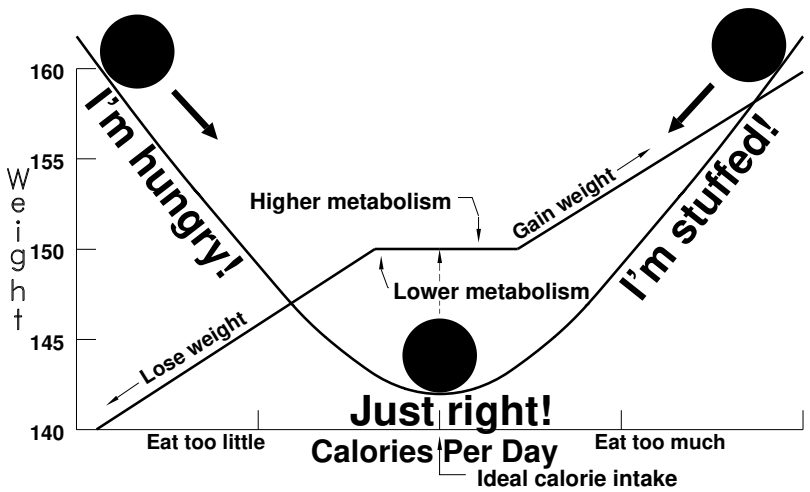
Here the horizontal axis represents the number of calories eaten per day, with the centre point, "Ideal calorie intake," the amount Sam burns per day. The rubber bag, like most models, doesn't precisely represent the underlying reality: the human body. It isn't necessary to exactly balance calories eaten with calories burned. If you eat a little too much, the body cranks up the burn rate a little: you feel warmer and more inclined to run up a flight of stairs rather than walk. If you eat a tad less than ideal, you may feel chilly and inclined to curl up with a book under the blankets and get a little extra sleep.

This is the lowest level of proportional weight control, and it works for all of us. It means that there's no need to become obsessed with matching calories eaten and burned; it's only when the balance shifts

decisively and consistently to one side or the other of the ideal calorie intake that we get into trouble.

The vertical axis makes it clear what that trouble amounts to. The rubber bag expands or shrinks: we gain or lose weight. Once what goes into the rubber bag exceeds your capacity to crank up the heat, the excess starts showing up as fat. Similarly, to achieve weight loss, you have to reduce what goes in below your capacity to adjust by banking the metabolic fires, forcing your body to tap its reserves: to burn fat and thereby shrink the rubber bag.

To complete our understanding of how feedback keeps Sam's weight under control, let's overlay the graph that shows how calories affect weight and the chart of feedback from calorie consumption to appetite.



The feedback, neatly centred around the ideal calorie intake, keeps the calories eaten within the region that changes in metabolism can adapt to. Since feedback balances what goes into the rubber bag with what's burned, weight remains constant. When Sam eats a bit too much or too little his metabolism adjusts, as does ours. But, if he goes beyond that point, his appetite begins to tell him to eat more or less before the shortfall or excess shows up on the scale or the waistline.

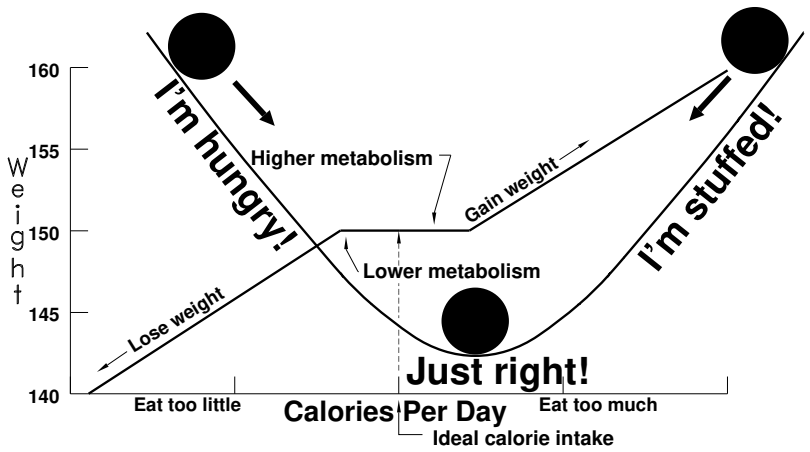
Ahhhh, Sam. . . , if you only knew the thoughts that run through our minds. Sam's got it made. But for those of us who don't the real question is what it is Sam has that we're lacking. And that's now

clear: a built in eat watch—a proportional negative feedback system that adjusts what he eats, by controlling appetite, to equal what his body burns. We're missing that negative feedback system. Should we begrudge Sam his genetic advantage and accustom ourselves to overweight, or just *fix the system*? Fix it, of course! But first, let's consider what happens when it's broken.

Overweight Oscillating Oscar

Many of us live the life of Oscar or at least know somebody like him. Oscar's always on a diet. "Gotta take off five pounds" he chants, like a mantra, although he usually runs about twenty pounds overweight. Funny thing is, every time you go out to eat with Oscar, he seems to eat less than anybody. He is, after all, dieting.

Skinny Sam is a gentleman and a scholar and would never countenance such thoughts but Lanky Lunkhead, having never read this book, frequently suggests behind Oscar's back that perhaps the odd midnight indulgence in peanut butter, salami, swiss cheese, avocado, fried egg, onion, and tomato sandwiches accounts for Oscar's perennial weight problem. Notwithstanding Lanky's sublimated craving for such delicacies, Oscar is simply struggling with a different feedback system.



Oscar has the very same feedback curve as Sam, but his is shifted a little to the right, toward eating too much. One day Sam eats slightly more than he needs, and the next day slightly less. But since feedback keeps him within the range his metabolism can adjust to, Sam's weight

stays the same. When Oscar eats slightly too much, though, he's pushed immediately into the region where he packs on weight. The next day, like Sam, he may eat less but, since that's within the flat part where metabolism compensates, he keeps all the weight he packs on whenever he eats a little too much.

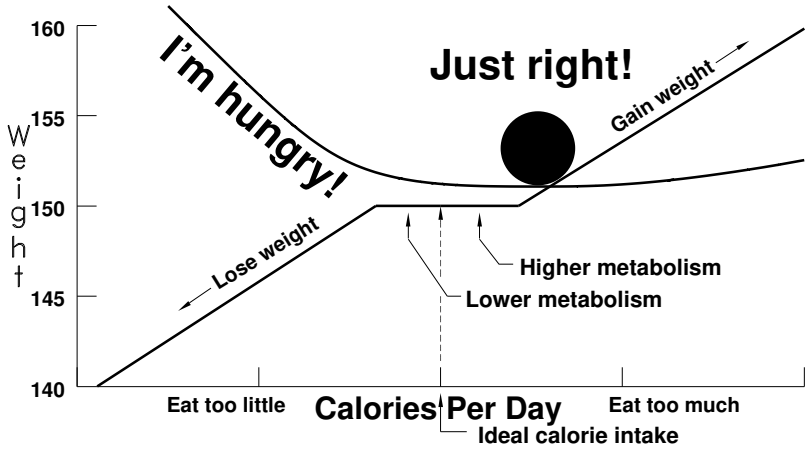
The shift in Oscar's feedback curve with respect to his body's need for calories acts as a ratchet; each excess runs his weight up, but equivalent shortfalls don't burn off the excess weight. Over time, Oscar begins to see the evidence of this on the scale and in how his clothes fit. Having lived with this condition all his life, Oscar knows there's only one solution: peel off the pounds. So, for the umpty-umpth time he embarks on a diet: perhaps a sure-fire plan that's worked before, or maybe the current rage all the celebrities are swearing by. "Peach fuzz, eh? Sounds promising. . . ."

Reducing is miserable for Oscar. In order to lose weight, he must reduce what goes in far enough to get into the "Lose weight" area of the curve. But that means the ball on the feedback chart has to climb well into the "I'm hungry!" region and stay there for an extended time. Over the years, Oscar has integrated this viewpoint into his self-image, "If I eat reasonably, I gain weight. Then I have to endure hunger just to get back where I started." What Oscar doesn't realise is that his problem is simply poor feedback from the calories he needs to his appetite. If he got accurate feedback, as Sam does, he'd never eat too much, feel hungry, or be forced to endure hunger to take off extra weight. Oscar's built-in eat watch is simply set 5 minutes too fast. Oscar needs to wear an accurate eat watch to put an end to his oscillations.

Bulky Blown-up Buster

Bulky Buster envies Oscar. Buster's big, and with every passing year he seems to get a little bigger. For the most part he's healthy, although he gets winded easily, and happy, though he'd certainly rather not worry about his weight every day. Buster knows the odds: he's seen those "Calculate your lifespan" tables and even worked them out on occasion. Indeed, five years of life would be a wonderful reward for getting rid of those fifty extra pounds, if only there were any way of doing that. Disgust with being overweight, resolve to reduce, commitment to a plan. . . failure to keep the weight off, acceptance of failure as inevitable, resignation to a lifetime of overweight, denial of the consequences, surrender to the temptation of food: Buster has trodden this circle many times in attempts to control his weight. Why

is it so hard for him? We need only look at his feedback chart.



Buster gets a clear signal every time he eats too little, but never hears a thing when he eats too much, unless it's enough to actually make him sick. Like Sam, like Oscar, like all of us, from time to time Buster's inclined to overeat. But nothing tells him to stop; not then, and not the next day. The extra calories show up, not as reduced appetite to compensate, but as pounds on the scale. Once that excess is stored as fat, the only way Buster can burn it off is by going hungry.

Buster feels like he's been dealt a lousy hand by life, and he's absolutely right. When he eats too little, he gets squawks from the stomach just as loud as Skinny Sam does, but when he errs on the other side, no alarm goes off. Many problems with Buster's feedback system can cause this, but the result is the same. While Oscar slowly drifts toward overweight, Buster feels himself on a Hellbound train, utterly unable to understand why he consistently packs on weight and powerless to control it other than by periods of deliberate starvation.

I do not mean to put down Buster! I spent most my life in this precise pattern of behaviour. What's "wrong with Buster" isn't a flaw of character. He's not inferior. He's just *wired up wrong* and, once he understands the problem as we now do, he can fix it.

One can imagine, before eyeglasses were invented, a culture that exalted those with 20/20 vision and disdained others who had difficulty seeing distant objects. (Imagine? Try becoming an airline pilot if your vision isn't perfect without glasses.) Poor vision might be attributed to "flabby eyes," resulting from a lack of visual exercise. (The quack Bates method of vision correction persists in claiming this today).

Yet what distinguishes the near- and farsighted from those with perfect vision is but a minor difference in the shape of the lens in the eye. Before corrective lenses, those who couldn't see clearly were indeed handicapped. Think about it; would you be better off with one arm and able to see clearly, or with two arms but unable to focus on anything more than six inches from your face?

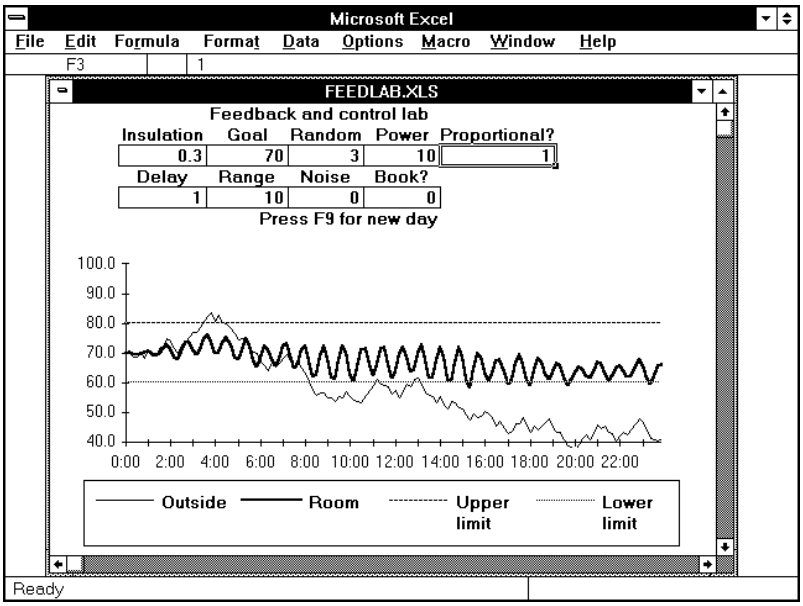
If Buster were born nearsighted, he'd wear glasses or contacts and never imagine himself a lesser man for doing so. He'd laugh, along with everybody, at a fool who suggested he throw away his glasses and apply all his will power to developing, instead, a "natural sense of sight." And yet Buster's weight problem, like Oscillating Oscar's and yours and mine stems from just as simple a biological shortcoming as poor eyesight. Buster's built-in eat watch runs too fast, and as long as he relies on it he'll go on gaining weight. To solve his problem, he doesn't need to feel guilty, develop a "stronger character," or change his lifestyle, any more than any of those things would have cured his myopia. No, Buster, like Oscar, like you and I, simply needs an eat watch to give him the feedback his body doesn't.

There are many ways in which an individual's appetite feedback curve can be related to calorie requirements but, as noted by the engineering aphorism, only three possible outcomes. Weight can blow up (gain constantly, like Buster), oscillate (Oscar's lose/gain rollercoaster, so familiar to many of us), or stay about the same (lucky Sam). If you flip the feedback curves in these charts left for right, you have depictions of an anorexic, an individual who tends to lose weight, and Sam. A multitude of reasons: organic, cultural, and psychological, may explain why feedback fails in certain people. Many diet books counsel searching yourself for the underlying causes of weight gain and remedying them. This may be an interesting and rewarding process, but it's no way to lose weight. It's kinda like becoming an expert watchmaker to fix your Timex that keeps stopping and nobody can seem to repair. The wiser man buys a new watch.

Fun with feedback

The temperature charts used as illustrations in this chapter were made with a mathematical model of the thermostat system implemented in Excel. Playing around with this model, entering different values that control the feedback, will give you an excellent feel for the kinds of behaviour a system exhibits in the presence of various kinds of feedback.

To experiment with this model, load the Excel worksheet **FEEDLAB.XLS**. Depending on the display board and monitor your computer is equipped with, you may have to resize the window in order to see the entire worksheet as shown below.



The outside temperature is shown as a thin red line and the inside temperature as a thicker green line. The outside temperature is generated randomly. Every time you enter a number in the control panel, a new outside temperature profile is generated. You can test the existing system with a different data by pressing **F9**. Each time you push it a new temperature database is generated.

The temperature data used by the charts in this chapter are included in the **FEEDLAB** spreadsheet. If you enter **1** in the **Book?** cell, the book data are used rather than randomly generated temperatures. To return to using random data, enter **0** in this cell.

The other boxes in the control panel specify the parameters of the system as follows.

Proportional. If this cell is **0**, the system is bang-bang: the heater is activated only when room temperature falls below the light blue line and the air conditioner only when it exceeds the purple upper limit line. If you enter **0**, heating and cooling are used whenever the temperature diverges from the value in the **Goal** cell, adjusted

proportionally based on how far it is from that value. For proportional control, the maximum capacity specified by **Power** is reached at the limit lines.

Goal. This is the temperature at which the thermostat attempts to maintain the room.

Range. The value in this cell determines how many degrees from the **Goal** the temperature is permitted to vary before heating or cooling is triggered (if **Proportional** is **0**), or reaches maximum **Power** (if **Proportional** is **1**). If the **Goal** temperature is 70° and **Range** is 10, the temperature limits will be 60° and 80°.

Power. This controls the rate of heating and cooling available, in terms of degrees of change in each 10 minute interval. If you set **Power** to **0**, the heater and air conditioner will have no effect when activated and room temperature will track outside temperature. (Try it.) If you set **Power** negative, the furnace cools and the air conditioner heats—this rigs the system for positive feedback. Positive feedback from negative **Power** settings combined with proportional control will usually drive the temperature into wild oscillations.

Random. The amount of daily temperature variation is controlled by this value. It specifies how many degrees the outside temperature can change in a 10 minute interval. For example, if it's currently 75 degrees and **Random** is set to 3, the temperature at the next 10 minute mark will be picked at random between 72°and 78°. If you set **Random** to **0**, the outside temperature remains constant.

Insulation. The value in this cell expresses how well the room is insulated in terms of the rate at which heat leaks through the walls to and from the outside. **Insulation** of **0** specifies a perfectly insulated room; changes in the temperature outdoors don't have any effect on the temperature inside. An **Insulation** value of **1** means total leakage to the outside: a three degree change outdoors will cause an identical change within the room, unless counteracted by the furnace or air conditioner.

Noise. As long as this cell is **0**, the thermostat bases its actions on perfectly accurate measurements of temperature. You can observe the effects of random measurement errors by setting **Noise** to the extent of the error range in degrees. For example, if the temperature is actually 70 degrees and **Noise** is set to **5**, the thermostat will act based on a reading randomly picked between 67.5° and 72.5°. The **Noise** affects every measurement, perturbing each randomly within the specified range. Nonzero **Noise** settings allow you to see how inaccurate measurements can trigger destructive positive feedback.

Delay. If this cell is **0**, the thermostat measures temperature in-

stantaneously and immediately takes whatever action is indicated. You can introduce delay between measurement and action by setting **Delay** to the number of 10 minute intervals that elapse between the measurement and the corresponding action. The propensity that delay has to drive even systems with strong negative feedback into oscillation, particularly those with proportional control, can be seen by setting **Delay** to **1**, **2**, or **3**. Larger values than that make the temperature oscillate even more wildly.

Mathematical details of this model are given in the section "Calculating feedback models" on page 206.

5

SIGNAL AND NOISE

> You can't make what you can't measure because you don't know when you've got it made.
>
> —Dr. Irving Gardner

We've traveled far, and learned much along the way. We waded through all these details in search of an eat watch: a way to know, day in and day out, how much to eat to achieve any weight goal we choose. And now we know exactly what an eat watch must do, if not yet how to make one.

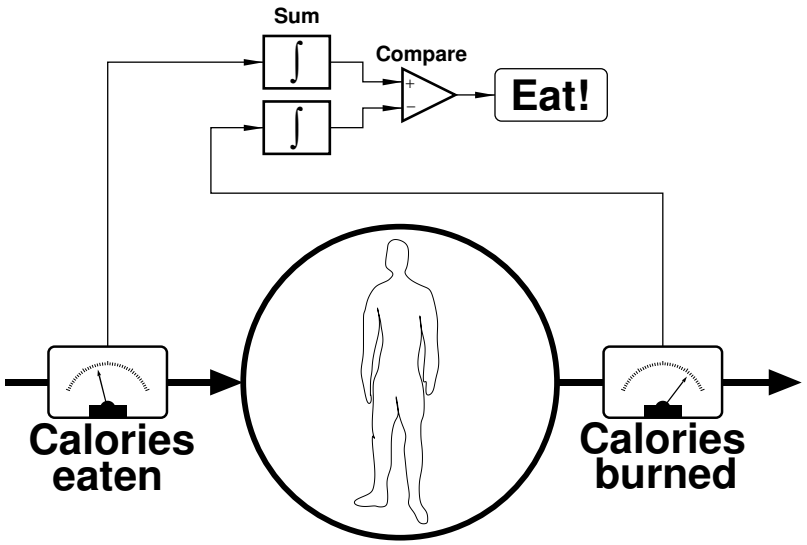
In chapter 3 we learned *how* the human body gains and loses weight: by eating too many or too few calories compared to what it burns. Further, we discovered that for most of us, adjusting the amount we eat—what goes into the rubber bag—is the only practical way to control our weight. Therefore, an eat watch must be able to **measure the balance** of what goes in and what gets burned: to calculate whether we're getting enough, too little, or too much food.

In chapter 4 we learned *why* some people constantly gain weight, while others maintain a constant weight, and still others seem trapped on a rollercoaster of gain and loss. It became clear that the mechanism, if not the cause, of most weight problems is a lack of negative feedback: a failure to adjust, by appetite, the amount eaten to the amount burned. The eat watch must then **provide feedback**, in a manner that will stabilise the system: allow you to achieve and maintain your desired weight.

The eat watch began as a mythical device, a miracle cure beyond reach. But along the way we've collected enough information about the body and about feedback to design something that does the job.

Wired science

By pulling together what we know about the eat watch, the rubber bag, and feedback, we can draw a wiring diagram for an eat watch, even though we may not yet know how to build some of the components.



We start with the simplified rubber bag view of the body presented on page 26. We've installed meters to measure the rate at which calories go in and get burned. The readings from these meters, which vary as the creature inside the rubber bag awakes from a deep sleep, drinks a cup of coffee with two teaspoons of sugar, then runs to catch the bus, are fed to "integrators"—boxes that add up calories over a period of time, say 24 hours, and report the total. The totals are sent to a comparison unit that subtracts the calories burned from calories eaten. The result of this is precisely what we're looking for: the calorie shortfall (if negative) or excess (if positive) that determines whether the rubber bag burns off fat or packs it on. The indicator on the eat watch says "**Eat!**" whenever the balance is negative and goes out when it's positive.

As long as you only eat when the "**Eat!**" indicator is lit, you'll never gain weight. If you'd like to lose some weight, simply adjust the indicator so it comes on only when the sum is negative by more than some number of calories. Suppose you want to take off 10 pounds over two months. Just work out the total calories you have to burn by multiplying the pounds you wish to lose by the calories in a pound of

fat, $10 \times 3500 = 35000$, divide by the number of days in two months, $35000/60 \approx 585$, and set the "**Eat!**" light to come on when the result is less than -585. To put on 2 pounds in 30 days, adjust it to say "**Eat!**" whenever the difference is +233 ($(2 \times 3500)/30$) or less.

With an eat watch helping to balance the nutritional books on a constant basis, you'll never err very far in the direction of too many calories. Consequently, you'll never have to atone by cutting your calorie intake way back. In other words, once you're done peeling off your extra weight, you'll never be hungry again, as long as you rely on the eat watch.

The calorie counting catch

Let us repair to the workshop and try to turn this back of the envelope sketch into hardware. Rummaging through the parts bin, we quickly find all the components at the top of the diagram. Integrators, comparators, and indicators are available for pennies apiece.

We come up short, however, looking for those confounded meters that read calories in and out. It's possible to measure these quantities, at least in principle. If you were crazy enough to do so, you could calculate calories in by looking up everything you ate, as you ate it, in a calorie counting book and punching in the numbers on a keyboard. You could track calories burned by measuring body temperature, blood sugar, heart and respiration rates, etc., especially if you were willing to calibrate the readings for your own body over a month. Biosensors that measure these quantities have been used on astronauts, athletes, and intensive care patients for years.

But the whole idea of the eat watch is to be unobtrusive and not disrupt your life! Being slim and trim and the envy of your peers loses a lot of its gloss if it means spending the rest of your life wired up like a labrat. "Bend over, please, this won't take but a moment."

No.

But it *could* be done. This is encouraging.

Cause and effect

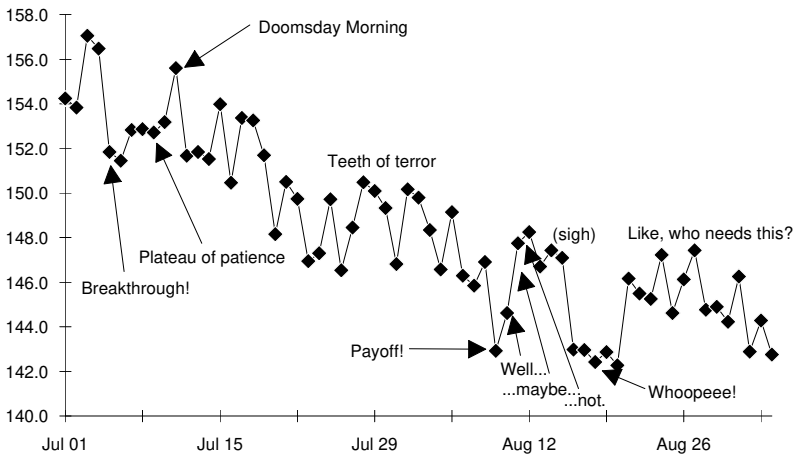
Let us stand up straight, step back from the yawning chasm of the absurd, shrug off the bioharness, and ponder whether there might be a better way of going about this. Perhaps the linkage between cause (calories eaten and burned) and effect (weight gained and lost) could be used to accomplish the same results without ending up as a cyberpunk centerfold.

After all, what we care about is *weight*, not calories. Might there be a way to extract the information we need from the weight numbers served up so easily by the scale? Indeed there is, but extracting the information we seek, calorie balance, from the confusing welter of weight measurements requires another mathematical trick borrowed, not from engineering but from the toolbox of the stock and commodity trader.

Like most attempts to characterise a complicated system by a single number, a scale throws away a great deal of the subtlety. Every morning the rubber bag sloshes over to the scale and heaves itself onto the treads with a resounding *splorp*. The scale responds with a number that means something or other. If only we knew what.... Over time, certainly, the scale will measure the cumulative effect of too much or too little food. But from day to day, the scale gives results that seem contradictory and confusing. We must seek the meaning hidden among the numbers and learn to sift the wisdom from the weight.

Dexter's diet

On July 1, Dexter went on a diet, resolute in his intention to shed 10 pounds before Labour Day. Every morning Dexter weighed himself and wrote the number on a piece of paper. Every evening, he plotted his weight on a graph and wrote any comments that came to mind in his Diet Diary. Let's relive those two months of Dexter's life by peeking at the records he kept.



Dexter's diary

July 1. 154.2 pounds. Here I go, and this time I'm going to succeed. I'd better—I've told everybody at the office I'm going on a diet, and if I don't slim down this time they'll rib me all the way 'till Christmas. So, farewell indulgence, hello Dexter's Slimming Summer.

July 2. 153.8 lbs. All right! One day, almost half a pound! I'm already ahead of schedule. At this rate. . . .

July 3. 157.1 lbs. Woe is me. Last night I got up, went into the pantry, and just *looked* at the popcorn jar. That's all. And today I woke up three pounds heavier than when I started to diet. My stomach is growling, my soul is bruised, and my weight is up. Good night.

July 4. 156.5 lbs. Some glorious Fourth. Well, at least the porkometer is down from yesterday. But it would be amusing if I could get back below where I started this diet, wouldn't it?

July 5. 151.8 lbs. Oh frabjous day, the diet is finally kicking in. Four pounds less, more than two below where I started! I shall not conclude the onion ring I swiped from yon Cassius at dinner had anything to do with it. Onward!

July 10. 153.2 lbs. Stuck on this pesky plateau. Still, I guess it's better to be stuck below where I started than spiraling upward toward Chandrasekhar's limit.

July 11. 155.6 lbs. One measly bowl of *sauerkraut* at bedtime, for the sake of Almighty Bob! I mean, every diet book says that stuff has fewer calories than sawdust, but boom!—here I am, almost two weeks into this cruel torture ritual, still two pounds above where I started. If it weren't so late and I weren't so tired I'd go make a double scoop sundae and chuck this damnable diet.

July 12. 151.7 lbs. Well, that's interesting. Yesterday must have been a blip. Either that, or maybe panic and depression is what really causes me to lose weight.

August 5. 149.1 lbs. Gosh, has it been three weeks? Well, not very interesting weeks, anyway. The occasional new low, but basically I'm stuck in an up and down cycle that's running about a week long. Maybe my body has adapted to this diet and I'll go on being hungry forever and never lose another pound. There's a cheerful thought.

August 9. 142.9 lbs. Maybe there's justice in the universe after all. One hundred and forty-three pounds...I've done it! Now, if I just stay here this diet is *history!*

August 10. 144.6 lbs. Up one and a quarter. Diet history doesn't lie in this direction.

August 11. 147.8 lbs. Is my life some kind of cruel experiment to see if somebody can never get a single break, or what? Shit in a sugar cone! I've eaten nothing: *nothing* extra, and I pack on five pounds in two days? I weighed less than this almost three weeks ago. Why go on?

August 12. 148.3 lbs. Truly marvelous. Up another half pound.

August 14. 146.7 lbs. At least it's lower today.

August 19. 142.9 lbs. Well, maybe this has finally paid off. I seem to have settled down below my goal of 144 pounds at last. These new clothes feel great, and for the first time in two years I don't feel like a fatty.

August 20. 142.3 lbs. Beach party! Had a wonderful time. What a joy to have a hot dog with mustard and relish and not worry about my weight!

August 21. 146.2 lbs. Up four pounds in one day. I'm *sure* I didn't eat any sand. I don't relish the prospect of a life without hot dogs.

Dexter deceived

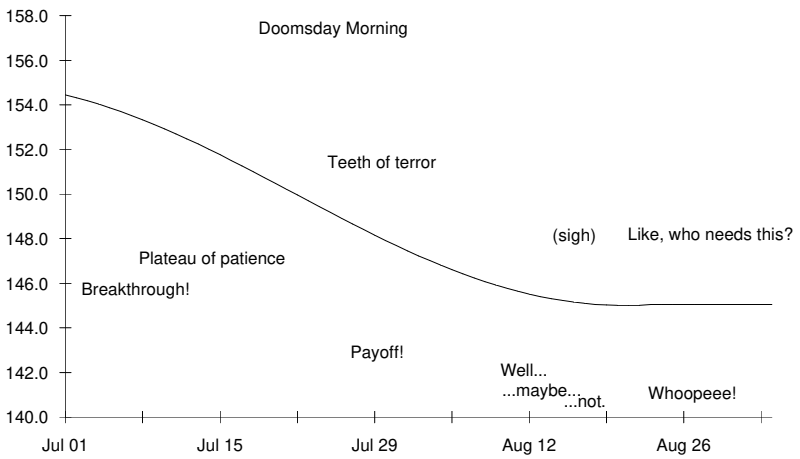
Examining Dexter's weight chart and diary evokes memories of similar times of triumph and days of despair in anybody who has dieted. Dexter exulted with each new low on the scale, while fearing it wouldn't last. He grew depressed as weight plateaus extended from days into weeks. His spirits rose and fell with the daily readings on the scale. When a month's progress was seemingly erased in a single day, a part of Dexter's joy in life withered and died.

Yet despite the ups and downs of the scale and the emotional battering they administered to Dexter, his diet worked perfectly, achieving precisely the result he intended in the anticipated time. Dexter was deceived by his scale. It didn't measure what he cared about: pounds of fat. Instead, the changes in daily weight reflected primarily what happened to be in the rubber bag at the instant it was weighed.

The detailed picture of what goes in and out of the rubber bag on page 33 explains why daily weight measurements have so little to do with how fat you really are. Dexter went on a two month diet to lose 10 pounds. And yet every single day, on average, a total of 13.5 pounds of food, air, and water went into Dexter's rubber bag, and a comparable amount went out. His daily weight loss during the diet was less than one fifth of a pound per day, yet each and every day almost 80 times that weight passed through his body!

If the body consumed and disposed of these substances on a rigid schedule, maintaining a precise balance at all times, weight would be consistent from day to day. But that is not the way of biological systems. A few salty potato chips are enough to cause the body to crave, drink, and retain a much larger amount of water to dilute the extra salt. The body's internal water balance varies widely over the day and from day to day. Since water accounts for three quarters of everything that goes into and out of the rubber bag, it dominates all other components of weight on the scale.

Every morning, when Dexter stepped on the scale, it's as if he carried, unknowingly, a water tank filled to an unknowable level by a mischievous elf, put there to confound his attempt to track the progress of his diet. If Dexter's scale had been able to disregard the extraneous day to day changes in weight, it would have produced a graph like this.

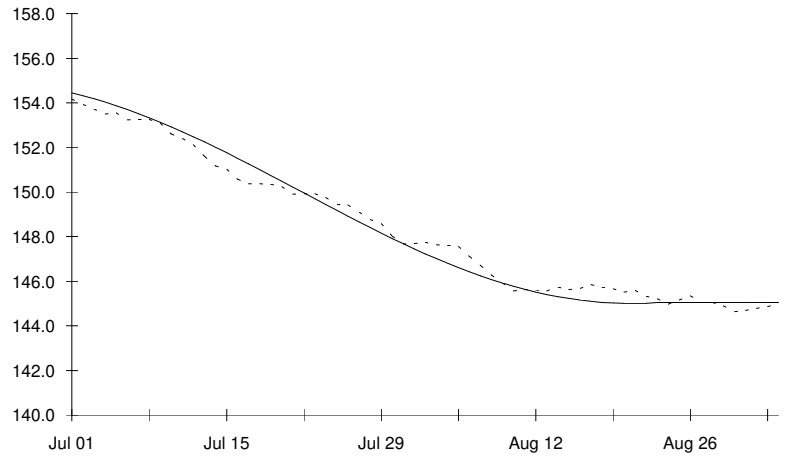


Shortly after Dexter began his diet, he started to lose weight. He continued to lose until he declared the diet successful in the third week of August, after which his weight leveled off at the goal of 145 pounds. Imagine how calm and confident Dexter's diary would have been if he'd plotted this curve instead of daily weight.

By relying solely on daily weights from his scale, Dexter endured two months of unnecessary suffering. His diet worked, as was inevitable from a simple calculation based on the rubber bag, but the day to day weight readings obscured his steady progress. An eat watch would have assured Dexter he was on the right course and making steady progress toward the goal. The scale seems, by comparison, a modern instrument of psychological torture, an engine of confusion and despair. Can it be made to tell the truth?

Dexter's discovery

You've seen the daily weight chart on page 66 that so exasperated Dexter. You've seen, above, the graph of Dexter's actual weight after correcting for all the variations caused by the momentary contents of the rubber bag. Consider this graph. The solid line is Dexter's true weight and the dashed line is produced by applying a simple mathematical procedure to the weight numbers from the scale, those foul figures that so vexed Dexter as he dieted.



Hidden all along among the random day-to-day variations in weight was what really mattered to Dexter: how much fat his body packed. All the despair, all the premature hope and subsequent betrayal could have been avoided had Dexter only known how to extract the truth about his body from the numbers on the scale.

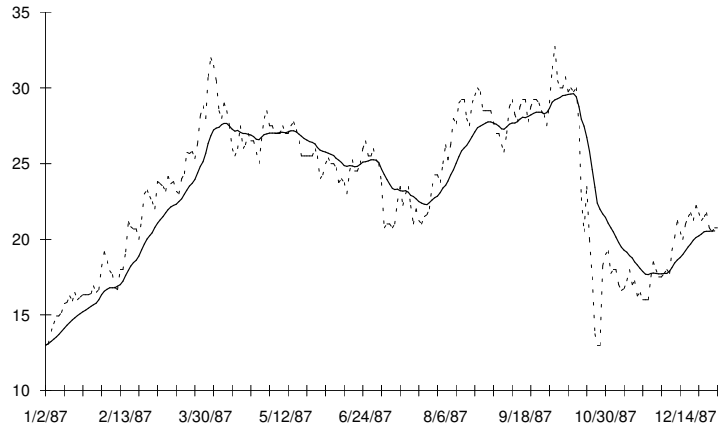
We shall now learn how to do this.

Moving averages

To extract the small change in body fat from the much larger day to day variation in weight that's largely a consequence of water flowing in and out of the rubber bag, we need to find the trend beneath all the daily variations: the long term direction of weight. But this is hardly a new problem; stock and commodity speculators have been doing this for over a century.

Here's the kind of raw data a stock trader looks at. This is a chart of the daily closing price of the stock of Autodesk, Inc., the company I founded, in the eventful year of 1987. That year saw Autodesk hit all-time highs, get clobbered by the Crash of '87, then begin a slow recovery as the year ended (which eventually carried it to a high of $60/share in 1990).

The price action of Autodesk in 1987 was more clearcut than in most years, yet an investor who looked at each day's price as it was quoted in the paper would suffer the same kind of ups and downs as Dexter endured throughout his diet. The most common technique for extracting an underlying trend from daily price data is a *moving average*. Here's a moving average view of Autodesk stock in 1987. The moving average is the solid line; the daily stock price is dashed.



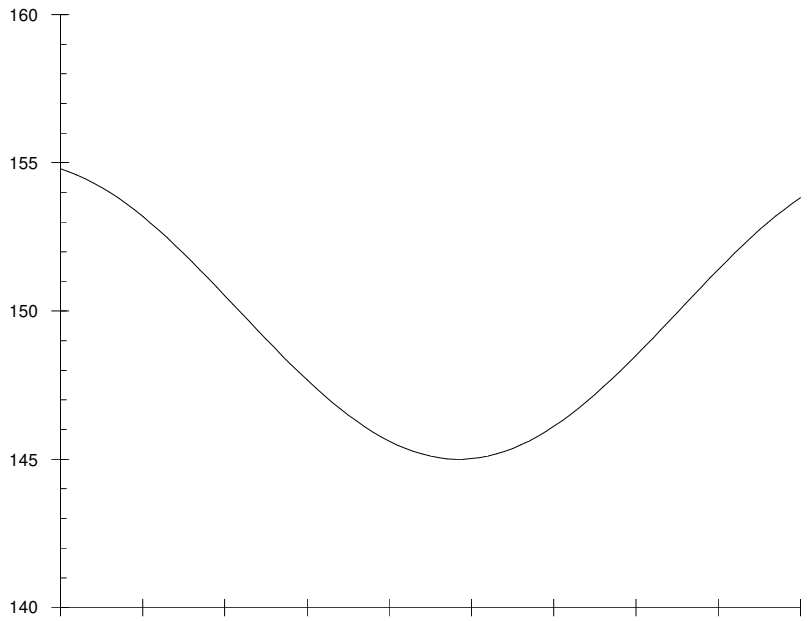
The moving average has distilled the trend from the daily price fluctuations. The six major up and down trends of the year are now readily apparent. If you'd owned the stock only while the moving average

was rising you'd have ended the year with a tidy profit, notwithstanding having your gains from August through October wiped out in a single day by the Crash. (Whether price charts and moving averages can predict the future price of a stock or commodity is controversial; many speculators swear by them and have profits to show for it while the majority of economists believe it's all nonsense. Here we aren't trying to predict anything; we're using a moving average solely to clear away the day to day clutter in order to see larger, long term changes. Nobody disputes the validity of moving averages for this; they are so used in many areas, for example, plotting an airplane's course from a series of radar returns.)

Meet Movin' Marvin

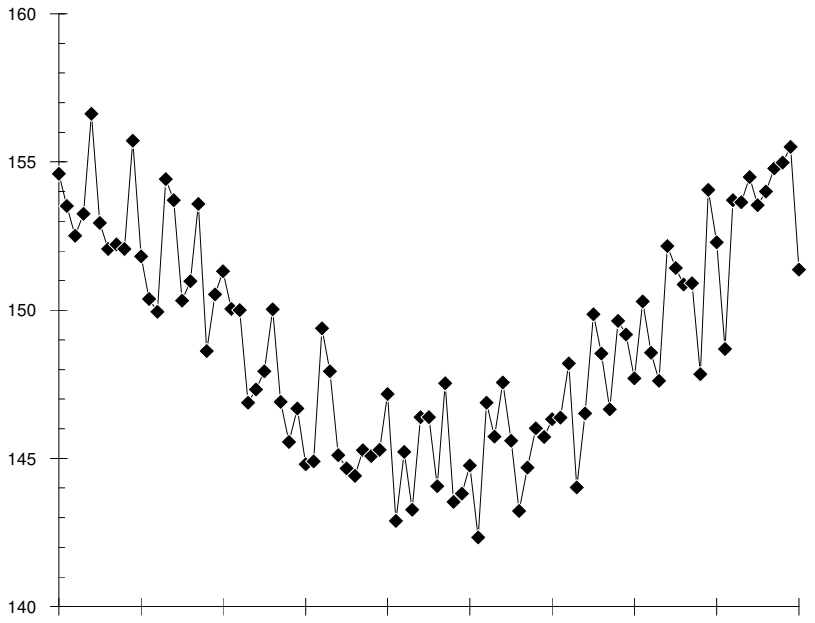
To see how moving averages can show the true trend of weight among the confusion of daily weight readings, we'll turn now to the unsuccessful diet of Movin' Marvin. Marvin lost 10 pounds in a little less than two months, then gained back most of it. (I'm forced to use this depressingly familiar circumstance in order to demonstrate how moving averages behave in both downtrends and uptrends.)

The true course of Marvin's diet is shown by this graph.



The vertical axis gives his weight in pounds, while the horizontal axis is marked every 10 days. This graph is an idealised representation of Marvin's true body weight. A chart like this would result if every day Marvin were subjected to medical tests that measured his actual weight, disregarding transient contents of the rubber bag.

Not wishing to be probed, scanned, or poked with needles, Marvin relies on the scale for weight. This gives him a graph that looks like this.



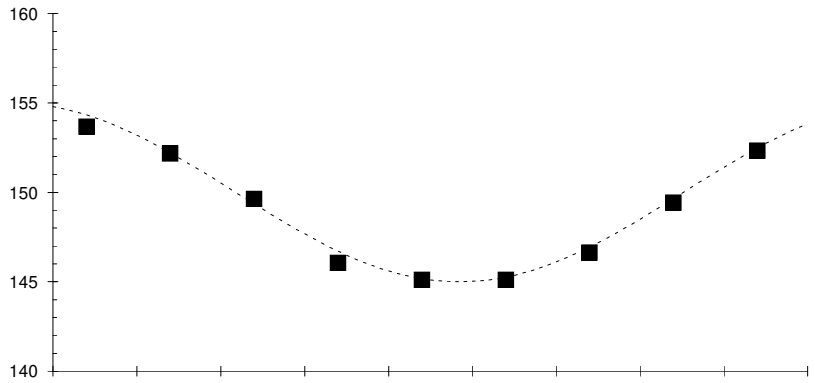
Knowing the true weight trend, you can see it despite the day to day jitter of the weight readings. Marvin, however, doesn't know the trend nor can he see the course of his diet laid out in advance. He has to live through the creation of this graph, day by day, and if you examine a week or so of weights, you'll see that these numbers hold just as much potential for false optimism and heartbreak as Dexter experienced in the course of his successful diet.

Simple moving averages

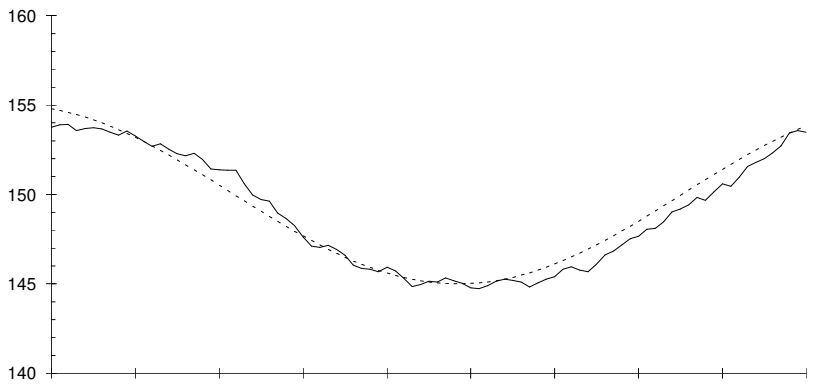
When faced with apparently random variation in a collection of things, the first thing a statistician does is compute an average or, more precisely, the arithmetic mean. What's the average height of 30 year

old men? Measure a whole bunch of them, add up their heights, and divide by the number you measured. Whether the number you get is useful for anything is another matter, but at least you can always easily calculate an average.

Since the weight trend is being obscured by an apparently random day to day variation caused mostly by the instantaneous water content of the rubber bag, what about averaging several day's weights and plotting the averages instead? Let's try it; take the weights for each 10 day period on the graph, calculate the average, and plot it as a little square in the middle of the 10 day interval. Here's the result, overlaid on the original chart showing the true weight trend.



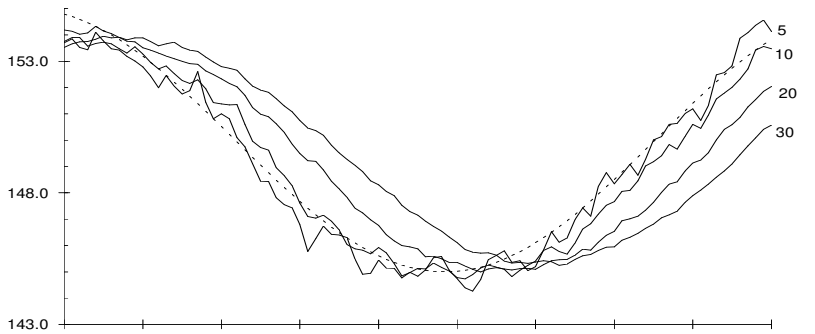
It looks like we're on to something here! The averages track the trend very closely indeed. Averaging has filtered out the influence of the daily variations, leaving only the longer term trend. But we can do even better. Rather than waiting for ten days to elapse before computing the average, why not each day calculate the average of the *last ten* days? This will give us a continuous graph rather than just one box every ten days, and we don't have to wait 10 days for the next average. Here's what happens when we try this scheme.



Bingo! Averaging the last ten days and plotting the average every day (the heavy solid line) closely follows the trend of actual weight (the light dashed line). What we've just computed is called a *10 day moving average*, "moving" because the average can be thought of as sliding along the curve of raw weight measurements, averaging the last 10 every day.

You'll notice, if you look closely at the two curves, that the moving average, although the same shape, lags slightly behind the actual trend. This occurs because the moving average for each day looks backward at the last 10 days' data, so it's influenced by prior measurements as well as the present. The lag might seem to be a problem at first glance, but it will actually turn out to be advantageous when we get around to using a moving average for weight control.

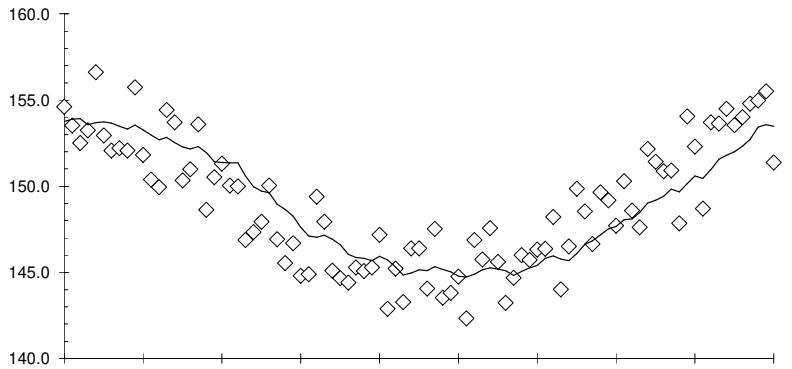
We can base a moving average on any number of days, not just 10. Here are 5, 10, 20, and 30 day moving averages of Marvin's daily weight.



As the number of days in the moving average increases, the curve becomes smoother (since day to day fluctuations are increasingly averaged out), but the moving average lags further behind the actual trend since the average includes readings more distant in the past.

Weighted moving averages

The uncanny way a moving average ferrets the trend from a mass of confusing measurements can be seen by plotting the 10 day moving average along with the original daily weights, shown as small diamonds.



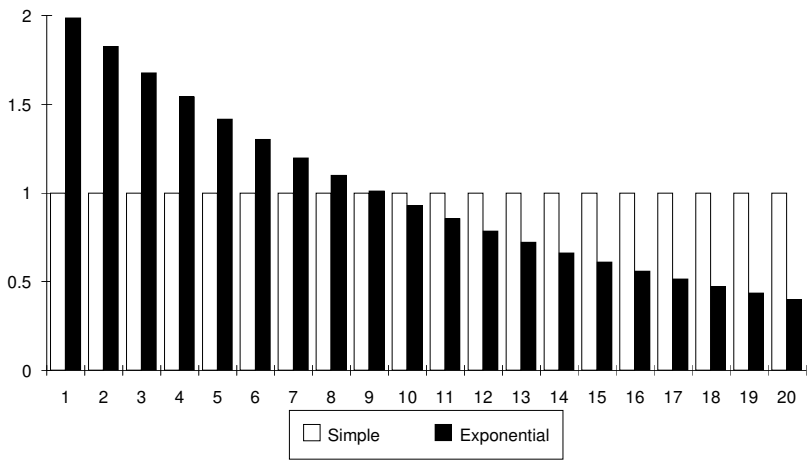
The moving averages we've used so far give equal significance to all the days in the average. This needn't be so. If you think about it, it doesn't make much sense, especially if you're interested in using a longer-term moving average to smooth out random bumps in the trend. Assume you're using a 20 day moving average. Why should your weight almost three weeks ago be considered equally relevant to the current trend as your weight this morning?

Various forms of *weighted moving averages* have been developed to address this objection. Instead of just adding up the measurements for a sequence of days and dividing by the number of days, in a weighted moving average each measurement is first multiplied by a *weight factor* which differs from day to day. The final sum is divided, not by the number of days, but by the sum of all the weight factors. If larger weight factors are used for more recent days and smaller factors for measurements further back in time, the trend will be more responsive

to recent changes without sacrificing the smoothing a moving average provides.

An unweighted moving average is simply a weighted moving average with all the weight factors equal to 1. You can use any weight factors you like, but a particular set with the jawbreaking monicker "Exponentially Smoothed Moving Average" has proven useful in applications ranging from air defence radar to trading the Chicago pork belly market. Let's put it to work on our bellies as well.

This graph compares the weight factors for an exponentially smoothed 20 day moving average with a simple moving average that weights every day equally.

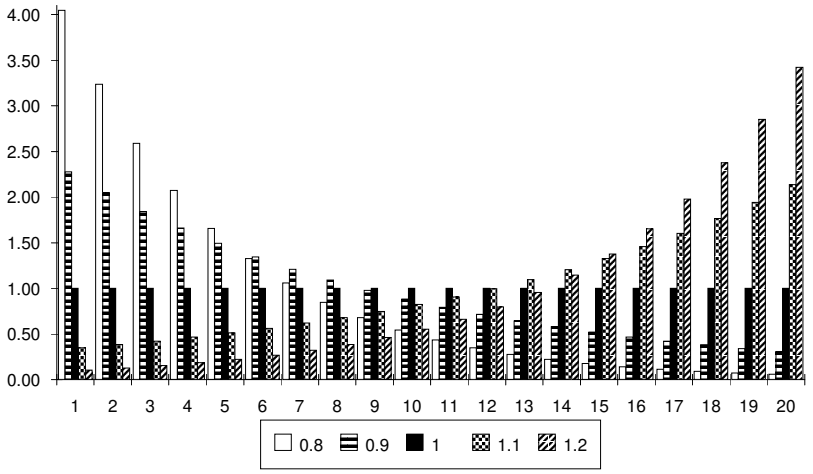


Exponential smoothing gives today's measurement twice the significance the simple average would assign it, yesterday's measurement a little less than that, and each successive day less than its predecessor with day 20 contributing only 20% as much to the result as with a simple moving average.

The weight factors in an exponentially smoothed moving average are successive powers of a number called the *smoothing constant*. An exponentially smoothed moving average with a smoothing constant of 1 is identical to a simple moving average, since 1 to any power is 1. Smoothing constants less than 1 weigh recent data more heavily, with the bias toward the most recent measurements increasing as the smoothing constant decreases toward zero. If the smoothing constant

exceeds 1, older data are weighted more heavily than recent measurements.

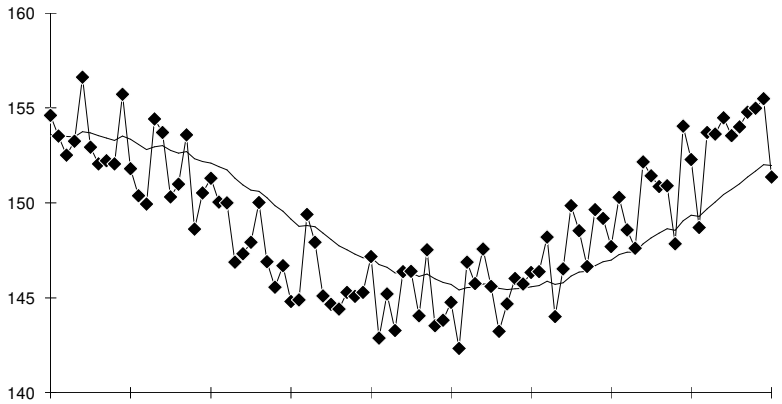
This plot shows the weight factors resulting from different values of the smoothing constant. Note how the weight factors are all 1 when the smoothing constant is 1.



When the smoothing constant is between 0.5 and 0.9, the weight given to old data drops off so rapidly compared to more recent measurements that there's no need to restrict the moving average to a specific number of days; we can average all the data we have, right back to the very start, and let the weight factors computed from the smoothing constant automatically discard the old data as it becomes irrelevant to the current trend.

Exponentially smoothed weighted moving Marvin

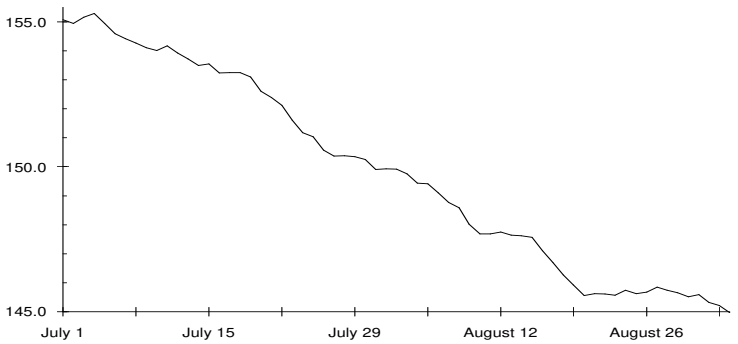
Replacing the simple moving average with an exponentially smoothed one with a smoothing constant of 0.9 (roughly equivalent to a 20 day simple moving average in terms of lagging the trend), we get the following plot showing the trend line produced by the moving average versus the original daily weights from which it was calculated.



At last we've found a tool that accurately extracts the trend of actual body weight, the direct consequence of the balance between what goes in to the rubber bag and what gets burned, from all the distraction and confusion based on whatever's in the bag at the moment you step on the scale. Now we'll learn how to interpret this trend line.

The truth in the trend

Armed with this new and potent tool, the moving average, let's reexamine Dexter's vexatious diet. This is how Dexter would have seen his weight loss if he'd plotted the exponentially smoothed moving average with smoothing constant 0.9 instead of daily weight. (This chart assumes Dexter had been recording his weight for a couple of weeks before he began the diet. If he hadn't, the first few days would look a little different but the rest of the graph would be identical.)



What a different view this is from the soul shredder called a "daily weight chart" on page 66!

The right way to think about a trend chart is to keep it simple. The trend line can do one of three things:

- Go up
- Go down
- Stay about the same

That's it. The moving average guarantees the trend line you plot will obviously behave in one of these ways; the short term fluctuations are averaged out and have little impact on the trend.

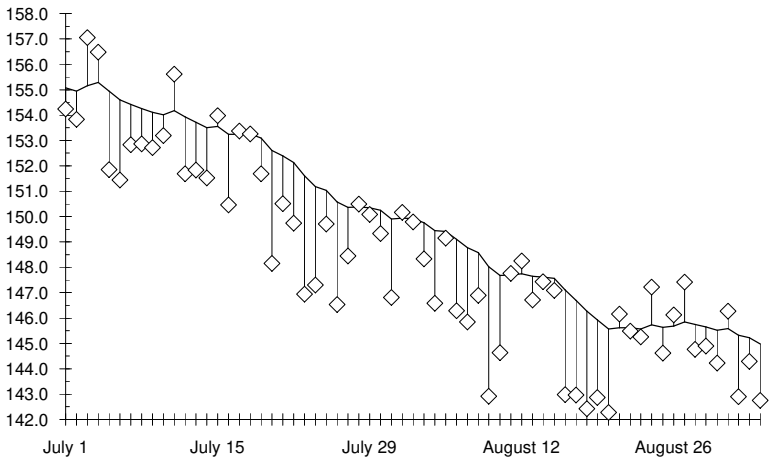
The first thing to observe from the graph is what strikes you at first glance: it *goes down*! Further, after the first week, as the diet begins to take hold, it goes down *relentlessly* until Dexter declares the diet a success at the end of August. To be precise, in the 51 days of Dexter's diet, here's the breakdown of day to day changes in the trend.

What happened?	**How many days?**
Went up	4
Went down	37
Stayed the same	10

Despite all the weight swings that so disturbed Dexter there were only four days when the trend line rose. The next thing to notice is how accurately the trend line approximates a straight line during the middle of the diet. Dexter had cut his food intake consistently and expected a steady weight loss. That's what happened, but the loss was hard to discern on the scale. The trend line makes it immediately apparent.

Floats and sinkers

Next, consider the trend line along with the daily weights from the scale.

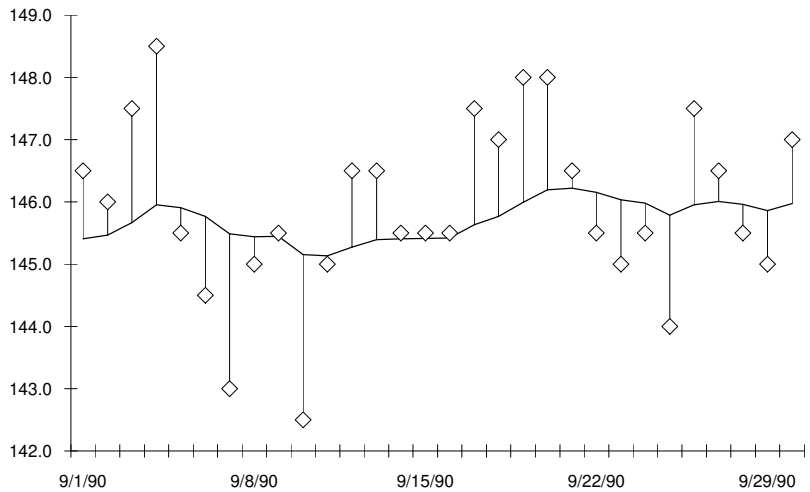


The trend line is drawn in as before, and each day's weight is plotted as a diamond. I've drawn lines from each weight measurement to the trend line to show the relationship between daily weight and the trend that day. Remember, in an exponentially smoothed moving average the most recent day's measurement has the greatest influence on the trend line. Recall also, that since the moving average looks back in time, it lags the actual trend. Consequently, when the trend is falling, most of the daily weights will be *below* the moving average trend line. Think of the trend as a fishing line in the water. Daily weights that fall below it are sinkers, pulling it down; the further the weight is below the trend line, the stronger it pulls the trend line down. When the trend is rising, most daily weights will be *above* the trend line: floats, tethered to the line, pulling it up.

The relationship between the trend line and the daily weights is another powerful indicator of what's really going on. It provides important information to Dexter during the course of his diet. No tabulation is required; a simple glance at the chart shows that regardless of all the ups and downs in daily weight, discounting a very few exceptions, the trend line, the indicator of Dexter's true weight, was being pulled down *continuously*. The apparent weight plateau that frustrated Dexter in the days preceding July 10th is seen in a very different light now. Even though his weight on the scale stubbornly refused to budge for about a week, every weight that week fell below the trend line and, consequently, dragged it downward.

The few days on which the rubber bag was brimming with water or what NASA refers to delicately as "solids," those days that occasioned Dexter such despair when viewed in isolation, are also seen in much better perspective on this chart. Many of these days, in fact the great majority, are actually *below the trend line* and still, regardless of their relationship to earlier days, act to pull it down. Those that manage to pop above the trend line have an impact on it which is clearly insignificant.

Steady as she goes. The relationship between the daily weight readings and the trend line is not only a powerful psychological tool in controlling weight, it also provides early warning about shifts in calorie intake and therefore changes in the trend of weight. While you're losing weight, you'll see a chart that looks like Dexter's: a falling trend line with most daily weights below it. Once you've stabilised your weight and are holding it essentially constant, you'll see a chart that looks like this, instead.

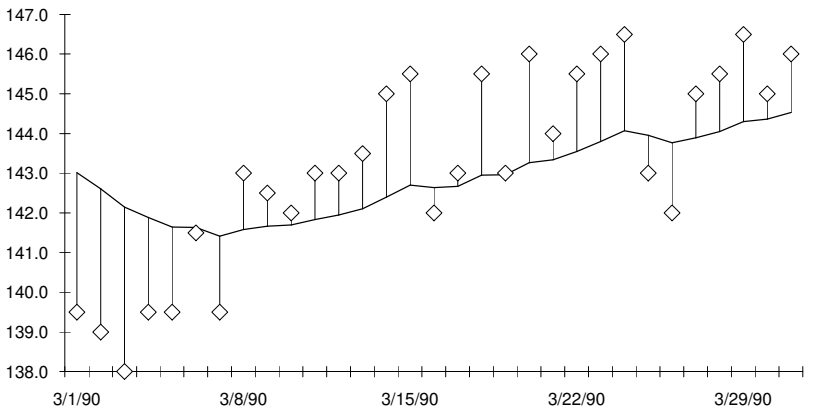


Weekly gain: 0.1 pounds. Daily excess: 66 calories.

I don't have to make up a name for this individual; this is my own chart for September 1990. My true weight that month held essentially steady right where I want it, around 145 pounds. As measured by the trend line, my weight that month never exceeded 146 1/4 nor fell below 145 1/4. Yet, like Dexter, if I'd relied solely on the scale to track my progress, I'd have seen a very different picture. While my true weight didn't vary by more than a pound that month, the difference

between the highest and lowest daily weights on the scale was *six pounds*—from a high of 149.5 to a low of 142.5. This chart shows the reality of stable weight, with the slightest discernable upward bias. The upward trend has been calculated to be equivalent to an excess of 66 calories a day, comparable to a single Oreo cookie, half a tablespoon of mayonnaise, or 5 peanuts roasted in the shell (each 50 calories), or half a can (6 oz.) of Pepsi (79 calories).

Bulking up. When the trend shifts from weight loss to gain, whether by intention (as in the following chart) or accidentally, the direction of the trend line and the relationship of the daily weights to it quickly diagnose the situation. Here's another of my own weight charts, this one from March of 1990. That month I'd slipped a little below my target of 145, so I decided to indulge in a few extra treats to bring my weight back up to the goal.

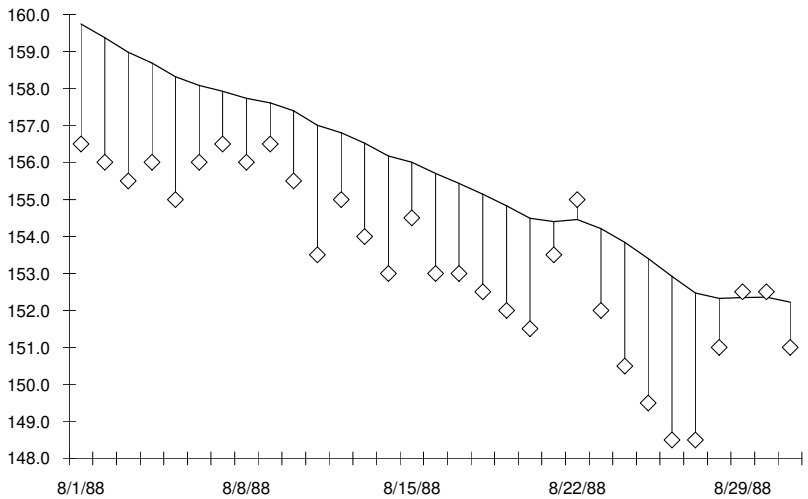


Weekly gain: 0.3 pounds. Daily excess: 171 calories.

Note the dramatic change around March 8th, as I pushed the feeding throttle up a notch. The weight readings, which had previously been mostly below the trend line, pulling it down, shifted predominantly above it, dragging it back upward. The prior downtrend was arrested and gave way to a comparable mild uptrend amounting, over the month, to a rate equal to a third of a pound per week. This was accomplished eating about an extra 170 calories a day, an adjustment I made by enjoying either a bowl of popcorn or a couple of slices of cheese in the evening.

If I hadn't been deliberately bringing my weight up to the target but had, instead, inadvertently thrown my weight out of balance by munching the odd handful of pistachio nuts (1 oz. = 170 calories) in the afternoon, this chart would quickly make me aware of the trouble I was getting myself into. A gain of a third of a pound per week is a comfortable, easy way to drift upward when you'd like to add a few pounds but, if it goes unnoticed and unchecked, will leave you 17 pounds heavier in a year. The trend chart, if heeded, will keep such slow and subtle weight creep from blindsiding you. Whenever you see a chart like this one and you aren't deliberately putting on weight, just cut back a few calories a day to restore the balance before a real problem develops.

Take it off! To complete the picture, here's my weight chart for August 1988—toward the end of the diet that took me from 215 pounds in January 1988 to my target of 145 in November that same year.



Weekly loss: 1.7 pounds. Daily deficit: 849 calories.

This chart is typical of a serious diet in mid-course: the trend line is more consistent than Dexter's chart on page 81 since my diet was underway months before the first day on the chart. As you'd expect, virtually every daily weight fell below the already falling trend line and acted to pull it down. Although the daily weight jumped all over the place, the trend line was almost ruler-straight for the month, indicating weight loss at the rate of 1.7 pounds a week, or 850 fewer calories going in my rubber bag every day than I burned. (Unlike the

stability or slow upward drift in the previous charts, a daily shortfall of 850 calories is serious business. When you constrict the intake of the rubber bag to that extent, the sentient being inside is going to say, "What happened?," probably accompanied by colourful language and epithets too powerful for this fragile and flammable paper to contain. An 850 calorie per day deficit corresponds to a loss of 90 pounds a year, plenty to deal with all but the most extreme weight problems in relatively short order. Notwithstanding the realities of such a severe weight-loss regime, which I'll discuss in chapter 9, it hardly implies incapacitation. That very month, August 1988, I researched, wrote, and presented the proposal that launched the Autodesk Cyberspace Initiative, our effort to make "virtual reality" technology available to everybody—to allow computer users to cross the barrier of the screen and directly experience the world inside their computers.)

Weight and calories

The trend line, generated from the daily weight readings by an exponentially smoothed moving average, is so smooth and regular it can be used to calculate average weight gain or loss and, from that, the daily excess or shortfall of calories that caused the observed change in weight.

For longer term changes, simply subtracting the trend reading at the end of the month from the trend at the beginning and dividing by four gives a reasonable approximation of the rate of weight gain or loss per week during that month. Clearly, this number should be interpreted in conjunction with the chart. If the calculation indicates no weekly gain but the chart shows a steep uptrend for the first two weeks and a compensating decline in the latter two, the situation is not one of stability but oscillation, to be damped if possible.

Consider my chart for August of 1988 on page 85. My weight, measured by the trend line, began the month at 159.74 and ended the month at 152.223 pounds. This represents a weight loss of:

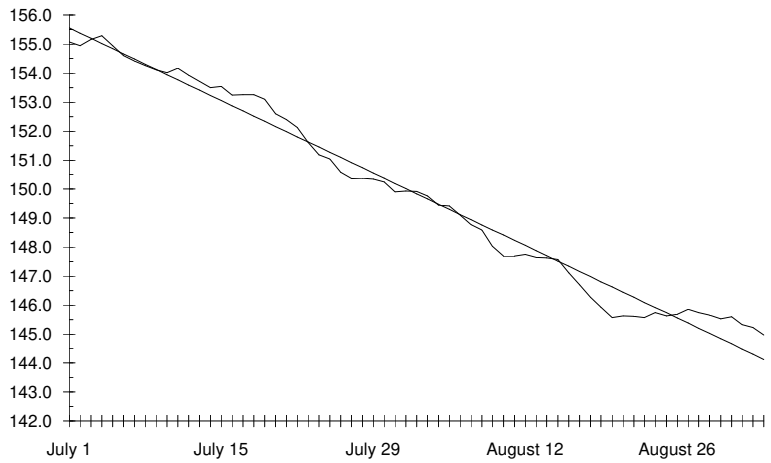
$$(159.74 - 152.223) \times \frac{7}{31} = 1.7 \frac{\text{pounds}}{\text{week}}$$

Since each pound gained or lost is equivalent to 3500 calories excess, stored as fat, or deficit, burned from fat by the rubber bag, this can be expressed as a daily calorie excess or shortfall by multiplying by calories per pound.

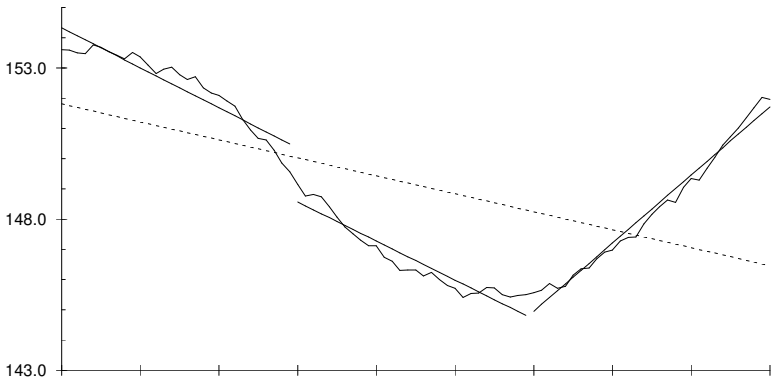
$$1.7 \frac{\text{pound}}{\text{week}} \times \frac{\text{week}}{7 \text{ days}} \times \frac{3500 \text{ calories}}{\text{pound}} = 850 \frac{\text{calories}}{\text{day}}$$

The Excel weight management worksheets actually use a more sophisticated and accurate technique to estimate the rate of weight loss or gain and the corresponding calorie shortfall or excess. Instead of just using the trend at the start and end of the month, they find a straight line that best approximates the overall trend and then use the slope of that line as the rate of change in weight. The mathematical details of this are given on page 209. If you're calculating by hand, it isn't worth the extra work to get the slightly more accurate values this technique provides; just use the first and last trend values as described above.

Here is the straight line trend determined by this procedure superimposed on Dexter's moving average, from which it was calculated.



As you can see, the computed straight line trend accurately reflects the rate of change in the moving average. Fitting a straight line to the trend doesn't eliminate the need to interpret the weight loss or gain and calorie excess or deficit in conjunction with the chart, taking into account the shape of the trend line. Consider this chart of Marvin's diet, showing the moving average and two very different straight line trends that can be calculated from it.

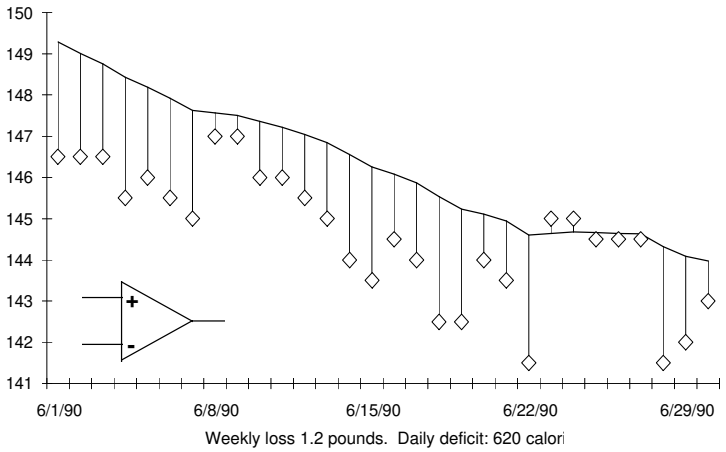


The familiar moving average trend line is drawn as before. The dashed line is the best fit to all 90 days of Marvin's diet. It's accurate, after a fashion, since Marvin ended the diet below the weight where he started, and he lost weight for 50 days but gained only in the last 40. But, obviously, it misses the point. What really happened was a sequence of successful weight loss, stability for a brief period, then rapid weight gain. Short term straight line trends, in this case month by month, identify the turnaround and provide accurate estimates of weight change and calories for each month.

As long as the moving average is roughly straight, the weekly weight and daily calorie figures can be relied upon. If there's a major change in trend during the month, you're better off basing your actions on the most recent direction of the trend rather than longer term values that don't account for a kink in the curve.

Closing the circle

Let's examine another month of my actual weight history.



From what we've learned already, this month is easy to interpret. It's a month of rapid weight loss proceeding at a steady pace. As we've seen before, the trend chart can be used to calculate the average daily calorie deficit for the month it represents. That indicates the extent of the excess or shortfall of calories entering the rubber bag that month.

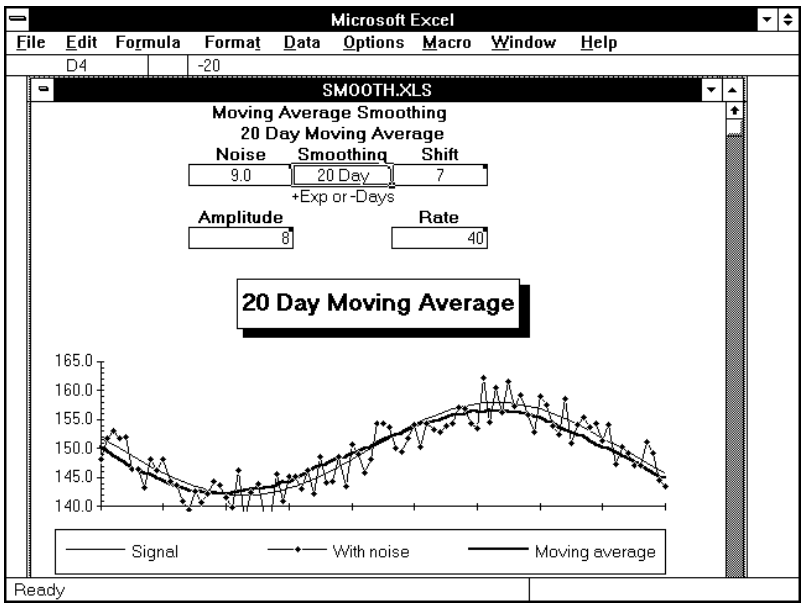
Carrying out these calculations indicates a weight loss of 1.2 pounds per week, equivalent to a shortfall of 620 calories per day. And what is that symbol beneath the trend line? It seems familiar. Why... it's the comparator from the eat watch diagram on page 64. What is the relationship between the change in the trend line from day to day and the balance of calories computed by the eat watch?

Quite simple, they are the very same thing.

Exploring moving averages

The charts of Marvin's diet in this chapter were generated from an Excel worksheet that's included to allow you to experiment further on your own and get a better feel for how moving averages identify the overall trend among data that subject to large short-term variations.

To use this model, load the worksheet **`SMOOTH.XLS`** into Excel. You should see a something like this on your screen.



Depending on your monitor and graphics board, you may have to resize the window to see the entire worksheet. The chart shows the true trend line as a thin red line. This trend is masked by random variations from day to day, resulting in daily measurements drawn as green diamonds connected by yellow lines. The trend extracted by the selected moving average is drawn as a thick blue line. The closer the blue line approximates the red line indicating the true trend, the more effective the moving average has been in filtering out the short term random variations in the measurements.

You can control the moving average model by entering values in the following boxes of the control panel.

Smoothing. This parameter selects the type of moving average and its degree of smoothing. If positive, an exponentially smoothed moving average with smoothing constant equal to **Smoothing** is used. Only smoothing constants between 0 and 1 are valid. If negative, a simple moving average over the last **–Smoothing** days is used. To see the effects of a 20 day simple moving average, enter "**–20**" in the **Smoothing** cell.

Noise. The **Noise** value specifies the day to day random perturbation of the basic trend. If you set **Noise** to 10, the measured values

will be randomly displaced ±5 from the true trend. The random displacement of points in the primary trend changes every time the worksheet is recalculated. To show the effects of a different random displacement of the current trend, press **F9** to force recalculation.

Shift. Since a moving average looks back at prior measurements, it lags the current trend. You can shift the moving average backward in time to cancel this lag by entering the number of days of displacement in the **Shift** cell. This allows you to compare the shape of the trend curve found by various moving averages with the original trend. A **Shift** value of zero disables displacement and produces a moving average that behaves, with respect to the actual trend, just as one calculated daily from current data. For a simple moving average, a **Shift** of half the days of **Smoothing** will generally align the trend and moving average. For an exponentially smoothed moving average, a **Smoothing** value of 0.9 can be aligned with a **Shift** of about 10.

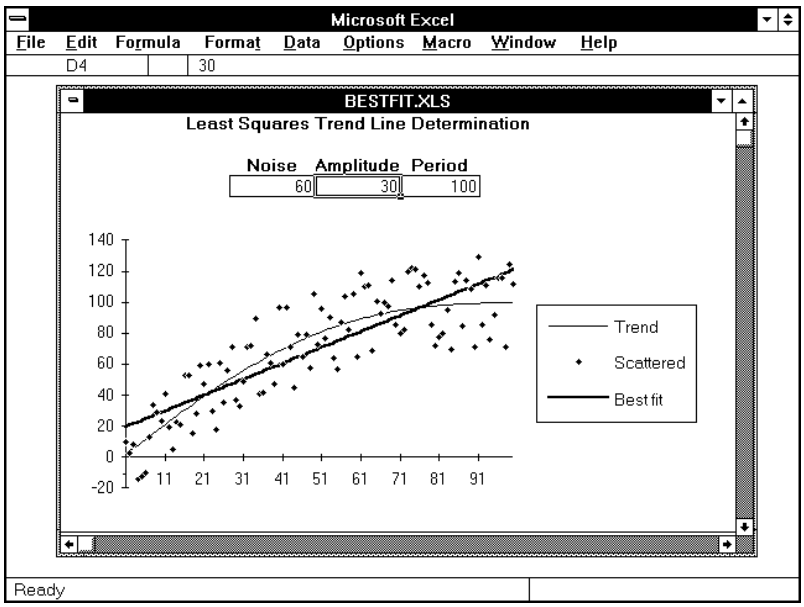
Amplitude. The trend used in this model is generated by a cosine function. **Amplitude** controls the extent of the trend; the peak to peak variation is twice the value of **Amplitude**.

Rate. **Rate** controls the period of the primary trend, specified as the number of days from trough to peak and vice versa. As you decrease **Rate**, the trend varies more rapidly, requiring a shorter-term moving average to follow.

Trying trend fitting

Another Excel worksheet, **BESTFIT.XLS**, allows you to see how a straight-line trend is fitted to randomly varying measurements of an underlying trend, and the extent to which the trend line estimated this way reflects the actual trend.

Load the worksheet and resize the window is necessary so your screen looks like this:



The actual trend in this model is a straight line that runs from zero to 100 over 100 days. You can introduce random noise into the measurements from which the trend is calculated by setting **Noise** to the width of the noise band. If **Noise** is 10, measurements are randomly displaced ± 5 from the actual trend.

You can also add a sinusoidal variation to the basic straight line trend, anything ranging from a small amplitude, high frequency, wiggle to a large secular change that ties the trend line into a knot. **Amplitude** controls the extent of the deviation from a straight line; the trend will range from **−Amplitude** to +**Amplitude** around the basic straight trend line. **Period** controls how rapidly the trend line wiggles from its central value in terms of days between crest and trough.

The fundamental rising trend, modified by the sinusoidal variation specified by **Amplitude** and **Period**, is shown as a blue line. The raw data points that result from displacing values on that curve based on the setting of **Noise** are plotted as green diamonds. The straight line trend that best fits the noisy data points shown by the green dots is plotted as a thick red line. To the extent this line is representative of the actual trend in blue, the trend fitting procedure can be trusted. Note, as you experiment with this worksheet, how long period, high amplitude variation in the basic trend, equivalent to reversals in an established trend of weight loss or gain, can spoof the trend line calculation and yield misleading trend estimates.

6

WHAT, ME EXERCISE?

> Those who do not find time for exercise now will have to find time for illness.
>
> —The Earl of Derby, 1873

Don't kid yourself into thinking that exercise, by itself, will make you lose weight. Consider the following activities, and the number of calories an average person burns per hour in each.

Activity	**Calories/hour**
Walking	300
Bicycling	300
Aerobics	400
Swimming	400
Tennis	500
Basketball	500
Jogging	700

Compare those numbers, remembering that they're for a full hour spent nonstop in the exercise, with the calories in the following food items:

Tasty Treat	**Calories**
Peanut butter sandwich	275
Pizza (3 slices)	500
Big Mac	560

Clearly, even an hour a day of exercise doesn't account for much food. And what's the likelihood you'll find the time to spend a full hour, every day, month after month, year after year, doing those exercises?

So, don't exercise to try to burn off calories and lose weight. Unless you're a professional athlete or obsessed with sports, you're not likely to spend enough time exercising strenuously enough to make much of a difference. Exercise *will* help you lose weight in more subtle ways. Regular exercise increases your rate of metabolism: the number of calories you burn all the time. Plus, for many people, exercise actually reduces appetite.

But these are side effects: hardly reasons to start exercising. The real reasons to exercise are that you'll *live longer* and *feel better*. Let's consider the case for exercise from those standpoints.

Living longer

I was never much of a one for sports. Every time I played baseball, I got hit in the mouth with a ball or bat. Whenever I played football, I ended up with a mouthful of mud. Imagine my delight when I discovered that the physical education requirement at my college could be satisfied by playing ping pong or on the rifle range.

After reaching that glorious stage in life when other people couldn't make me do things I'd rather not, the case against exercising seemed straightforward and overwhelmingly persuasive.

1. Exercising consumed time.
2. Exercising was not programming.
3. Therefore, by exercising, less time was available for programming.

I'm a hacker—I like to program! Substitute your own favourite activity for programming and you'll see what I mean. In addition, exercise carried all the unpleasant connotations of high school calisthenics, or the equivalent indignity of more modern, yet equally regimented, forms of workouts.

But is there a flaw in this argument after all? Indeed there is. The premises are correct, but the conclusion doesn't account for the fact that regular exercise will, in all likelihood, allow you to live longer. Let's look at the numbers.

This "Life Extension Worksheet" is provided as an Excel worksheet. You may want to load **`LIFEXT.XLS`** and plug in your own numbers to compare with mine. Directions for calculating increased lifespan by hand are given on page 204.

LIFEXT.XLS

Life Extension Worksheet	
Your age today, years:	*40*
Expected increased life span, years:	*3*
Equivalent minutes per day to age 65:	172.8
Exercise minutes per day:	*15*
Years consumed exercising to age 65:	0.26
Net life extension after exercising, years:	2.74
Net life extension after exercising, days:	1000

So, if you're 40 years old, and you exercise 15 minutes a day from now until you turn 65, you'll have spent a total of about a quarter of a year exercising in those 25 years.

But, if by exercising you manage to live 3 years longer, you're ahead by a total of two and three quarters years by age 65—1000 days. Your increased life span works out to an additional 172 minutes per day from age 40 through 65. Even after spending 15 minutes exercising, the life extension you can expect from getting into shape gives you what amounts to two and half more hours *per day* to do whatever you enjoy most! Even if you live only one additional year through physical fitness, you'll still end up with 270 more days by exercising.

Of course, we're talking percentages here; you could be run over by a truck tomorrow. But hey, if you're in shape you may *dodge* that truck!

Feeling better

Exercising not only gives you more time to live, it makes the time you live more enjoyable. You'll feel better, think straighter, sleep more soundly, and have more capacity and endurance for everything you wish to do. How much? It varies from person to person; the only way to experience the benefits is to start an exercise program and see for yourself.

Fortunately, the payoff becomes apparent pretty early-on, particularly in a program like this one where you can always compare your current level of fitness with the much lower levels you strove to master only a few weeks before.

If you don't buy the "feeling better" argument, consider this. Virtually all medical evidence shows that if you don't exercise, you're more likely to suffer a heart attack or, if you're going to have one anyway, to have it earlier in life. Even if you're resolute in believing you won't feel one whit better from exercising, you'll certainly concede that you'll feel a whole lot worse after collapsing to the floor with a coronary. I've no direct experience with this particular unpleasantness from life's menu of surprises, but folks I've talked to who have are unanimous that it's best avoided. Those who dropped dead right away were unavailable for comment.

The fitness ladder

Convinced? Great! Not convinced?... please bear with me a little longer before skipping to the next chapter.

Since exercise seems, on the face of it, so distasteful and the time devoted to it stolen, perforce, from other more pleasant activities, I've designed this exercise program around the following goals.

- Minimum time per day.
- Time spent doesn't increase as you progress.
- Easy to start, regardless of the shape you're in.
- No pain.
- Progress at your own pace.
- No equipment needed. Exercise anywhere, in private if you like.

The general outlines for this program were derived from the Royal Canadian Air Force "5BX" exercise program for men. I originally used that program, but found it unnecessarily complicated and confusing for people, like myself, interested simply in achieving a reasonable level of fitness and maintaining that level throughout their life. The RCAF programs for men and women are entirely different: I know of no reason this should be. My program is self-paced, relying on your own body to tell you how far and how fast to advance. Thus it should work fine for women as well as men. (Of course, I'm male and I may be missing something. Both men and women should feel free to modify the program as you like. It's your body!)

The program is organised around a "fitness ladder" with 48 rungs. Each rung prescribes a given number of repetitions of five exercises. The first 15 rungs constitute the **Introductory Ladder** and involve easier variants of the exercises in the **Lifetime Ladder**, rungs 16 through 48. The exercises are intended to be done *every day*. Completing all the exercises typically takes between 10 and 15 minutes.

Climbing the ladder

Regardless of the shape you're in (or think you're in), start at the first rung of the Introductory Ladder and work your way up. The pace at which you climb the ladder depends on your own body. If you're in reasonable shape to start with, you may progress through the introductory rungs rapidly, then slow down as you reach the higher, more difficult levels.

Just as it's important to start at rung 1, it's also important not to rush from rung to rung too quickly. Please spend at least five days on each rung as you advance; many people will prefer to spend at least a week per rung. When I was developing this plan, I used the following schedule, which I recommend.

Spend one week on each rung. On a given day of the week, for example Sunday, try the next higher rung. If it seems as easy as the current rung felt the week before, move up to that level. If you have difficulty completing any exercise of the new rung, or you can't complete it in 15 minutes, or you feel pain or exhaustion at that level, stay at your current level for another week.

Introductory ladder

The introductory ladder contains 15 steps, each of which specifies a number of repetitions of the same five exercises. The exercises in the introductory ladder are easier versions of those that appear in the corresponding positions of the lifetime ladder–they exercise the same muscles in the same ways and develop the basic strength you'll need as you progress to the lifetime ladder. To perform the exercises at a given rung, examine the entry for that rung in the table and proceed as it directs. For example, suppose you're on rung 10, which reads:

Rung	Bend	Sit up	Leg lift	Push up	Steps	Count
10	16	16	18	11	350	4 50

Proceed as follows:

Bend (introductory)

Stand upright with your legs apart, hands outstretched above your head. Bend forward, as far as you can, trying to touch your toes (it's OK if you can't reach your toes). Then straighten up and bend backward moderately. Repeat the specified number of times.

EXERPLAN.XLS

Introductory Ladder

Rung	Bend	Sit up	Leg lift	Push up	Steps	Count	
1	2	3	4	2	105	1	30
2	3	4	5	3	140	1	65
3	4	6	6	3	170	2	20
4	6	7	8	4	200	2	50
5	7	9	9	5	225	3	0
6	8	10	10	6	255	3	30
7	10	11	12	7	280	3	55
8	12	13	14	8	305	4	5
9	14	15	16	9	325	4	25
10	16	16	18	11	350	4	50
11	18	18	20	12	370	4	70
12	20	20	22	13	390	5	15
13	23	21	25	15	405	5	30
14	25	23	27	16	425	5	50
15	28	25	30	18	440	5	65

Sit up (introductory)

Lie on your back on the floor, feet slightly apart, hands at your side. Lift your head and shoulders off the floor far enough so that you can see your heels. Smoothly lower your head and shoulders back to the floor. Repeat the specified number of times.

Leg lift (introductory)

Lie face down on the floor, legs slightly apart, with the palms of your hands under your thighs. Lift your left leg, bending at the hip and knee, while simultaneously lifting your head from the floor. Smoothly lower both your head and leg. Then lift your right leg and head in the same manner. Repeat the specified number of times (each repetition involves lifting both the left and right legs).

Push up (introductory)

Lie face down on the floor with palms just outside your shoulders and arms bent. Keeping your knees on the floor and allowing your legs to bend at the knee but holding your upper body straight, lift your body until your arms are straight. Then smoothly lower your body back to the floor. Repeat the specified number of times.

Run and jump (introductory)

Run in place at a brisk pace for the specified number of steps, lifting your legs 4 to 6 inches from the floor with each step. Every 75 steps, stop and do 7 introductory "jumping jacks": stand with your legs together, arms at your side. Jump up in the air, extending your legs to the side and your arms outward to the level of your shoulders. Then jump up again, bringing your legs back together and your arms back to your side.

The "Count" column in the table helps you keep track of the running and jumping phases of this exercise. The first number is how many complete sets of 75 steps of running and 7 jumping jacks you should perform. The second number gives the number of extra steps you should run after the last full set (don't jump after these final steps).

Be sure to count a running step only as your left foot touches the floor, *not* every time either foot touches. The easiest way to keep count is to count to 75 as you run, do the 7 jumps, then start counting from 1 again for the next running phase. I find that keeping track of the number of complete sets of running and jumping is best done by setting out a number of coins equal to the number of sets for the current rung and moving a coin from one pile to another as you complete each set.

Lifetime ladder

After you're comfortable with the exercises of rung 15, the top of the Introductory Ladder, you're ready to graduate to the Lifetime Ladder, rungs 16 and above, where you'll eventually find the level of fitness you're happy with. The entries for rungs in the Lifetime Ladder are interpreted exactly as those in the Introductory Ladder, but each specifies a somewhat more demanding exercise. Note, however, that the number of repetitions is reduced as you move from rung 15 to rung 16. This compensates for the increased difficulty of the exercises in the Lifetime Ladder and should make the transition no more difficult

than between any two other rungs. The exercises in the Lifetime Ladder are sufficiently demanding that if you're seriously out of shape you may not be able to do a single one when you begin the exercise program at rung 1 of the Introductory Ladder. Don't worry; that's what the Introductory Ladder is all about. By the time you each rung 16, you'll have the strength and stamina you need to take it in stride.

EXERPLAN.XLS

Lifetime Ladder

Rung	Bend	Sit up	Prone lift	Push up	Steps	Count	
16	14	10	12	9	340	4	40
17	15	11	14	10	355	4	55
18	16	12	16	11	375	5	0
19	18	13	17	12	390	5	15
20	19	14	19	13	405	5	30
21	21	15	21	14	420	5	45
22	22	16	23	15	435	5	60
23	24	17	25	16	445	5	70
24	25	18	27	17	460	6	10
25	27	20	29	18	470	6	20
26	29	21	31	19	480	6	30
27	31	23	33	20	490	6	40
28	33	24	36	21	500	6	50
29	34	26	38	22	510	6	60

Continued on next page...

Here are the exercises of the Lifetime Ladder:

Bend and bounce

Stand upright with your legs apart, hands outstretched above your head. Bend forward and touch the floor between your legs, bounce up a few inches, and touch the floor again. Then straighten up and bend backward. Repeat the specified number of times.

Sit up

Lie on your back on the floor, feet slightly apart, hands at your side. Lift your upper body, bending at the waist, until you're sitting up

vertically. Keep your arms at your sides and your feet on the floor—avoid the temptation to "cheat" by pulling yourself up with your arms or levering yourself up by raising your legs. Smoothly lower your body back to the floor. Repeat the specified number of times.

. . . continued from previous page.

Lifetime Ladder

Rung	Bend	Sit up	Prone lift	Push up	Steps	Count	
30	36	28	40	23	515	6	65
31	38	29	43	24	525	7	0
32	40	31	45	25	530	7	5
33	43	33	48	26	535	7	10
34	45	35	51	27	540	7	15
35	47	37	54	28	540	7	15
36	49	39	56	29	545	7	20
37	51	41	59	30	545	7	20
38	54	43	62	31	545	7	20
39	56	46	65	32	550	7	25
40	59	48	68	33	555	7	30
41	61	50	72	34	555	7	30
42	64	53	75	35	555	7	30
43	66	55	78	36	560	7	35
44	69	58	81	37	560	7	35
45	72	61	85	38	560	7	35
46	74	64	88	39	575	7	50
47	77	66	92	40	575	7	50
48	80	69	96	41	575	7	50

Prone lift

Lie face down on the floor, legs slightly apart, with the palms of your hands under your thighs. Lift both legs, bending at the hip, at least high enough that your thighs are lifted from your hands. Simultaneously lift your head and shoulders from the floor. Smoothly lower your head, shoulders, and both legs. Repeat the specified number of times.

Push up

Lie face down on the floor with palms just outside your shoulders and arms bent. Keeping your back straight, pivoting on your toes, lift your body until your arms are straight. Then smoothly lower your body back to the floor, touching your chest. Repeat the specified number of times.

Run and jump

Run in place at a brisk pace for the specified number of steps, lifting your legs 4 to 6 inches from the floor with each step. Every 75 steps, stop and do 10 "jumping jacks": stand with your legs together, arms at your side. Jump up in the air, extending your legs to the side and your arms upward as high as you can (ideally touching your fingers together above your head, but at least above your shoulders). Then jump up again, bringing your legs back together and your arms back to your side.

The "Count" column in the table makes it easier to keep track of the running and jumping phases of this exercise. The first number is how many complete sets of 75 steps of running and 10 jumping jacks you should perform. The second number gives the number of extra steps you should run after the last full set (don't jump after these final steps).

Be sure to count a step in running only as your left foot touches the floor, *not* every time either foot touches. The easiest way to keep count is to repeatedly count to 75 as you run, do the ten jumps, then start counting from 1 again for the next running phase. I find that keeping count of the number of complete sets of running and jumping is best done by setting out a number of coins equal to the number of sets you're doing at the current rung and moving a coin from one pile to another after each set is completed.

How much is enough?

The Lifetime Ladder is called that because most people will find an optimal level of fitness on one of its rungs and maintain that level, more or less, for most of their subsequent years. The ideal level to attain depends on your age, your general state of health, and the characteristics of your own body. This isn't about training to become a professional athlete—it's a common sense program to maintain reasonable fitness in the interests of health and overall well-being. There's no reason to

go off the deep end striving for levels above those you're happy with, and can sustain on a permanent basis.

Almost all adults in good general health can reach and maintain rung 20 of the Lifetime Ladder, assuming they're not overweight or otherwise physically constrained. Most people below the age of 50 will have no trouble reaching rung 25. Beyond that, just continue to advance until you settle on a level you're happy with and can maintain every day. If, after a couple of months, the exercises at that rung begin to seem easier, your body's telling you its conditioning is continuing to improve. Try moving up to the next level and if it doesn't pose a problem, settle there.

Progress and motivation

Before you begin this program you may scarcely believe you have any hope of reaching the levels of fitness the middle rungs on the Lifetime Ladder represent. "Sheesh. . . ," you say, "I can't even *see* my toes, no less touch them, and you're tellin' me in a year or so I'm gonna be doing 20 Marine pushups every day? Gimme a break!"

Gimme a couple of weeks. Very few people will start this program in worse shape than I was when I began to develop it. In only 90 days, I had reached rung 28, my initial goal, while managing to lose 20 pounds in the same period. Since then, I've slowly drifted upward, settling, after two and a half years, at rung 36. I'm happy there, although I may continue to creep upward over time.

Almost anybody can have the same success with this exercise program *or with any other sane program.* There's nothing magical about any particular set of exercises or plan for doing them. Developing physical fitness through exercise is just like losing weight: extremely simple, but based on an unpleasant fact most people would rather ignore.

For an exercise program to work, you have to follow it. All the exercise books in the world won't make you healthy as long as they're sitting on your shelf and you're sitting on your backside. This program is designed to motivate you to start it, progress through it, and keep it up for the rest of your life. Here's how.

Easy to start

The first rung on the Introductory Ladder can be accomplished in a few minutes by almost anybody who's able to walk up a single flight

of stairs without collapsing. In fact, it's so easy, *why don't you try it right now?*

That wasn't so hard, was it? Oh, you didn't try it. Please, give it a shot.

Feeling of accomplishment and progress

Now that you've tried that first rung today, go make a note of it in the "Rung" column of your weight log for today. Now that that column isn't blank, you'll feel better and better as you make each day's entry after completing the exercises. That's nothing compared to how you'll feel as you start to move up the rungs and you see the number climbing from week to week, month to month. The long-term rewards from exercise are longer life and better health: this program provides short-term feedback showing your progress as you persist in it (or lack of progress if you find too many excuses to skip the few minutes it takes, day after day).

No pain or exhaustion

You exercise to build health, and when you're healthy you don't hurt and you aren't exhausted. The last thing you need is an exercise program that makes you feel awful. This program won't do that. You may ache a little after starting rung 1, but that should stop in a few days. After that, only move up to the next rung when you're comfortable at the current level *however long that takes*. If you advance to the next rung and find it's making you sore, or exhausted, or you have trouble completing the exercises in 15 minutes, no problem! Just drop back down to the previous rung, where you know you're already comfortable, and try the next level in another week or so. In all likelihood by then it won't present any problem. If it does, be patient; your body continues to gain strength and capacity even as you remain on a given rung.

Small time commitment

Since this program won't make you hurt or tire you out, the only other excuse to skip it is the time it takes. Now 15 minutes a day isn't much time, even if you ignore the time you gain by not dropping dead prematurely. But the effective bite out of your day can be reduced even further. More than half your exercise time is spent in the run and jump exercise, especially after you advance to the middle rungs

of the Lifetime Ladder. I've found that, with a little practice, I have no trouble keeping count of the 75 steps and 10 jumping jacks while letting my mind free-run on whatever I'm interested in at the moment. In fact, in the couple of years I've been following this program, I've had some of my very best ideas while doing the running and jumping exercises. I don't know whether it has something to do with getting the circulation going, or just with being forced to *think* for five minutes or so, but it happens. (It is hard to keep track of the number of sets of running and jumping at the same time. That's why I recommend using coins or other markers to keep count, freeing your mind for more interesting pursuits.)

Further, the time required remains pretty much the same as you progress from rung to rung. Since each rung calls for more repetitions of each exercise this might not seem to make sense, but as your conditioning improves you'll find you're performing the exercises at a brisker pace, keeping the total time roughly constant. If one exercise seems to take forever to get through, that's an indication you've moved up to that rung too quickly.

View from a height

In exercise, as in controlling your weight, success is the very best motivator. Once you've followed this program through the Introductory Ladder onto the Lifetime Ladder, you will be able to look back on your early steps and find it hard to believe you ever could have found progressing up the lower rungs challenging at all.

Progress in this program is so dramatic I recommend, on occasion, that you take the time to repeat the exercises for a rung five or ten below your current level. Remember when you found that hard? Can you imagine ever wanting to be that unfit again? Certainly not, especially since the time and effort to maintain your current rung are no more than you were spending to attain that much lower rung.

Daily and monthly feedback

Just as the feedback of the record sheet and charts is essential to controlling your weight, similar feedback can help you meet your fitness goals. The daily feedback in the exercise program is even more visceral than the number on a scale or a daily trend figure. It's how you *feel* after doing the exercises each day. If you progress up the rungs at the pace your body dictates, each day's exercise will leave you pleasantly invigorated. If you drop out of the program for a few

days and try to jump back in at the same rung where you left it, you'll notice the difference—right away!

Instead of a vague sense of your fitness and stamina slipping away, you'll see precisely how much you've lost by neglecting your body's need for exercise. Precisely, since after this happens and you drop back as many rungs as you need to resume the program without pain or exhaustion, your log will reflect the loss in fitness from neglecting daily exercise.

As you note each day's level in the "Rung" field of the log sheet and enter those data into the spreadsheet every month, you're amassing a permanent record of your progress toward fitness. Just as the declining, then leveling out trend line on the weight chart shows your success in controlling your weight, the ascending exercise rung line documents, month after month, your climb toward and eventual maintenance of physical fitness. Looking back at your old charts and recalling the difference in how you felt then and now will make it easy to keep going.

Private and portable

Unlike organised exercise programs or those requiring special equipment, you can begin this program at any time, practice it anywhere, and progress at your own pace without coercion or embarrassment. People who travel frequently usually find their exercise programs disrupted when they're on the road. After a two-week trip, they go back to the gym and are startled to discover how much they've slipped. Trying to catch up in a hurry leaves them sore the next day: hardly an incentive to go do it again! And before long the exercise program lies abandoned.

With this program, that *need never happen*. All you need is yourself, fifteen minutes, and enough floor space to lie down. You can continue this exercise program in your hotel room, while visiting family, or wherever, and unless you wish to tell them, nobody need ever know.

By exercising in private and keeping track of your own progress, you're assuming responsibility for your own health. If you undertake an exercise program for any other reason, you're likely to fail. As you advance through this program, you'll see your progress and take pride in it. If you put it aside for a time, you'll see the price you're paying reflected right in the numbers, and you can make your own decision about just how much time is worth devoting to better health and longer life.

Details

As you progress in this exercise program, you'll undoubtedly encounter numerous special situations that affect your progress. I'll try to discuss some of the most common, based on my own experience.

A regular schedule

If you want to make an exercise program a regular part of your life, it's best to assign it a particular time in the day and become accustomed to exercising then. If you're always used, for example, to doing your exercises right before hopping in the shower, it will increase the sense that something's wrong if you should skip them one day.

If, instead, you try to shoehorn exercising into a random snippet of "free time" every day, you're demoting it to a lower priority. Before long, it will become a duty to be disposed of at the end of the day and then, in all likelihood, discarded as one of the things you "can't make time for."

Certainly anybody with a harried schedule will have to improvise from time to time, and that's OK; it's far better to work an exercise session in at a weird time than skip it. But from day to day, try to find a time that fits your schedule and stick to it.

When you're sick

When you come down with a cold or 'flu, you may be sufficiently wiped out that the very thought of exercising makes you shudder even worse. That's fine; exercising is about being healthy. The last thing you want to do is associate exercising with feeling even more awful than you already do after being trampled by a rhinovirus. Put the program on hold until you're on the mend and feel up to resuming it.

When you do start exercising again, you may be in for a surprise. If you stop exercising for four or five days, it's normal to have to drop back one rung and work back up. After a week of illness, you may have to drop three rungs or even more. People talk about a cold "taking something out of you." With the feedback this program provides, you'll see it right in the numbers. What's more, you'll know when your recovery is complete, since that's when you'll return to the rung you'd attained before falling ill.

If you're seriously sick: typhoid, plague, creeping body rot, rely on the guidance of your doctor about exercise.

Serious problems

The marvelous mechanism that is your body has many signals to let you know when problems arise. If you're exercising and you encounter chest pains, shortness of breath, or other indications that something is awry inside your rib cage, *don't ignore them!*

Please, if any of these symptoms arise, stop exercising, consult a doctor, and resume the program only under the guidance of a medical professional. Physicians can wire you up and run a comprehensive set of diagnostics to find out whether something is seriously wrong or you're just trying to push your body beyond its natural limits.

Ignoring these signals from your body is the height of folly. It can lead to all kinds of tedious and exasperating side effects such as sudden death.

Other exercise

This exercise program is intended to help you reach and maintain a reasonable level of physical fitness. It's safe to say that once you're doing the exercises above rung 20, you're in far better shape than most of the people you pass on the street.

If you're inclined to participate in active sports, work out with weights, or engage in other forms of exercise, great! With this program as a foundation, you can extend your fitness in any number of ways. If you have the time, and you enjoy it, it'll only make you healthier and happier. I'd recommend, however, that unless you participate on an absolutely regular schedule, you look on those forms of training as supplemental to the basic level of fitness maintenance provided by this program.

If, nevertheless, you're inclined to say, "One hour at the gym is worth a day's exercise on the Lifetime Ladder" it's easy to see if that's true. If you find it hard to maintain your current rung, or to progress at the rate you wish, then the other exercise isn't adequately replacing the balanced set of exercises this program provides. Feedback doesn't lie.

The weight log spreadsheet contains a feature to help you keep track of other exercise programs. If you participate, whether regularly or sporadically, in such a program, put a check mark after the "Rung" column on your log sheet every day you do the other exercise. Record these check marks in the "Flag" field of the weight log worksheet by entering the number 1 in the Flag cells for the days you checked on your log sheet. The monthly log will display, at the foot of the

Flag field, the percentage of days that month you performed the other exercise. This can give you a feel for how significant that activity is with regard to your weight or your progress up the Lifetime Ladder. The monthly logs, kept in your log book, will show your participation, which you can review as you evaluate your weight and health progress.

I use the Flag field to keep track of a weightlifting program with which I supplement my regular exercise. Every day I work out with weights, I check the flag field; at the end of the month I can see how frequently I got around to it. You can use the flag field to keep track of any event you'd like to track in connection with your weight and health, for example, every time you go out for pizza with the gang at lunchtime, or swim the Hellespont in lieu of dinner.

High altitude

If you normally live at sea level and travel to the mountains, remember that the air there is thinner. Each lungfull of air contains less oxygen, and it's oxygen you burn as you exercise. Consequently, you may find it's hard to get through your normal exercises, especially the running and jumping part. Don't push, just drop back a couple of rungs. If you spend an extended period of time at high altitude, you'll probably advance back to your original rung as your body adapts.

Regular exercise greatly reduces the effects of altitude. As you exercise, you increase the capacity of your heart to pump blood and your lungs to replenish the oxygen it carries. That's just what you need in the mountains, so don't be surprised how little you puff and wheeze on your first ski trip after a few months of regular exercise.

Part II

Management

7

WEIGHT MONITORING

As we've seen in chapter 5, it's possible to extract the information that's needed for effective weight control, actual changes in weight, from daily weight figures. In this chapter we'll turn to the mechanics of keeping track of your weight and deriving the feedback you need from it.

Getting started

The first step in getting control of your weight is putting the weight measuring system into effect: starting to wear an eat watch. Don't put it off; start right away, even if you aren't interested or ready to start dieting until later. By the time you do begin to diet, you'll be familiar with how your weight behaves, comfortable with the tools, and used to interpreting the messages they send.

Get a good scale

To be useful, weight data should be reasonably accurate. The day to day variations in the rubber bag are bad enough without the scale getting into the act and adding its own two pounds. If you don't have a reasonably accurate scale, buy one. You don't need a super-expensive doctor's scale, but your scale should be accurate to a pound or so. Electronic scales that use a strain gauge instead of moving parts are cheap and plenty accurate; that's what I use.

Many scales read a little high or low all the time: what scientists call "systematic error." As long as it's only a few pounds and remains the same, this is no problem as long as you always use the same scale. But if a scale reads high one day and low the next, it's yet another source of confusion: the last thing you need. Try stepping on a scale

four or five times in succession. If it reads the same weight within a pound or so each time, it's fine. If the weight jumps all around, for example 170, 172, 168, 175 on successive weighings, junk it and get a better scale.

Keep in mind the variation among scales when you're traveling. If you visiting a friend and happen to step on his scale and it says you've gained 10 pounds overnight, odds are it's the scale, not you.

Start a logbook

The best way to keep your weight records is in a looseleaf binder. You could just use random pieces of paper, but you're far more likely to lose something that way. Even if you're keeping your records on a computer, you'll still need a logbook to record daily weights awaiting entry into the computer, and to file printed weight logs and charts from earlier months.

Get a three-ring looseleaf binder (a thin one is fine) and a package of index tabs. Make tabs for the following sections:

- Daily Log
- Monthly Logs
- Monthly Charts
- Long Term Charts

The "Daily Log" section is where you'll record the daily weight from the scale. Fill it with a year's supply of blank log pages. If you're using Excel, you can print the blank log pages at the same time you create the weight database for the year. Load the worksheet **`WEIGTEMP.XLS`** (it loads several other files automatically).

`WEIGTEMP.XLS` comes configured for monitoring weight in pounds. If you measure your weight in kilograms, enter 0 in the cell that displays "Pounds" in the "Weight" column; to specify your weight in stones, enter -1 in this cell. If you change the system of measurement, use **File Save** to update **`WEIGTEMP.XLS`** on your disc. When you create logs for subsequent years, then, the units you prefer will already be selected.

A new **Weight** menu will appear at the right of the standard Excel menus. Pick **New year log** from it. You'll be asked for the year you're making the log for (normally, you'll just use the default, the current year) and the month you'd like to start with, if not January. A new blank weight log worksheet is created, and you're asked to confirm saving it as **`WEIGHT`***yy***`.XLS`**, where "*yy*" is the current year

(for example, the log for 1995 will be named **`WEIGHT95.XLS`**). If you prefer a different name, fine; just enter it instead of the name proposed in the **File Save As** dialogue. Once the log worksheet for the year is saved, print it with **File Print**. Since you haven't entered any data yet, blank log pages suitable for recording your weight will be printed.

If you aren't using a computer, just run off a dozen photocopies of the blank form on page 116 and file them in the "Daily Log" section. Each month write the name of the month at the top of the form as you start to use it. You'll need to punch holes in the forms to file them in your logbook; buy a cheap three hole punch if you don't already own one.

Every day

Keeping track of your weight takes less than a minute per day. Once your logbook is started, making the entries in it will quickly become part of your daily routine to the extent you hardly think about it any more.

Weigh in

Weight records are most useful if you record your weight every day, at the same time of day, under the same circumstances. The best time to weigh yourself is right after you awake for the day. Since you won't have eaten since going to sleep, your body will tend to have its most consistent weight at that time. Always weigh yourself dressed the same way. The easiest way to get consistent results is to weigh in stark naked.

Log daily weight

If you keep the logsheet in a book near your scale, you won't forget to enter your weight every day.

Even if you're using the Excel worksheet as your permanent log, it makes sense to record your weight on paper. At the end of the month, you can spend 5 minutes entering the data into the spreadsheet from the paper log. You can, if you like, enter your weight into the computer every day but unless you're obsessed with tracking day-by-day results, it's much quicker to scribble the number on the paper sheet and enter a whole month's data in one swell foop. (Besides, people like me shouldn't *consider* touching a computer right after

_____ 19__

Date	Day	Weight	Trend	Rung
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				

getting up—operating complicated machinery when possessed of the cognitive powers of a sea slug and the disposition of a polar bear with a toothache is most unwise.)

Keep the log for the current month on the first page of the "Daily log" section of your logbook. If you forget to weigh yourself or can't weigh in that day (for example, when you're traveling), make a note in the weight column of the log indicating what happened. Don't leave the column blank—that's likely to cause you to enter the next day's weight in the slot for the missing day and get the day and weight columns out of whack.

April 1989

Date	Day	Weight	Trend	Rung
4/1/89	Saturday	*145.5*		*25*
4/2/89	Sunday	*145.5*		*25*
4/3/89	Monday	*145.0*		*25*
4/4/89	Tuesday	*146.5*		*26*
4/5/89	Wednesday	*146.5*		*26*
4/6/89	Thursday	*145.0*		*26*
4/7/89	Friday	*146.0*		*26*
4/8/89	Saturday	*144.0*		*26*
4/9/89	Sunday	*145.5*		*26*
4/10/89	Monday	*Travel*		
4/11/89	Tuesday	*Travel*		
4/12/89	Wednesday	*145.5*		*25*
4/13/89	Thursday	*146.5*		*25*
4/14/89	Friday	*145.0*		*25*
4/15/89	Saturday	*140.5*		*26*
4/16/89	Sunday			
4/17/89	Monday			

⋮

Here's a sample log filled out for the first two weeks of April 1989. This individual is using Excel, so he's left the "Trend" column blank; Excel will calculate it automatically when the log is copied to the worksheet.

If you aren't using Excel, calculate the daily trend figure as described on page 201 and enter it in the "Trend" column. You could calculate

all the trend numbers at the end of the month, but it's better to spend a few seconds every day rather than look upon it as a page full of calculations to do each month. If you keep a cheap pocket calculator next to your logbook, you can calculate the trend in less time than it takes to write the number in the book.

Log exercise rung

If you're following the optional exercise program in chapter 6, record the level of exercise in the "Rung" column, right after you complete the exercises for the day. If you skip a day, or aren't participating in the exercise regime, leave the "Rung" entry blank.

Daily summary

- Weigh yourself
- Record weight in log
- Calculate trend number (Non-Excel users only)
- Exercise (optional)
- Record exercise rung (optional)

Every month

At the end of the month, the log is used to produce a weight and trend chart and to calculate weekly weight loss or gain and the daily calorie shortfall or excess.

With Excel

Excel performs all the calculation and charting automatically. If you aren't using Excel, skip to the next section for the equivalent manual calculations. Load the current year's database, created originally as described on page 114, into Excel. The file name would be, by default, **`WEIGHT95.XLS`** for the year 1995. Scroll to the proper month and enter the data from the "Weight" column of the paper log into the corresponding cells of the worksheet. There's a little-known feature in Excel that makes entering tables of numbers like this easy. Select the Weight cell for the first day of the month by moving the mouse there and pushing the button. Then, without releasing the mouse button, drag the selection downward to the Weight cell for the last day of the month and then release the button. Now you can type the weight for each successive day of the month, right from the log sheet, pressing

ENTER after each number; Excel automatically advances to the next cell in the column. If the weight is missing for a day, enter an explanatory word in the Weight cell, for example "Travel" or "Forgot." Don't leave the Weight cell blank; Excel needs a non-number there to account for the missing weight.

If you've recorded exercise rung numbers in the "Rung" column of the log, transcribe them to the Excel worksheet in the same manner, except there's no problem with leaving missing entries in the Rung column, or the entire column, blank. Finally, if you're recording some other event relevant to your weight: participation in some sport or exercise program, days you skipped lunch, or whatever (see page 108), for every day you've flagged with a check mark to the right of the Rung column on the logsheet, enter a **1** in the "Flag" column of the worksheet; leave flag cells for unchecked days blank. Flag cells you mark with a **1** will display a check-off mark rather than the number 1 to make the function of the field clear.

Once you've transcribed the data from the paper logsheet to the Excel worksheet, save the worksheet to disc with **File Save**. Next, print a permanent logsheet containing the calculated trend with **File Print**. Enter the number of the month (1 for January, 2 for February, etc.) in both the From and To page boxes in the print dialogue, then click OK. Take the log sheet that emerges from the printer, check it against the original paper log, and if it's OK, three-hole punch the page and file it at the end of the "Monthly Logs" section in your logbook. The new sheet becomes part of the permanent record of your weight. Discard the original sheet on which you wrote your daily weight.

Now create the weight chart and analysis for the month by selecting any cell within the month (move the pointer there with the mouse and click), then choosing **Monthly chart** from the **Weight** menu. Excel will clank and grind for a few seconds, and render a chart unto you. Print a copy of the chart with **File Print**, three-hole punch the page, and file it at the end of the "Monthly Charts" section of your logbook. If you have plenty of disc space, you may want to save the chart as an Excel chart file: choose **File Save As** and enter a name like "**JUL90**" to identify the chart file. If you don't wish to keep the chart file, choose **File Close** and answer "No" to the "Save Changes" query—you can always regenerate the chart for any month by selecting a cell within that month and choosing **Weight Monthly chart**. The shortcut key CONTROL+**m** can be used to create a monthly chart instead of the **Weight Monthly chart** menu item, if you prefer.

Next, add the new month's data to the permanent weight and trend database by choosing **Update history** from the **Weight** menu. The

new month is appended to the history worksheet, **WEIGHIST.XLS**, used for long-term chart generation. You can examine it directly by popping its window to the front with the **Window** menu. If you forget to update the history database, don't worry; all data added since the last update will be copied into the history the next time you request an update, or automatically before any long term chart is generated.

Finally, save the updated weight worksheet with **File Save** and close it with **File Close**. You're done with Excel for the month, and you can leave it if you like. This is an excellent time to make a backup of the files in your **WEIGHT** directory onto a floppy, label it with the date, and put the backup away in a safe place. Your lifetime weight database is too important to lose in a hard disc crash! Now you're ready to interpret the chart in conjunction with your weight control objectives. Turn to the "Monthly analysis" section below.

Excel User Monthly Checklist

- Load **WEIGHT***yy*.**XLS**
- Enter daily weight from log
- Enter daily exercise from log
- Save worksheet
- Print monthly log page and file
- Print monthly chart and file
- Make floppy disc backup

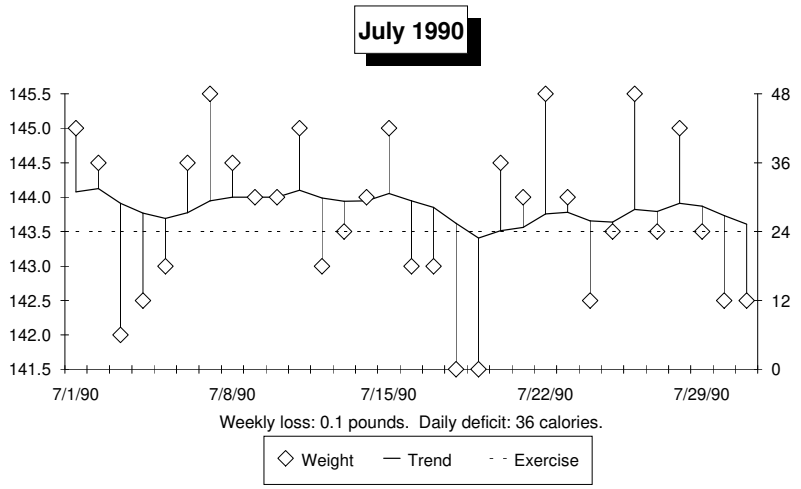
By hand

If you're keeping the log by hand and calculating the new trend number every day, when the end of the month arrives your logsheet is already complete. Simply move it from the "Daily Log" section of the logbook to the end of "Monthly Logs." Copy the last number in the Trend column of the completed logsheet to the blank above the first day in the Trend column of next month's. Label the new month's logsheet with the month and year.

Next, calculate the rate of weekly weight loss or gain and the daily calorie deficit or excess from the first and last trend values of the month following the instructions on page 203. Finally, plot a weight chart for the month, using the chart below as a model, as described on page 203. Write the weight loss or gain rate and calorie deficit or excess at the bottom of the chart and file it at the end of the "Monthly Charts" section of your logbook. Now it's time to look at the chart and see what it means.

Monthly analysis

Here's my own chart for July of 1990, generated automatically by Excel. If I'd plotted the chart by hand, it might not look as crisp, but the message would be no less clear.



The chart is presented in the "Floats and sinkers" form described in chapter 5 (see page 81). The heavy line is the weight trend; individual daily weights are plotted as diamonds with lighter lines tying them to the trend for that day. The exercise rung is plotted as a light dashed line with missing days blank (or the whole line absent if you've opted not to exercise). The weight scale, in pounds, is at the left while the right hand scale reads exercise rungs. At the bottom of the chart, a trend analysis appears.

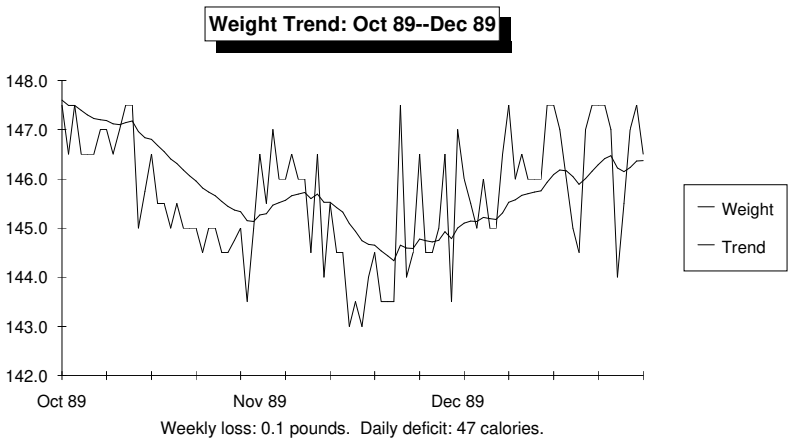
This chart is easy to interpret. The analysis, as well as the trend line, indicates my weight was, for all intents and purposes, constant in July. The very slight downtrend of a tenth of a pound per week indicates I ate about 36 fewer calories per day than I burned, a shortfall I could remedy, if it bothered me, by eating the equivalent of one more pat of butter or slice of bacon per day.

Long term charts

Excel users can easily prepare long-term charts that show daily weight and the course of the trend over a number of months. From the

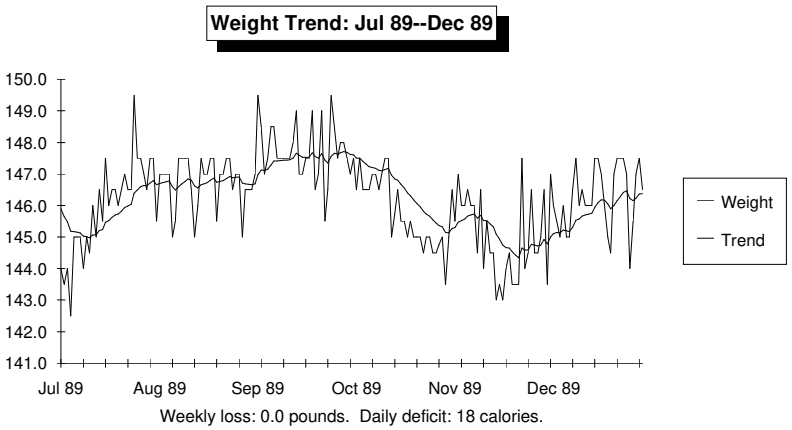
Weight menu, you can select any of the following of charts, illustrated here with my weight data from 1989.

Weight Quarterly chart plots data for the last three months:

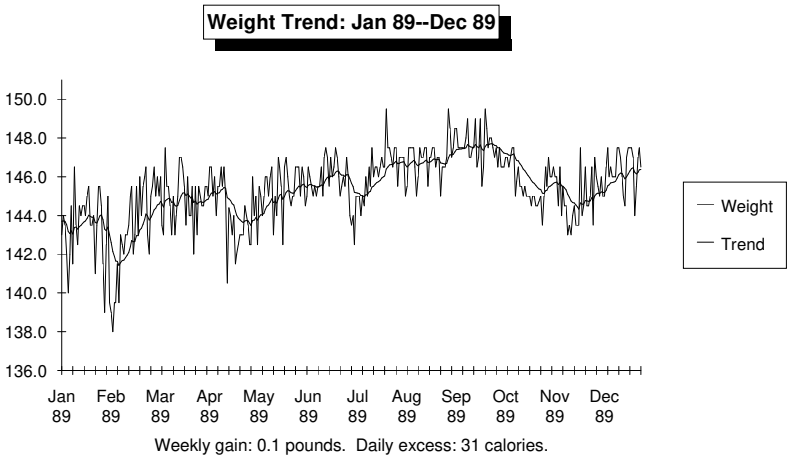


Long term charts show only the daily weight and trend, with the weight plotted as a thin blue line and the trend as a thick red one (obviously, you'll need a colour screen and/or printer to appreciate the colour, but you can tell the lines apart by their thickness even in black and white.)

Weight Semiannual chart shows the last six months in the same format as the quarterly chart.



Notice how the longer term view changes the appearance of the chart. What looked like a reversal of trend on the quarterly chart now is seen more a part of a lazy drift back and forth around my weight goal of 145. For an even more distant view, choose **Weight Annual chart** to plot the last 12 months.



This shows that over all of 1989, as measured by the trend, my weight varied only from 142 through 147.5, and that the changes within that band were gentle. This is a picture of the eat watch in

action: providing proportional negative feedback to keep my weight within a couple of pounds of the goal of 145.

You can make a chart of the entire historical database, back to the very first weight you entered, by selecting **Weight Complete history chart**.

Obviously, you won't be able to produce a quarterly chart until you've collected three months of weight data, or a semiannual or annual chart until you have six or twelve. Be patient, let the data pile up, and before long you'll be able to review your progress over the months. File the long term charts you print in the "Long Term Charts" section of your logbook. You'll find them interesting to review on occasion, particularly as they come to document your weight loss and subsequent success in maintaining your goal.

If you're charting by hand, I don't recommend going to all the trouble of re-plotting to make long term charts. The easiest way to obtain a longer view is to remove the charts for a series of months from your logbook and arrange them, overlapping one another, on your desk or on the floor, to form a wide chart. Be sure to line up the charts so the same weight is at the same place on the vertical grid. You can also photocopy the monthly charts then tape the copies, properly aligned, into a scroll. You can unwind the scroll to see any long term view you like. If you do decide to plot long term charts, don't bother with the daily weights. Just plot the trend, since plotting the daily weights doubles the time and makes the resulting graph look "busy." The daily weights contribute nothing to the analysis; the Excel macros plot them because it takes no longer for the computer to do it, and it's interesting to see the long term relationship between the weight and trend.

Every year

At the end of the year, make up a new year's supply of blank daily log sheets. Excel users should simply repeat the procedure used to make the first batch (see page 114). When the new **WEIGHT***xx***.XLS** worksheet appears, copy the last trend number from the previous year's log (the Trend entry for December 31st) and enter it in the Trend column of the new year's log on the line above the January 1st entry labeled "Trend carry forward." This lets the trend for the new year continue right where it ended the previous year. Once that's done, save the blank log worksheet for the new year and use **File Print** to print the logsheets for the next year; file them in the "Daily Log" section of the logbook. Be sure to make a floppy disc backup of everything

in the **WEIGHT** directory and save the backup in a safe place. Should your weight records fall victim to a hard disc disaster, you need only reload the most recent backup and re-enter the data for the subsequent days from the logsheets.

If you're keeping records manually, just copy some more blank log sheets for the new year and continue to carry the trend from the last day of each month onto the new month's log as before.

The end of the year is an excellent time to sit back and review the charts for the preceding twelvemonth. Looking back over the changes in your weight over that time, whether quick loss as you removed weight, minor fluctuations after achieving stability, or an upward creep when something disturbed the balance, and reflecting on the events at those times, how you felt, and how you reacted to the changes, will increase your understanding of how weight affects you and, more importantly, how you can affect it.

8

PLANNING MEALS

> Dry dog food is far better than canned! It is more economical, takes up less space, and is generally better tasting. With reconstituted dried milk (and sugar if you like) most dry food tastes not too different from dry breakfast cereal. A hundred pound sack of dry dog food contains as many calories as a ton of fresh potatoes. The dog food also contains protein, vitamins, etc., that the potatoes do not.
>
> —Robert B. DePugh, in *Can You Survive?*

Our understanding of the rubber bag has led us to an effective tool that accurately indicates whether too much, too little, or just the right amount of food is going in. In the last chapter you've learned how to work that tool, integrating it into your daily and monthly routine so the information it yields can guide your eating.

All the information in the world, however, doesn't change a thing until somebody takes action based upon it. In losing weight, "somebody" is your body. Now we'll turn to planning meals to control the calories that go in. Analysis of the trend based on daily weight measurements is the key engineering trick to weight control. Meal planning for predictable calorie intake is the central management tool which closes the circle and achieves control over weight.

Why plan meals?

The goal of meal planning is a predictable and reliable daily calorie intake. We can't really wear an eat watch to tell us when to stop eating, but we can accomplish the same objective with a little paperwork in advance. By planning meals then sticking to the plan, you're not only guaranteed to achieve your goal, you eliminate the uncertainty about

meals and the need for on-the-fly judgements about what, when, and how much to eat that are a prime contributor to weight gain in people living stressful, chaotic lives.

Planning meals in advance may seem foreign; an act that stamps out some of the precious spontaneity that makes life enjoyable. I think you'll see the reality isn't that bad, but first consider why planning meals is worth discussing at all. Eating is important; it's one of very few things in life that isn't optional. If you don't eat, you die. If you eat too much for too long, you die. You wouldn't consider for a moment investing in a company that had no budgets, where everybody said, "We just spend whatever we feel like from day to day, and hope it will all work out in the long run." Not only would such a business be prone to bankruptcy, its managers would have no way of knowing where the money was going; there'd be no way to measure actual performance against goals to discover where problems lay. No, only a fool would risk his money on such a venture.

Yet by trying to "wing it" with regard to what you eat, to balance your long term calorie intake meal by meal, making every decision on the spur of the moment, you're placing something even more precious than your money, your own health, in the hands of a process you know inevitably leads to serious trouble.

You encounter, in business, the rare exceptions: managers who can run a small to medium sized business without a budget or a plan. They are "naturals," endowed either with a talent for assimilating vast quantities of detail and extracting the meaning within, or else with a sixth sense for emerging problems and an instinct for solving them. These rare individuals, born with a "sense for business," are the managerial equivalent of people with a built-in eat watch like Skinny Sam. They can get along without the help of the numbers and calculations the rest of us need to steer a steady course.

So it is with weight control. Just because some people manage without planning their meals doesn't mean it'll work for you or me. We must, like most managers in business, supplement our unreliable instincts with numbers that chart our goal and guide us there.

Calorie targets

In business, a budget collapses a huge amount of detail, the individual transactions, into a small collection of numbers: how much money is allocated to various general purposes. In planning meals, all the multitude of foods and the infinite variety of meals are similarly reduced to a single number: calories per day. To plan meals, it's essential to

know how many calories per day you're trying to eat. Where does that number come from?

As you gain more and more experience monitoring and controlling your weight, you'll collect enough information to know precisely how many calories your own body needs per day. Until then, you can start with guidelines for people about like you. Based on your height, frame size, and sex look up the calories burned per day in the tables on pages 22 and 23. Pick a number in the middle of the range given. For example, Dietin' Doris, five foot four in her bare feet with an average build, would start with a calorie target of 1770. (The range in the table runs from 1574 to 1967, and the average of these numbers is $(1574 + 1967)/2 = 1770$.)

This target assumes Doris' goal is maintaining her present weight. If she wants to lose or gain weight, it must be adjusted based on the daily calorie shortfall or excess she intends. To lose weight at the rate of one pound per week, Doris should eat 500 fewer calories per day than she burns. (Thus, over a week she'll end up 3500 calories shy and hence burn off 3500 calories of fat: one pound.)

Subtracting the calorie cutback, 500, from the number she burns gives the number she can eat per day. Her calorie target is thus $1770 - 500 = 1270$ calories per day.

How many meals, and when?

Only total calories per day count. For the most part it doesn't matter when you eat them or how you spread them around the day, so long as your schedule stays pretty much the same, day in and day out. If, over the years, you've settled into a regular schedule of meals, there's no reason to change it; just adjust *what* you eat at those meals so the total calories comes out right. For most people, this means the regular three meals a day, and eating the same kinds of food at those meals you're accustomed to.

If you have an unusual eating schedule you're happy with, by all means keep it. Just divide the calories you need over the meals you eat in a reasonable manner. For various reasons dating back to the lifestyle of programmers in the bronze age of computing, I have long preferred one of the weirdest meal schedules of all. I eat basically one meal a day, about 7 or 8 hours after I awake. I supplement this, on occasion, with a light snack a few hours later. Virtually every diet book ever written considers this a prescription for disaster; most counsel eating more frequently than normal with less per meal. Indeed, for years I was a walking (or waddling) testament to this conventional wisdom.

And yet, merely by adjusting calories per day, I lost 70 pounds and subsequently stabilised my weight while retaining the one meal per day schedule I prefer.

Meal schedule can affect how hungry you feel, how much energy you have at various times in the day, how well you sleep, and a host of other things. But, as long as it's regular, it doesn't have a whole lot to do with whether you gain or lose weight. So, stay with what works for you.

(One exception is worth noting. If you eat a large meal and then immediately go to sleep, all those calories are going to be lazily paddling around in your bloodstream for hours while your metabolism is at its very lowest level. Fat cells will start banking the extra calories and you'll end up packing on weight yet wake up ravenously hungry the next day [since all the calories were turned into fat]. There's an easy solution: don't do it. Eat meals early enough before retiring so your body has a chance to burn the calories.)

A regular schedule

Whatever meal schedule you choose, it should be regular: pretty much the same from day to day. Eating at different times on the weekend compared to weekdays is no problem, but no prescription for calamitous weight gain is so reliable as a chaotic, unpredictable meal schedule.

If you literally don't know when and where your next meal is coming from; if you're always "planning to catch something when I get a chance," you have no way to know how much you should eat at any given meal. If you know you're going to have a large dinner at 7 P.M., it's easy to compensate by going light on lunch. But if you go out to lunch having no idea whether dinner is going to be a thick steak with mashed potatoes or a bag of corn chips, how can you decide what kind of lunch is appropriate?

Animals who evolved over millions of years in a world where cold and hunger were the normal conditions of existence survive by playing it safe. If dinner *might be* whatever the vending machine can be coaxed to produce for whatever change you can find in your pocket (the modern, high tech equivalent of the paleolithic kids' plaintive "Awwww, Mom, not grubs again?"), you're not likely to settle for the cottage cheese slender special at high noon.

When lunchtime comes and goes unnoticed in the press of events, when dinner is deferred hour after hour until "just this last thing is finished," when you finally do get around to eating you're likely to

address the contents of the refrigerator with all the moderation of a Great White in a swimming pool crowded with splashing pinks. Then the next day, unlike the shark, you'll regret it.

It is possible to maintain a constant calorie intake in the face of an unpredictable meal schedule, but just barely. You have to constantly compensate from meal to meal, count calories incessantly, and often end up skipping meals and going hungry. This is the last thing you need when you're already short on calories trying to lose weight.

If it's at all possible, try to force your meals into a regular schedule, at least for the duration of your diet. You may find, in the process, you have more power over your schedule than you thought. For example, if you don't ever know whether, when, or where the gang will go out to lunch, consider brown bagging it instead. You'll miss some of the gossip and comradely banter, but every day you'll be able to count on a predictable number of calories at a known time.

Choose the chow

The next step is to plan, in advance, meals that add up to your calorie target, each day. Rigid planning of meals, in advance, and strict adherence to the plan is the most important management trick in losing weight. You will sacrifice some spontaneity for the duration of your diet, but you will be amply rewarded by rapid weight loss with the minimum hunger.

What to eat? Remember, you're an omnivore! It doesn't make much difference in terms of the weight you'll lose, but it has a lot to do with how you feel as the weight comes off. The best plan is to start with the meal schedule you're comfortable with now, and plan meals around that schedule composed of the kinds of foods you like to eat.

Meals through the day

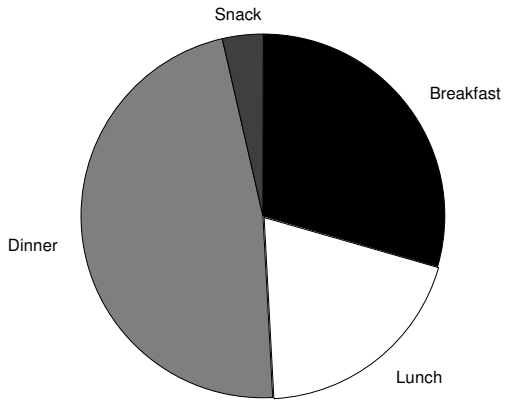
Most people don't spread their nutrition evenly through the day. Some prefer a large breakfast, a very light lunch, and a moderate dinner, while others skip breakfast entirely, eat a substantial meal in the middle of the day, and have a light supper in the evening. If you're happy with your present pattern of meals, stick with it. You may discover, once you start to cut back on food, that you consistently feel hungry at a specific time of day, in the late afternoon, for example. If that occurs, try shifting the balance among meals—moving, perhaps, some calories from dinner to lunch to spread your calories more evenly.

Doris plans a day

Let's consider a specific example of meal planning. Dietin' Doris, as we saw above, wants to eat about 1270 calories a day to lose a pound a week. She's used to a fairly substantial breakfast, a light lunch, and eats the largest meal of the day at dinnertime. She frequently enjoys a light snack in the middle of the evening. Doris decides to stay with this schedule, and apportions her 1270 calories like this.

Meal	**Calories**
Breakfast	375
Lunch	250
Dinner	600
Snack	45
Total	1270

The calories are divided among the meals as follows:



Having decided how many calories each meal should contain, Doris can work out specific menus for each meal, turning to the table of calories in various foods on page 215, or with the assistance of the Excel meal planning worksheet described below.

Starting with breakfast, Doris lists the kind of food she usually eats and comes up with:

Food	**Calories**
2 Scrambled eggs	190
Orange juice (8 oz.)	112
Bacon (2 slices)	72
Total	374

Right on the button! It looks like the slice of toast with butter and jelly will have to be foregone, but this is still a pretty hearty start to the day, if not one that's good for your heart.

Turning next to lunch, Doris tots up the components of her usual brown bag sandwich:

Food	**Calories**
Whole wheat bread (2 slices)	134
Turkey bologna (2 slices)	114
Brown mustard (2 tbsp.)	10
Iceberg lettuce	7
Total	265

Doris usually has a cup of tea with artificial sweetener or a diet cola with lunch and since neither beverage contains any calories to speak of, they needn't be included in the list. Lunch is slightly over the target of 250, but she'll compensate by adjusting another meal.

For dinner, Doris opts for a real treat:

Food	**Calories**
Porterhouse steak, broiled (4 oz.)	247
Baked potato with...	150
Sour cream (1 tbsp.)	26
Salad, consisting of:	
Iceberg lettuce (2 cups)	14
Chopped onion (1 cup)	65
Diced tomato (1 tomato)	26
Blue cheese dressing (1 tbsp.)	77
Total	605

Close enough! Adding up the three meals so far, Doris finds she's used up 1244 of her 1270 calories. That leaves 26 calories for the snack instead of the intended 45 but there are still lots of options available that won't push Doris over 1270.

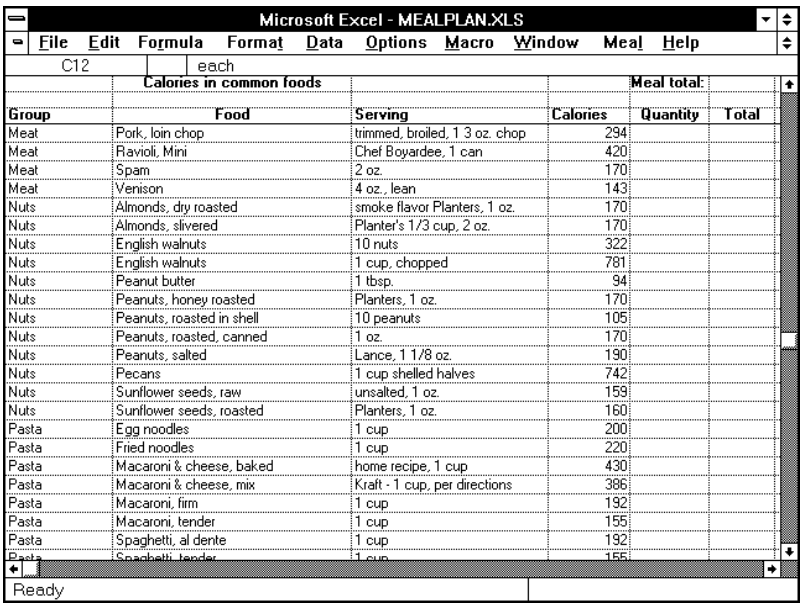
Snack option	Calories
1 tomato, sliced, with salt	26
Air-popped popcorn, 1 cup	25
Dill pickles, 6 (six!)	24
Olives, 5	25

I'm not recommending you choose the kinds of food Doris did, y'understand! If there's any truth in all the claims about cholesterol, Doris is eating as if she'd won a triple bypass on Wheel Of Fortune and wanted to use it before the offer expired. I deliberately loaded Doris' diet plan with the kinds of food you seldom think of in conjunction with dieting to drive home the point that losing weight needn't involve eating tiny quantities of foods with odd names that taste like sawdust. Assuming her calorie burn rate is 1770, as given by the table, Doris can eat like this, day after day, month after month, and lose weight at the rate of *fifty pounds per year*.

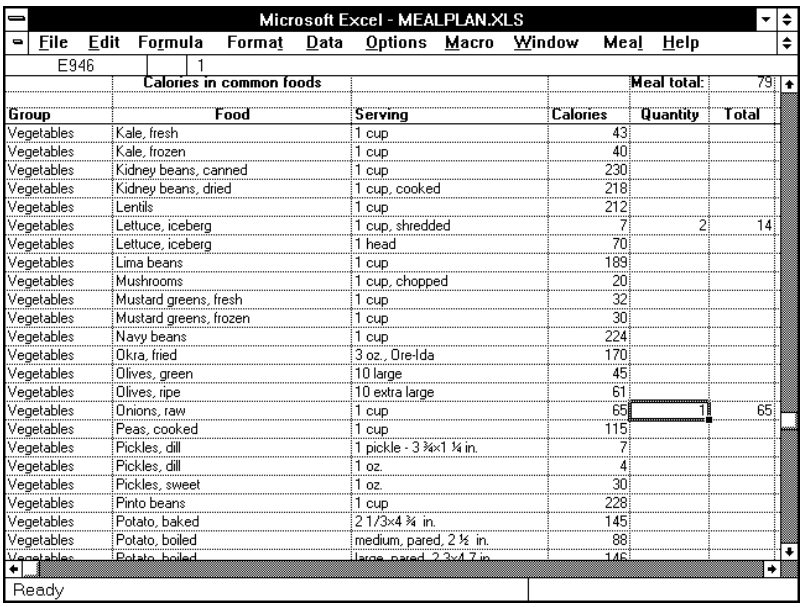
If Doris substitutes what the current consensus deems "healthier foods" for those she picked above (unsweetened cereal with skim milk at breakfast instead of bacon and eggs, poached fish instead of steak for dinner), she'll find she can almost always increase portion sizes or add additional foods to her meals, since most contain fewer calories per serving. Why? Foods that pack cholesterol do so because they're rich in fat and, as we've learned, nothing delivers lots of calories in a small package like fat: 3500 calories a pound. So when you choose foods that are lighter in fat, you're reducing cholesterol and calories at the same time.

Meal planning with Excel

Rather than do lots of arithmetic and flipping through calorie tables, you can use the **MEALPLAN.XLS** worksheet and Excel to expedite the selection of foods. When you load the worksheet, you'll see a screen like this:

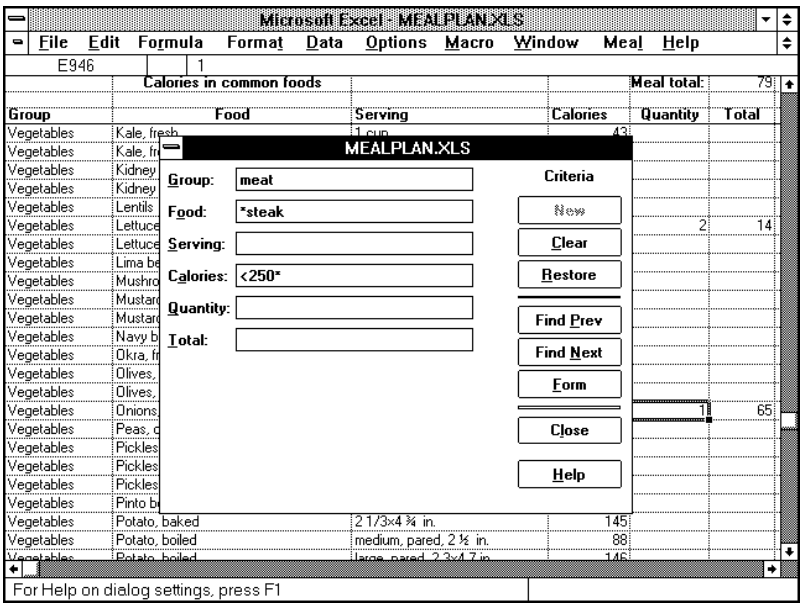


Note that a new **Meal** menu has appeared at the right of the menu bar, after the standard Excel menus. To clear any previous meal, select **Meal Clear meal**. The "Meal total" in the upper right of the screen will be blank, indicating no foods are selected for the current meal. You include foods in a meal simply by scrolling the display to the desired food (they are organised by food groups such as "Fish," "Dairy," and "Vegetable" in alphabetical order, then alphabetically within a group by the name of the food), then entering the quantity of food you intend to eat, in terms of the given "Serving" size, in the "Quantity" cell. The "Calories" column gives the number of calories per serving of each food so you can easily see the consequences of including a given food in your meal.

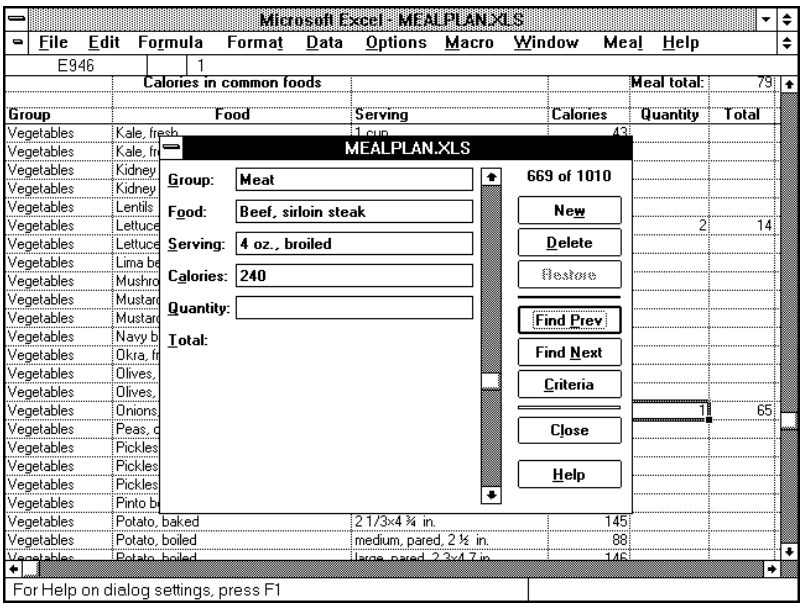


Here we're in the Vegetable aisle, entering the ingredients for the green salad Doris had for dinner. We've entered **2** in the Quantity cell for iceberg lettuce, since two cups will be included. The Total column shows the lettuce contributes a mighty 14 calories toward the daily goal. Next, we enter **1** in the Quantity field for onions, throwing a cup of chopped onions into the salad bowl (that may be a bit much, but perhaps Doris is taking a plane trip tomorrow and wants to deter her seatmate from striking up idle conversation). These are the first two items included so far in the meal and their total calories, 79, appears as the Meal total at the upper right.

Scrolling back and forth through a huge list of foods isn't much of an improvement over a printed table. Excel's **Data Form** facility, however, lets you retrieve foods from the database based on a wide variety of selection criteria.



Doris is shopping for steak. After pressing the "Criteria" button to specify constraints on the foods selected, she's entered "**meat**" as the food group (to avoid seeing frozen entrees such as "Stuffer's Iguana Steak with Amanita Gravy," or "Cruft Pasteurised Processed Steak-like Substance" in the dairy case), and "***steak**" as the Food category to choose all items containing the word "steak." Finally, in the interest of hitting the calorie target, Doris has specified "**<250**" in the Calorie field so only items with that number of calories or fewer need apply. Pressing the "Form" button returns Doris to the data form, allowing her to find foods that meet these criteria. Each time she presses "Find Next," the next qualifying food appears. After a few presses, Doris is tempted by a Sirloin steak.



When she settles on a porterhouse steak, she simply enters **1** in the Quantity field of the data form to add that item to the menu, with the standard serving size. If she planned on eating 6 ounces of steak, she'd enter **1.5** for the Quantity to indicate one and a half times the standard serving.

As each item is selected, the Meal total increases. If the meal exceeds the allowed calories, items can be removed by scrolling through the database or by using the **Data Form** to select items with a Quantity **>0** and present them for review.

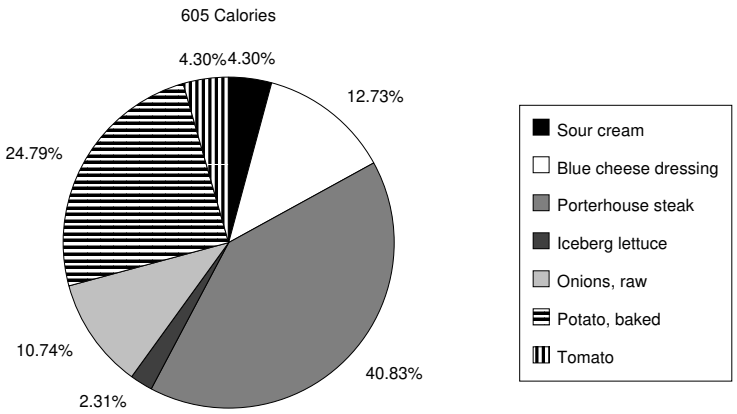
When a meal has been composed to your satisfaction, choose **Meal Extract meal** to create a new worksheet containing a summary of the food included in the meal. When the meal summary worksheet appears, the cell containing its title is highlighted; enter an appropriate description (for example, "Sunday Dinner") if you wish.

Dinner

Group	Food	Serving	Calories	Quantity	Total
Dairy	Sour cream	1 tbsp.	26	1	26
Dressing	Blue cheese dressing	1 tbsp.	77	1	77
Meat	Porterhouse steak	4 oz., broiled	247	1	247
Vegetable	Iceberg lettuce	1 cup, shredded	7	2	14
Vegetable	Onions, raw	1 cup	65	1	65
Vegetable	Potato, baked	each	150	1	150
Vegetable	Tomato	1 tomato	26	1	26
Total calories:					**605**

You can print a copy of the menu to use as you prepare the meal, or save it on disc for future reference, as you like.

When you're trying to adjust a meal to a given number of calories, it's useful to see which components of the meal account for most of the calories. Choosing **Meal Chart calories** generates a pie chart showing the relative calorie contribution of each item comprising the current meal.



The pie chart often points out aspects of a menu that don't jump out as obviously from a table of numbers. Doris might be startled to discover just how many of the calories in her dinner came from that single one tablespoon dollop of blue cheese salad dressing. The pie chart fingers it as the third largest calorie item, accounting for more than 12% of the entire calories in the meal. Given this information Doris might, for example, switch to a low-fat dressing that contains only 3 calories per tablespoon. It might not taste as lush and creamy, but the calories saved would allow her to add, for example, an ear of corn on the cob and still wind up with fewer calories.

If you frequently eat foods not included in the **MEALPLAN** database, you can easily add them. Use **Edit Insert** to open a blank row for the new item, enter its description in the same format as the other entries, then select the Total cell of the line above and the Total cell of the new line and use **Edit Fill Down** to copy the formula that computes the total calories onto the new line. Test the new item by entering **1** in its Quantity cell and make sure the Total for the item and the Meal total at the upper right reflect the calories in the new food. You can

use the **Data Sort** command to re-sort the food database any way you like: by food name, by number of calories, or by a combination of criteria. Refer to the Excel manual for details.

Eat watch in action

The eat watch is finally complete. First we discovered how to monitor the balance between calories in and calories out and now, by planning menus with specific calorie content, we've provided the second aspect of the eat watch, the signal that tells you when to stop eating. With menu planning, the signal is obvious. Prepare the food for each meal in the proper quantity, eat it all, then shut yo' mouth. What could be easier?

Before we apply this new-found tool to weight loss, we need to discuss some problems with meal planning in the real world and what can be done about them.

Serving size: helpings don't help

Meal planning requires total control over not just what you eat, but also how much. This is more difficult in practice than it might seem at first glance, particularly when you're sharing home cooking with the rest of your family. Assume that Doris managed to lose the weight she set out to, and now she's back eating the 1770 calories a day that keeps her weight stable. After a few months of stable weight, Doris decides to put the annoyance of planning meals and charting weight behind her and rely on her judgement.

One night, there's a little left-over mashed potatoes. Both Doris and her husband Larry *hate* leftovers, and the kids... forget it! Larry scans the table, "Who's gonna make these mashed potatoes go away?" After two small faces disappear beneath the tabletop and the earnest supplications of Slobbers the Dawg go unheeded, Larry and Doris agree to split it. Doris ends up with an extra cup of the lumpy white and, to make it palatable, plops a pat of butter on the top. Hardly yummy, but at least it won't be staring out from the refrigerator tomorrow morning. Instead, it will be working its way to Doris' waistline. The extra helping of mashed potatoes and butter adds up to 173 calories and represents, all by itself, a 10% increase over the number of calories Doris needs to eat for steady weight.

If this isn't an isolated incident, but instead the next day Doris "has to have" another drumstick, or treats herself to a glass of milk before bedtime, a slight shift has occurred in the balance between calories

in and calories burned. If Doris had continued to plan her meals, it would never have happened. If Doris were still charting her weight and plotting the trend, it wouldn't go unnoticed. But she is doing neither, having concluded from her success in losing weight that she's developed a natural sense of weight control.

If the balance slips by as little as 150 calories a day—a glass of whole milk, an ounce of Fritos, a cup of plain yogurt, a bagel: Doris may start slipping from her stable weight. And the change will be so subtle, initially, that she won't even notice. The weight gain will be less than a third of a pound a week. This would show up quickly as a rising trend line, but it disappears in the several pound day to day variations in weight. Even after a month, Doris has only gained a pound and a quarter and doesn't notice it, either on the scale, in how her clothes fit, or how she looks and feels.

And since the change is so gradual, she continues not to notice as her weight creeps upward for a couple more months: tasting the gravy while making Thanksgiving dinner, polishing off the Chinese food in the restaurant to avoid asking for a doggie bag, "you can't go the ball game and not have a hot dog," and so on. Finally, Doris does notice. By that time, she's tacked on five or ten pounds, and now she really feels awful: not just fat, but persecuted and powerless. "I didn't change *anything*," she laments. "I haven't gone back to my old chocolate sundae pig-outs or pizza binges, and here I go gaining weight again!"

And all from one extra helping of mashed potatoes a day. Doris was overweight most of her life because she wasn't born with a built-in eat watch. She lost weight when she remedied that shortcoming by planning her meals around the number of calories she burned, guided by the trend of her weight. After becoming slender for the first time since grade school, she made the mistake of removing the eat watch. She fell back on her body's feedback mechanism to tell her how much to eat, and it continued to deceive her. To maintain her weight, Doris needs the continuing guidance of the eat watch. There's no need for meal planning to be obtrusive or interfere with Doris' enjoyment of meals. Indeed, in time, guided by the trend line and her experience with different meals, she'll probably be able to adjust up and down without ever adding up another calorie. But that skill takes time to acquire, and it works only in conjunction with the safety net of the trend chart to warn you of problems before they get too big and depressing to remedy.

Sneaky serving sizes

If calorie tables are to be of any use, you have to count the serving size you really eat, not the nominal size in the table. With food that comes in clearly-defined units, such as eggs, slices of bread, onions, or bottles of beer, it's easy to count how many you eat. But food that's made in a pot and ladled onto a plate or items you use without ever measuring, for example peanut butter and jelly on a slice of bread, can be very misleading.

Consider mayonnaise. An item in a calorie table that tells you the stuff runs 100 calories a tablespoon is only useful if you know how many tablespoons you're actually spreading on your turkey sandwich. It's tempting to just run down the table, find the entry for mayonnaise, and use the number given. But if you're actually using something more like five tablespoons instead of one (it can be done, trust me), that little miscalculation alone is enough to make you gain forty pounds a year. When you start planning meals, figure on actually measuring out those things you currently dispense with the "glop and slop" technique.

You may feel silly, for a while, carefully filling a measuring spoon with catsup, using a measuring cup on peas, or weighing ground beef with a kitchen scale. But feeling silly sure beats feeling fat, and before long you'll get used to what various quantities of food look like and be able to largely eyeball it, as long as you're honest with yourself.

Processed food manufacturers are another source of confusion with regard to serving size. They all want to convince you their food is low in calories (and sodium and cholesterol and all the other hot buttons), so they frequently print numbers on the package based on an unrealistically small serving. Get used to looking carefully at the "Servings per container" line along with the calories. For example, I have in my hand a can of Campbell's Cream of Mushroom soup. For time immemorial, or at least since can openers were discovered by the Assyrians, people have been popping the tops off these little red and white food modules and dumping them into a saucepan along with a can of water. Warm and tasty, but hardly low-cal, you think. But a glance at the can reveals the startling claim:

Calories 100

Only a *hundred calories?* Oh, well, they probably assume you're splitting the soup with somebody else, right? But looking at the whole label reveals:

Serving size .....4 oz.–condensed

(8 oz. as prepared - 226 g)
Servings per container 2 3/4
Calories 100

Two and three quarters servings per can? Now, that's convenient, isn't it? A little voice in the back of my head keeps whispering it's 2 3/4 servings a can to make the calories per serving come out 100, not in the interest of feeding an average family of 2.75 people. If you just glanced at the can, you might assume the whole can of soup was 100 calories. If you made the reasonable assumption that a serving was half a can, you'd conclude the total was 200 calories. But by reading the fine print the truth is revealed; each can of soup actually adds up to 275 calories—a far cry from that innocent little 100 on the label.

Or, how about snack food? Your favourite potato, corn, or tortilla chips probably come in at about 150 calories a serving, according to the bag. Well, that's no more than a glass of milk! But what's a serving? Hmmmm... one ounce. *One ounce*, now there's a laugh; when's the last time you or anybody you know sat down and polished off one ounce of potato chips? Got a postal scale? Go get it, and stack up potato chips until it reads one ounce. You may feel like an idiot, but I won't tell. Not a heck of a lot of potato chips in that "serving," are there? If you're anything like me, a "serving" of potato chips is a lot closer to an 8 ounce bag than a one ounce handful. Now we're talking major league calories: 1200 to be precise, between *half and three quarters* the total calories burned by most people in a day. And that's before the bean dip.

Meal planning won't control your calories unless you eat the quantity of food you plan. Be extra careful with "serving sizes" to make sure they reflect the quantity you really eat, and not some marketeer's idea of what makes a product "lite."

Eating out

Restaurants pose their own special problems. On the one hand, portion sizes are generally reasonable (at least here in health-conscious California), and you aren't tempted to take extra helpings as at home. Fast food joints, despite their reputation, actually work fine with meal planning. Since the individual items of food are completely standardised and the calorie contents are published in any number of books, you can just choose what you order to total up to the allotment for the meal you're having. As long as you don't order more than that, you're home free.

You can't get calorie counts at tonier restaurants, but you can guess pretty closely based on the main ingredients of a dish. As long as you don't eat out all the time, and you eat about the same amount of the same kinds of things you've worked out for home meals, you probably won't have any problem. The real difficulties arise at those eateries which delimit the hacker's universe: the pizza place and the Chinese restaurant. There's nothing inherently wrong with either kind of food (well, at least not with Chinese food), it's the way you tend to eat it.

If, like most people, you order a variety of Chinese dishes and take some of each, and if the people at the table have widely differing appetites, there's almost no way you can know how much you've had. Chinese food, gobbled from a mound in the middle of the table, exhibits the "pizza/popcorn phenomenon," the culinary equivalent of the tragedy of the commons. The essential difference between this kind of dining and normal meals is:

The faster you eat, the more you get.

This truth is burned deeply into the brain of anybody whose impecunious college days were fueled, in large part, by midnight pizza feeding frenzies. In other restaurants, or at the dinner table with cultured companions, poaching food from adjacent plates is frowned upon and may result in fork wounds. But when there's just a huge pile of eats, you have to be especially on your guard. The best way to deal with the problem, in my experience, is to take a reasonable amount at the beginning, filling up your plate to the degree it would be at home, then eat that much and stop. If there's food left over, so be it; surely somebody has a dog or will enjoy it for breakfast tomorrow (congealed pizza. . . nothin' like it!). Far better even to let something go to waste, shameful as we've all been raised to think of it, than have it go to your waist and spend weeks dieting it off.

Menu mix-and-match

Rather than planning a whole day's diet from scratch, it's generally more convenient to divide your calorie goal into meals, as Doris did, then prepare a variety of menus for each meal. You can decide which breakfast or what dinner far in advance, based on what you found at the supermarket, or on the spur of the moment; it's up to you. As long as all the alternatives for each meal add up to roughly the same

number of calories, you can pick any menu from the list, make it up, and dig in.

As you gain experience with planning meals, you'll undoubtedly amass a larger and larger collection of different meals, all of which are interchangeable in terms of calories. Also, you'll come to learn which restaurant foods are roughly equivalent in calories to your normal allocation for each meal. As this happens, you'll probably conclude that meal planning, which originally seemed likely to endow something you once derived great joy from, eating, into an exercise with all the romance and excitement of double-entry bookkeeping, is actually liberating. No longer do you have to worry whether you're eating too much or too little. No more do you have to forego something you like because you gulped too much at lunchtime. Now you'll be able to know, in advance, how much food to make or order, eat everything you make, and enjoy it all without feeling guilty.

Weight control seems almost an extra added benefit.

Taking the easy way out

Does the detail and complexity of planning meals seem out of place in our age of modern conveniences? Does adding up tables of numbers, even with the help of a computer, strike you as the last thing you want to do in connection with food? Do you look at all of this meal planning and calorie calculation and say, "Can't I just push a button and make it all happen automatically?"

Well, do I have a deal for you.

If you're not overly fussy about everything you eat being lovingly prepared on the stove; if cooking is something you do in order to eat, not because you enjoy it; and if "plenty and now" eclipses "gourmet epiphany" among your culinary desiderata, your meal planning and preparation can be simplified by about a factor of fifty.

What I'm talking about is frozen entrees and dinners, ready to microwave. When we prattle on about technological revolutions, we tend to get stuck on computers and cellular phones and satellite dishes, but for my money microwavable frozen food is right up there with the biggies. On a moment's notice, you can walk into the local feed store and choose among hundreds of well-balanced, generally nutritious meals, selected from the cuisine of a dozen different cultures. At a price amazingly close to the cost of the raw ingredients purchased at retail, you can pick what piques your palate, pop it in a poke, and pack it home. Don't want to eat it tonight? No problem, stick in the freezer and it'll be just as good six months from now! Hungry? Well, pop

that sucker in the nuke, set the scrooch gun for six minutes, and it's feedin' time, late twentieth century style!

What's more, there's no pots and pans to wash, no stems and peelings to rot in the garbage for a week, and... no leftovers—the portions are precalculated for one person and one meal. No more "runaway spaghetti inflation" (oops, too much water ..., add some spaghetti ..., too much spaghetti ..., add some water, etc.: just like making a bathtub of nitroglycerine when you were a kid). Plus, *they print the number of calories right on the box:* no more arithmetic! If you've budgeted 600 calories for dinner, just cruise the cache of cryogenic comestibles: here a Beef Stroganoff, there a zucchini side dish, everywhere a taste treat, until you hit the magic number. Further, given the number of different entrees and side dishes, the potential combinations are such that, even if you only ate frozen food from the local supermarket for the rest of your life, you'd never be forced to repeat the same meal.

(Some manufacturers don't deign to tell you the calorie content of their products on the box. Some provide a toll-free number you can call to obtain the information they consider you unworthy to know before purchase, but I choose to look at it this way: if they can't be bothered to tell me how *much* food is inside the box, how much do you think they care about *how it tastes?* Some frozen foods don't tell you how many calories they contain [or provide any other nutritional information], and others attempt to confuse you with deceptive serving sizes: for example claiming a package that a normal person would eat for a meal actually contains two servings. But companies that don't respect their customers enough to tell them the basic truth about what they're selling are rarely inclined to spend time on the finer and subtler points: if there's no calorie count on the box, or a package purports to contain 12 "servings" of 20 calories apiece, the odds are what's inside tastes like Kal Kan. Pass it by, and patronise honest companies that respect your intelligence.)

Now, I'm not saying that you don't give up something by eschewing fresh food and chewing exclusively on frozen. But, speaking as one who eats frozen food five days a week, you don't give up much, especially if you value the time and effort home cooking requires. Frozen food may not compete with the finest work of a great cook, but it's a lot better than *my* cooking, as the survivors of my culinary experiments will attest. One thing you don't get in frozen food is crisp vegetables and other crunchy roughage; it's as incompatible with the medium as luscious, liquid massed violin sound is with digital audio. But there's an easy fix. While Chef Magnetron is toiling away *à*

la cuisine congelée, don't sit around looking at your watch, muttering "When's dinner?" Spend the time doing something useful, like making up a fresh green salad to begin or end your meal, depending on which side of the Atlantic you prefer. By the time of the blessed beep, you'll have prepared the perfect complement to your meal: crunchy, fresh, filling, and full of fibre.

If frozen entrees are a convenience to the person in a hurry and a help to those trying to plan their meals whose good intentions can't overcome an aversion to accounting, they're salvation in a box for the serious dieter. As we'll see in the next chapter, serious weight loss is a serious business. It involves mood swings from elation to despair, the struggle between short term gratification and long term goals at the most visceral of levels: this meal right now against a longer life span. How can frozen dinners help? By guaranteeing you that, precisely on schedule, you'll get exactly the food you need: no more, no less. When the diet willies take hold, there's real comfort in knowing that in precisely four hours, ten minutes, and twenty-six seconds you will have a meal you know is tasty, nutritious, and filling—one that will banish your hunger, however bad it seems at the moment.

Once you've stabilised your weight and expanded your diet to encompass a wider variety of food, there is comfort in knowing that, whatever happens, you can regain control of your weight simply by going back to the frozen food that awaits in your freezer or the grocer's. Having taken weight off once that way, you know it isn't intolerable. Knowing you can always resolve an emerging weight problem, before anybody notices but you, will give you the freedom and confidence to explore variations in diet and style of life after you achieve your weight goal.

Summary

You've turned many pages, and turned over many difficult concepts in your mind since we embarked on our quest for an eat watch. Finally, our quest has come to an end.

The original dream was of a device that monitored, moment by moment, the calories we ate and burned, that told us when to eat and when to stop. On our many side-trips into apparently unrelated areas of engineering, mathematics, and management, we've found a way, starting from nothing more than daily weight, to accurately calculate the balance of calories eaten against calories burned. We've discovered the simple link between this calorie balance and weight gain or loss. Finally, we've developed a way, meal planning, to accurately

control the number of calories we eat without disrupting our meal schedule or forswearing the kinds of food we enjoy. Taken together, these techniques constitute an eat watch: they monitor calories in and calories burned (actually their balance, which is all that matters), and they tell us how much to eat, and when.

The long-sought tool of weight loss and permanent control is now ours. In the next chapter we'll turn to the practical steps to put it to work.

9

LOSING WEIGHT

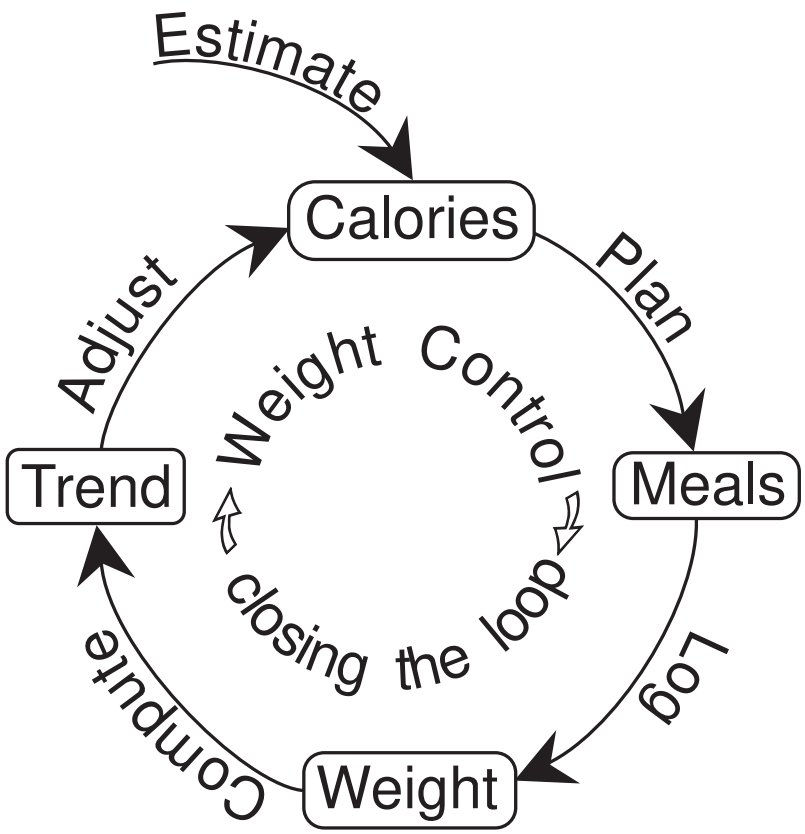
Ninety percent of this game is half mental.

—Yogi Berra

At last, we're ready to turn to the task of losing weight. We've studied the mechanics of the body to learn *how* it gains and loses weight. We've modeled the body as a feedback system to understand *why* we have trouble controlling our weight while others don't. We've found a way, starting from simple daily weight measurements, to determine the true course of the body's weight and the fragile balance between the calories that go in to the rubber bag and what gets burned. Engineering has given us the tools of weight control; we possess a power we didn't before. Now we must grasp those tools and use that power to manage a successful program of weight loss and permanent weight control.

Closing the loop

It's time to pull together all the seemingly disjoint threads in the previous chapters into a unified whole. We already know what we need: a proportional control negative feedback system that tells how much to eat. All the pieces of that system are now in hand. We need only hook them up into this; the solution to the problem of weight control.



As you'd expect, the system forms a closed loop. Many of the words are familiar. Let's take a detailed look at how it fits together.

Estimate Calories

You start with an initial estimate of the number of calories per day your body burns. This doesn't have to be particularly accurate, since feedback will soon establish your own actual rate. Make an estimate using the tables on pages 22 and 23 based on your height, build, and sex. If you're active physically, use a number toward the high end of the range, and if your daily workout consists of changing channels, guess closer to the lower number. Don't worry about the exact number—it's nothing more than a guess.

If your goal is maintaining a constant weight, use the number directly from the table. If you wish to lose or gain weight, subtract or add

the number of calories specified by your diet plan. (See page 157 for details.)

Plan Meals

With the calorie number in hand, you can plan a variety of meals, as described in chapter 8, that regulate what goes in to that number of calories per day. As long as you follow the meal plan, you'll be guaranteed to receive the intended number of calories every day: no more, no less.

Log Weight

With your calorie intake—what goes in—under control, the effect should be reflected in your weight. Log your weight every day as described in chapter 7. As you collect daily weight information, you amass data that contain the truth about the balance of calories in and calories burned.

Compute Trend

Once you've collected a couple of weeks of daily weight readings you can compute the weight trend, chart the progress of the trend, and interpret the chart as described in chapter 7. We began with a rough estimate of the number of calories to achieve an intended weight goal. The trend figures and chart express reality: what actually happened. By fitting a straight line to the trend, you obtain the *actual* calorie shortfall or excess, based on your own body's true rate of burning calories, not a number picked from some table.

Adjust Calories

With the true calorie balance now known, adjust your calorie target to match your body's burn rate. Suppose you started assuming your body burned 2200 calories a day and planning to eat 1700 calories a day in order to lose a pound a week. After the first month of the diet, you examine the trend chart and discover you actually lost weight faster than you planned: at the rate of 1 1/4 pounds a week, evidence of a daily shortfall of 600 calories instead of the 500 you intended.

As long as you're carefully following the meal plan you know your calorie intake is close to 1700. The only possible cause of the discrepancy, then, is that you're actually burning 2300 calories a day rather

than the 2200 you guessed. Now you get to choose; if you feel fine losing 1 1/4 pounds a week and prefer to get the diet over with so much the quicker, stay with your original meal plan. If, on the other hand, the extra calorie shortfall is bothering you, simply adjust your meal plan to supply 1800 calories a day: the 2300 you really burn minus 500 for the planned weight loss. In a couple more weeks, you should see a trend line that's falling one pound a week.

And around we go...

Surely, what we have here is a feedback system, and like any feedback system, it just keeps on going. Information: daily weight, the trend calculated from it, and the actual calorie balance determined from the trend, leads to action: controlling calories eaten by adjusting your meal plan. Feedback is negative since, when you discover *too few* calories going in, you compensate by *adding* calories to the meal plan and vice versa. Control is proportional because adjustments to the meal plan are incremental, based on the degree to which reality, reflected in the trend line, diverges from the goal. (A bang bang diet would, by contrast, let you eat anything you liked as long as you were within 10 pounds of your goal. When the scale cried "tilt," you'd have to stop eating lunch until you got back to the goal. Some people actually do this, but it's stressful to the body and hardly a way to enjoy life.)

The most important aspect of our proportional negative feedback system is the one we've come to expect, *it works*. It is robust, reliable, stable, and self-adjusting. Since we have a closed feedback loop, even changes that would otherwise require careful compensation are accounted for automatically.

Suppose you take up jogging and run a couple of miles every other day. The number of calories you burn increases and, with meal planning holding calories eaten constant, shows up before long as a falling trend line. How many extra calories are you burning by jogging? Just look at the trend chart! The calorie deficit calculated from the trend tells you precisely how much more to eat now that you're more active.

If, on the other hand, you have lunch every day at *Chez Maintenant*, the trendy gourmet drive-thru joint and, unbeknownst to you, Chef Bubba starts making his secret sauce for the Escargot Burger with two tablespoons of mayonnaise instead of one, the extra hundred calories that crept past your meal plan will soon engender a slow, steady rise in the trend line. Even if you don't know what changed, the course of action is clear: cut back 100 calories somewhere. If the rest of your meals are pretty predictable, you may even be able to finger the

culprit and switch to the tasty yet less filling Slug Nuggets.

Assured stability

From everything we've learned about feedback systems you might remark, "Well, of course it works! How could it possibly fail?" And of course it can't, as long as each link in the feedback loop continues to function. Once you implement this plan, the only way you will ever substantially diverge from whatever weight goal you set for yourself is by eating more or fewer calories than your meal plan prescribes, or ceasing to calculate your weight trend and adjust your meal plan based upon it.

You may have some trouble getting used to this plan and you will certainly endure some hunger if you're currently overweight and cut way back on calories to reduce, but as long as you continue to let the feedback of the trend line guide what you eat, *you will never gain or lose weight unexpectedly or uncontrollably*. Think about that. For the price of calculating the trend and planning meals, you will have purchased total freedom in the kinds of food you eat, your meal schedule, and how much or how little you choose to exercise. As long as you keep the calories where the meal plan dictates and continue to adjust them as the trend varies, no change will cause your weight to creep very far from where you want it.

This is truly worth it. Eat what you like, not what somebody says you "should." Schedule meals around your life, not your life around some "permanent weight maintenance plan." As your activity changes from season to season and year to year, don't worry about your weight creeping out of control. Any change is automatically corrected, long before it reaches the point where anybody else notices, and the correction requires only a small adjustment to your meal plan. You are free. Free to experiment with food, meal schedules, exercise, or anything else; free to find what works for you: what makes you feel good, have the most energy, and enhances the enjoyment of your life.

As engineers, we discovered the underlying cause of weight gain, a broken feedback system, and found a fix for it. As managers, we developed mechanisms and procedures to apply the tools of engineering to forever banish overweight from our lives. And now, having not just a fix, not just a plan for coping, but a real *solution*, we can go to work in earnest on losing weight.

Getting ready

Before embarking on a program of weight loss, it's wise to spend a couple of months monitoring your daily weight, keeping a weight log, and producing the charts at the end of each month. You'll become accustomed to the procedures and, more important, familiar with how your weight behaves from day to day and the trend from week to week. You'll be in a better position then to appreciate the changes that occur when you cut back on calories. If you decide to try the exercise program in chapter 6, it makes sense to start right away and get a couple of months of slow progress under your (ample) belt before beginning weight loss. Why? Because it will give you a base line for the shape you were in before losing weight and a powerful incentive to continue weight loss once you discover how much relatively small reductions in weight contribute to your fitness and stamina, seen directly in your reaction to exercise and the rate you advance from rung to rung. Also, exercising stimulates the growth of muscle tissue. As you diet, the body can consume muscles as well as fat to meet its calorie needs. Exercise not only protects and increases your muscle strength during a diet, it causes more rapid loss of fat. Since you're adding muscle tissue, not burning it, fat remains the only source of energy and is consumed all the more rapidly.

Before embarking on any project, it's important to have a plan. A plan is a statement of goals and expectations, not a straitjacket; plans can be changed as events unfold. But without a plan, there's no standard against which to measure your progress, and consequently no feeling of accomplishment as you approach the goal.

Weight goals

What *should* you weigh? No two people are the same. You can't look up an "ideal weight" in a table and conclude you're a fatty if you're above it or wasting away if you're slightly below some magic number.

The following tables provide general weight guidelines for men and women. The height in these tables is measured barefoot, and the weights assume no clothes.

"Frame" is a measure of how robustly you're built. If your nickname is "Spider," you probably have a small frame; if "Magilla," you're likely a large. In any case the overlap between the categories is so large and the variation from person to person so great there's no reason to worry precisely which category you fall into.

There's really no such thing as an "ideal weight" for anybody. The

human body is highly adaptable; as long as you're within five or ten pounds of the optimum you'll be fine. It's far more important to find a weight at which you feel good, one you have no trouble maintaining, than to struggle for a number printed in a table, churned out by an equation in all likelihood, that has nothing to do with your own body.

Optimum weight: Men

Height		Frame		
Feet	Inches	Small	Medium	Large
5	1	111–119	119–130	126–141
5	2	115–123	122–134	130–145
5	3	118–126	125–137	133–149
5	4	122–130	128–141	137–153
5	5	126–134	132–144	140–157
5	6	129–138	135–148	144–162
5	7	133–142	139–152	148–166
5	8	137–146	143–157	152–170
5	9	141–151	147–161	156–175
5	10	145–155	151–166	161–180
5	11	149–159	155–170	165–185
6	0	153–163	160–175	169–190
6	1	157–168	165–180	174–195
6	2	161–172	169–186	179–200
6	3	165–177	174–191	183–205
6	4	170–181	179–197	188–211

My own experience taught me to be skeptical of recommended weight tables. When I began my diet in 1988, my goal was 165, my weight in those halcyon college days of fitness and the bottom of my diet in the 1970s. This is close to the middle of the published range for a person of my height and build. When I reached 165, I still felt fat; I was obviously packing fat in all the usual places. Plus, I was having no trouble continuing the diet and weight loss was proceeding at a steady pace. So... I decided to continue until the inner tube was deflated.

It wasn't until I reached 155 that I began to feel the fat monster capitulate. At 155 I had no obvious paunch and the difference of 10 pounds, much more perceptible than 10 pounds between, say, 195 and 205, made me feel *much* better. I was advancing through the exercise program by then and I could feel how the additional weight reduction

contributed to my fitness.

Optimum weight: Women

Height		Frame		
Feet	Inches	Small	Medium	Large
4	8	90–97	94–105	103–117
4	9	92–100	97–108	106–120
4	10	95–103	100–112	109–123
4	11	98–106	103–115	112–127
5	0	101–109	106–119	115–130
5	1	104–112	110–122	118–134
5	2	107–116	113–126	122–138
5	3	110–119	117–130	125–142
5	4	114–123	120–134	129–146
5	5	118–127	124–138	133–150
5	6	122–131	128–142	136–154
5	7	126–136	132–147	140–159
5	8	130–140	136–151	145–164
5	9	134–145	140–156	149–168
5	10	139–150	144–160	153–173
5	11	144–155	148–165	158–178
6	0	149–161	153–170	162–184

I initially tried to stabilise my weight at 155, but I discovered a tendency to creep upward from that point. It seemed I had to constantly watch my diet on a daily basis to remain at 155. Feedback systems often have points of natural stability. Experience had taught me that 165 was such a stable point, but I didn't feel good there. I'd learned that 155 was unstable. So, I decided to see if there was a stable point below 155 I could be happy with. In due course, I arrived at 145. That was it. I haven't deviated from that weight by more than five pounds for over two years.

I'm sure you're not interested in the details of my weight, but the story is worth recounting because it points out how you, as I, must find your own individual weight goal in the process of reducing and maintaining your weight. I'm a person who'd tended to overweight all his life, with an average build, and yet I settled at a weight slightly below the published recommended minimum for a small framed person my height.

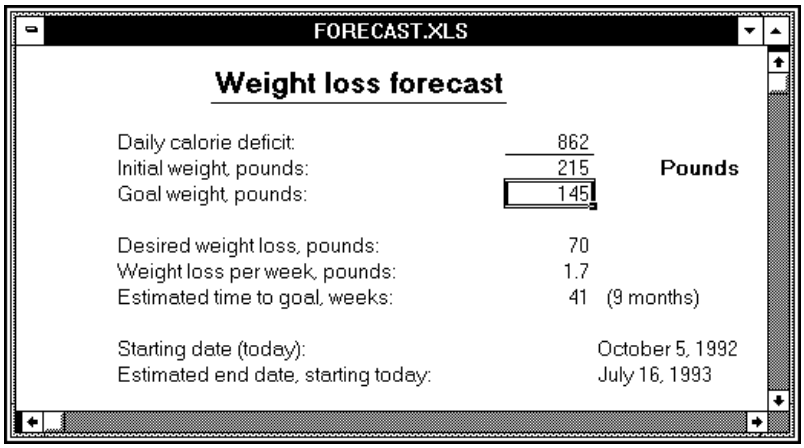
Choose your goal, but prepare for refinements as you approach it

and discover where you feel the best. Watching the trend line will help you find a goal that's easy to live with.

Diet planning

You know what you weigh now. Given an initial target weight, either from the tables above or from your own past ("I want to be able to fit into my old football uniform"), it's easy to plot the course of a diet to get from here to there.

A Excel worksheet for diet planning is supplied in the file **FORECAST.XLS**. When you load this worksheet you're presented with the following screen:



Enter your current weight and goal on the indicated lines. If you measure your weight in kilograms instead of pounds, enter 0 in the cell that shows "Pounds" to the right of the "Initial weight"; for stones, enter −1 in this cell. You can then try various values in the "Daily calorie deficit" cell and observe the predicted length of the diet and completion date, assuming you started the diet today. Instructions for manually calculating the duration of a diet are given on page 204.

As you experiment with various calorie deficits, remember that a deficit of 500 calories a day translates to a loss of 52 pounds per year. If you're patient, you can lose all the weight you want to at that rate. Larger deficits peel the weight off faster but extract a greater price in hunger along the way. As the diet progresses you'll see the actual calorie shortfall based on the trend and compare it to the plan. Once you're into the diet and begin to observe a consistent calorie

shortfall and weekly weight loss, you can revise the forecast based on the actual numbers you're observing, or adjust your meal plan to achieve the intended rate of reduction.

Ask the doctor

Every diet book implores you not to begin any diet without first consulting, then proceeding under the supervision of a physician. This is excellent advice. First, we who write diet books don't want to get sued for gazillions of dollars if you drop dead two days into the diet, whatever the reason. But seriously, you're about to put your body through a significant period of organic stress and it's wise to make sure you're up to it. Further, doctors are in the business of maintaining the human body, and explaining your goals and plans to somebody who's seen it all before many times is well worth the time and money of a visit to the doc.

I'll be honest and admit I didn't follow my own advice here. Doctors ... *brrrrrr* ... can't stand 'em. But please do the reasonable thing: as I say, not as I did.

Important. If you've been, or think you may have been exposed to toxic chemicals such as pesticides, defoliants, or industrial chemicals, *don't* begin this or any other diet without consulting a doctor. Toxic chemicals accumulate in fat cells and cause no harm as long as they're immured there, but if you rapidly lose weight they can be released faster than your body can dispose of them and can lead to serious problems. Fortunately, most hackers have been exposed only to tetchy computers and flaky software which rot the mind, not the flesh.

Take a "before" picture

As you lose weight, the changes in how you look and feel occur so gradually you're apt not to notice them from day to day. Weight charts help you see how far you've come, but there's nothing like comparing your appearance before your diet with your present shape to make your progress obvious. Ask somebody to snap a couple of pictures of you before you start your diet. In addition to a mug shot, get a full-length picture and, if you can stomach the thought, a profile. These don't have to be portrait quality; snapshots will do.

As your diet progresses and you feel, on occasion, a need for encouragement and a sense you're making progress, pull out the "before" pictures and compare them with how you look in the mirror. What you're going through may not be the greatest of fun, but the payoff

will be right before your eyes. Even after you're through dieting and accustomed to slenderness and stable weight, keep that "before" picture around. Hide it, if you wish, beneath those neckties Uncle Fred has given you for Christmas every year since 1965, but keep it. Every now and then the years you spent overweight and feeling powerless will seem like a dream and the minor annoyance of controlling your weight no longer necessary. Whenever that happens, pull out those pictures. Then you'll remember.

Before long, folks will forget your former appearance. A "before" picture remains your own private link to the past, a reminder that being thin is much better and well worth the minor effort to maintain. (Yes, I have a "before" picture, and I look at it occasionally. Unfortunately, so can you. *Business Week* kindly featured my "before" picture in the issue of May 25, 1987. Sigh. Still, it does show what you can do with a wide angle lens.)

The initial plunge

> Well, the first days are the hardest days,
> Don't you worry any more.
> 'Cause when life looks like Easy Street,
> There is danger at your door.
>
> —The Grateful Dead, *Uncle John's Band*

No matter how long or severe your diet, the first 72 hours are the worst. This unfortunate fact leads many people to abandon diets which, if continued, would soon yield sustainable weight loss without undue discomfort. Once you've surmounted the difficult period at the start of a diet, you can be assured the worst is behind you; it's unlikely you'll experience anything that bad for the rest of its course. Humans may have a limitless ability to ignore unpleasant facts, but we're also able to endure truly awful realities: high school, boot camp, root canals, going public, life—as long as we know it's only for a while and we'll never have to do it again.

Planning a diet from an understanding of how weight loss really works gives you a handle on how long you'll have to endure its unpleasantness. Knowing how feedback can control your weight equips you with at least intellectual confidence that once you've lost weight you'll never have to go through *that* again. As you see the trend line in action, your initial confidence will increase as experience confirms theory, logic, and calculation.

In this section we'll look at the mechanics of getting a diet underway, why the first days are the hardest days, and how to get through them to the easier part beyond.

Breaking down (fat) is hard to do

The reason it's so tough to start a diet follows directly from our understanding of the rubber bag, how fat cells store and release calories, and the relationship between calorie intake, weight gain or loss, and hunger as shown by the chart on page 55. Regardless of the shape of your own feedback curve, if you tend to overweight it's certain the left side of the curve, the hunger signal when you eat too little, looks much like the one in that graph.

In order to lose weight, you have to reduce your calories sufficiently to move beyond the flat part of the curve where your body compensates by adjusting metabolism into the downslope at the left where you're actually losing weight. This follows from understanding the simple world of a fat cell. There's no central control in your body that tells cells what to do metabolically. You can think all the right thoughts for as long as you want, but the only thing that's going to cause your fat cells to start tapping their reserves is lowering blood sugar, the ultimate product of the food you eat, below a given level. As the fat cells, one by one, detect low blood sugar, they cease banking excess calories or sitting on the sidelines and begin breaking down fat and releasing energy into the bloodstream. This is what's happening as you move from the flat part of the curve onto the downslope: the fat cells are beginning to make up the shortage of food and, as they do, your weight begins to fall.

Once that happens, you're in "burn mode." Part of your daily need for calories is now being met by breaking down fat, and as long as that continues your blood sugar won't drop to the very low levels that trigger severe hunger. Unfortunately, first you have to get into that mode, and that's what makes the start of a diet so trying. To begin losing weight, you have to cut back substantially on calories, enough to move beyond what metabolism can adjust for, to trigger the fat cells to make up the shortage. But, as you can see from the feedback chart, that requires going well into the region where hunger urges you to eat more. Further, there's a delay between the time you reduce your calorie intake and when blood sugar falls low enough for the fat cells to react. Even more time elapses before substantial calories from breaking down fat reach the bloodstream. Unfortunately, hunger has no such delay.

This explains the rocky start every dieter must endure. There is a delay, usually between 48 and 72 hours, between the time you cut back on calories and when fat burning begins in earnest. In those hours, you will experience the most severe shortage of nutrition in the entire course of your diet. You'll feel cold, weak, irritable, tired yet prone to sleep poorly, and a constant, gnawing hunger that urges you toward the refrigerator and implores you to rethink your resolve to lose weight. Yes, it really is that bad, and I'm not going to try to sugar coat it as many diet books do; better to face it squarely and know what you're in for and that it's worth enduring.

First, some perspective: the first two or three days of a diet are rough but, all in all, you won't feel anything close to as miserable as when you catch a winter cold, nor will you suffer as long or feel the lingering effects of a cold. A cold makes you feel really awful and leaves you in worse shape. Starting a diet makes you feel less miserable for fewer days than a cold and it's the first step toward much better health. Only the fact that it's self-inflicted makes it harder to live through. After all, you don't voluntarily catch a cold and you don't have the option of ending it at will. I view what must be endured in the first few days of a diet as an investment that will pay off in reduced suffering later on. As I mentioned in conjunction with exercise, it's worth comparing the undeniable aggravation of dieting with the inestimably less enjoyable sequelæ of excess weight: heart attacks, strokes, and premature death. If you think of a balance sheet with three days of hunger on one side and six weeks of recuperation from a coronary on the other, it's a lot easier to get through the first days into the long haul where dieting becomes at most a nuisance to be tolerated.

When to start

Plan to start your diet at a time when you have at least two weeks, ideally a month, of "normal life," what you do in a typical day, ahead of you. It's hard enough to make the initial adaptation to losing weight without trying to fit it around a vacation, the holidays, extensive travel, lots of entertaining, and the like. All of these events can be taken in stride once you're used to managing a diet, but it's best to hit your stride before dealing with the distractions, complications, and temptations they present. Starting a diet in a period that's representative of your normal life helps you adapt your diet to a typical day, not an odd special case.

Start your diet at the beginning of a work week: Monday for most of us. As your body initially reacts to reduced calories and makes

the shift into burning fat to make up the deficit, you're going to feel hungry. If you're just sitting around with nothing else to think about, the hunger may dominate your thoughts to the extent you're tempted to give up the diet. But, if instead you're busy, trying to get a lot of things done in a limited amount of time, your thoughts will be focused on the task at hand and hunger, while still present, will recede from the centre of your attention. In fact, keeping busy is one of the very best ways to get over the initial hump in dieting. If you anticipate a particularly difficult and stressful week coming up at work, that's an excellent time to plan to start your diet.

This is one of the ways stress actually helps you lose weight. Being on a diet doesn't help you handle stress; indeed, it reduces your energy somewhat and will probably make you more irritable than usual. (The latter isn't altogether a liability in high-stress environments. In P. G. Wodehouse's story "The Juice Of an Orange" the dieting hero tames a wild animal and gets the girl thanks to this very irascibility. My personal experience is less dramatic, but I *have* won some arguments I'd likely have lost otherwise.) However, stress and preoccupation with difficult and numerous tasks *does* help you diet. On many occasions you've probably become immersed in a thorny problem and worked right through your usual mealtime, noticing only hours later. The same thing happens when dieting. Not that you should delay or skip meals: a regular schedule is particularly important in the early days of a diet. But the same absorption that leads to skipping meals beforehand can keep you from counting the seconds until the next meal once a diet is underway.

Planning to start a diet on a quiet weekend at home is unwise, and scheduling it to begin during a restful vacation is an absolutely *wretched* idea. Not only will you manage to wreck what would otherwise be a blessed period of serene relaxation, you'll have to deal with the very worst part of dieting, the few days of hunger when you start, in an environment where the minutes pass ever... so... slowly, and the next meal seems something of legend, receding forever into the misty future. By getting the diet underway at the start of the work week, by the time the weekend arrives you'll be well adapted and, in all likelihood, the hunger you experience will be minor and readily tolerated.

Planning and scheduling meals

A really rigid meal plan and schedule makes the early days of a diet much easier to stomach. I'd suggest, before you start, sitting down

and working out the first five days' menus in complete detail, based on the meal plan you've developed as described in chapter 8. That way, when you do feel hungry, you're at least certain when your next meal is coming and what it will consist of—just pull out the plan and look. If you space your meals evenly through the day and balance the calories among them, a glance at the plan assures you that, however hungry you feel at the moment, you don't have that long to go before you can eat something to assuage your hunger.

In addition, a rigid plan protects you against one of the most dangerous temptations in dieting: the tendency, when preparing or ordering a meal whilst really hungry, to add a little more food. The plan helps you overcome this ever-present danger of the first and hardest days. Trust the plan, follow it to the letter, and in a few days you'll find most of the hunger and temptation behind you.

Make a special effort to eat your meals at regular times for the first week. If random delays result in your meals coming at odd times, your calorie balance around the day will be uneven. This will almost certainly cause worse than usual hunger during the longer gaps between meals. It's bad enough waiting for the next meal without the uncertainty of not knowing when it will arrive. When you start your diet, do whatever's necessary to make your meal schedule regular: pack a lunch, eat frozen food, and decline dinner invitations that would skew your mealtime. Once you're firmly on the course of weight loss you can relax these constraints, but a regular schedule at the beginning is well worth it for the peace of mind in knowing when you'll get to eat next.

The fast track

By far the simplest and most healthy way to get your diet underway is to start directly on the meal plan you've laid out for the duration of the diet, choosing when you begin as described above. Grit your teeth, reassure yourself that in three or four days you'll be feeling fine, and get it over with.

There is, however, an alternative. I don't recommend it, but I have done it myself, and if you find it impossible to get through the first few days of dieting on the regular meal plan, you might consider it. The idea is to start your diet by drastically cutting your calorie intake for the first few days: to engage in a partial fast. "Huh? I'm *hungry* and you're telling me to eat *less*?"

There are couple of reasons to try it if all else fails. Remember, what makes the first few days of a diet tough is the delay between

your cutting back on calories, the consequent fall in blood sugar, and the eventual transition to burning fat to make up the shortfall. If you gradually reduce calories, your body will tend to adjust metabolism downward rather than tap its fat reserves. That's why you need a substantial calorie deficit like 500 calories a day to get a diet underway. An even larger shortfall will cause a more precipitous plunge in blood sugar and should trigger the transition to burning fat more quickly. Starting your diet with a radical cutback in calories may reduce the length of the transition from three days to two or even fewer.

Second, fasting often induces a kind of "beyond hunger" state in many people. You may find this easier to endure for a day or two than the consequences of a smaller calorie shortage. Your reaction may be different, but many people find they don't feel much worse on 500 calories a day for one or two days than on 1200. If you're going to feel hungry, better to minimise the duration and wring the maximum weight loss from it.

If frustration with getting into a diet leads you to try this approach, be reasonable. Don't consider going totally off the feed. Instead, plan a calorie intake of 500 to 600 calories for each of the first two days of your diet, then move on to the regular meal plan. Since you'll be eating very little, concentrate on foods with lots of bulk but few calories. For example:

Food	**Calories**
Breakfast	
Low-fat cottage cheese (1 cup)	164
Lunch	
Hard boiled egg	82
Dinner	
Low-fat cottage cheese (1 cup)	164
Salad, consisting of:	
Iceberg lettuce (1 cup)	7
Chopped onion (1/2 cup)	33
Diced tomato (1 tomato)	26
Italian dressing (1 tbsp.)	69
Total	545

You can season any of these foods with salt, pepper, or any other spices that are essentially free of calories. Along with these food items, drink plenty of liquids: at least three quarts a day. As we'll see on page 167, you need to keep plenty of fluid flowing through the rubber bag for the duration of your diet to dilute and flush out the

nasty chemical by-products of breaking down fat. This is especially important when you're administering a shock to the system by fasting. You're trying to get the fat cells to start burning earlier and quicker, and you need even more water to wash out the gunk they'll spew as they come on line. Further, having your stomach filled with anything, even water that's just passing through, helps counter the immediate desire to eat; polishing off a tall glass of your favourite (non calorie bearing) beverage is at least putting something in your mouth when you'd rather be eating. And yes, in case you didn't know, and, like most hackers, are a confirmed guzzler of diet soft drinks and aren't overly obsessed with organic this and natural that, be aware that caffeine is a highly effective appetite suppressant.

I don't recommend this kind of gung-ho start to a diet, but if you really have trouble getting past the first few days on your regular meal plan, you may want to give it a shot. I've done it both ways, and I must say that if, for some reason, I ever needed to lose a lot of weight again I would start off with a two day 500–600 calorie fast.

The long haul

After two or three days, the worst part of your diet is behind you, receding into the past if never completely forgotten. You've adjusted to reduced calorie intake, fat is being consumed to make up most of the difference between the calories you're eating and what you're burning, and the weight is coming off, although it will take a little while for the trend to clearly reflect this. Now you're into the main part of the diet, where you'll stay until you arrive at your weight goal. As the weeks pass, you'll probably find the diet becomes less and less of a bother; your body continues to slowly adapt to burning fat more efficiently, you become accustomed to eating less, and, before long, you'll start to notice the difference in how you look and feel. Once the changes in your waistline and weight become obvious, you're into the payoff period: where the benefits so obviously outweigh whatever discomfort you experience that abandoning the diet becomes unthinkable.

Trend tracking and monthly adjustment

Continue to record your weight every day, compute the trend number from it, and chart the trend at the end of every month. In the first few weeks of your diet, you may want to calculate the trend and plot the weight chart weekly or even daily. If you're using Excel, you can enter weights as frequently or infrequently as you like. Excel will

produce charts of partial as well as complete months; just select a cell in the current month, even if the remaining days are blank, and pick **Weight Monthly chart**. A chart showing the month to date will be generated, complete with trend analysis of the days so far.

Partial month charts are an interesting way to watch the trend begin to drop initially and then settle into a steady decline, but don't attach too much significance to the first couple of weeks or try to adjust your meal plan based on every week's change in the trend. After a month, look at the trend chart, compare the weekly weight loss rate and daily calorie deficit with what you planned, and make the appropriate adjustments to your meal plan or diet plan as described on page 151.

When you adjust your meal plan to increase or decrease calorie intake, don't expect to see the change reflected immediately in the trend line; remember, it lags behind. Give any change at least two weeks to show up in the trend or, better, wait until the next monthly review of your plan. Since the effect of changes is subtle and slow to emerge in the trend, monthly adjustment is adequate and keeps you from constantly fiddling with your meal plan.

Pernicious painful plateaus and baneful bounces

One reason to plot the trend daily or weekly is to overcome the psychological punishment day to day variations in weight would otherwise mete out: the awful week-long plateaus and day to day zig-zags in weight that reflect nothing more than how much water happens to be in the rubber bag. As we saw in the chronicle of Dexter's diet on page 66, you'll go nuts if you concentrate on daily weight. Focus exclusively on the trend to reveal the slow, inexorable progress of your diet.

If you encounter periods when your weight seems painted on the scale, or if one morning you wake up hungry as a cave bear yet five pounds heavier than yesterday, examine the trend line on the chart. As long as the trend line is falling, you're continuing to lose weight. As long as your daily weight, whatever it may be, is below the trend, it's continuing to drag the trend line downward. Recalling these simple facts and taking the time to plot a trend chart so you can see them in action lets you bypass the torture that drives most dieters to despair.

Every few months you may encounter a stronger kind of plateau: a period where the trend line itself falls more slowly or even remains constant for a few days. As we've discussed in connection with finding a permanent weight goal, there are certain weights where the body seems especially stable. I think these plateaus in the trend indicate

you're passing through one of those stable points. If you're taking off lots of weight, it stands to reason there will be periods when the body pauses, adjusts to all the changes going on, then resumes losing weight. Stay with the diet and in a few more days the trend will resume its decline, usually at the same rate as before or steeper, making up for lost time. The simple arithmetic of the rubber bag always wins out in the end; as long as you're eating less than you burn, your weight will continue to fall at a rate determined by the calorie deficit.

If you encounter a plateau in the trend that's on the verge of driving you nuts you might, as a last resort, consider a one- or two-day fast of the kind described on page 163. That may be enough to break the temporary equilibrium and start the trend downward again. On the other hand, simple patience will certainly have the same effect in at most a few more days. The best way to treat these rare plateaus in the trend is philosophically and with patience; think of them as a preview of the stability you seek when you reach your weight goal. When the body settles in around the goal and you increase your calories to balance what you burn, you can expect a trend line that stays almost flat month after month.

Fatty Metabolite and the Ketones

These dudes aren't a forgotten early sixties doo-wop band; they're a nasty bunch of chemicals that wind up in your bloodstream, menacingly swinging their carbon chains, as an unavoidable consequence of losing weight. Losing weight means burning fat. Burning fat means individual fat cells tapping their reserves, breaking down the complex fat molecules into the simple molecules you burn. Chemical plants produce waste products, and fat cells are no exception. Instead of pumping nasty stuff into the river at midnight that makes aluminium canoes fizz, fat cells dump their waste into the bloodstream in broad daylight, right along with the useful products of breaking down fat.

Most prominent among the waste products of burning fat are a group of chemicals called *ketones*. As long as you're burning fat, your body will be subjected to a constant dose of extra ketones in the blood, a condition referred to as *ketosis*. Ketones are, in the contemporary argot, toxic waste, and the prospect of subjecting yourself to a long-term dose of them is off-putting to anybody contemplating a diet.

But the alternative, not losing weight, is much less healthy. With a little knowledge and a simple trick, ketones can be conquered. First, while ketones are toxic, they're only slightly so. Dieting won't make you see huge hairy bats (unless, of course, you saw huge hairy bats

before). Second, the waste products of burning fat aren't insidious—they don't accumulate in the body like heavy metals or some organic toxins. Instead, they get swept out of the bloodstream by the kidneys and liver and are excreted in fairly short order. This lets us cope with the problem by a very simple expedient.

Drink lots of liquids

As you burn fat, various waste products are released into your bloodstream. One way to minimise the impact of these chemicals is to dilute them in the bloodstream and, at the same time, crank up the rate at which the kidneys remove waste and dispose of it. This is easy to do; turn up the throttle on the bottle—drink more liquids every day.

For the duration of your diet, you should drink *at least two quarts* of liquid per day. "Liquid" means water or any non-caloric beverage you enjoy: diet soft drinks, artificially sweetened lemonade, Coiled Springs reduced benzene designer seltzer, etc. "Liquid" does not mean milk, beer, or Classic Coke, unless you're willing to subtract the calories they contain from the food you eat.

The best way to ensure you drink enough liquid every day is to make up a two quart pitcher of your beverage of choice, or buy a two quart (or two litre—they're about the same) bottle of your favourite commercial swill, then make sure you empty it by the end of the day. That way you won't have to keep a mental total, adding up every little cup and glass; as long as you empty the pitcher, you're cool.

That's "at least two quarts," by the way. Go ahead and drink any other liquids you like, whenever you feel like it, but make sure you guzzle the two quart minimum every day. It's hard to err in the direction of too much. As we saw on page 33, the body is a very efficient water pump; the more you put in, the more that comes out. And come out it will. Yes, increasing the number of trips to the bathroom every day is annoying, but with every visit you make to the temple of the porcelain goddess, you're flushing out chemicals released from burning fat that would otherwise continue to circulate in your blood, gumming up the works.

Stinko!

Many things change as you lose weight. You're eating fewer calories than before, drinking more liquids to help flush the system, and your entire body is adapting to a different size and shape. The body is an organic whole, not a bunch of loosely coupled pieces Frankenstitched

together. When you burn fat, you change the body's centre of gravity, you adopt a different posture to compensate, you reduce the amount of insulation, spurring increased metabolism to maintain your body temperature; these and many other adjustments occur, mostly unnoticed as the pounds peel off.

Cells are torn down and others are built. All this dynamism in your body shifts its normal chemical balance. Some of these changes manifest themselves in odd ways you should be aware of. Remember that "what goes out" of the rubber bag isn't entirely a matter of what transpires in the bathroom. A substantial amount of water, for example, transpires through your skin—it is released as water vapour even when you aren't obviously sweating. Additional water is released as moisture in the air you exhale, and still more if you drool.

The ketones that result from burning fat may show up in your breath as well as your blood. If it starts to seem like Monsanto's moved in among your molars, endure it for the moment—it's a sure sign you're burning fat.

As your body chemistry adjusts, other curious things may happen. One day, trapped in a tedious meeting, I began to emit an odor evocative of a roadkill skunk marinated in ratpiss. My esteemed colleagues were either too polite to remark upon this phenomenon, or (more likely) unsure of the culprit, so I managed to escape to the open air unfingered as the malodorous miscreant. This situation persisted for about two weeks, after which it disappeared for good as suddenly as its onset.

Should these or other side-effects of losing weight afflict you, take comfort in the knowledge they will pass. In the meanwhile, you can resort to any of the widely marketed remedies for these embarrassing problems. In my experience, they work adequately. You may not, as the advertising suggests, be dragged off to Lovers' Lane, but at least you won't be mistaken for Love Canal.

I, Klingon?

As you lose weight, the padding beneath your skin impolitely referred to as fat disappears. This can be lead to some surprises, particularly if you're working your way up the exercise ladder at the same time. As you exercise, you build muscles and increase the performance of the cardiovascular system (heart and blood vessels) that delivers matter and energy throughout your body. New blood vessels grow to fuel the muscles you're adding and more blood flows through the arteries upstream. This, combined with less fat to hide the machinery, may

result in your regarding your body one day, especially just after exercising, and wondering if you're in the midst of transmogrifying into a bad guy from one of the lower budget episodes of the original *Star Trek*. In particular, you may develop bulging blue veins, particularly on your arms and legs.

Unlikely as it may seem, this is a good sign. It indicates you're building muscles and that your heart is increasing in capacity to support them. Before long, everything will re-equilibrate and you'll resemble a human being once again.

Solid waste

When you diet, you eat less. Not just fewer calories, but less in terms of total bulk. Over the years your body has adjusted to the quantity of food you've been eating. When you abruptly reduce the volume of food, you're apt to disrupt the normal pace that solids move through the body. In other words, you may wind up full of shit. This isn't pleasant to think about or discuss, but it's even less pleasant when it happens to you unexpectedly, so it merits a brief discussion of how to avoid the problem.

Ideally, what you'd like to do is maintain the same *volume* of food you were eating before the diet while reducing its calorie content to the level in your diet plan. If you could manage this, you'd never have a problem, since the flow through your digestive system is driven by volume, not calories. Unfortunately, it's rarely possible to achieve this unless you were eating extremely high-calorie, low-residue foods before your diet, but you can come close. What you're looking for is foods with a high fibre content and relatively few calories, and this basically brings us to the vegetable aisle in the supermarket. A whole cup of raw cabbage, shredded, has only 17 calories but the bulk, mostly fibre, fills four ounces of volume. An entire artichoke, thorns and all, comes in at only 67 calories. A *head* of iceberg lettuce is just 70 calories, for Heaven's sake! Or consider green peppers, just 16 calories apiece.

The best way to avoid clogged pipes and green skin is to include lots of the leafy green stuff in your diet. You get a large amount of bulk per calorie, and not only does it make the digestive system move right along, it also makes for large, satisfying meals because there's lots of volume to munch down at every sitting. Including salads and lots of vegetables is by far the best way to increase the bulk in your diet. In addition, vegetables are rich in nutrients and slow to digest, meaning they'll satisfy you longer after each meal.

If the problem persists, sterner measures may be called for. Some people swear by adding bran to their food, and it may work for you; consider trying it. Personally, I find it gritty and unpalatable as sawdust (which it basically is—both are mostly cellulose). In addition, a one ounce serving of bran (six tablespoons) contains 90 calories, almost as much as Kellogg's Sugar Frosted Flakes (110 calories per ounce). Beyond bran lie a multitude of heavily advertised remedies, most of which are reasonably effective and harmless if used in moderation and infrequently.

Starving and health

Always bear in mind that dieting is the polite term for "deliberate starvation." Starvation in the interest of improved long-term health, to be sure, but starvation nonetheless. A balanced diet and a daily multivitamin guard against the obvious risks of starvation. Still, it's prudent to remember that burning fat is neither as efficient nor as healthy a way of fueling your body as eating a diet that matches your calorie needs, and to recognise that your defences will be lowered to some degree for the duration of your diet.

Burning fat makes up some of the deficit in calories, but not all. (It's an ongoing deficit that causes fat to continue to be burned.) Your metabolism reacts by slowing down, and in addition you'll have less fat to insulate against heat loss. You'll tend to get chilled more easily and, at the same time, your resistance to infection will be reduced. Play it safe: dress warmly, avoid getting chilled and, if possible, try to limit your exposure to people at the office who are passing around this season's cold. The middle of a diet is no time to be singin' in the rain, especially if it's chilly. If there's a really nasty 'flu going around or predicted for the season, you might ask your doctor about getting vaccinated against it.

The kind of moderate, pound a week diet we're talking about doesn't pose a serious health risk and in any case the benefits far outweigh the increased odds of ending up with a King Hell cold for a week, one you'd probably have caught anyway. But why take chances? It's in that vein you might consider putting down a 500 milligram Vitamin C tablet every day along with a regular multivitamin. In all likelihood the whole Vitamin C business is utterly bogus and ascorbic acid no more effective in preventing colds than peach fuzz. So if the suggestion seems appalling, ignore it. I'll confess to embracing this particular fad for a decade, but then what do I know? I haven't had a cold to speak of in ten years.

Why don't they notice?

After you've lost a substantial amount of weight: 10 to 15 pounds, you'll really notice the difference in how you feel. The changes in your appearance will be obvious without pulling out the "before" picture and comparing. You may be surprised and/or disappointed to discover that people you encounter every day don't remark on the dramatic change you perceive. There are several reasons for this, and it's nothing to get upset about.

It's hard to notice slow, gradual changes. You have the advantage of being inside your body. You can feel the difference in how you move, how your clothes fit, and how much energy you have. Others have only your appearance to go by, and that's often limited to your face and hands. While the difference would be obvious if they compared a picture from a few months ago with your present self, your slow, steady progress may go unnoticed until some day somebody looks at you, startled, and exclaims, "Hey! Didn't you used to be fat?"

When people do notice a change, many will react in the time proven and honourable manner of minding their own business and keeping their mouths shut. Politeness and consideration are usually the motivation. How would you feel if you noticed a friend seemed to be slimmer and you blurted out at lunch, "Hey, haven't you lost some weight?" And then he quietly said, eyes averted, "Well, no actually, I haven't."

Don't worry, eventually they will notice.

Late night, hungry, and alone

> A hungry stomach will not allow its owner to forget it, whatever his cares and sorrows.
>
> —Homer, *The Odyssey*, c. 800 B.C.

The generally smooth and steady progress of a diet, like the course of a life, is occasionally punctuated by "bad days." Throughout this book I've tried to concentrate on facts and methods instead of persuasion and motivation. I believe that, ultimately, success in anything requires motivation from within; that the person undertaking a task believes in its worth and values accomplishing it above whatever effort is required to that end. Still, a little encouragement along the way helps, especially when unexpected difficulties crop up or fatigue begins to take its toll. This section is intended to provide a little encouragement when the inevitable bad day comes along, to remind you of the reasons you

decided to lose weight in the first place, and the enduring reasons to stay the course.

The worst times in a diet often occur late at night. You've eaten the last meal of the day, and a few hours later you're hungry again. You may not be able to get to sleep for hunger, or you may have awakened, stomach growling, "Feed me." It's just you and the hunger, alone, in the middle of the night. But even if you're in a room full of people in the afternoon, you are still truly alone.

You're alone because only you have the power to stay on your meal plan. If you confide your hunger to anybody, they'll either react by thinking "Why is he bothering me with this?" or, more often, by saying, "Well, that's simple. Go eat something!" Neither helps. For if you go and have a snack, you've taken the first step toward pitching out the meal plan. The next time, it probably won't take quite as bad a day, and before long the meal plan will lie abandoned, the diet in shambles, and your weight trend on an upward climb, probably no longer being watched. What helps in these rare but trying times is reflection on precisely why you got yourself into this mess in the first place and soberly weighing your present discomfort against achieving the goal you're striving for.

Why am I doing this to myself?

Only you know precisely why you decided to lose weight, but let's tick off some of the likely reasons.

Live longer

> Fat men are more likely to die suddenly than the slender.
>
> —Hippocrates, *Aphorisms*, c. 400 B.C.

Every day you see plenty of fat people and lots of old people, but have you noticed how few old, fat people you see? All those geezers who make it into their eighties and nineties and call it the "prime of life" seem to be the lean, wiry type, don't they? This isn't because people suddenly feel compelled to lose weight sometime in their fifth or sixth decades. As the original hipster pointed out 2400 years ago, it's because the fat ones are dying off early.

This is the most fundamental reason to lose weight: to live longer. Whatever you value in life, *you can't enjoy it if you're dead!* What's the trade-off between a few bad days in the course of a diet, or even low-level irritation for several months, against living for five or ten

more years? Of seeing your grandchildren grow up? Of seeing your life's work serve as the foundation for the next generation? Of finally getting the money out of your IRA? Of a happy retirement on the Moon? Whatever... death disqualifies you from every activity.

Dieting is unpleasant and bad days are wretched, but dropping dead is worse. Tomorrow will be better.

Better health

> Feed by measure and defy the physician.
>
> —John Heywood, *Proverbs*, 1546

Even if excess weight doesn't shorten your life, you're far more likely to suffer a variety of medical problems that will make the years you live less enjoyable. These range from really big annoyances like heart attacks to lesser maladies such as habitual shortness of breath and muscle aches and pains. A few years ago I went through a couple of weeks where I'd haul a 75 pound computer printer home, use it for a day or so, have it break, haul it to the shop, pick it up, and so on. As I recall, I ended up hauling the sucker back and forth about six times before I finally junked it. Every time I wrestled that beast into the car and out again, I woke up the next day with my muscles screaming for mercy. And yet for years, I walked around with the equivalent of that printer strapped around my middle, day in and day out. No wonder I felt awful! You can get accustomed to almost anything. If you've been overweight for a long time, it's hard to know what it's costing you not just in terms of potential health problems down the road, but in how you feel every day. The only way to find out how great you'll feel without the excess ballast is to see the diet through and experience its happy conclusion for yourself.

If a bad day comes a month or two into the diet, think back to the beginning. Think beyond the hunger to how you feel physically and what you've accomplished so far. And remember that your present situation pales before how much you'll enjoy finally achieving the goal.

Accomplish more

> Great eaters and great sleepers are incapable of anything else that is great.
>
> —Henry IV of France (1553–1610)

There's a not-so-subtle discrimination against overweight people in most organisations, and it's based on the flip side of the argument that finally convinced me to lose weight. It's easy to imagine the following thoughts passing through the mind of a person considering promoting an overweight employee to a position of greater responsibility. "Andy's bright, trustworthy, loyal, and one of the hardest-working people I've ever met—in short in matters intellectual, social, and professional he is the very model of a modern middle manager. But I have to consider the whole picture. This is a management job, not a technical position. I'm betting a large budget, an important project, and more than a little of my own reputation on whoever I pick. Do I really want to bet all that on somebody who can't even manage his *weight*...?" The prejudice is normally far more subtle than this line of reasoning, but don't doubt for a minute it's there. Another barrier blocking the advancement of overweight people is the perception they aren't "dynamic" and don't have the energy and stamina to see through difficult tasks.

In my experience this discrimination against the overweight is totally unjustified, but that doesn't keep it from happening every day. As we've seen, most overweight people don't suffer from flaws in character or weakness of will; they just have a broken feedback system. But if others assume there's something wrong with them, the consequences will be no less severe for being unjustified and unfair.

Can I learn from being hungry?

Do you want to *eat*, or to *stop the hunger*? There is an important distinction between these desires. Most of the times we eat, we're not actually hungry. We eat because it's our regular meal time or because we associate eating with a given activity ("It just isn't a movie without the popcorn"). We eat because it's part of social ritual, or a respite from the press of events. Any why not? Eating is one of the most physically enjoyable things you can do in public.

Hunger is something very different. Hunger is a command, not a request. Hunger is looking at your dog curled up sleeping on the rug and thinking, "I wonder how much meat there is beneath all that fur?" True hunger, although part of the daily life of billions of people on this planet, is rare in Western industrialised countries except among the very poor and those engaged in dieting. One thing you learn from the worst moments in a diet is what hunger really is. Not only does it help one appreciate the suffering of those deprived of food by circumstances rather than choice, it also teaches an important lesson

about why we eat.

After you've truly experienced hunger once or twice in the course of a diet, you realise that most of the times people say, "I'm really hungry" they're nothing of the sort. In all likelihood they're motivated to eat by something entirely distinct from hunger. Getting to know hunger first hand teaches you how unrelated the motivation to eat is from your need for calories and how important it is, therefore, to control what you eat by some means other than instinct.

How will I feel right after I eat?

Think about how you'll feel if you do go and wolf down something to slake your hunger. Yes, the hunger will be gone, but will what replaces it be an improvement? You've invested a great deal of effort in getting to this point of your diet, and at this very moment it's all on the line. All the monitoring, all the calculation, all the analysis of the trend and the carefully crafted feedback systems are for nought if you ignore the meal plan whenever it proves uncomfortable. Weigh the immediate surcease of hunger with the feeling of accomplishment you'll have after the next regular meal in knowing you weathered a difficult time and emerged still on course.

What food is worth it?

When hunger strikes, you're already undoubtedly thinking of food, so why not put in concrete terms? Turn to the table of calories on page 215 and look up the foods you're tempted to wolf down. Think about their calories compared to the calorie deficit in your meal plan, and work out, in your mind, how much longer your diet will run if you add such a food every day. Rather than increasing your focus on food, that may let you balance the food you're craving in a purely numerical way against the forecast length of your diet and the knowledge that once the diet is done your weight problem will be solved and you'll never have to endure hunger like this again.

Secret weapons

If thinking about all these things doesn't work, or makes you dwell even more on the hunger, there are more substantial ways of dealing with the problem.

Liquids. Try filling up on liquid. Often putting something, anything, in your stomach will quiet the hunger monster long enough to get to the next meal.

Caffeine. Next higher in yield among tactical weapons is diet soft drinks with caffeine. Caffeine is an appetite suppressing chemical which hits the bloodstream quickly and takes effect almost immediately. I'm not suggesting you get addicted to the stuff in order to diet, but odds are you're hardly a stranger to it already. Since none of these beverages have any calories, if you can get through a hunger attack with them, you're home free.

Bouillon. Crossing the strategic threshold ever so slightly brings us to a mug of piping hot bouillon. Two bouillon cubes make eight fluid ounces but contain only 8 calories, almost negligible. Not only is it rich and salty, it's hot, which counteracts the chilliness that often accompanies hunger.

If none of these work, and your diet is really on the line, it's time to push the button and launch the heavy stuff. Consider the following alternatives.

Sauerkraut. This is my personal favourite. A cup runs about 45 calories, and it's good either cold or heated in the microwave to banish the shivers.

Dill pickles. For megatons per calorie, these little green warheads are hard to top. Each medium size pickle runs about 7 calories, which means you can eat *four* of them and still only bust the plan by about 30 calories. Of course this is so because they're basically crunchy water.

Popcorn. *Popcorn?????* Yes, popcorn. To make this work you need one of those air poppers and a little restraint. You may be startled to learn that one cup of air-popped popcorn is only 25 calories. This means you can make two cups of the stuff, 8 ounces by volume, and still only go 50 calories over the plan. Remember, I'm talking about air-popped popcorn *without butter* (you can salt to your heart's (ahem) content), and that's two cups *popped*, not the trashbag full you get from popping two cups of kernels.

The morning after. I mention these secret weapon foods not to tempt you but to provide alternatives less damaging than chucking the whole diet and ordering out pizza. Any of these choices will still leave you with a calorie shortfall for the day and keep you losing weight. However, remember that if you feast on one of these treats late at night, your weight in the morning may show a dismaying increase because the food's still sitting in the rubber bag. Ignore it, trust the trend, and stay on the plan.

These secret weapon foods should remain secure in the arsenal except in times of crisis. If you want to include a midnight snack in your meal plan, fine; allocate a reasonable number of calories to it (not too many, as you don't want lots of calories in the system while you're sleeping; see page 130), and make a list of alternatives with about that number of calories. But if you find a frequent need for an emergency buck-you-up, it's a sign your calorie balance over the day is uneven or you're trying to lose weight too quickly (see below). These problems should be addressed by revising the diet and/or meal plans, not by frequently resorting to unplanned snacks, however low calorie.

Too many bad days

I don't mean to imply by dwelling on bad days that you'll experience them frequently or that extreme measures are needed to survive them. In my experience, really difficult times happened no more frequently than every other month, and never lasted beyond the next meal. If you find you're suffering real hunger (as opposed to the desire to eat—learn to distinguish them) on a frequent or regular basis, it's time to revise your meal or diet plan. If hunger occurs at the same time every day, try shifting calories from another meal to the meal that precedes the problem period. Often a few shuffles of calories among meals can match the calories you eat to when you need them during the day and eliminate hunger attacks.

You can also try removing calories from a largish meal and allocating them to a planned snack in the middle of the problem interval. This moves in the direction of more meals with fewer calories apiece which many people find helps them minimise hunger. As long as your meal plan adds up to the same calories per day, any schedule is fine. Experiment until you find what works best for you.

If no amount of shifting calories from meal to meal or fiddling with your meal schedule works, if you still experience frequent attacks of serious hunger (as opposed to the "Gee, I wish it were time for

dinner" that's normal whilst dieting), it's time to revisit your original diet plan—you may be trying to lose weight too rapidly. If your calorie deficit, calculated from the trend, is substantially above 500 calories per day this is particularly likely. Adjust your meal plan to bring the daily calorie shortfall down to the vicinity of 500. You won't lose weight as fast, but neither will you suffer hunger attacks that may prompt you to abandon the diet entirely. Also, remember there's nothing magic about a 500 calorie per day shortfall; it's convenient to talk about since it translates into a pound a week which many people find tolerable, but recall the wide variation in individual calorie requirements. A 500 calorie per day cutback reduces the food intake of a five foot tall, lightly built woman by more than a third but it's only one fifth the daily requirement of a robust six foot man. Clearly, the woman is going to miss those 500 calories a lot more than the man, and should probably choose a more gradual rate of weight loss to minimise hunger. Refer to the directions for planning the calorie cutback and diet duration on page 157, explore several alternatives, then revise your meal plan to achieve the new calorie target.

Success and stability

Eventually, your weight will approach the goal. Having successfully managed weight loss, you must now crown that achievement with a smooth transition to stable weight. The next chapter will discuss keeping your weight close to the goal permanently. But first, you need to move from losing weight to stability, and there are a few tricks associated with that process.

Safety margin or natural stability

Plan for a "safety margin" of 2 or 3 pounds, measured by the trend, below your original target. If you were aiming for 165 and have no trouble continuing the diet, take the trend line down to 163 or 162 before beginning the transition to stable weight. That way, if you bounce up a little in the process (as frequently happens), you won't wind up above the goal wondering whether you should start dieting again.

You may be lucky and discover a natural goal right near the end of your diet. If you're aiming for 165 pounds and you get to 168 and hit a plateau where the trend line just stays there, day after day, and you seem more bothered by hunger than for a long time, you've probably found a weight you'll have little trouble maintaining; in all likelihood

it's one of those points of natural stability. Don't go nuts trying to get past it. In all probability, even if you did, you'd wind up back at the stable point in a few months anyway.

Increase calories gradually

At the end of your diet, don't just take the calorie deficit from your last month's trend chart and immediately add that number to your meal plan. That's a guaranteed prescription for a disheartening bounce upward in weight. All the time you've been dieting, your body has become more and more efficient at using the limited number of calories you've been supplying and accustomed to meeting its needs by burning fat. Remember how difficult it was getting the body to start burning fat at the start of the diet—those awful first few days? At the end of your diet it also takes a while to shift from burning fat to meeting all your calorie needs from food. Fortunately, there's no discomfort associated with this process.

The best way to make the transition is gradually, over four to six weeks. By the end of your diet, you'll have a very accurate idea of your daily calorie shortfall, calculated from the trend line. Eventually, you want to increase your food intake to bring the shortfall to zero, but *not all at once*. If you suddenly added back the entire shortfall, you'd gain weight because your fat cells continued to pump calories into the bloodstream and your metabolism remained adjusted for a lower calorie intake.

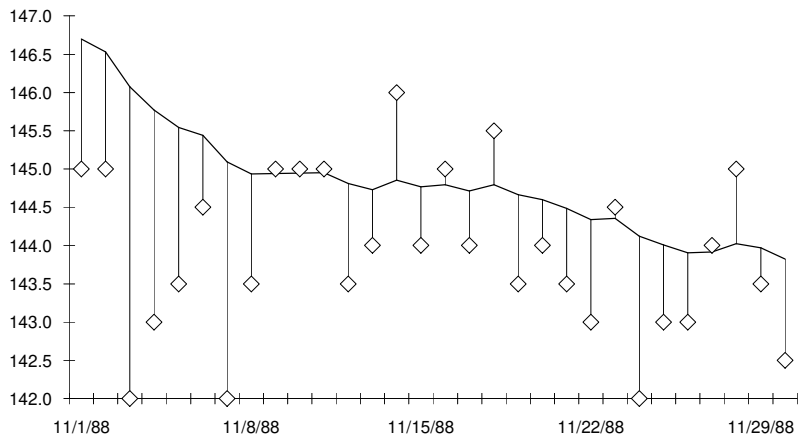
Instead, divide the calorie shortfall over a number of weeks, and each week add that number of calories to your meal plan. For example, suppose the trend chart for the last full month of your diet indicated a shortfall of 560 calories a day. For a four week transition you'd divide that number by 4, obtaining 140 calories. Add that number of calories to your meal plan each week of the transition period. If you'd planned meals for 1720 calories a day in the last month of the diet, you'd plan the four weeks of transition as follows.

Week	Calories
1	1860
2	2000
3	2140
4	2280

You'll arrive, at the end of the four weeks, at a food intake equal to the calories you were burning during the last month of your diet.

Allow for some settling

Your weight may wander around a bit during the transition period. After all, as you gradually bring your calorie intake up to equal what you burn, you're making the most substantial change since you began the diet. A variation of three pounds above or below your initial goal is normal during the transition period. If the trend line turns up, crosses the goal, and keeps on rising, you're probably adding calories too quickly. Drop the calories back by one week's allotment (140 in the example above), let things stabilise, then try adding the next step in a couple of weeks.



Weekly loss: 0.5 pounds. Daily deficit: 273 calories.

Here's a chart of the transition to stability at the end of my diet in 1988. I began the transition at the end of the first week of November and added calories at a steady rate, week by week, throughout the month. You can see how the trend line, which had been declining 1.7 pounds per week over the entire diet, halted its fall, leveled out, and declined only slightly over the rest of the November. Since I intended to take my weight two or three pounds below my goal of 145 as a safety margin, the gradual decline during the first three weeks of the transition didn't concern me.

Soft landing

After four to eight weeks of gradually adding calories to your meal plan, watching the trend line, and adjusting to the increased calorie

intake, your weight should have settled within three pounds of the goal and the trend line should be close to flat. Daily weights will be coming in above and below the trend line with roughly equal frequency.

And that's it: no fireworks, no sirens, no flashing lights. Your diet is finished. Your weight problem is history. The discomfort is at an end. In the next chapter we shall see how to guarantee you will never gain back the weight you have just managed to lose.

10

PERFECT WEIGHT FOREVER

> The superior man makes the difficulty to be overcome his first interest; success comes only later.
>
> —Confucius, *Analects*, c. 500 B.C.

After you've attained your weight goal, it's only natural to worry about whether you'll be able to stay thin, especially if you've dieted before and later regained all the weight you lost. Friends who greet you with a cheery "Say, you've lost a lot of weight. Now, can you keep it off?" hardly contribute to your peace of mind.

In fact, there is no reason for anxiety about gaining back the weight you've just lost. Most people regain weight after dieting for the very same reason they were overweight in the first place: their appetite doesn't tell them how much to eat. Unlike most dieters, you not only know the cause of the problem, you have a solution for it: a feedback system, an eat watch. What's more, since it's just allowed you to lose weight you have no reason to doubt its reliability. Now we'll see how the eat watch that guided your weight loss can guarantee you'll never need to diet again.

Regaining: the problem and the cause

The statistics are depressing. The vast majority of people who lose weight end up, in relatively short order, gaining back every pound they lost. Perhaps it's happened to you; it happened repeatedly to me. Seemingly, at the very moment of triumph, the seeds of its undoing are sown. After a few cycles of depressing, uncontrollable weight gain and painful dieting, it's tempting to just give up; to assume you were never meant to be thin. Well, right now you *are* thin, whether for the first time or the twentieth. How can you evade the fate of most dieters

and avoid regaining the weight you've lost? By relying on the same feedback you used to lose weight.

Let's try to understand why so many people fail to keep weight off after struggling to lose it. The rubber bag tells us that weight gain stems from a very simple cause: eating more food than the body burns. Feedback explains why: people prone to overweight lack a built-in feedback system to balance the calories they eat against what they burn; their appetite doesn't tell them to stop eating when enough calories have gone in.

A person with a broken feedback system will always tend to gain or lose weight. In chapter 4 we've seen how Oscar and Buster, victims of incorrect feedback, gain weight simply by heeding the deceptive message of appetite. When Oscar or Buster go on a diet, the diet tells them what to eat and when. And, for reasons we now understand, it works! As long as they follow the diet and don't cheat, they lose weight as rapidly as promised and arrive at the end of the diet thin, happy, and feeling in command of their weight.

Then they put the diet away and rely, once again, on their built-in feedback system to tell them how much to eat. *But it's still broken!* Sure enough, their weight starts to creep upward and before long all the progress of the diet is erased. People with a tendency to gain weight need *continual* guidance about how much to eat. Withdrawing this guidance at the end of a diet, or couching the need for ongoing feedback in a manner that implies, "You're a fatty, and to be slim you'll have to spend the rest of your life on a diet" is as deplorable as lending a pair of glasses to a nearsighted person for six weeks, then removing them and saying, "OK. You're on your own."

If your eyes don't focus, you need optical correction to live a normal life, and you need it all life long. The fix that lets you see as well as a person born with perfect vision needn't be obtrusive nor prevent you from doing anything you wish, but you have to continue using it. If you happen, instead, to lack a built-in eat watch, you shouldn't feel any more guilty about technologically overcoming that limitation than your friends do about wearing glasses. Gotta problem? Quit whining, fix it, and get on with yer' life!

Causes for confidence

Consider how you, having achieved your weight goal from an understanding of the rubber bag, feedback, and how the trend reveals the true balance of calories, differ from a dieter ignorant of all these

"gory details," who, seeing his target weight appear on the scale assumes success is at hand and appetite back in command.

You're armed with data, charts, and direct personal experience that tell you precisely how *your* body works. You don't have to trust any book, especially this one. You've devised a diet plan of your own, seen for yourself how it worked, and used it to achieve a long term goal many people never attempt.

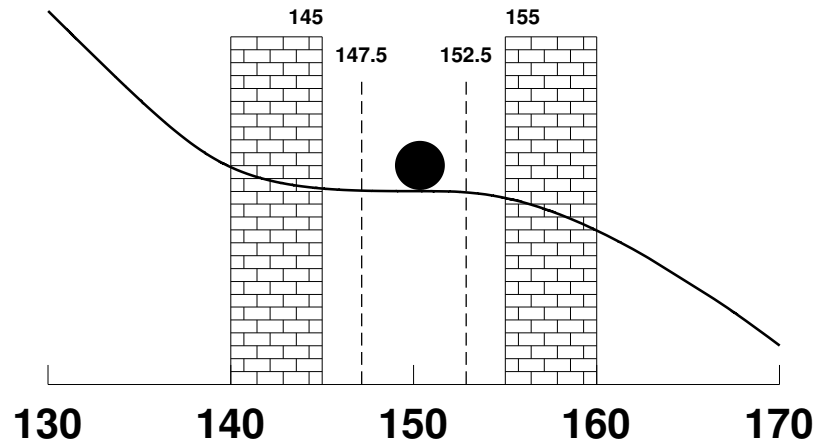
You've survived an unpleasant experience, shedding weight, and there's no motivation quite so strong as the desire to never endure *that* again.

You've learned, by riding out the most difficult days of your diet, the distinction between real hunger and simply wanting to eat. You understand how portions at meals must be controlled to match calorie needs, not by a sense of feeling "full" while still at the table.

You've stabilised your weight near the goal you set for yourself. Permanent weight control is now just a matter of preserving this stability.

You're beginning to think of yourself as thin and healthy; these attributes are becoming part of your sense of self. Before long you won't consider forfeiting them any more than you'd contemplate cutting off a finger.

Feedback forever



How can you guarantee you'll never regain the weight you lost? Suppose your weight goal is 150 pounds and your appetite feedback curve is the disastrous one shown above. If you rely on your appetite alone, every time you eat too little you'll get an unmistakable signal

to eat more, but overeating raises no warning. Overeating actually tends to make you eat more, since once your weight begins to creep upward you'll get depressed and seek solace in food. When you end your diet at 150 pounds, you're treacherously balanced on the flat part of the curve there. As long as you stay close to 150 all will be well. You're like the backwards-wired thermostat on page 46 which didn't cause a problem as long as the temperature stayed close to 70 degrees. Eating too little is no problem; smooth negative feedback tells you to eat more. But inevitably, sooner or later, you'll eat a little too much: over the holidays, at a party, or when you can't gauge portion sizes accurately. Then, as your weight begins to creep upward, the malign influence of positive feedback takes command, and weight gain begets additional overeating in a process that literally feeds upon itself.

The initial overeating that set off the destructive feedback loop was probably an isolated incident, not a permanent change in diet. It may even have been inadvertent, the result of additional calories added to a regular meal or reduced physical activity unaccompanied by lower calorie intake. The correction needed to restore balance is usually small and easy to make. But if the slow creep upward isn't spotted and arrested in time, before long you've gained 10 or 15 pounds and you're in a real mess. Losing that much weight requires a serious diet and the very thought of going back on a diet, particularly so soon after the last one, is hard to entertain. The temptation to abandon weight control is tremendous once things have gotten this far out of hand; you're well on your way to giving back all the gains of your diet.

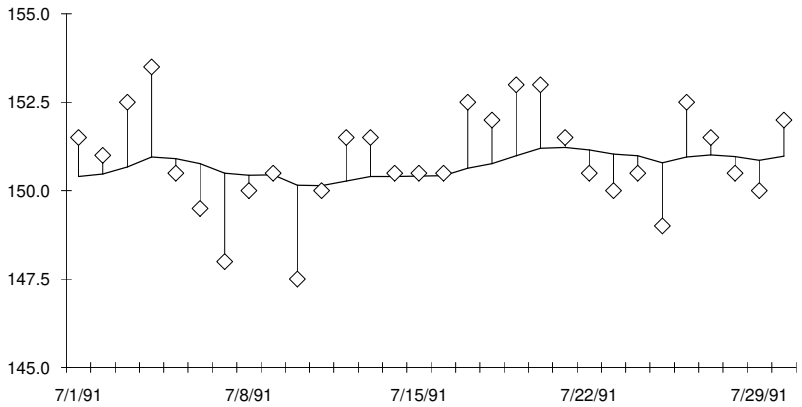
The problem, clearly, is lack of feedback. You need continual guidance to achieve an accurate calorie balance week after week, month after month, year after year. And we know just how to do that! The very same trend calculation and charts that tracked the calorie deficit during your diet can now guarantee stable weight forever. All you need to do is adjust your meals not for a calorie deficit, but to balance the calories you eat with the calories you burn.

To control your weight you set limits to the fluctuation of the trend and plan specific actions whenever the trend line impinges on a limit. As when dieting you only consider the trend; daily weight is used solely to calculate it. *The band* is a 5 pound region centred around your goal weight; this encompasses the normal week to week variation. There's no need to be obsessed with a perfectly constant trend line; a couple of pounds more or less aren't really noticeable and in any case are swamped by day to day changes in weight. If your weight goal is 150 pounds, the band ranges from 147.5 to 152.5, shown as dashed lines on the chart. As long as the trend is within this range,

there's no reason to change what you're eating. Eat whatever you like, consistent with the calorie burn rate you determined at the end of your diet (see page 180).

Fine tuning

Continue logging weight daily and producing trend charts at the end of the month. As long as the trend remains within the five pound band around your goal, month-end chart analysis focuses on the slope of the trend line and the calorie excess or deficit it indicates. Consider the following trend chart.



Weekly gain: 0.1 pounds. Daily excess: 72 calories.

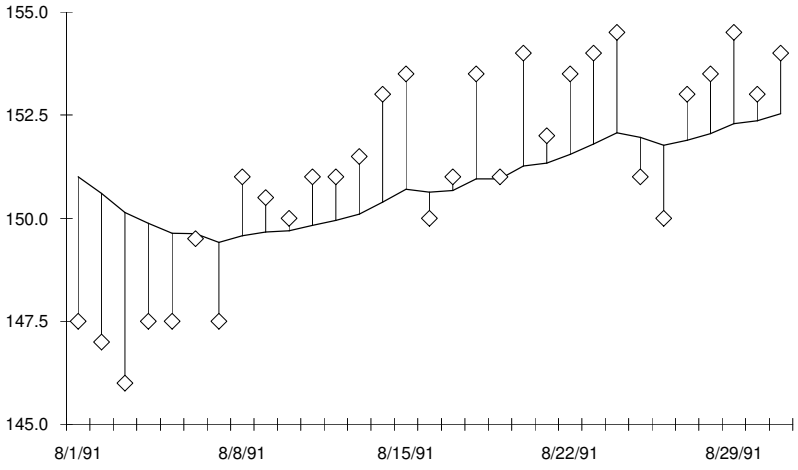
The goal is 150 and the trend is allowed to vary freely in the 147.5 to 152.5 band. Since the trend never touched either limit this chart represents success in keeping the trend close to the goal. However, there's a slight upslope, equivalent to 72 extra calories a day. In addition the trend varied between 150 and 151, not back and forth around 150. This suggests you should cut back slightly on calories the next month. Since 72 calories a day is less than one tablespoon of salad dressing or about half an ounce of cheese, you could make the adjustment by lightening up slightly on salad at dinner or by ordering your lunchtime burger without cheese. Had the trend line remained below 150 all month and shown a slow downslope, you'd add comparable foods in the next month to move up to 150.

Adjusting your food consumption based on the trend forms an exquisitely sensitive negative feedback system. The slope of the trend

reacts to even the slightest changes in calorie balance and allows you to make adjustments, up or down, so slight they are scarcely perceptible. By insuring you get just the calories you need, you're guaranteed to never be hungry as long as you adjust the size of your meals and their schedule based on your need for calories throughout the day. As you gain experience balancing the trend line it will become second nature, and you'll probably find the fluctuations decrease even more.

Early warning

Not only does the trend let you balance your calories, it's a tireless sentry that notifies you of emerging weight problems while they're still easy to correct. Suppose you just printed a trend chart like this one:



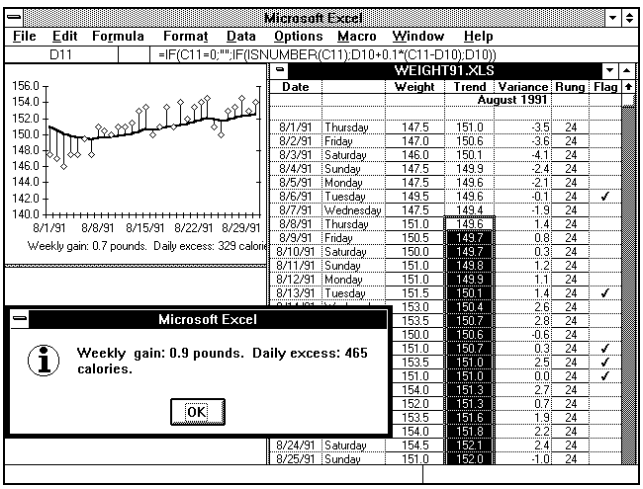
Weekly gain: 0.7 pounds. Daily excess: 329 calories.

Clearly, a dramatic change in calorie balance occurred in the last three weeks of this month. This rapid climb, starting from the goal weight of 150 indicates an immediate need to reduce your calorie intake by about 350 calories a day (the 329 excess shown in the chart plus a tad more to cause a slow drift downward to 150 pounds). Since you were eating too many calories and gaining weight, cutting back to slightly fewer than what you're burning should not leave you hungry, as your daily deficit will still be less than 100 calories as you return to the goal.

Bumping the band

Decide for yourself how closely you want to track the slope of the trend and balance your calories. You can view it as a kind of game, worth playing well in pursuit of a perfectly flat trend line. On the other hand, the whole idea of adding ten calories one month and subtracting fifteen the next may seem a particularly horrid example of obsessive compulsive behaviour. No matter, what's really important is what you do when the trend line wanders outside the 5 pound band centred around your weight goal. If your goal is 150 pounds, the band limits are 147.5 and 152.5. Whenever the trend line ends a month outside this range, action to correct the divergence is triggered. In the chart above, the rapid rise left the trend right at 152.5 at month's end. If the rise were not halted by reducing calories based on the slope of the trend, by next month the trend would have climbed well above 152.5, requiring a mandatory cutback to restore the trend to below that mark.

If the trend changes during a month, the calorie excess or deficit reported in the chart may be misleading, as explained on page 87. When the trend reverses, it's best to calculate the calorie adjustment based on the start and end weights of the trend divided by the number of days the trend continued. Instructions for manually calculating calorie excess or deficit are given on page 203. Excel users can obtain the calorie balance from a partial month trend by selecting the trend cells for the portion of the month containing the trend (for the chart above, you'd select August 8th through August 31st), then picking **Weight Trend snapshot** or pressing the accelerator key CONTROL+**t**. A window like the following will appear.



By considering only the part of August when the trend was rising, we obtain a more accurate estimate of the rate of weight gain and calorie surplus. Instead of the 329 calories calculated from the entire month, during the last three weeks there was actually an excess of 465 calories per day, indicating the need for a more severe cutback in food. If you were calculating by hand, you'd subtract the trend value on August 8th, 149.6, from the trend at the end of the month, 152.5, divide by the number of days between those dates ($31 - 8 = 23$), then multiply by 3500 calories per pound, yielding:

$$\frac{152.5 - 149.6 \text{ pounds}}{31 - 8 \text{ day}} \times 3500 \frac{\text{calories}}{\text{pound}} \approx 441 \frac{\text{calories}}{\text{day}}$$

This estimate is equivalent to that calculated by Excel for the purpose of planning a calorie cutback.

When the trend rises above the band, reduce your calorie intake by more than the excess reported by the trend chart or calculated from the most recent trend as explained above. Next month's chart will show a falling trend line which should soon return or already be within the 5 pound band. Once the trend line ends the month between 147.5 and 152.5, resume the usual minor adjustments to your food intake as described above, based on the slope of the trend.

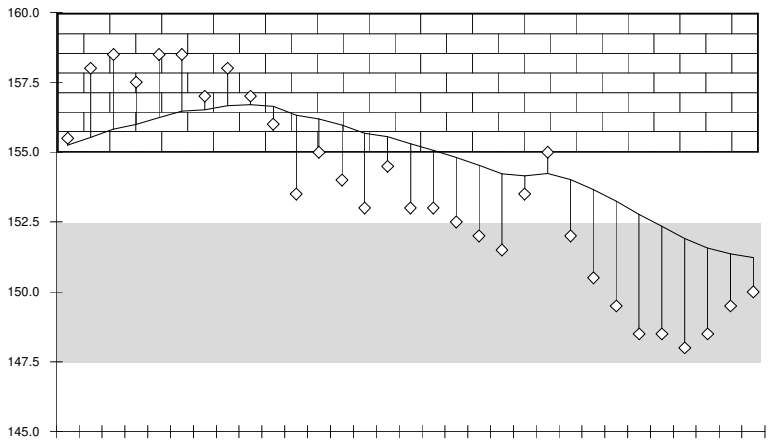
The adjustment you make when the trend line wanders outside the band is up to you. After you have a year or so of experience controlling your weight, you can usually figure out the reason for the rise pretty easily (too many extra large buckets of popcorn at the movies, your discovery that Señor Picante's Macho Cheese tortilla chips are the perfect complement to your Saturday night poker game, etc.). Correction consists simply of cutting back on the food that's responsible for the extra calories, plus a little more to bring the trend down to within the band.

How you adjust your calorie intake isn't important. What is essential is that you *do adjust it*. Whenever you end any month outside the 5 pound band you must deliberately reduce calorie intake (if you're above) or increase calorie intake (if below), by more than the calorie excess or deficit reported in the last trend chart. Once you make the indicated adjustment to what you eat, the trend line will quickly return to the goal weight.

Hitting the wall

If you make minor monthly adjustments to your food intake based on the slope of the trend your weight will rarely stray outside the 5 pound

band requiring mandatory adjustments to your calorie intake. But, over the years, stresses and circumstances unanticipated by carefully drawn plans will occur: a four month *tour de France gastronomique*, a coupla years in the slammer for insider trading, a sudden obsession with cheesecake, a bout of malaria. Events like these may set you heading for a serious weight problem. But long before things spiral out of control, the trend line will detect the danger and invoke stronger measures to avert catastrophe.



The five pound band around the goal weight, shown here in grey, contains most normal fluctuations. A ten pound region limits the permissible variation. The brick wall indicates the region the trend is prohibited from entering. With a goal weight of 150 pounds, brick walls are built at 145 and 155. (Only the upper brick wall is shown on this graph, as it's the one most of us worry about.) If the trend at the end of a month exceeds 155 pounds, the warning bell sounds and immediate action is taken to return the trend to the goal. What immediate action? Simply resuming the very same meal plan you used to lose weight in the first place. You know it works; you adjusted it over the duration of your diet into something you can live with. Dust it off and use it now.

With a 10 pound brick walls around your goal weight, even if you hit the wall above your goal, you only need to take off 5 pounds. With a 500 calorie a day deficit you can do that in little more than a month

so you're hardly looking at a severe calorie cutback nor a long-term diet to restore stability. In the unlikely event of the trend ending a month more than five pounds below the goal, add about 500 calories a day to your diet to bring it back.

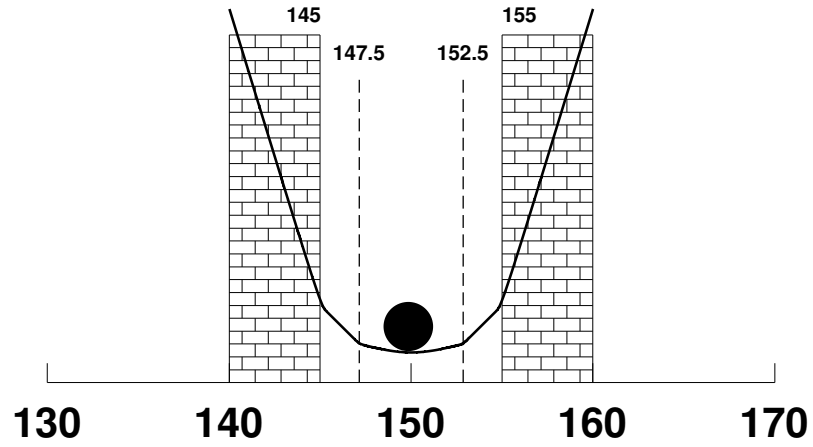
In the chart above, the trend ended the previous month above 155, indicating the brick wall had been hit. The meal plan, calculated for a 500 calorie a day deficit, was put into effect immediately. The trend continued to rise for the first week of the month since daily weight remained above the trend line, but before long the diet took hold and the trend began to fall at the expected rate of about a pound a week. By month's end, the trend had fallen to within the 5 pound band around the goal. After hitting a brick wall, it's best to continue the meal plan until the trend goes past the goal weight since going off the diet may cause the trend to bounce upward, but you could end the diet at the conclusion of this month and return to managing the trend within the 5 pound band around 150.

If you adjust your calorie intake month by month, variations outside the 5 pound band will be infrequent. Since you make adjustments when the 5 pound band is violated, hitting the brick wall will be exceedingly rare. Still, it can happen, and if and when it does you are ready. If the first and second layers of defence against gaining weight fail, a sure-fire solution, resuming the diet that got you to the goal in the first place, is invoked and will correct the problem, whatever its cause, in little more than a month. If you do hit the wall, try to understand why. Hitting the wall indicates the normal weight regulating feedback failed, and once you figure out why you can avoid the discomfort of dieting in the future.

But even if you hit the wall and have to diet, it's not for long, and the incipient weight gain is corrected well before your clothes don't fit or anybody notices you've gained a pound. Hitting the wall and dieting back to the goal is a private matter between you and the trend line, and you are the sole beneficiary. The best way to think of the brick wall is like a parachute. You hope you'll never need it, but it's nice to know it's there.

Feedback on the job

What we've constructed, by defining a 5 pound band for variation and a 10 pound range surrounded by brick walls, then prescribing the action to be taken when the trend is in each region, is a negative feedback system to replace the built-in one, shown on page 185, that misleads us into gaining weight.



By using the trend to adjust food intake, we have implemented a very different feedback system. As weight varies within the 5 pound band around the goal, 150 pounds here, it is subject to only a minor degree of feedback, applied by monthly adjustments to what you eat based on the slope of the trend line. If you choose not to bother with such small adjustments, the floor of the feedback curve from 147.5 to 152.5 pounds will be flat and your weight completely free to vary within that band.

Once the trend ends a month outside the 5 pound band but within the brick walls, calorie consumption is adjusted. The size of the adjustment is determined from the calorie excess or deficit indicated by the trend. Thus, when the trend strays outside the band it encounters negative feedback proportional to the calorie imbalance that caused it to diverge. This feedback, shown as a steeper line outside the 5 pound band, should normally return the trend to within the band in short order.

If, for whatever reason, the feedback invoked when the band is crossed doesn't have the intended effect, the trend will sooner or later hit the brick wall. When this happens, bang-bang negative feedback is triggered to ensure the trend is quickly reversed and brought back to the goal. Resuming a meal plan already proven effective for losing weight (or adding comparable calories if the trend hits the brick wall below the weight goal), provides absolute assurance the trend cannot slip out of control. This constitutes very strong negative feedback that kicks in when the brick wall is hit, shown by the steep rise in the feedback curve at that threshold.

The rules of the game

The adjustments to what you eat based on the trend's relationship to the goal weight are as follows.

More than 5 pounds above goal. You've hit the high brick wall. Immediately resume the meal plan you used to lose weight and stay on it until the trend falls to less than the goal weight.

Between 2.5 and 5 pounds above goal. The trend has risen above the band. Reduce your calorie consumption by cutting out food slightly more than the calorie excess reported on recent trend charts.

Within 2.5 pounds of the goal. No adjustment is required. You can, if you wish, fine tune the trend by adding or subtracting food equal to the deficit or excess reported in the last month's trend chart.

Between 2.5 and 5 pounds below goal. The trend has fallen below the band. Increase your calorie consumption by slightly more than the deficit reported on recent trend charts.

More than 5 pounds below goal. You've hit the low brick wall. Start with the meal plan you used to achieve stable weight at the end of your diet (see page 180), then add an *additional* 250 to 500 calories per day. If, at the end of the next month, you're still more than 5 pounds below the goal, add even more calories to your meal plan.

How can it fail?

From everything we've learned about feedback, it should be abundantly clear that there is simply no way your weight can get out of control as long as you keep the feedback this plan provides in effect. And whatever could possess you to abandon it? A desire to be fat once again? Not bloody likely, especially after you've just spent so much time and trouble getting thin! Because it's too much bother? Preposterous! It only takes 30 seconds a day to log your weight, compute the trend, and plot it on a chart, even if you do it by hand. To avoid restrictions on what you eat? But there are no restrictions, not a single one. All that feedback, the eat watch, does is tell you *how*

much to eat—you eat whatever foods you like, whenever you wish. What you choose to eat can make a difference in how you feel, but it won't affect your weight.

Will you tire of making the continual adjustments? Don't confuse the incremental month to month changes in what you eat based on the trend with the rollercoaster of binge eating and dieting that afflicts so many people. First, as long as your weight never strays outside the 5 pound band, adjustments are completely optional and in any case are tiny: fewer calories per day than a glass of skim milk. As you monitor the trend month after month, you'll probably find that before long you don't have to do any arithmetic or formal meal planning at all. Whenever the trend's a little above the goal, eat less, and when it's below the goal, enjoy a little more every day. It is entirely possible to spend years without ever straying outside the 5 pound band.

Will you become frustrated by repeatedly having to cut back calories when you exceed the band or hit the brick wall? Again, no. As you master controlling what you eat, these occurrences will become increasingly rare, but even when it happens it's not that awful. Since the brick wall triggers weight loss when the trend exceeds the goal by 5 pounds, you're never more than about a month from the goal. In fact, if the diet you use after hitting the wall has a moderate 500 calorie a day shortfall, within three weeks the trend should be back within the band.

The only way you can gain back the weight you lost is by deliberately choosing to; by discarding the simple and easy feedback that keeps your weight under control; by taking off the eat watch. The slow creep into snowballing weight gain that is the undoing of most dieters simply cannot happen to you any other way. And if you aren't already committed to maintaining your weight, wait until you've gotten really used to being thin and fit. Then no temptation will induce you to resume the life of a fat person.

Proportional feedbag

The only ongoing irritation in managing your weight is planning meals and calculating calorie intake. As you gain experience in keeping your weight within the band and confidence in your ability to do so, you will eventually be able to extirpate this lingering annoyance from your life.

The actual number of calories you eat and burn every day, while interesting to know, doesn't really matter. Only the balance between calories in and calories out, expressed by the difference of these quan-

tities, affects the rubber bag. That's why the block in the diagram of the eat watch on page 64 that controls the **Eat!** signal subtracts calories burned from calories eaten. To keep your weight within the band, all you have to do is keep calories in balance: the result of the subtraction at zero.

After several months of planning meals and adjusting calorie content up and down to stabilise the trend, you may find you're developing an excellent sense of how many calories different foods contain and, more importantly, how much and what kinds of food are appropriate at each meal. You're still planning meals but you're doing it subconsciously, all in your head. In effect, you've advanced from planning meals by counting on your fingers, adding up tables of calories and carefully measuring food, to doing sums in your head. No longer will you look at a bowl of mashed potatoes and think "137 calories a cup." Instead, you know that a dollop the size of a baseball with gravy on the top is about right along with a drumstick of broiled chicken and an ear of corn on the cob. Through carefully planning meals, you've taught yourself by practice and repetition, the only way humans ever learn anything, how to gauge the proper amount of food at each meal.

You're not relying on your appetite; it's still broken, in all likelihood, and shouldn't be trusted in any case. You're using your eyes to measure what your stomach can't: how much to eat at a sitting. After a year of stable weight, you will probably have become sufficiently accomplished at this skill so the only time you resort to a calorie table is upon encountering new food items, to find something comparable among the foods you regularly eat. As you practice the skill of planning meals by eyeball, the trend provides constant guidance. Any tendency to err in either direction quickly manifests itself in a rising or falling trend, which not only tells you there's a problem but how many calories you're high or low. Further, the band and the brick wall protect you during the transition from formal meal plans to your own judgement. If you try to dispense with meal plans too early, the trend will let you know by exceeding the band or hitting the brick wall, and the planning and adjustment required under those circumstances will rescue you before a real problem develops.

In a year or so, controlling your weight like this will seem as easy as riding a bicycle, and something you're no more likely to ever forget. Like riding a bicycle, it was far from easy to learn, but hard-won skills tend to be the most enduring. Unlike a bicycle, no matter how skilled you become in managing your weight, you need never remove the training wheels. Every day you continue to log your weight, every month you compute and chart the trend and make any necessary

adjustments, and every year you add another dozen charts of stable weight to your ever-growing archive. When people ask "How do you manage to stay so thin?" you can answer honestly, "Simple, whenever I start to gain, I eat a little less. Whenever I start to lose, I eat a little more." Simple, indeed. But, as we've learned from our long and arduous journey through the wilds of engineering and the swamps of management, from pounds of fat and thermostats, and rubber bags and things, simple does not mean easy.

Evading evangelism

Once you've succeeded in controlling your weight, a tremendous weight is lifted from your mind as well as your body. Discovering you have the power to lick a long-standing and difficult problem may motivate you to attempt many other things you scarcely contemplated before. Go to it! You gain not only physical stamina by losing weight, but a sense of power that contributes to anything you undertake.

But don't let success in weight control engender disdain and contempt for others who haven't yet achieved your happy state. Disrespect for and discrimination against those who happen to be overweight is bad enough already without adding recruits to the ranks of the self-righteously slim. You succeeded by understanding you suffered not from a character flaw or weakness of will, but a broken feedback system: not a deep-seated psychological problem but a built-in eat watch that ran too fast.

Now that your weight problem is solved, don't become a tiresome nag, exhorting others to emulate you. Your very success is the strongest form of persuasion: the argument by example. As the months pass and those who predicted, "Just wait, he'll gain it all back" are proven wrong, others may begin to wonder if they, too, can solve their weight problems as you have.

If you want to recommend this book, hey, go right ahead. But just because this plan worked for you doesn't mean it will work for everybody. Anybody can control their weight: it's simply a matter of balancing calories, but the means that work for you may seem intolerable or utterly baffling to the next fellow. That individual may eventually become thin and healthy with a plan that strikes you as fascism cloaked in mumbo jumbo. In this book I've tried to present a relentlessly rational approach to weight control. You can't persuade somebody to be rational. You're better off trying to out-stubborn a cat.

The dream

> *Oh my God! M-535: Advanced Topics In Differential Geometry, final exam 8:00 May 25: next Monday.* I signed up for that course... *but I never went to class—never even bought the textbook. I totally forgot about it. It's too late to drop the course now. And if I fail, I won't graduate and my job offer will fall through and....*

Toss, turn: you wake up in a cold sweat and realise it was only a dream. Somehow, years ago, you did graduate, and this recurring nightmare is only a product of your mind recycling the anxieties of college days. This is "*The Dream*," and almost everybody who survived college has it occasionally, even after decades.

The nightmare is so common it's been studied by psychologists. The funny thing is, it only seems to afflict people who eventually succeeded. Those who failed or dropped out don't have the dream.

Perhaps, a year or so after you've reached your weight goal and gotten used to thinking of yourself as thin and fit, you'll have a different dream.

> *Oh my God! I have just eaten an entire* dozen *jelly doughnuts. Mute but damning evidence is before me: the empty box, covered with my fingerprints already dusted by powdered sugar. I can't guess how many thousand calories it was and I lack the courage to look it up, but the scale will doubtless tell the tale....*

Toss, turn: you wake up, dismayed and depressed, and in a few seconds, as consciousness seeps into your skull, you realise. It was only, like the years you spent overweight now increasingly seem, a bad dream.

Part III

Details

11

PENCIL AND PAPER

> More seems to come out of these equations than goes in. For why otherwise would wise men invest time and energy in them?
>
> —Lewis Carroll Epstein

Calculating daily trend

When you first start keeping your log, the very first day, enter your weight in the "Trend" column as well as the "Weight" column. Thereafter, calculate the number for the "Trend" column as follows:

1. Subtract yesterday's trend from today's weight. Write the result with a minus sign if it's negative.

2. Shift the decimal place in the resulting number one place to the left. Round the number to one decimal place by dropping the second decimal and increasing the first decimal by one if the second decimal place is 5 or greater.

3. Add this number to yesterday's trend number and enter in today's trend column.

For example, here's a log for November 1990, You're about to make the entry for November 4th. You've just weighed yourself at 171.5, and entered that number in the weight column. Your log now looks like this:

November 19 90

Date	Day	Weight	Trend	Rung
			173.6	
1	Thu	172.5	173.5	1
2	Fri	171.5	173.3	1
3	Sat	172	173.2	1
4	Sun	171.5		1
5				
6				

To compute the trend number, subtract yesterday's trend number (173.2) from today's weight (171.5):

$$\begin{array}{r} 171.5 \\ -\ 173.2 \\ \hline -1.7 \end{array}$$

Next, shift the decimal point in the difference one position to the left, giving -0.17. This number is rounded to one decimal place by looking at its second decimal place and adding one to the first decimal if it's five or more. Since the second decimal place is 7, we round the number to -0.2. Finally, this number is added to yesterday's trend number (173.2). Since we're adding a negative number, the result is less:

$$\begin{array}{r} 173.2 \\ +\ -0.2 \\ \hline 173.0 \end{array}$$

This result, 173.0, is entered as the trend number for the 4th.

When you begin a new log sheet for the next month, copy the trend number for the last day of the previous month to the line right below the "Trend" column heading of the new log. When you compute the trend for the first day of the new month, use that entry as the previous day's trend number.

This may seem a lot of trouble at first, but once you get accustomed to it, you can calculate the new trend number in a few seconds.

(Those conversant with mathematics will recognise this as an "exponentially smoothed moving average with 10% smoothing," and the instructions above as the wordy equivalent of the expression $T_n = T_{n-1} + 0.1(W_n - T_{n-1})$ where T_n is the trend number for day n and W_n is the weight number for day n. If you're using a calculator to

compute the trend, use this formula. Complete mathematical definitions of various forms of moving averages are given on page 207. The trick of avoiding division by choosing a smoothing percentage of 10% and shifting the decimal place instead has been used for decades by financial analysts making stock and commodity price charts.)

Calculating weight loss rate

To calculate the number of pounds you're losing (or gaining) per week in a given month, subtract the final trend number for the month from the initial trend number, then divide by 4 to get weekly weight loss (or gain). For example, if on the first of the month the trend entry was 167 and on the last day of the month it stood at 160, you lost a total of 7 pounds that month. The loss per week is then $7/4$, or 1.75 pounds.

Calculating calorie deficit

To calculate the average daily calorie shortfall (or excess) for a month, take the total weight loss (or gain) that month (for example $167-160 =$ 7 pounds) measured from the trend numbers, multiply by 3500 to obtain the total calories burned from fat (or stored there), then divide by the number of days in the month (31 for July, for example) to give the average daily calorie shortfall or excess. If you started July with the trend at 167 and ended it with the trend at 160, then each day you ate an average of

$$\frac{(167 - 160) \times 3500}{31} = 790$$

fewer calories than you burned.

Making weight charts

It only takes a couple of minutes to make a monthly weight chart from a completed log page. It's up to you whether to update the chart every day or wait 'till the end of the month and plot all the data in one sitting. One advantage of making the chart monthly is that at the end of the month you know the weight range for the month so you don't have problems with a line running off the bottom (or, horror of horrors, the top) of the page.

To make a chart, get a piece of graph paper and draw axes at the bottom, left, and right. Mark off ticks on the bottom for every day,

and ticks at the left for pounds. The right axis runs from 0 to 48 and is used to plot the rung in the exercise program you completed each day. To save time, make up a blank chart with the axes drawn in, the days of the month marked on the horizontal axis, and the rung numbers on the right, then run off a year's supply on a copier. All you have to do each month is label the weight scale on the vertical axis and plot the data. Plot both the daily weight readings and trend data on the chart, along with the exercise rung. The best way to distinguish the different lines on the chart is to draw them in different colours, for example black for daily weight, blue for the trend line, and red for the exercise rung line. Using all those different coloured pens may make you feel like a nerd, but since you aren't using a computer, it's OK. Model your hand-drawn charts after the computer-generated one on page 121.

Forecasting weight loss

To calculate how long it will take to reach a weight goal starting from a given weight, on a diet that restricts the calories you eat to some number fewer than you burn every day, first subtract the weight goal from the starting weight to get the number of pounds you need to lose. Multiplying by 3500 obtains the total number of calories you need to burn from fat to reduce your weight by the desired amount. Now divide by the daily calorie shortfall anticipated in your diet plan. The result will be the number of days it should take to lose the weight. You can divide the number of days by 7 to get weeks, or by 30 for time in months.

Using the numbers from the example on page 157, we calculate as follows. Subtracting the weight, 145, from the initial weight, 215, gives a weight loss of 70 pounds. Multiplying this by 3500 calories/pound indicates that a total of 245000 calories of fat (whew!) will have to be burned to lose that 70 pounds. The dieter intends to reduce his daily intake by 862 calories below what he burns, so dividing this into 245000 tells us how long the diet will take: 284 days. Dividing by 7 expresses this as 41 weeks (after rounding to the nearest week); dividing by 30 gives the duration as slightly less than 9 1/2 months.

Forecasting life extension

To calculate the extra minutes per day equivalent to extending your life by a given number of years, start with a guess at your minimum lifespan, overweight and out of shape. If you're less than 60, use 65

years, figuring on dropping dead on the day you retire. Life's like that, isn't it? If you're 60 or above, add 10 years to your current age. Next, subtract your age from this number, giving the years you'd live in your present shape. For example, if you're 40 now, and assuming you'd live to 65 without losing weight or exercising, you'd calculate $65 - 40 = 25$ years to live.

Next, make an assumption about the number of years you'll increase your life expectancy by exercising. The figure of 3 years used in chapter 6 is conservative; some estimates run as high as 4 years reduced expectancy simply from being 15 pounds overweight. Multiply the years of increased lifespan by 1440, the number of minutes in a day ($24 \times 60 = 1440$), to obtain the total minutes of increased lifespan, then divide by the number of years you'd live otherwise to obtain the extra minutes per day. Assuming 3 years of increased life span and 25 years to live otherwise, you'd calculate:

$$3 \text{ years} \times 1440 \frac{\text{minutes}}{\text{day}} \times \frac{1}{25 \text{ years}} = 172.8 \frac{\text{minutes}}{\text{day}}$$

Thus, if losing weight and exercising extends your life by 3 years past age 65, you've added extra time to your life equivalent to more than 172 minutes a day: almost *three extra hours*!

But at what cost in time? If you extend your life 3 years past age 65 with 15 minutes of daily exercise, you have a net gain of $172 - 15 = 157$ minutes a day, still more than two and a half hours. Another perspective on the time invested in a longer life is given by calculating the total years you'll spend exercising from now until the end of your estimated lifespan. Take your estimated years to live, multiply by the minutes per day spent exercising, and divide by 1440. Using the same assumptions as before, and figuring on 15 minutes a day of exercise, yields:

$$25 \text{ years} \times 15 \frac{\text{minutes}}{\text{day}} \times \frac{\text{day}}{1440 \text{ minutes}} = 0.26 \text{ years}$$

Thus, in the 25 years from age 40 to 65, you'd spend a total of about a quarter of a year exercising. If that bought you three more years to live, you'd end up with 2 3/4 extra years, more than 1000 additional days ($2.75 \times 365 \approx 1000$), to enjoy life, even if you figure the time spent on exercise was otherwise completely wasted and you derived no other benefits from it apart from a longer life span.

Calculating feedback models

The thermostat feedback system modeled by the Excel worksheet **FEEDLAB.XLS** (see page 59) isn't really practical to work by hand. The amount of calculation required to simulate one day is such that you'll almost certainly give up before gaining the intuitive understanding of feedback that comes from changing parameters and seeing the computer immediately simulate the consequences.

Nonetheless, here is the mathematical basis of the model. From these equations you can implement the simulation in another spreadsheet or as a standalone program. The parameters that control the model are identified by their labels on the **FEEDLAB** control panel.

Given:

$$\begin{aligned} A &= \textbf{Range} \\ D &= \textbf{Delay} \\ G &= \textbf{Goal} \\ L &= \textbf{Insulation} \\ N &= \textbf{Noise} \\ P &= \textbf{Power} \\ R &= \textbf{Random} \end{aligned}$$

Calculate the following variables for each time step i:

$$\begin{aligned} O_i &= \text{Outside temperature} \\ E_i &= \text{Error (deviation from goal)} \\ C_i &= \text{Correction applied by feedback} \\ T_i &= \text{Inside temperature} \end{aligned}$$

with the following initial conditions:

$$\begin{aligned} O_0 &= 70 \\ T_0 &= 70 \end{aligned}$$

For each 10 minute time interval $i \geq 1$ calculate the inside temperature T_i as follows. $\Re$ is a pseudorandom number ranging from -1 to 1, with a new value generated at each occurrence of $\Re$.

$$
\begin{aligned}
O_i &= O_{i-1} + \Re R \\
E_i &= (G - T_i) + \Re N \\
j &= \begin{cases} 0 & \text{if } D > i \\ i - D & \text{otherwise} \end{cases} \\
C_i &= \begin{cases} P & \text{if } E_j \geq A \\ -P & \text{if } E_j \leq -A \\ \begin{cases} E_j(P/A) & \texttt{Proportional} \\ 0 & \text{otherwise} \end{cases} & \text{if } |E_j| < A \end{cases} \\
T_i &= T_{i-1} + L(O_i - T_{i-1}) + C_{i-1}
\end{aligned}
$$

Calculating moving averages

Quick and easy instructions for calculating the daily trend from weight are given above on page 201. That calculation uses a particular exponentially smoothed moving average chosen for ease of calculation as well its effectiveness in extracting the trend from daily weights. This section presents the mathematical definition of all the forms of moving averages described in chapter 5. You don't have to understand this material to understand moving averages, and it's certainly not necessary to use moving averages to control your weight. If you're interested in experimenting on your own with moving averages on a computer, these equations provide the foundation for the programs you'll write.

All moving averages operate on a time series of measurements, M_1, M_2,..., M_d, where d is the total number of measurements made to date and M_d is the most recently made measurement. For convenience in the discussion, we'll assume one measurement is made per day; any other regular interval is equivalent.

Simple moving averages

The n *day simple moving average* for day d is computed by:

$$A_d = \frac{\sum_{i=1}^{n} M_{(d-i)+1}}{n} \quad n \leq d$$

If we have ten measurements, M_1 through M_{10}, and we wish to compute a four day moving average, the moving averages for successive days are:

$$\begin{aligned} A_4 &= (M_4 + M_3 + M_2 + M_1)/4 \\ A_5 &= (M_5 + M_4 + M_3 + M_2)/4 \\ &\vdots \\ A_{10} &= (M_{10} + M_9 + M_8 + M_7)/4 \end{aligned}$$

We can't compute a four day moving average until we have four days worth of data. That's why the first moving average in this example is A_4.

Weighted moving averages

A *weighted moving average* is calculated by defining *weight factors*, W_1, W_2,..., W_n for each day in the n day moving average. The weighted moving average for day d is then:

$$A_d = \frac{\sum_{i=1}^{n} W_i M_{(d-i)+1}}{\sum_{i=1}^{n} W_i} \quad n \leq d$$

Note that if all the weights, W_i are 1, this equation reduces to that of a simple moving average.

Exponentially smoothed moving averages

An *exponentially smoothed moving average* is a weighted moving average in which the weight factors are powers of S, the *smoothing constant*. An exponentially smoothed moving average is computed over *all* the data accumulated so far instead of being chopped off after some number of days. For day d the exponentially smoothed moving average is:

$$A_d = \frac{\sum_{i=1}^{d} S^{i-1} M_{(d-i)+1}}{\sum_{i=1}^{d} S^{i-1}}$$

But this is just a geometric sequence! The next term in such a sequence is given by:

$$A_d = (1 - S)M_d + SA_{d-1}$$

Calculation is expedited and comprehension served if we substitute:

$$P = 1 - S$$

for S into the equation for the next term. Doing a little algebra, we discover:

$$\begin{aligned} A_d &= PM_d + (1 - P)A_{d-1} \\ &= PM_d + A_{d-1} - PA_{d-1} \\ &= A_{d-1} + P(M_d - A_{d-1}) \end{aligned}$$

This reformulation makes the operation of smoothing very intuitive. Every day, we take the old trend number A_{d-1}, calculate the difference between it and today's measurement M_d, then add a percentage of that difference P to the old trend value obtain the new one. Obviously, the closer P is to 1 (and hence the closer S is to zero), the more influence the new measurement has upon the trend. If $P = 1$, the old trend value A_{d-1} cancels out and the moving average tracks the data precisely.

For example, with the smoothing constant $S = 0.9$ we use on weight data, we calculate the new trend value A_d from the previous trend value A_{d-1} and today's weight M_d as:

$$\begin{aligned} A_d &= A_{d-1} + (1 - 0.9)(M_d - A_{d-1}) \\ &= A_{d-1} + 0.1(M_d - A_{d-1}) \end{aligned}$$

In discussions of exponentially smoothed moving averages, particularly their financial applications, beware of confusing the smoothing constant S with the variant form $P = (1 - S)$ introduced to simplify calculation and make the effect of the new data on the moving average more apparent. P is often referred to as the "smoothing percentage"; the term "10% smoothing" refers to a calculation in which $P = 10/100 = 0.1$ and hence $S = 0.9$.

Calculating best fit trends

To calculate the rate of weight loss or gain and the calorie shortfall or excess responsible for it from the moving average trend line, the Excel spreadsheet finds the straight line trend that best fits the curve traced out by the moving average by the method of *least squares*. The process of finding a line that accurately represents the trend of a collection of data points is called *linear regression*, and the least squares method is the most frequently used approach to the problem.

Any non-vertical straight line (you'd be in a fine pickle if your weight trend line were vertical, wouldn't you?) can be expressed in the form:

$$Y = mX + b$$

where m is the *slope*, giving the change in the Y axis value for each unit change along the X axis, and b is the *intercept*, the point at which the line crosses the Y axis when X is zero.

To find m and b for the line that best fits a collection of data points D_1, D_2,..., D_n we calculate:

$$
\begin{aligned}
m &= \frac{n\sum_{i=1}^{n} iD_i - (\sum_{i=1}^{n} i)(\sum_{i=1}^{n} D_i)}{n\sum_{i=1}^{n} i^2 - (\sum_{i=1}^{n} i)^2} \\
b &= \frac{(\sum_{i=1}^{n} D_i)(\sum_{i=1}^{n} i^2) - (\sum_{i=1}^{n} i)(\sum_{i=1}^{n} iD_i)}{n\sum_{i=1}^{n} i^2 - (\sum_{i=1}^{n} i)^2}
\end{aligned}
$$

Since we're only interested in the rate of change, we only need the slope, m, which gives the daily rate of change in the line that best fits the moving average trend curve. From the slope, the average weight change per week is just seven times the daily change,

$$7m$$

and the average daily calorie deficit (if negative) or excess (if positive) is:

$$3500m$$

12

UNITS AND CONVERSION FACTORS

Units of Volume (Fluid Measure)

	Tsp	Tbsp	Fl. oz.	Pint	Quart	Gallon
Tsp	1	1/3	1/6	1/96	1/192	1/768
Tbsp	3	1	1/2	1/32	1/64	1/256
Fl. oz.	6	2	1	1/16	1/32	1/128
Pint	96	32	16	1	1/2	1/8
Quart	192	64	32	2	1	1/4
Gallon	768	256	128	8	4	1

1 cup = 16 tbsp. = 8 fl. oz. = 1/2 pint

	Cubic Inch	Cubic Cm.	Liter
Tsp	0.300781	4.928922	0.004929
Tbsp	0.902344	14.78676	0.014786
Fl. oz.	1.804688	29.57353	0.029573
Pint	28.875	473.1765	0.473163
Quart	57.75	946.3529	0.946326
Gallon	231	3785.412	3.785306

Units of Energy (Food value)

1 kilogram calorie (kcal) = 4.184 kilojoule (kJ)
1 kilojoule (kJ) = 0.239 kilogram calorie (kcal)

Units of Length

	Inch	Foot	Yard	Mile
Inch	1	1/12	1/36	1/63360
Foot	12	1	1/3	1/5280
Yard	36	3	1	1/1760
Mile	63360	5280	1760	1

	Millimeter	Centimeter	Meter
Inch	25.4	2.54	0.0254
Foot	304.8	30.48	0.3048
Yard	914.4	91.44	0.9144
Mile	1609344	160934.4	1609.344

Units of Weight (Avoirdupois)

	Ounce	Pound	Ton
Ounce	1	1/16	1/32000
Pound	16	1	1/2000
Ton	32000	2000	1

	Gram	Kilogram	Metric Ton	Stone
Ounce	28.34952	0.02835	2.835×10^{-5}	1/224
Pound	453.5924	0.453592	0.000454	1/14
Ton	907184.7	907.1847	0.907185	142.8571

Units of Dry Volume

	Pint (dry)	Quart (dry)	Peck	Bushel
Pint (dry)	1	1/2	1/16	1/64
Quart (dry)	2	1	1/8	1/32
Peck	16	8	1	1/4
Bushel	64	32	4	1

	Cubic Inch	Cubic Cm.	Liter
Pint (dry)	33.60031	550.6105	0.550595
Quart (dry)	67.20063	1101.221	1.10119
Peck	537.605	8809.768	8.809521
Bushel	2150.42	35239.07	35.23808

Abbreviations

bu	bushel
cal	(kilogram) calorie
cc	cubic centimeter
cm	centimeter
cu	cubic
fl	fluid
ft	foot
g	gram
gal	gallon
J	joule
kcal	kilogram calorie
kg	kilogram
kJ	kilojoule
L	liter
lb	pound
mi	mile
mm	millimeter
oz	ounce
pk	peck
pt	pint
qt	quart
tbsp	tablespoon
tsp	teaspoon
yd	yard

The Weight of Water

	Pounds	Grams	Kilograms
Cubic cm.	0.002205	1	0.001
Cubic inch	0.036127	16.387064	0.0163871
Liter	2.204684	1000.028	1.000028
Gallon	8.345404	3785.4118	3.7854118
Cubic foot	62.42796	28316.847	28.316847

A more comprehensive version of these conversion tables is supplied in an Excel worksheet, **`UNITS.XLS`**.

13

CALORIES IN VARIOUS FOODS

Alcohol

Beer, 12 fl. oz.	145
Beer, light, 12 fl. oz.	100
Liquor, 100 proof, 1 fl. oz.	83
Liquor, 80 proof, 1 fl. oz.	65
Liquor, 86 proof, 1 fl. oz.	70
Liquor, 90 proof, 1 fl. oz.	74
Wine, 4 fl. oz.	100

Arby's

Beef n Cheddar, each	455
Chicken breast, each	493
Chicken club, each	610
French fries, 2 1/2 oz.	246
Ham n Cheese, each	292
Jamocha shake, 11 1/2 fl. oz.	326
Potato cakes, 1 serving	204
Roast beef, each	353
Super Roast Beef, each	501
Turkey deluxe, each	375

Beverages

Bouillon, beef or chicken, instant, 1 tsp.	2
Bouillon, beef or chicken, 1 cube	4
Coca-Cola Classic, 12 fl. oz.	144
Coca-Cola, New, 12 fl. oz.	154
Coffee, 1 cup	2
Coffee, Cafe Vienna, General Foods—6 fl. oz.	30

Diet Coke, 12 fl. oz.	1
Diet Pepsi, 12 fl. oz.	1
Sprite, 12 fl. oz.	142

Bread

Bagel, Sara Lee Deli style	230
Bagel, plain, each	150
Biscuit, home recipe—2 in.	108
Blueberry muffin, 1 muffin	112
Bread cubes, 1 cup	111
Bread stuffing, dry, crumbly—1 cup	501
Bread, rye, 1 slice	61
Bread, white, 1 slice	68
Bread, whole wheat, 1 slice	67
Brown and serve roll, 1 roll	84
Bun, hamburger, each	119
Bun, hot dog, each	119
Butter Tastin' Biscuit, 1869 Brand, each	100
Buttermilk biscuit, fluffy, Hungry Jack, each	90
Cornbread muffin, 1 muffin, home recipe	126
Cornbread twists, 1 stick—Pillsbury	70
Cornbread, from mix, 1/9 of 12 oz. mix, 1 egg, milk	178
Crescent roll, 1 roll—Pillsbury	100
Croissant, each	200
Croutons, seasoned, 1/2 oz—Pepperidge Farm	70
Dinner roll, cloverleaf or pan roll	83
Eggo blueberry waffles, each	130
Eggo buttermilk waffles, each	120
Eggo oat bran waffles, each	110
English muffin, Thomas', 1 muffin	130
French bread, 1 slice	73
Hoagie roll, 11 1/2×3 in.	392
Lite bread, 1 slice—Merita lite wheat	40
Lite pancake mix, 4 in. pancake—Aunt Jemima	43
Oat bran muffin, 1 muffin—Duncan Hines	110
Onion roll, Pepperidge Farm, each	150
Pancake mix, 4 in. pancake—Aunt Jemima	83
Pancakes, home recipe, 1 4 in. cake	62
Pancakes, home recipe, 1 6 in. cake	169
Pillsbury buttermilk biscuit, 1 biscuit	50
Pita bread, 1/2 round bread, Mediterranean	80
Taco shells, 1 shell—Old El Paso	55

Burger King

Bleu Cheese dressing, 1 packet	300
Cheese Whopper, each	711
Chef salad, each	180
Chicken salad, each	140
Chicken specialty, each	688
Chicken Tenders, 1 piece	34
Croissan'wich, Ham, egg and cheese	335
Croissan'wich, Bacon, egg and cheese	355
Croissan'wich, Sausage, egg and cheese	538
French dressing, 1 packet	280
French fries, 1 serving	227
Garden salad, each	90
House dressing, 1 packet	260
Onion rings, 1 serving	274
Reduced Italian dressing, 1 packet	30
Salad bacon bits, 1 packet	16
Salad croutons, 1 packet	29
Thousand Island, 1 packet	240
Vanilla milkshake, regular	321
Whaler, each	488
Whopper, each	628

Candy

5th Avenue Bar, each	270
Bar None, each	240
Chocolate Caramel Figurine Bar, each	100
Chocolate Figurine Diet Bar, each	100
Figurine, Peanut Butter Chocolate, each	100
Fruit Roll-Ups, 1/2 oz. roll	50
Granola bar, Nature Valley, each, Oats 'n Honey	120
Granola bar, Nature Valley, each, peanut butter	120
Halvah, 1 oz. bar	160
Hershey bar with almonds, each	250
Hershey chocolate bar, each	250
Hershey's Kisses, 9 pieces	220
Hershey's Mr. Goodbar, each 1 3/4 oz.	300
Hershey's Symphony chocolate, Almonds & Toffee Chips	220
Kit Kat bar, each	250
Krackel bar, each	250
Kudos, chocolate chip, 1 granola bar	180
M&Ms, peanut, 1 package	250
M&Ms, plain, 1 package	240

Mars bar, each	240
Marshmallow, 1 large	23
Peanut butter cups, Reese's—2 cups	280
Reese's Pieces, 1 package, 1.95 oz.	270
Rolo caramels, 9 pieces	270
S'Mores Figurine Diet Bar, each	100
Skor Toffee bar, each	220
Snickers, each	275
Twix candy bar, 1 package, 2 bars	280
Vanilla Figurine Diet Bar, each	100
Whatchamacallit candy bar, each	260

Cereal

Cheerios, 1 oz. or 11/4 cups	110
Cracklin' Oat Bran, 1 oz. or 1/2 cup	110
Honey Bunches of Oats, Post cereal—2/3 cup	110
Kellogg's Corn Flakes, 1 oz. or 1 cup	100
Kellogg's Crispix, 1 oz. or 1 cup	110
Kellogg's Frosted Flakes, 1 oz. or 3/4 cup	110
Kellogg's Heartwise, 1 oz. or 2/3 cup	90
Kellogg's Product 19, 1 oz. or 1 cup	100
Kellogg's Raisin Bran, 1 oz. or 3/4 cup	120
Kellogg's Special K, 1 oz. or 1 cup	110
Mueslix Crispy Blend, 1 oz. or 2/3 cup	160
Mueslix Golden Crunch, 1 oz. or 1/2 cup	120
Nature Valley cereal, toasted oat—1 cup	390
Nut & Honey Crunch, 1 oz. or 2/3 cup	110
Oatmeal, cooked, 1 cup	132
Oatmeal, dry, 1 cup	312
Rice Chex, 1 oz., or 1 1/8 cup	110
Rice Krispies, 1 oz. or 1 cup	110
Shredded wheat, regular, 1 biscuit	80
Shredded Wheat Squares, Fruit—1 oz. or 1/2 cup	90
Spoonsize shredded wheat, 1 cup	165
Total cereal, 1 oz. or 1 cup	100
Trix cereal, 1 oz. or 1 cup	110
Wheat Chex, 1 oz.	100
Wheaties, 1 oz. or 1 cup	100

Cookies

Butter cookies, 1 Danish butter cookie	23
Chocolate chip cookie, home recipe	51
Chocolate chip cookies, Girl Scout Country Hearth	35
Chocolate chip cookies, Entenmann's	49

Fig newtons, Lance, 1 package	150
Girl Scout cookies, Trefoils—shortbread	30
Girl Scout cookies, Country Hearth Choc Chip	35
Girl Scout cookies, Thin Mints	40
Girl Scout cookies, Do-si-dos p'nut butter	50
Girl scout cookies, Cabana cremes	60
Girl Scout cookies, Tagalongs—peanut butter	80
Girl Scout Samoas, coconut cookie	80
Nekot, Lance p'nut butter cookies	210
Oatmeal cookie, 1 2 5/8 in. cookie	59
Oatmeal raisin cookies, Entenmann's	49
Oreos, each	50
Pecan Sandy, each	80
Sugar cookie, home recipe—2 1/4 in.	36
Vanilla wafers cookies, Keebler	20

Crackers

American Heritage sesame crackers, 4 crackers	80
Bacon crackers, 1 cracker—Nabisco	10
Cheese crackers, Lance Toastchee—6 crackers	190
Cheese on wheat, Lance crackers, 1 package	180
Goldfish crackers, original, 45 crackers	140
Goldfish crackers, pretzel, 40 crackers	120
Ritz crackers, 4 crackers	70
Rye-chee crackers, 1 package—Lance	190
Saltine crackers, each	12
Sunshine American Heritage, 1 wheat bran cracker	150
Sunshine Cheez-it crackers, 12 crackers, 1/2 oz.	70
Thin Bits, 12 crackers	70
Town House crackers, 4 crackers	70
Triscuit, 3 wafers	60
Van-O-Lunch, Lance, 6 crackers	180
Vegetable Thins, Nabisco—7 crackers	70
Waverly wafers, 4 crackers	70
Wheat Bran crackers, Sunshine, 1 cracker	15
Wheat Thins, 8 crackers	70

Dairy

Butter, 1 tbsp	100
Butter, 1 pat	36
Butter, stick, 4 oz.	813
Buttermilk, low-fat, 1 cup	90
Cheese, American, 1 slice, Kraft	100
Cheese, American "Lite", 1 slice	70

Cheese, Brie, 1 oz.	95
Cheese, Camembert, 1 oz.	85
Cheese, cheddar, 1 oz., or 1/4 cup shredded	114
Cheese, colby, 1 oz.	112
Cheese, gouda, 1 oz.	101
Cheese, liver, 1 oz.	86
Cheese, Monterey jack, 1 oz.	106
Cheese, mozarrella, skim, 1 oz., partly skim milk	79
Cheese, mozzarella, 1 oz., or 1/4 cup shredded	90
Cheese, muenster, 1 oz.	104
Cheese, Parmesan, grated, 1 tbsp.	23
Cheese, Parmesan, grated, 1 oz.	129
Cheese, pimento, 1 oz.	106
Cheese, provolone, 1 oz.	100
Cheese, ricotta, 1 oz., part-skim	35
Cheese, Swiss, 1 oz.	107
Cheese, Swiss slices, 1 1/4 oz. 7 1/2×4 in. slice	130
Cottage cheese, 1% fat, 1 cup	164
Cottage cheese, 2% fat, 1 cup	203
Cottage cheese, creamed, 1 cup	217
Cottage cheese, dry curd, 1 cup	123
Cream cheese, 1 oz.	414
Cream cheese, light, Kraft—1 oz., 2 tbsp.	60
Cream, light, 1 tbsp.	29
Cream, light, 1 cup	469
Egg nog, 1 cup	342
Half and half, 1 tbsp.	20
Half and half, 1 cup	315
Ice cream, vanilla, hard, 1 cup	269
Ice cream, vanilla, soft, 1 cup	377
Ice cream, "death from within", 1 cup	500
Ice milk, vanilla, hard, 1 cup	184
Ice milk, vanilla, soft, 1 cup	223
Imitation sour cream, 1 tbsp.—Light Choice	25
Margarine, 1 tbsp.	102
Margarine, 1 stick	816
Milk, low fat, 8 fl. oz., 1% fat	102
Milk, low fat, 8 fl. oz., 2% fat	121
Milk, nonfat (skim), 8 fl. oz.	86
Milk, whole, 8 fl. oz. 3.3% fat	150
Non-dairy creamer, 1 tsp.	11
Soft margarine, 1 tbsp.—Fleishmann	100
Sour cream, 1 tbsp.	26
Sour cream, 1 cup	493
Squeeze cheese, 1 oz.	82
Velveeta cheese, 1 oz.	80
Velveeta cheese slices, 3/4 oz. slice	68

Whipped cream, 1 cup, canned pressurised	154
Whipping cream, heavy, 1 cup, whipped	410
Whipping cream, light, 1 cup, whipped	349
Yogurt, Weight Watchers	150
Yogurt, Dannon plain, 1 cup	140
Yogurt, Dannon vanilla, 8 oz.	210
Yogurt, Dannon with fruit, 1 cup	240
Yogurt, plain, 1 cup	150

Dessert

Angel food cake, 1/12 of 9 in. cake	137
Apple pie, frozen, 1/6 of pie, Banquet	250
Apple spice cake, 1 Hostess Light	130
Banana cake, from mix, 1/12 cake—Pillsbury	250
Blackout pudding cake, Entenmann's 1/12 of cake	96
Blueberry crunch cake, Entenmann's 1/12 of cake	113
Carrot 'n Spice cake, Pillsbury mix—1/12 cake	260
Carrot cake, Entenmann's 1/12 of cake	114
Cheese crumb Babka, Entenmann's 1/12 of cake	105
Cherry pie, frozen, 1/6 pie, Banquet	250
Chocolate cake, 1/12 of 2 layer cake	308
Chocolate fudge, 1 cu. in.	84
Chocolate pound cake, Entenmann's 1/12 of cake	123
Cinnamon Raisin Danish, each, Pillsbury	140
Cinnamon Roll, each, Pillsbury	210
Coffee cake, apple raisin, Entenmann's 1/12 of cake	90
Coffee cake, Bavarian creme, Entenmann's 1/12 of cake	103
Coffee cake, cheese-filled, Entenmann's 1/12 of cake	105
Coffee cake, cherry cheese, Entenmann's 1/12 of cake	90
Crunch cake, banana walnut, Entenmann's 1/12 of cake	123
Crystal Light popsicles, 1 diet frozen drink bar	14
Devils food cake, 1/12 of 9 in. cake	312
Double fudge cake, Entenmann's 1/12 of cake	116
Fig Cake, Lance—2 1/8 oz.	210
Frozen yogurt, peach, Sealtest fat-free, 1 cup	200
Fudge brownie with walnuts, Pillsbury mix—2 in. square	150
Fudge golden cake, Entenmann's 1/12 of cake	116
Gingerbread cake, 1/9 of 8×8 in. cake	174
Golden pound cake, Entenmann's 1/12 of cake	98
Hershey's Fudge Topping, 1 tbsp.	50
Hostess lights, 1 apple spice cake	130
Iced cinnamon roll, Pillsbury	110
Lemon twist, Entenmann's 1/12 of cake	113
Oatmeal Cake, Lance—creme-filled	240
Orange Danish, Pillsbury	140

Orange sunshine cake, Entenmann's 1/12 of cake	105
Peach pie, 1/8 pie	301
Pecan pie, 1/8 of 9 in. pie	431
Pumpkin pie, 1/8 pie	241
Raspberry twist, Entenmann's 1/12 of cake	113
Streusel coffee cake, Pillsbury, 1/8 of cake	180
Twinkies, each	160
White cake, 1/12 of 2 layer cake	333
Yellow cake, 1/12 of 2 layer cake	310

Domino's Pizza

Cheese pizza, 1 slice, 16 in. pizza	188
Deluxe pizza, 1 slice, 16 in. pizza	299
Ham pizza, 1 slice, 16 in. pizza	208
Pepperoni pizza, 1 slice, 16 in. pizza	230
Pizza, double cheese, 1 slice, 16 in. pizza	272
Pizza, sausage & mushroom, 1 slice, 16 oz. pizza	215
Veggie pizza, 1 slice, 16 in. pizza	249

Dressing

Blue cheese dressing, 1 tbsp.	77
Blue cheese dressing, 1 cup	1235
Blue cheese, low fat, 1 tbsp.	3
Blue cheese, low fat, 1 cup	47
Italian dressing, 1 tbsp.	69
Italian dressing, 1 cup	1098
Oil and vinegar dressing, Newman's Own, 1 tbsp.	81
Ranch fat free dressing, Kraft, 1 tbsp.	16
Ranch salad dressing, Hidden Valley 1 tbsp.	40

Dunkin' Donuts

Apple filled donut, each	250
Cake donut, each	270
Chocolate croissant, each	440
Chocolate frosted donut, each	200
Croissant, each	310
Donut, Bavarian creme-filled, each	240
Glazed donut, each	200
Glazed French cruller, each	140
Jelly donut, each	220
Oat bran muffin, each	330

Eggs

Egg white, 1 large egg white	17
Egg yolk, from 1 large egg	59
Egg, fried in butter, 1 large egg	99
Egg, raw, boiled, or poached, 1 large	82
Scrambled eggs, 1 egg with butter & milk	111
Scrambled eggs, 1 cup, with butter & milk	325

Fish

Alaska King crab, 1 leg	129
Alaska King crab, steamed, 4 oz.	109
Blue crab, steamed, 1 cup or 4.8 oz.	138
Catfish, fried, 4 oz. fillet	259
Catfish, raw, 4 oz.	132
Clams, canned, 1 can	112
Crab cakes, 1 2 oz. cake	93
Crab meat, canned, 1 cup or 4.8 oz.	133
Crab, deviled, 1 cup	451
Crab, deviled, frozen, Mrs. Paul's—1 cake	170
Crayfish, steamed, 4 oz.	129
Croaker, fried, 4 oz.	251
Croaker, raw, 4 oz.	119
Dolphinfish, raw, 4 oz.	97
Eel, baked, 4 oz.	267
Fish sticks, Mrs. Paul's, 4 sticks	200
Fish, breaded and fried, 3 1/2 oz.	250
Fish, raw, broiled, poached, 3 1/2 oz.	140
Flounder, baked, 4 oz.	132
Flounder, fried, 2 fillets, Mrs. Paul's	270
Halibut, broiled, 4 oz.	194
Mackerel, Atlantic, baked, 4 oz.	297
Mackerel, Spanish, baked, 4 oz.	179
Oysters, canned, 1 cup or 9 oz.	179
Oysters, fried, 6 medium, or 3.14 oz.	173
Oysters, steamed, 12 medium, or 3 oz.	117
Perch, baked, 4 oz.	132
Sardines in oil, drained, 3 3/4 oz.—Atlantic	192
Sardines, tomato sauce, 3 3/4 oz.	189
Scallops, frozen, Mrs. Paul's—3 1/2 oz.	230
Scallops, fried, 4 oz. or 7 large scallops	242
Scallops, steamed, 4 oz.	127
Shad, raw, 4 oz.	223
Shark, raw, 4 oz.	148

Shrimp, fried, 4 oz.	275
Shrimp, fried, frozen, Mrs. Paul's—3 oz.	200
Shrimp, steamed, 4 oz.	112
Surimi, 4 oz.	116
Tuna, bluefin, steamed, 4 oz.	209
Tuna, canned in oil, 1 6 1/4 oz. can, drained	331
Tuna, canned in water, 1 6 1/4 oz. can	234

Frozen food

Almond Chicken, La Choy frozen dinner	290
Baby Bay Shrimp, Armour Dinner Classics Lite	250
Baked Chicken Breast w/ gravy, Stouffer's frozen dinner	300
Barbecue Style Chicken, Stouffer's frozen dinner	390
Bean & cheese burrito entree, Old El Paso, each	340
Bean & cheese chimichanga, Old El Paso, each	350
Beef & bean burrito, hot, Old El Paso, each	340
Beef & bean burrito, medium, Old El Paso, each	330
Beef & bean burrito, mild, Old El Paso, each	330
Beef & Broccoli, La Choy frozen dinner	290
Beef & pork chimichanga, Old El Paso, each	340
Beef Burgundy with Parsley Noodles, Light & Elegant	250
Beef Cannelloni, Lean Cuisine, 9 5/8 oz.	260
Beef chimichangas, Old El Paso, each	380
Beef Chop Suey with Rice, Stouffer's entree	300
Beef Dijon, Stouffer's frozen dinner	290
Beef Enchanadas, Lean Cuisine, 9 1/4 oz.	280
Beef enchilada, Old El Paso, each	210
Beef enchilada dinner, Old El Paso, 11 oz.	390
Beef Julienne with rice & pepper, Light & Elegant	260
Beef Pepper Steak, Armour Dinner Classics Lite	290
Beef pie, Banquet, 1 frozen pot pie	500
Beef pie, Morton—7 oz.	430
Beef pie, Stouffer's entree	500
Beef pot pie, 1 pie—Swanson	380
Beef Ragout, Stouffer's frozen dinner	300
Beef Short Rib in Gravy, Stouffer entree	350
Beef Sirloin Tips, Le Menu frozen dinner	400
Beef Stroganoff, Le Menu frozen dinner	450
Beef Stroganoff, Armour Dinner Classics	420
Beef Stroganoff with Parsley Noodles, Light & Elegant	290
Beef Stroganoff with Parsley Noodles, Stouffer entree	390
Beef Teriyaki in Sauce, Stouffer entree	290
Beef Teriyaki with rice & pea pods, Light & Elegant	240
Beef, cheese chimichanga dinner, Old El Paso, 11 oz.	510
Beefsteak Ranchero, Lean Cuisine, 9 1/4 oz.	270

Breast of Turkey, Le Menu frozen dinner	270
Cashew Chicken in Sauce, Stouffer entree	380
Cheese Cannelloni, Lean Cuisine, 9 1/8 oz.	260
Cheese enchilada, Old El Paso, each	250
Cheese enchilada dinner, Old El Paso, 11 oz.	590
Cheese enchiladas, Stouffer entree	590
Cheese Pizza, Lean Cuisine, French bread	310
Cheese Stuffed Shells, Stouffer's frozen dinner	310
Chicken & noodles, Armour Dinner Classics	340
Chicken a l'Orange, Lean Cuisine, 8 oz.	260
Chicken a la King, Le Menu frozen dinner	330
Chicken a la King with Rice, Stouffer entree	290
Chicken and Vermicelli, Lean Cuisine, 11 3/4 oz.	270
Chicken Breast Marsala, Armour Dinner Classics Lite	270
Chicken Burgundy, Armour Dinner Classics Lite	250
Chicken Cacciatore, Armour Dinner Classics Lite	240
Chicken Cacciatore, Lean Cuisine, 10 7/8 oz.	250
Chicken chimichangas, Old El Paso, each	370
Chicken Chow Mein, Stouffer entree	130
Chicken Chow Mein, Lean Cuisine, 11 1/4 oz.	250
Chicken Chow Mein, Imperial, La Choy frozen dinner	270
Chicken Cordon Bleu, Le Menu frozen dinner	470
Chicken Divan, Stouffer entree	320
Chicken Enchanadas, Lean Cuisine, 9 7/8 oz.	270
Chicken enchilada, Old El Paso, each	220
Chicken enchilada with sour cream, Old El Paso, each	280
Chicken Enchiladas, Stouffer entree	490
Chicken Enchiladas Suiza, Weight Watchers 9.37 oz.	330
Chicken Florentine, Stouffer's frozen dinner	430
Chicken Florentine, Le Menu frozen dinner	340
Chicken fricassee, Armour Dinner Classics	340
Chicken in Cheese Sauce, Light & Elegant	295
Chicken in Herb, Lean Cuisine, 9 1/2 oz.	260
Chicken Italiano, Stouffer's frozen dinner	280
Chicken Marsala, Lean Cuisine, 8 1/8 oz.	190
Chicken Milan, Armour Dinner Classics	320
Chicken Oriental, Armour Dinner Classics Lite	280
Chicken Oriental, Lean Cuisine, 9 3/8 oz.	230
Chicken Parmesan, Lean Cuisine, 10 oz.	260
Chicken Parmigiana, Le Menu frozen dinner	400
Chicken Parmigiana, Stouffer's frozen dinner	360
Chicken Parmigiana with Parsley, Light & Elegant	260
Chicken pie, Banquet, 1 frozen pot pie	540
Chicken pie, Stouffer entree	530
Chicken pie, Morton—7 oz.	415
Chicken pot pie, 1 pie—Swanson	370
Chicken Tenderloins, Stouffer's frozen dinner	330

Chicken tenderloins in barbecue sauce, Stouffer entree	270
Chicken with Supreme Sauce, Stouffer's frozen dinner	360
Chicken, Sweet and Sour, Le Menu frozen dinner	450
Chili Con Carne with Beans, Stouffer entree	260
Chopped Sirloin Beef, Le Menu frozen dinner	440
Creamed Chicken, Stouffer entree	300
Creamed Chipped Beef, Stouffer entree—11 oz.	460
Curry Turkey with Rice, Stouffer's frozen dinner	320
Deluxe Pizza, Lean Cuisine, French bread	350
Escalloped Chicken & Noodles, Stouffer entree	420
Fiesta Beef, Stouffer's frozen dinner	270
Fiesta Lasagna, Stouffer entree	430
Fillet of Sole, Le Menu frozen dinner	360
Fish Divan, Lean Cuisine, 12 3/8 oz.	260
Fish Florentine, Lean Cuisine, 9 oz.	230
Fish Jardiniere, Lean Cuisine, 11 1/4 oz.	290
Fried Chicken, Stouffer's frozen dinner	450
Glazed Chicken, Lean Cuisine, 8 1/2 oz.	270
Glazed Chicken with Vegetable Rice, Light & Elegant	240
Green Pepper Steak with Rice, Stouffer entree	330
Ham & Asparagus Bake, Stouffer entree	510
Ham Steak, Le Menu frozen dinner	300
Homestyle Chicken and Noodles, Stouffer entree	310
Homestyle Meatloaf, Stouffer's frozen dinner	410
Homestyle Pot Roast, Stouffer's frozen dinner	220
Lasagna, Stouffer—10 1/2 oz.	360
Lasagna Florentine, Light & Elegant	280
Lasagna with Meat, Lean Cuisine, 10 1/4 oz.	270
Linguini with Clam, Lean Cuisine, 9 5/8	270
Lobster Newburg, Stouffer entree	380
Macaroni & Beef w/ Tomatoes, Stouffer—11 1/2 oz.	340
Macaroni & Cheese, Stouffer entree—12 oz.	500
Macaroni & cheese dinner, Banquet—10 oz.	415
Macaroni & Cheese with Bread Crumbs, Light & Elegant	300
Manicotti, Le Menu frozen dinner	360
Meat Lasagna, Lean Cuisine, 10 1/4 oz.	270
Meatball Stew, Lean Cuisine, 10 oz.	250
Mincemeat pie, frozen, 1/6 pie, Banquet	260
Noodles & chicken dinner, Banquet—10 oz.	340
Oriental Beef, Lean Cuisine, 8 5/8 oz.	250
Oven Fried Fish, Weight Watchers	300
Pasta Mornay with Ham, Lean Cuisine, 9 3/8 oz.	280
Pasta Shells, Cheese with Tomato, Stouffer entree	330
Pepper Steak, Le Menu frozen dinner	370
Pepperoni Pizza, Lean Cuisine, French bread	340
Pizza, Extra Cheese, Lean Cuisine, French bread	350
Pizza, frozen, individual, 8 oz.	550

Rigatoni Bake, Lean Cuisine, 9 3/4 oz.	260
Roast Turkey Breast, Stouffer's frozen dinner	330
Salisbury Steak, Armour Dinner Classics Lite	270
Salisbury Steak, Armour Dinner Classics	460
Salisbury Steak, Lean Cuisine, 9 1/2 oz.	280
Salisbury Steak in Gravy, Stouffer entree	250
Salisbury Steak with Gravy, Stouffer's frozen dinner	400
Sausage Pizza, Lean Cuisine, French bread	350
Seafood Newburg, Armour Dinner Classics	300
Seafood w/ Natural Herbs, Armour Dinner Classics Lite	220
Sesame Chicken, Stouffer's frozen dinner	320
Shrimp and Chicken, Lean Cuisine, 10 1/8 oz.	270
Shrimp Creole dinner, Healthy Choice	210
Shrimp Creole with rice & pepper, Light & Elegant	220
Shrimp Primavera, Stouffer's frozen dinner	240
Shrimp with Lobster Sauce, La Choy frozen dinner	220
Sirloin roast, Armour Dinner Classics	300
Sirloin tips, Armour Dinner Classics	340
Sliced Turkey & Gravy, Light & Elegant	240
Sliced Turkey Breast, Lean Cuisine, 8 oz.	240
Spaghetti & meatballs dinner, Banquet—10 oz.	290
Spaghetti with Beef, Lean Cuisine, 11 1/2 oz.	280
Spaghetti with Meat Sauce, Stouffer entree	370
Spaghetti with Meat Sauce, Light & Elegant	290
Spaghetti with Meatballs, Stouffer entree	380
Steak Diane, Armour Dinner Classics Lite	290
Stuffed Cabbage, Lean Cuisine, 10 3/4 oz.	220
Stuffed Green Peppers with Beef, Stouffer entree	400
Stuffed Turkey Breast, Weight Watchers	260
Swedish Meatballs in Gravy, Stouffer entree	480
Sweet & Sour Chicken, Armour Dinner Classics Lite	250
Sweet & Sour Chicken, Healthy Choice frozen dinner	280
Szechuan Beef, Lean Cuisine, 9 1/4 oz.	260
Taco dinner, 1 taco—Old El Paso	67
Tortellini Beef with Marinara, Stouffer entree	360
Tortellini Cheese in Alfredo, Stouffer entree	600
Tortellini Cheese with Tomato Sauce, Stouffer entree	360
Tortellini Cheese with Vinaigret, Stouffer entree	400
Tortellini with Meat, Armour Dinner Classics Lite	250
Tortilla Grande, Stouffer entree	530
Tuna Lasagna, Lean Cuisine, 9 3/4 oz.	270
Tuna Noodle Casserole, Stouffer entree	310
Tuna pie, Banquet, 1 frozen pot pie	540
Turkey & dressing, Armour Dinner Classics	330
Turkey Casserole with Gravy, Stouffer entree	360
Turkey Dijon, Lean Cuisine, 9 1/2 oz.	270
Turkey pie, Banquet, 1 frozen pot pie	500

Turkey pie, Morton—7 oz.	420
Turkey Pie, Stouffer entree	540
Turkey pot pie, 1 pie—Swanson	390
Turkey Tetrazzini, Stouffer entree	380
Veal Parmigiana, Armour Dinner Classics	400
Vegetable Lasagna, Stouffer entree	420
Vegetarian Chili, Stouffer's frozen dinner	280
Welsh Rarebit, Stouffer entree—10 oz.	700
Yankee Pot Roast, Le Menu frozen dinner	370
Yankee pot roast, Armour Dinner Classic	390
Zucchini Lasagna, Lean Cuisine, 11 oz.	260

Fruit

Apple, medium, 1 apple, 2 3/4 in., 1/3 lb.	80
Apricot, each	20
Avocado, each	380
Banana, 1 medium—8 3/4 in.	101
Cantaloupe, each	160
Cantaloupe, 1 cup, cubed	48
Grape, each	2
Honeydew melon, 1 cup, cubed	56
Lemon, each	30
Nectarine, 1 2 1/2 in. fruit	88
Orange, Florida, 1 medium orange	71
Orange, navel, 1 medium orange	71
Peach, peeled, medium, 2 1/2 in.	38
Peach, peeled, large, 2 3/4 in.	58
Pear, Bartlett, 1 medium pear, 2 1/2×3 1/2 in.	100
Pineapple, sliced, in syrup, 3 in. slice	43
Pineapple, diced, 1 cup	80
Plum, each	35
Plum, Damson, 10 plums, 1 in.	66
Prune, each	20
Raisins, 1 1/2 oz.	124
Strawberries, fresh, 1 cup	53
Strawberries, frozen sliced, 1 cup, with sugar	278
Watermelon, 1 cup	45

Ingredients

Baking powder, tsp.	4
Bisquick, 1 cup	480
Caramel cake icing, 1/12 cake	64
Chocolate cake icing, 1/12 cake	104
Chocolate syrup, Hershey's, 1 tbsp.	40

Corn meal, 1 cup	502
Corn oil, 1 tbsp.	122
Cream cheese icing, Pillsbury, 1/12 cake	160
Flour, 1 cup	455
Hamburger Helper, Chili, 1 box w/o meat	520
Hamburger Helper, Lasagna, 1 box, 7 3/4 oz.	800
Hamburger Helper, Stroganoff, 1 box, w/o meat	950
Oil, salad, 1 tbsp.	120
Pepper, black, 1 tsp.	5
Salt, 1 tbsp.	0
Tuna Helper, Au gratin, w/o tuna, 1 package	900
Tuna Helper, Mushroom, w/o tuna, 1 package	700
Vegetable oil, 1 tbsp.—most varieties	122
White cake icing, 1/12 cake	100
Whole wheat flour, 1 cup	400

Juice

Apple juice, 1 cup	117
Grapefruit juice, 1 cup	96
Hi-C, 8 fl. oz.	133
Orange juice, fresh, 8 fl. oz.	112
Orange juice, frozen reconstituted, 8 fl. oz.	122
Tomato juice, 6 fl. oz.	30
V8 Juice, regular or spicy, 6 fl. oz.	35

Kentucky Fried Chicken

Barbecue sauce, 1 oz.	35
Biscuit, each	235
Chicken breast, center, extra crispy	342
Chicken breast, center, original recipe	283
Chicken breast, side, original recipe	267
Chicken breast, side, extra crispy	343
Chicken drumstick, original recipe	146
Chicken drumstick, extra crispy	204
Chicken Littles, each	169
Chicken sandwich, each	482
Chicken thigh, original recipe	294
Chicken thigh, extra crispy	406
Chicken wing, original recipe	178
Chicken wing, extra crispy	254
Coleslaw, 1 serving	119
Corn on the cob, 1 serving, 5 oz.	176
French fries, 1 serving	244
Honey sauce, 1 oz.	49

Kentucky nuggets, 1 nugget	46
Mashed potatoes, 1 serving with gravy	71
Mustard sauce, 1 oz.	36
Sweet'n'sour sauce, 1 oz.	58

McDonald's

1000 Island dressing, 1 package	390
Apple pie, each	260
Big Mac, each	560
Bleu Cheese dressing, 1 package	350
Caesar dressing, 1 package	300
Cheeseburger, each	310
Chef salad, each	230
Chicken McNuggets, 1 nugget	48
Chicken salad, each	140
Chocolate chip cookies, 1 box	330
Chocolate milkshake, 1 milkshake—10.3 fl. oz.	390
Egg McMuffin, each	330
Filet-O-Fish, each	432
French dressing, 1 package	230
French fries, small serving	220
French fries, medium serving	320
French fries, large serving	400
Garden salad, 1 salad	110
Hamburger, each	260
Hash browns, each	130
Ice cream, soft serve cone	140
McDonaldland cookies, box	290
McNuggets barbecue sauce, 1.1 oz.	50
McNuggets mustard sauce, 1 serving	70
McNuggets sweet & sour sauce, 1 serving	60
Peppercorn dressing, 1 package	400
Quarter Pounder, each	410
Quarter Pounder with cheese, each	520
Ranch dressing, 1 package	330
Red French dressing, 1 package	160
Sausage biscuit, 1 biscuit & patty	440
Side salad, 1 salad	60
Strawberry milkshake, 1 milkshake—10.3 fl. oz.	380
Sundae, hot caramel, each	340
Sundae, hot fudge, each	310
Sundae, strawberry, each	280
Thousand Island Dressing, 1 package—2 oz.	390
Vanilla milkshake, 1 milkshake—10.3 fl. oz.	350
Vinaigrette dressing, 1 package	60

Meat

Bacon, 1 slice, 20/lb.	36
Beef bologna, 1 slice, 1 oz.	89
Beef salami, 1 slice, 0.8 oz.	58
Beef stew, 8 oz.—Dinty Moore	220
Beef, chuck roast, 4 oz., lean	265
Beef, flank steak, 4 oz., broiled	288
Beef, ground, cooked, 4 oz., extra lean	288
Beef, ground, cooked, 4 oz., regular	347
Beef, ground, raw, 4 oz., extra lean	265
Beef, ground, raw, 4 oz., lean	298
Beef, ground, raw, 4 oz., regular	351
Beef, porterhouse steak, 4 oz., broiled	247
Beef, round roast, 4 oz., lean	208
Beef, sirloin steak, 4 oz., broiled	240
Beef, T-bone steak, 4 oz., broiled, lean	243
Breakfast sausage, link, 1 link, 1 oz. raw	48
Breakfast sausage, patty, 1 patty, 3 7/8 in.	100
Chili con carne, 15 1/2 oz. can	572
Corned beef brisket, 4 oz.	284
Corned beef, canned, 1 oz.	71
Country ham, 4 oz., lean	220
Ham, canned, 4 oz., unheated	164
Ham, cooked smoked, 1 slice—Oscar Mayer	20
Ham, extra lean, 4 oz.	164
Ham, picnic, 4 oz.	177
Ham, regular, 4 oz., lean	201
Ham, sliced, 1 slice, 1 oz.	52
Hot dog, beef, 1 hot dog, 8 per pound	184
Hot dog, pork and beef, 1 hot dog, 8 per pound	183
Italian sausage, 1 link, 1/4 pound	268
Little smoked sausage, 1 link	43
Liverwurst, 1 oz.	93
Luncheon meat, beef, 1 slice, 1 oz.	87
Peppered sandwich loaf, pork, beef, 1 slice, 1 oz.	42
Pepperoni, 1 oz., 14 slices, Hormel	140
Pork and beans, 1 cup	311
Pork and beans, 1 can, 20 oz.	692
Pork center rib, 1 chop, 3 oz., pan-fried	219
Pork loin roast, 4 oz., lean	268
Pork spareribs, 4 oz., braised	451
Pork, Boston butt roast, 4 oz., lean	291
Pork, loin chop, trimmed, broiled, 1 3 oz. chop	294
Ravioli, Mini, Chef Boyardee, 1 can	420
Spam, 2 oz.	170

Venison, 4 oz., lean	143

Nuts

Almonds, dry roasted, smoke flavor Planters, 1 oz.	170
Almonds, slivered, Planter's 1/3 cup, 2 oz.	170
English walnuts, 10 nuts	322
English walnuts, 1 cup, chopped	781
Peanut butter, 1 tbsp.	94
Peanuts, honey roasted, Planters, 1 oz.	170
Peanuts, roasted in shell, 10 peanuts	105
Peanuts, roasted, canned, 1 oz.	170
Peanuts, salted, Lance, 1 1/8 oz.	190
Pecans, 1 cup shelled halves	742
Sunflower seeds, raw, unsalted, 1 oz.	159
Sunflower seeds, roasted, Planters, 1 oz.	160

Pasta

Egg noodles, 1 cup	200
Fried noodles, 1 cup	220
Macaroni & cheese, baked, home recipe, 1 cup	430
Macaroni & cheese, mix, Kraft—1 cup, per directions	386
Macaroni, firm, 1 cup	192
Macaroni, tender, 1 cup	155
Spaghetti, al dente, 1 cup	192
Spaghetti, tender, 1 cup	155
Suddenly Salad Classic Pasta, Betty Crocker—1 box	960

Pizza Hut

Cheese, 1 slice—Thin 'n Crispy	149
Cheese, 1 slice—pan pizza	246
Cheese, 1 slice—Hand Tossed	259
Pepperoni, 1 slice—Thin 'n Crispy	207
Pepperoni, 1 slice—Hand Tossed	250
Pepperoni, 1 slice—pan pizza	270
Pepperoni, 1 pizza—Personal Pan	675
Super Supreme, 1 slice—Thin 'n Crispy	232
Super Supreme, 1 slice—pan pizza	266
Super Supreme, 1 slice—Hand Tossed	278
Supreme, 1 slice—Thin 'n Crispy	230
Supreme, 1 slice—Hand Tossed	270
Supreme, 1 slice—pan pizza	290
Supreme, 1 pizza—Personal Pan	647

Poultry

Chicken back, fried, w/o skin, 1/2 back	167
Chicken back, fried, with skin, 1/2 back	238
Chicken back, roasted, w/o skin, 1/2 back	96
Chicken back, roasted, with skin, 1/2 back	159
Chicken breast, fried, w/o skin, 1/2 breast	161
Chicken breast, fried, with skin, 1/2 breast	218
Chicken breast, roasted, w/o skin, 1/2 breast	142
Chicken breast, roasted, with skin, 1/2 breast	193
Chicken breast, smoked, Butterball, 1 slice	30
Chicken drumstick, fried, w/o skin, 1 drumstick	82
Chicken drumstick, fried, with skin, 1 drumstick	120
Chicken drumstick, roasted, w/o skin	76
Chicken drumstick, roasted, with skin	112
Chicken giblets, fried, 1 cup or 5 oz.	402
Chicken hot dog, 1 hot dog, 10 per pound	116
Chicken livers, simmered, 1 cup or 5 oz. or 7 livers	219
Chicken neck, fried, w/o skin, 1 neck	50
Chicken neck, fried, with skin, 1 neck	119
Chicken neck, simmered, w/o skin	32
Chicken neck, simmered, with skin	94
Chicken thigh, fried, w/o skin, 1 thigh	113
Chicken thigh, fried, with skin, 1 thigh	162
Chicken thigh, roasted, w/o skin	109
Chicken thigh, roasted, with skin	153
Chicken wing, fried, w/o skin, 1 wing	42
Chicken wing, fried, with skin, 1 wing	103
Chicken wing, roasted, w/o skin	43
Chicken wing, roasted, with skin	99
Chicken, dark meat, fried, 1 cup, or 5 oz. w/o skin	334
Chicken, dark meat, roasted, 1 cup or 5 oz., w/o skin	250
Chicken, light meat, fried, 1 cup, or 5 oz., w/o skin	268
Chicken, light meat, roasted, 1 cup or 5 oz., w/o skin	214
Duck, roasted, w/o skin, 4 oz.	228
Duck, roasted, with skin, 4 oz.	382
Goose liver, raw, 4 oz.	151
Goose, roasted, w/o skin, 4 oz.	270
Pheasant, raw, w/o skin, 4 oz.	151
Quail, raw, w/o skin, 4 oz.	152
Turkey bologna, 1 slice—average	57
Turkey bologna, 1 slice—Butterball	70
Turkey ham, 1 slice—Louis Rich	35
Turkey hot dog, 1 hot dog, 10 per pound	102
Turkey kielbasa, 4 oz.—Louis Rich	160

Turkey loaf, sliced, 2 slices, 1 1/2 oz.	47
Turkey pastrami, 1 slice, Louis Rich	35
Turkey sausage, Louis Rich—4 oz.	160
Turkey, raw, average, 4 oz., w/o skin	135
Turkey, roasted, 1 cup, or 5 oz.	238

Salad

Bac O's, 1 tbsp	40
Blue cheese dressing, 1 tbsp.	80
French dressing, 1 tbsp.	60
Italian dressing, 1 tbsp.	70
Potato salad with egg, home recipe, 1 cup	363
Thousand island dressing, 1 tbsp.	70
Three bean salad, Green Giant, 1 cup	140
Tuna salad, home recipe, 1 cup	349

Sauces

Au jus gravy mix, with water, 1 cup	19
Barbecue sauce, 1 tbsp.—Hunt's	20
Brown gravy mix, with water, 1 cup	9
Catsup, 1 tbsp.	18
Chicken gravy mix, with water, 1 cup	83
Enchilada sauce, hot, 1 cup—Old El Paso	120
Enchilada sauce, mild, 1 cup—Old El Paso	100
Mayonnaise, 1 tbsp.	100
Mayonnaise, 1 cup	1577
Mayonnaise, Weight Watchers, 1 tbsp.	50
Miracle Whip, 1 tbsp.	70
Miracle Whip Light, 1 tbsp.	45
Mushroom gravy mix, with water, 1 cup	70
Mustard, brown, 1 tsp.	5
Mustard, yellow, 1 tbsp.	10
Pizza Quick sauce, Ragu, 3 tbsp.	35
Soy sauce, 1 tbsp.	12
Spaghetti sauce, basil, 1 cup—Classico	100
Spaghetti sauce, beef-pork, 1 cup—Classico	140
Spaghetti sauce, mushroom, 1 cup—Classico	140
Spaghetti sauce, Newman's own, 1 cup	140
Spaghetti sauce, Ragu, Homestyle, 1 cup	100
Spaghetti sauce, Ragu, Chunky Gardenstyle, 1 cup	140
Spaghetti sauce, Ragu, 1 cup	160
Spaghetti sauce, Ragu, Fresh Italian, 1 cup	180
Spaghetti sauce, Ragu, Thick & Hearty, 1 cup	200
Taco sauce, 1 tbsp.—Old El Paso	5

Taco seasoning mix, 1 package—Old El Paso	100
Thick n Chunky Salsa, 1 tbsp.—Old El Paso	3
Vinegar, 1 fl. oz.	4
Vinegar, cider, 1 cup	34
Vinegar, distilled, 1 cup	29
White sauce mix, with milk, 1 cup	241
Worcestershire sauce, 1 tbsp.	15

Snacks

Canned onion rings, 1 2.8 oz. can—Durkee	480
Chee-tos, 1 oz.—25 chips	150
Doritos, 1 oz.	140
Fritos, 1 oz.	150
Popcorn, air-popped, 1 cup	25
Popcorn, microwave, Newman's Own, 8 cups	360
Popcorn, microwave, Golden Valley—1 bag, 8 cups	374
Popcorn, microwave, light, Orville Redenbacher—1 bag	234
Popcorn, with oil & salt, 1 cup	41
Potato chips, Lay's—1 oz.	150
Pretzel sticks, 1 oz.	111
Pretzels, 3-ring, 10 pretzels	117
Pringles corn chips, 1 can, 6 oz.	840
Tortilla chips, 1 oz.—Old El Paso	150

Soup

Bean with bacon soup, 1 can—Campbell's	431
Beef broth, Campbell's—1 can	40
Chicken noodle soup, 1 can—Campbell's	140
Chicken with rice soup, 1 can—Campbell's	150
Chicken with stars soup, 1 can—Campbell's	150
Chili beef soup, 1 can—Campbell's	385
Cream of chicken soup, 1 can—Campbell's	307
Cream of mushroom soup, 1 can—Campbell's	275
Cream of potato soup, 1 can—Campbell's	311
French onion soup, 1 can—Campbell's	150
Golden mushroom soup, 1 can—Campbell's	220
Hot and sour soup, 1 cup	100
Meatball vegetable soup, 1 can—Campbell's	275
Split pea soup, 1 can—Campbell's	450
Tomato soup, 1 can—Campbell's	247
Vegetable beef soup, 1 can—Campbell's	175
Vegetable soup, 1 can—Campbell's	225
Wonton soup, 1 cup	210

Sugar

Blackstrap molasses, 1 tbsp.	43
Blackstrap molasses, 1 cup	699
Honey, 1 tbsp.	64
Jam, 1 tbsp.	54
Jelly, 1 tsp.	18
Jelly, 1 tbsp.	49
Maple syrup, Aunt Jemima, 1 fl. oz.	102
Maple syrup, Aunt Jemima Lite, 1 fl. oz.	58
Sugar, 1 tsp.	15
Sugar, 1 tbsp.	46
Sugar, 1 cup	770

Taco Bell

Bean burrito, green sauce	351
Bean burrito, red sauce	357
Beef burrito, green sauce	398
Beef burrito, red sauce	403
Burrito supreme, green sauce	407
Burrito supreme, red sauce	413
Enchirito, green sauce	371
Enchirito, red sauce	382
Guacamole sauce, 1 serving	34
Soft taco, each	228
Taco, regular taco	183
Taco Bellgrande, each	355
Taco light, each	410
Tostada, green sauce	237
Tostada, red sauce	243

Vegetables

Artichokes, 1 artichoke	67
Asparagus, canned, 1 10 1/2 oz. can	54
Asparagus, fresh, 1 cup, boiled	36
Baked beans, 1 cup, canned, w/o pork	306
Bean curd, 4 oz.	81
Bean sprouts, boiled, 1 cup	35
Bean sprouts, raw, 1 cup	37
Beets, 1 cup, fresh	54
Beets, canned, 1 can, 10 1/2 oz.	109
Blackeye peas, 1 cup	178

Broccoli, cooked, 1 cup	40
Brussel sprouts, 1 cup, fresh	56
Butternut squash, baked—1 cup	139
Cabbage, cooked, 1 cup	31
Cabbage, raw, shredded, 1 cup	17
Carrot, raw, 1 carrot	30
Carrots, cooked, 1 cup	45
Carrots, sliced, 1 cup	48
Cauliflower, boiled, 1 cup	28
Cauliflower, raw, 1 cup, chopped	31
Celery, 3 small stalks, 5 in.	9
Chard, fresh, 1 cup	32
Coleslaw with French dressing, 1 cup	114
Coleslaw with salad dressing, 1 cup	119
Collards, canned, 1 cup	51
Collards, fresh, 1 cup	42
Corn on the cob, 1 5 in. ear	70
Corn, canned whole kernel, 1 can—10 oz.	360
Corn, cooked, 1 cup	140
Corn, creamed, 1 can, 15 1/2 oz.	320
Cucumbers, each	30
Eggplant, 1 cup, boiled	38
Eggplant sticks, fried, Mrs. Paul's, 3 1/2 oz.	240
Garbanzos, dry, 1 cup	367
Garden medley, Green Giant, 1 can—beans, carrots, corn	158
Garlic, raw, 1 clove	4
Great northern beans, 1 cup	212
Green beans, boiled, 1 cup	31
Green beans, canned, Del Monte, 1 16 oz. can	80
Green beans, low sodium, Del Monte, 1 16 oz. can	80
Green pepper, 1 pepper, 1/5 pound	16
Green pepper, diced, 1 cup	33
Grits, Quaker, 1 cup	133
Hotdog relish, 1 oz., Vlasic	40
Kale, fresh, 1 cup	43
Kale, frozen, 1 cup	40
Kidney beans, canned, 1 cup	230
Kidney beans, dried, 1 cup, cooked	218
Lentils, 1 cup	212
Lettuce, iceberg, 1 cup, shredded	7
Lettuce, iceberg, 1 head	70
Lima beans, 1 cup	189
Mushrooms, 1 cup, chopped	20
Mustard greens, fresh, 1 cup	32
Mustard greens, frozen, 1 cup	30
Navy beans, 1 cup	224
Okra, fried, 3 oz., Ore-Ida	170

Olives, green, 10 large	45
Olives, ripe, 10 extra large	61
Onions, raw, 1 cup	65
Peas, cooked, 1 cup	115
Pickles, dill, 1 pickle—3 3/4×1 1/4 in.	7
Pickles, dill, 1 oz.	4
Pickles, sweet, 1 oz.	30
Pinto beans, 1 cup	228
Potato, baked, 2 1/3×4 3/4 in.	145
Potato, boiled, medium, pared, 2 1/2 in.	88
Potato, boiled, large, pared, 2.3×4.7 in.	146
Potato, french fries, 3 oz.	130
Potato, frozen french fries, Golden Crinkles 3 oz.	120
Potato, frozen hash browns, Golden Patties 2 1/2 oz.	140
Potato, microwave hash browns, Ore-Ida, 2 oz.	120
Potatoes, mashed instant, from flakes, 1 cup	195
Potatoes, mashed with milk, 1 cup	137
Radish, 10 medium radishes	8
Radish, 1 cup sliced	20
Refried beans, 1 cup—Old El Paso	200
Refried beans with green chili, 1 cup—Old El Paso	200
Refried beans with sausage, 1 cup—Old El Paso	720
Rice a Roni, wild rice—1/4 box	110
Rice pilaf, Green Giant—1 cup	220
Rice, brown, 1 cup, cooked	232
Rice, fried, 1 cup	418
Rice, instant, 1 cup, cooked	180
Rice, white, 1 cup, cooked	223
Sauerkraut, canned, 1 cup	42
Snow peas, 1 package, LaChoy	70
Spinach, fresh, 1 cup	14
Spinach, frozen, 1 cup	46
Squash, 1 cup	30
Sugar snap peas, Green Giant, 1 cup	50
Sweet potatoes, canned, 1 cup	216
Sweet potatoes, fresh, 5×2 in., boiled	172
Tater Tots, 3 oz.—Ore Ida	150
Tofu, 4 oz.	81
Tomato, raw, 1 tomato	26
Tomatoes, canned, 1 can—16 oz.	95
Turnip greens, canned, 1 cup	42
Turnip greens, fresh, 1 cup	29
Turnip greens, frozen, 1 cup	38
Watermelon, 1 cup	42
Zucchini, 1 cup	22

Wendy's

Big Classic, each	470
Chicken filet, each	200
French fries, 1 serving	300
Frosty, small	400
Single, each	350

ABOUT THE AUTHOR

John Walker founded Autodesk, Inc. in 1982, and was its president through 1986 and chairman until 1988.

Autodesk, one of the five largest personal computer software companies, has become a leader in the computer aided design industry; its product, *AutoCAD*, is the *de facto* worldwide standard for computer aided design and drafting.

John Walker is co-author of *AutoCAD* and several other Autodesk products, including *AutoSketch*, *AutoShade*, and *Cellular Automata Laboratory*.

His first book, *The Autodesk File*, was published in 1989 by New Riders Publishing. It chronicles Autodesk's growth from $60,000 pooled by a bunch of programmers to a billion dollar company in less than eight years. Despite good reviews, *The Autodesk File* never became a bestseller.

So, why not a diet book? If this doesn't sell well, Walker may try a book about cats.

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