ANATOMY of a Design

How to Think Like a Digitizer & Become a Better Embroiderer

Lindee Goodall

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Lindee G Embroidery
embroidery design & education

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About the Author

Lindee Goodall is the founder and former owner of Cactus Punch, the first independent company to design embroidery specifically for the home market. Combining a degree in art, a life long love of sewing and crafts, and a background in programming, Lindee melds the art with the science of creating a smooth running and creative design. With 15 years of digitizing experience, she now owns and operates Lindee G Embroidery, providing quality embroidery designs and educational products.

Lindee was an Impressions Magazine 1997 Digitizer of Distinction and won first place for Creative Use of Stock Designs as well as the overall Creativity Award in the 2002 Stitches Magazine Stitch-Off. She also won first place at METS in 1997 for best original digitized design.

She is the author of two other self-published books on embroidery, *Poetry in Motion* and the *Embroidery Cookbook* and was a contributor to *Embroidery Machine Essentials* by Jeanine Twigg.

Lindee has given workshops and seminars on digitizing, embroidery techniques, and how to make money with embroidery. She has taught at numerous venues including: ISS Shows, Original Sewing & Quilt Expo, Creative Embroidery Conference, Houston Quilt Market, Viking, Pfaff, and Singer Conventions, Brother Back to School, Sewing & Stitchery Expo, Martha's School of Art and Fashion, Sydney Arts and Crafts Show, and Echidna Convention. Lindee has been a frequent guest on Martha's Sewing Room, America Sews, America Quilts, Quilting from the Heartland, and Quilting with Shar.

She has also written numerous articles on digitizing and embroidery techniques for Stitches Magazine, Profitable Embroiderer, Threads, Sew News, Creative Machine Embroidery, and Designs in Machine Embroidery.

Keep an eye on my YouTube site. I may not be taping any new PBS shows but here I can do my own mini-segments!

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Table of Contents

Notice i

About the Author ii

How to Contact Lindee ii

Credits & Acknowledgments vi

Cover vi

Welcome! 1

Foreward 2

About this eBook 3

Introduction 5

About This Book 6

Do You Digitize? Do You Want to Digitize? 7

Should You Digitize? 7

Attention Newbies 8

Advanced Users 9

Using Auto-Digitizing Software? 9

Why Make Changes? 10

If You Do Digitize 10

When Not To Digitize 11

Foolish Assumptions 11

Getting Started 13

Comments on Free Designs 13

Some Preliminaries 15

The Physics of Embroidery 17

Bare Bones Basics of Stitches 19

Principle 1: A Stitch Requires 2 Needle Penetrations 19

Principle 2: All Stitches Are Straight 20

Caution! Watch Zoom Levels… 21

Stitch Types 25

Running Stitches 25

Running Stitch Uses 27

Satin Stitches 27

Satin Stitch Uses 28

Fill Stitches 28

A Few Cautions on Fill Types 29

Fill Stitch Uses 29

Three Stitch Types, Infinite Variety 29

Why You Need to Know 30

Stitch Properties 31

Not All Attributes Apply to All Stitch Types 31

Default Values 31

Table of Contents

More About Attributes 32

Stitch Length 35

Stitch Length Minimums 35
Use Short Stitches with Discretion! 37
Stitch Length Maximums 37
Long Stitches 38
Advantages 38
Disadvantages 38
Short to Moderate Stitches: Advantages and Disadvantages 39
The Long and the Short of It 40
Review 40
Apply Your Knowledge: Test Your Machine 41
Creating the Swatch Chart 41

Density 47

"Normal" Density 48
Density Determinants 48
Fabric and Thread 48
Stitch Type and Length 49
Underlay 49
Effect 49
Preference 50
Density Guidelines 50
Applying What You've Learned 51
How To Measure Density and Stitch Length 51
What If I Find Problems? 52
Revisiting the Swatch Chart 53

Shortening, Angle, & Pattern 55

What is Shortening? 55
Why Should You Know About It? 56
Angle 56
Pattern 57
What Creates Pattern? 57
Examples of Pattern and Motif Fills 58
Pattern Cautions 58
Pattern Sample Swatch Chart 58

Underlay 59

Guidelines 59
Purpose 60
Consistent and Orderly 60
Appropriate 61
Cautions 62
Types of Underlay 62
Satin Underlay Options 62
Complex Fill Underlay Options 63
How Underlay is Used 64
What If Underlay is Removed? 64
When Is Underlay not Required? 65
When to Add More Underlay 65
The Underlay Golden Rules 66
Make it Sew… Or You Won't Know! 66

Tie-Offs 67

Table of Contents

Golden Rule of Tie-Offs 68
Reminder For Editors 68

COMPENSATION 69
Successful Embroidery is a Shared Responsibility 70
Distortion in Action 71
More on Push and Pull 72
How Can You Fix The Missing Row? 73
How to Compensate 74
Pull Comp Settings 76
Magic Revisited 77
What to Look for On-Screen 78
How Much Compensation? 79
What If Compensation Needs Adjusting 80
Summing Up Compensation 80

PUTTING IT ALL TOGETHER 81
Watch it Sew 82
Color Sorting 83
Resizing 84
Using Other Threads 85
Summary 85

GLOSSARY 87

RESOURCES 93
Recommended Websites 93
Echidna Club 93
Embroidery.com 93
Lindee G Embroidery 93
Where to Get the Downloadable Files 93
Where to Find Other Products 94
MacEmb.com 94
Designer's Gallery 94
AdorableIdeas.com 94

COLOR SEQUENCES 95
Design Info for Downloadable Files 95

Credits & Acknowledgments

Cover

Photography by Lindee Goodall assisted by Bill Goodall. Cover design by Lindee Goodall. Baby Lock Ellisimo embroidery machine courtesy of Baby Lock. Embroidery thread provided by Hemingworth and Embroidery.com. Original artwork for rose design by Kristie Walker, Echidna Sewing Products.

I'd like to personally thank Gary Walker, Echidna Sewing Products, for coercing me back into the embroidery business and encouraging (well, maybe nagging…) me to write this book!

Welcome!

To all machine embroidery enthusiasts,

For 28 years now I have lived and breathed sewing and embroidery. In fact it ís all I've done since leaving school and I have to say that I have loved every minute of it.

I am proud of what myself and my team have achieved in Australia and around the world. We have all been dedicated to providing our customers with the very best services and products available.

Along the way I have met many wonderful people and developed long lasting business and personal friendships. Perhaps the most endearing and enduring of these relationships is the one I have with Lindee and Bill Goodall.

We met at a time when home embroidery machines were in their infancy and home embroidery itself was more like an enigma than a craft or hobby.

Together, albeit separated by the Pacific Ocean we improvised, innovated, educated and inspired thousands of home embroiderers to garner more enjoyment from this amazing hobby we call machine embroidery.

You see, in the early days, everyone was learning, home embroidery machines work very differently to commercial machines. Lindee was one of the few that realized this fact and quickly developed digitising and designing skills to suit what was in essence a completely new market.

Now, with a little bit of pushing and prodding from me, Lindee has compressed years of knowledge and dare I say it, experimentation into an easy to read and understand Interactive E-Book publication, *Anatomy of a Design*.

I use the word experimentation because often that is exactly what embroidery is. Lindee has been doing this for years, so home embroiderers like yourself, won't have to. This book is for all embroiderers and will give you a greater understanding of exactly what is happening each and every time your embroidery machine is put to task.

Whether you digitise yourself and are looking to hone your skills or simply rely on designs created of others, *Anatomy of a Design* will without question help you to improve your embroidery results. Best of all you will realize that no college degree is required, just some basic and clearly articulated knowledge which is exactly what *Anatomy of a Design* delivers.

Congratulations Lindee on a job well done and thanks for letting me talk you back into the industry, although, I don't think you needed too much coercing!

It's great to have you back.

Yours sincerely
Gary Walker
Managing Director
Echidna Sewing Products
Australia.

Foreward

About Leanne

Leanne Church has been in the machine embroidery industry for 14 years in Australia. Previously a chef and florist, she expanded her sewing hobby into the industry. As a sewing machine demonstrator, she was introduced to digitising software in 1995. In 1997 she was invited as the only Australian presenter at Viking Sewing Machine Convention in the U.S. and was a Husqvarna Viking educator in 1998-99. She has written many articles for Machine Embroidery and is now the Support and Education Coordinator of Australia's leading machine embroidery supplier, Echidna Sewing Products.

Prior to 1990, embroidery machines were not only huge, but extremely expensive and were strictly relegated to the professional commercial embroiderer. That changed in 1990 with the introduction of the Memory Craft 8000 by Janome, a hooped embroidery machine geared towards the home market. The first home machines offered pre-programmed designs on memory cards—designs which we could only stitch as they were intended. Now with the evolution of embroidery software and a personal computer, the world has opened up a whole new experience. Embroiderers around the world can create their own designs from different artwork or edit a design from another embroiderer and let their imagination run wild.

In this e-book Lindee has used her 15 years of industry experience to explain in easy to understand terms the technical aspects that commercial digitisers have kept behind doors for years. Lindee has been around the world and spoken to many people about her love of embroidery and has now put all of her knowledge in this e-book to demystify the art of digitising.

Anatomy of a Design is a comprehensive guide that will dispel many of the secrets with digitising and give you a total understanding of how things come together to create a perfect design—understanding the framework of an embroidery design and the way it will react to the fabric, the importance of underlay, selecting the correct stabiliser, thread and needles for a design and the different types of stitching styles that can make or break a good design.

Beyond the comprehensive information, probably the most outstanding part of this book is the interaction. An e-book allows the pages to come alive and take you into another world. You will see words or sentences that are highlighted and if you click on them they take you into the glossary or a website with even more information. You have a design that comes to life in the book and shows you how the design stitches. This is truly the way of the future and you could not get this from the pages of a traditional printed book.

Welcome to the world of digitising and computerised embroidery!

Leanne Church
Support & Education Coordinator
Echidna Sewing Products

About this eBook

If this is your first experience with an ebook, you might be wondering why I chose this format. Why not the traditional printed format?

First of all, ebooks save a lot of money—printing costs have skyrocketed and they continue to rise. A printed version would have cost you more both for the book and for shipping. Printing takes a lot of time; ebooks are available much sooner. Printing also consumes natural resources and contributes to pollution. Shipping is free on ebooks, costing you only a little bandwidth and can be received nearly instantaneously.

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Links in the glossary take you to a related term. You'll recognize linked text because it is underlined blue text. There's an active link to my website on the footer area of this page. If you click it and you have an internet connection, you'll land right on my home page.

> **Note**: I did try to define any terminology that might be unfamiliar to you. However, if you come across a term you don't know, check out the glossary in Appendix A.

Notes

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It's always wise to check the name of the web site with the link you clicked to make sure the destination appears like a reasonable match. It is possible that an unscrupulous person could send you to an entirely dangerous site.

About this eBook

Notes

The table of contents is also live—just click on a chapter or topic and instantly you're there. The table of contents is also available as bookmarks in Acrobat. With the bookmarks panel open, you can instantly link to any section in the book. To see a bookmarks panel on the left side of this document, make the following menu selection in Acrobat: **View > Navigation Panels > Bookmarks**.

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Video, audio, and animations can be embedded in an ebook—try that in any printed version! There are several embedded animations of designs sewing. In print, you'll still see the image, you just won't see it in motion.

Ebooks offer search options to quickly locate text throughout the document. How many times have you looked in the index for something and couldn't find it? Search lets you find a phrase or a word anywhere in this book.

Of course, you can still print the book for easy reference if you want to. Having the interactive digital version and the printed analog version gives you the best of both worlds!

If you do print, this book was designed to be printed duplexed in color. When printed this way, all the new chapters will start on the right hand page (odd-numbered page) as is customary with printed books. This means some chapters have a blank page at the end. I've titled this page "Notes" so you won't think that for some reason the page didn't print.

The book is still readable in black and white, it just won't be as pretty. In fact, I encourage you to print it out, store it in a notebook and make notes—you don't have to worry about "ruining" a book!

Introduction

Embroidery machines and their software have advanced rapidly since I first saw a home embroidery machine at a Macintosh User's Group swap meet in Cincinnati, Ohio back around 1992. I was so in the dark about embroidery machines—I still had a mechanical Necchi sewing machine—that I just had no concept how it could work. The guy had the machine, some thread and his Mac but no samples nor was he demonstrating it. I was still in the mind set of hand embroidery and I just didn't get it.

Fast forward a year on yet another Saturday morning. I'm sitting on the couch getting my weekly dose of PBS sewing shows and Kaye Wood is featuring two guests on her Strip Quilting show who are demonstrating the same little embroidery machine with a Mac laptop. By this time, I have a Pfaff 1475 and have learned to free-motion embroider and create my own programmable decorative stitches so now I immediately grasp what it does and how I could use it.

Another six months go by and the show is rerun and this time I decide I need to find out where to get one and see how it works first hand. Looking back, it seems like the Universe was giving me a new direction for my life.

I finally got the message and bought a Huskygram (P.O.E.M.) in 1994. Back then, there was no information available. We were still living in a pre-internet world (at least as far as we know it today), instead using CompuServe, Prodigy, and similar services to share information. The age of home embroidery machines was just beginning. Janome had a machine, Brother had just introduced their machine, but the P.O.E.M. was the only one that had digitizing software at that time.

Dealers and educators knew little if anything about proper embroidery techniques or how to make a production-friendly design. In retrospect, this was a good thing for me because sometimes no information is better than wrong information. This left me free to experiment and develop my own theories, which I later discovered were in-line with professional techniques.

Today embroiderers have easy access to a ton of information—a lot of it good but a lot of it questionable at best and some of it just down right wrong. How do you know the difference? Most embroiderers don't want to do all the experimenting I did to figure out how things work—they just want to get things done with excellent results.

Notes

My First Embroidery Machine!

This is the same machine I saw at that fortuitous Mac User's Group meeting.

Does this look like a machine that could start a world-renowned embroidery design business? By the way, that is a 6" plastic ruler lying there for size reference. The hoop attaches with a magnet, so you can imagine what might happen if you were embroidering on a large heavy bath towel and it suddenly slipped off the table. I jumped from this machine, purchased in September, 1994 to a ten-needle commercial machine 13 months later!

Introduction

Notes

You may think you don't know much about fabrics because you haven't formally studied about fabric attributes but if you've been sewing for a long time, your subconscious has stored a lot of information that you just aren't consciously aware of and this contributes to your "fabric sense."

Today's machines are bigger, faster, and have myriad features built in with loads more available via software. These features do come at a cost—it is much easier to become overwhelmed and you can make a real mess faster and with greater impact than with a 300 stitch-per-minute machine with a sewing field less than 4x4 inches. Frustration does not create fun, one of the primary reasons why we embroider.

In the early to mid-nineties when home embroidery machines first began to come on the scene, most owners were those who were familiar with sewing machines and had been sewing for awhile. Today, many home embroiderers, as well as commercial embroiderers, have no previous sewing experience and therefore have not acquired what I call "fabric sense." Fabric sense is gained from working with a variety of fabric types and learning how they react under the needle and when constructed into various items.

If you've been sewing for a while, you've probably made a garment using an unsuitable fabric. For example, if you use a stable woven fabric with a fair amount of body and combine that with a pattern for a soft, drapey garment, the final result is more likely to resemble a tent with you as the center pole rather than a garment that softly skims your body.

The same thing can happen with embroidery and more than once I've found myself embroidering on something I would *never* have sewn with because it was just too troublesome. In other words, just because you have fabric, thread, and a machine doesn't mean they go together. Unfortunately, it seems that our fabric sense is often ignored when we shift into "embroidery mode."

So how do you know if a design will work? Experience helps but knowing what to look for and understanding how designs are built will go a long way towards preventing incompatible fabric/design marriages. Embroidery lasts the lifetime of the garment. Since it is a "til death do we part" commitment, you want partners that will complement each other and make a good marriage.

About This Book

This book covers important design aspects an experienced digitizer applies when creating a design. Does that mean its just for digitizers? Absolutely not! As an embroiderer, the more you know about a design's attributes and how those attributes impact fabric, the better you become at controlling factors that can improve your results.

Introduction

Notes

One of the most frequent comments I get from students who have taken my three day digitizing seminar is that coming in, they thought they wanted to digitize but after learning what was involved they decided to leave it to the pros. They realized it was going to take way more time and effort than they were willing to spend.

They did however gain a much better appreciation for a well-thought out, artful design and learned how to differentiate a design problem from a sewing one. In this book, I've pulled the relevant material from that three day seminar and packed it into these pages, complete with illustrations. Now you can learn what they did in a fraction of the time and at a fraction of the cost.

If you're still interested in pursuing digitizing, well just stay tuned for future ebooks and recorded sessions, which will be available through my website at lindeegembroidery.com.

Do You Digitize? Do You Want to Digitize?

When I ask this question in a class, I generally ask for a show of hands based on the following answers:

- No, not yet but I want to
- I'm trying to learn
- Yes, I digitize
- No, not in this lifetime!

Whatever your answer, if you want better embroidery this book's for you. Yes, we will be talking about "techy stuff" from a digitizer's perspective but the goal is not to teach you how to digitize (even though at times it sounds like I'm writing as if you may already be a digitizer). The goal is to teach you how to become more knowledgeable about how designs are constructed so that you can become a savvier embroiderer. As a result you'll make better design/fabric/stabilizer choices, which along with sound embroidery techniques—hooping, tension management, needle and thread choices—will automatically elevate the quality of your embroidery.

Should You Digitize?

Many machines are coming bundled with some level of digitizing software. Although digitizing programs have become easier to use and information on how to do it is readily available, creating a beautiful, smooth-running design is more complex than a few mouse clicks. Even if you use an auto-digitizing program, learning how to use it takes time. Tweaking the design to make it more interesting and sew-worthy can require a lot of time, not just to do it but to know how, when, and why to do it. Furthermore, if you

Introduction

Notes

are only digitizing once a month or less often, chances are you are only figuring out what you've forgotten since the last time so you aren't making much progress.

However, if you have software that lets you edit a design and you know some basic digitizing theory, you can really maximize your design library. You'll be able to optimize designs for a wider range of fabrics and you can even build new designs by extracting parts from various designs and recombining them.

> **Important Note!** Please familiarize yourself with copyright laws. A recombined design from files that you did not create still belongs to the original designer(s) and whatever restrictions applied to the original designs, still apply to the new version.

This book won't teach you how to edit; the only goal is to explain how a design is constructed by learning about stitch types and stitch attributes and why it's important to you as an embroiderer.

Whether you should or shouldn't digitize is a personal choice; don't feel you have to just because you have the software—and if you do want to digitize, don't feel you have to use the software that came bundled with your machine. While its true it's "free" in the sense that you have the software, keep in mind there is a time cost as well as a "fun cost" to working with software. If your software is confusing or unintuitive to you, and you want to digitize, don't let it be an anchor keeping you from buying software that you can use and enjoy. Find a program that works the way you do and set aside the time to really learn it.

In any case, I highly recommend learning to use your machine and developing good embroidery skills before learning to digitize. Without good technique you will never know if a poor result is a digitizing problem or a sewing problem. Embroidery technique is a subject for another book.

Attention Newbies

If you are a new embroiderer, you may feel overwhelmed by this information. Don't worry, as you begin embroidering things will start to fall into place. You may want to reread this as you become more skilled. Unlike a class where you must absorb all the information at once, with this book, you can add your own notes and refer back to it any time you need a little refresher.

Advanced Users

If you have digitizing software, you may have noticed its accompanying manual teaches you *how to use the software*; it does not teach you *how to be a digitizer*. You may have a quick-start tutorial but more than likely the manual focuses just on how to use the software. The manual will tell you what those buttons, menu items, and dialog windows do, but unless you know what to do with them they are relatively useless. It's rather like receiving a power saw. You know that you plug it in, turn it on and it will cut things. Does that make you a master carpenter?

Think of any other program you've purchased. Let's focus on Microsoft® Word for a moment. The documentation teaches you about the menu options, buttons, and program functions, but does it teach you how to write? If you don't know how to write, you take a course in the type of writing you're interested in: technical writing, fiction, non-fiction, legal contracts, etc. Then, using Word as your tool (a much better option than a typewriter or pen and pad), you write, format, edit and publish or print your document. Your document may be just a simple note or list or it may be a fully illustrated, annotated, indexed, multi-column book. The more complex your document, the more software features you will use and the more time you will spend reworking and fine-tuning until it is exactly what you want. And, you will have invested much more time learning the program and all its capabilities and nuances.

While the goal of this manual is not to teach you how to digitize, understanding how a design is constructed will help you make better choices with your software.

Using Auto-Digitizing Software?

Newer auto-digitizing features or programs are pretty amazing, and obviously some are better than others. If you are using an auto-digitizing program, you'll have a much better appreciation for what the software is doing under the hood plus be better prepared to tweak various settings in your software to improve the design and optimize it for different fabrics.

With the right type of graphic, some of these programs do an incredibly amazing job of taking a complex process and making it magically easy to create a quick design. The downside is that these quick designs are often constructed of flat fills with outlines and therefore not as interesting as they could be. To really maximize your creativity and quality with these programs, you need to understand how a digitizer—and your auto-digitizing program—"thinks."

Notes

Introduction

Notes

In this book we'll start to learn to think like a digitizer. We'll start at the beginning with what constitutes a stitch and then move on to learn about stitch length, density, compensation, and underlay. We'll look at how these choices can affect the design—for the better or the worse!

What if you are only working with stock designs and may not be making those attribute choices? Depending on your skill, the tools in your software, and the file format, you may be able to tweak some settings to optimize the design for your target fabric. If for some reason you can't do that, or are simply unwilling—some designs will require more work than they're worth—you have the ultimate choice of whether or not to sew it in the first place.

Do you ever use a keyboard lettering program? Chances are there are settings you can control and this book will help you make better choices here as well.

WHY MAKE CHANGES?

Have you ever purchased a "one size fits all" garment? How well did it fit *you*? Is it truly optimal for both a skinny model and a voluptuous, curvy, plus-size woman? I doubt it!

Embroidery is similar. What works well on a heavy, wool jacket back will overpower a delicate, light-weight cotton. After reading this book you'll be able to look at how a design is constructed and determine what fabrics it does fit well with. And, if you digitize you'll learn things you can do in your software to adjust your own designs and optimize them for different fabrics.

If You Do Digitize

If you have digitizing software and know how to use it, I'll show you how to create some utility files. In fact, if you have Generations™, I'll even provide step-by-step instructions, which should be easily adaptable to other programs as well.

While designs can be more fun to create, utility designs can help you optimize stitch choices for a wide variety of fabrics, threads, and effects. These files require very basic digitizing skills so you will need to know how to use your own software to create them.

If you don't digitize, a download link will be provided for a sample. Sew these out on various fabrics and see how they cover the fabric and how they feel. Do keep in mind, these files only reflect settings in my software, not yours, so if you do begin digitizing, you will want to make a set for each program you use.

When Not To Digitize

While I'm on the subject of digitizing, let me say a few words about why you might not want to digitize even if you know how.

Digitizing takes a lot of time—time to find or create the artwork, actual digitizing time, sewing time, editing time, and more sewing time. In some cases, you may rack up more machine time test sewing than total editing and digitizing time. Is it really worth it?

Stock designs are not only abundant these days but affordable—and with the advent of the internet and places like embroidery.com, you can feed your need instantly. Many designs are available for less than $10—what's your time worth?

Foolish Assumptions

If you're still reading this book, I'm going to make the following assumptions:

- **You are a home or commercial embroiderer.** A design that runs well on one, runs well on the other. A home machine has some unique advantages over commercial machines and a multi-needle machine obviously has advantages over a single-needle.
- **You know how to use your embroidery machine.** You can load a design to it, select it, and sew it. You know to adjust tensions, wind a bobbin properly and thread your machine. This book is not a "how to embroider basics" book.
- **You've been embroidering for a while.** How long is "a while?" Long enough to be comfortable with your machine, have gotten good results and "less good" results and can tell the difference. You don't need to know why, although you might have some idea.
- **You have reasonably good embroidery techniques.** By this, I mean that in addition to the above, you know how to hoop correctly and select appropriate stabilizers.

If you aren't at this level yet, avoid modifying or creating new designs until you have established a good solid embroidery technique. If you are sewing designs from reputable sources and consistently getting poor results, focus on your embroidery technique first!

Notes

Notes

Chapter 1

Getting Started

Notes

In This Chapter

- What to know about free designs
- Why you should buy at least some designs
- How file format affects ease of change
- What if you need to modify a stitch file

Now that you've been embroidering for a while and have learned some important sewing skills and techniques, we're going to step back and learn some digitizing concepts that will make the difference between a professionally created design and—well, how can I say this nicely?—an unprofessional one. Whether you are creating the design or not is inconsequential; you need to know this to enable you to separate the wheat from the chaff to be able to produce great embroidery on a consistent basis.

Comments on Free Designs

Free designs proliferate on the internet. There are great ones and awful ones and all manner in between. I highly recommend that in addition to your stash of freebies, you also purchase designs from reputable design companies.

Why? Free designs are seldom the best designs. If you embroider, you really need to experience some top notch designs to see how a creative, well constructed design makes your machine sing with joy and you burst with pride at the finished result.

If you digitize, you can gain amazing insights into how to create novel and interesting effects by studying designs from master digitizers. There is no way for a digitizer to hide what she did in an embroidery design, all secrets are bared. You may not know *why* the digitizer did something, but you can easily see *what.* By sewing it and snooping about on-screen, you can probably figure out how. Look at it as an inexpensive class you can take on your own schedule.

One master digitizer I highly recommend is John Deer. You can find his designs at AdorableIdeas.com

Professional digitizers will use free designs as a way to let you sample their style and quality. They're kind of like those taste test samples at the grocery—just a bite, not a full course meal. These

Notes

designs may be simpler, smaller, and less detailed than other designs in their collection but they've still used proper digitizing techniques and testing procedures.

Newbie digitizers often share designs because they are so excited to have finally created something and they want to immediately share it with the world—even though they may have never even sewn the design first! Do you really want to be their guinea pig? Some home embroiderers simply like making designs and sharing them just for the love it generates and some of them may actually be reasonably good. But the bulk are ordinary at best.

I just saw Dr. Seuss designs on a Russian web site. Do you really think they are licensed to offer them?

Be wary, though, of free designs. Who digitized it? Have you sewn their designs successfully before? What does it look like on screen? Unless the problem is just ugly colors, if it's not attractive there it won't get any better when you sew it. Is the design something that won't get you in trouble if you wear it to say, Disney World? If the design resembles a cartoon character or other recognizable copyrighted image, don't even bother downloading it.

Just because you paid for a design doesn't mean that it is an indication of quality!

There's an old adage, "you get what you pay for" and it applies well here. And keep in mind that free designs still have a cost. How's that you say? You incur costs when you sew it. It's costing you time and resources. Time to find it, download it to your computer, load it to your machine, prepare the fabric, prepare the machine, and sew it. You're using consumable products: embroidery thread, bobbin thread, needles, stabilizer and fabric.

If you are sewing low quality designs you are wasting time and resources. Thread, needles and stabilizer are easily and inexpensively replaced. Depending on what you embroidered on—hopefully you tested the design first rather than jumping in and embroidering on a priceless heirloom—the cost may be minimal or drastic. Time, however, is your most valuable and limited resource; time can't be replaced.

And then what if you spend time fixing a free design? A few minutes spent on a particularly nice free design is well worth it but if the design needs major surgery, what then? You'd be much better off buying a well-digitized design. I can tell you from experience that it is often easier to completely redigitize a design than to edit it. (Warning: This could be a copyright violation!)

And speaking of time, how much time are you spending scouring the net looking for the latest freebies?

Getting Started 1

Hopefully, after reading this book and learning a few detective skills, you'll be able take a quick tour through any design in your embroidery software and determine how sew-worthy that design is for your intended project.

Notes

Some Preliminaries

Before we really get started, let's talk about file formats. Embroidery designs can be classified into one of two types: the source file and the stitch file.

Source files are the original design files. Source files created in modern digitizing programs, with few exceptions, have the following attributes:

- They can only be opened in the program that created them.
- They cannot be sewn.
- They are usually larger than the corresponding stitch file.
- They are often object files; stitch areas are defined by outlines and various stitch parameters. (Not all programs create object files.)
- They can be easily edited and their attributes manipulated with the right software (and the right skills).
- They are rarely available to anyone but the digitizer because they are seldom included as part of stock design collections.

Stitch or sew files are created from the source file and have the following attributes:

- They are the files that the sewing machine actually recognizes.
- They contain an embroidery machine readable list of stitch coordinates, basic color information, and other machine commands.
- They can commonly be imported into many programs and converted to other stitch file formats.
- They are difficult to edit because you are working at a stitch level rather than an object.
- They may or may not retain color information.
- Common sew file formats are: .csd, .dst, .exp, .hus, .jef, .pcs, .pes, .sew, .vip, .vp3, .xxx

Although it is possible to save a sew file type as a stitch file, the sew file will not acquire the attributes it had in its original object format. There are programs that attempt to recreate the object structure of a design for ease of editing. However, the more complex the design, the less accurate this process will be.

1 Getting Started

Notes

Are you a Mac user? If so, then you'll definitely want to get BriTon Leap's Convert It Mac. You can color, convert, and add basting stitches to designs without ever leaving the comfort of OS X.

As we look at the various stitch attributes, keep in mind that many of them can only be easily and fully manipulated in the object, or source file format. If you create your own designs, always save a source format in addition to any formats you may need for your sewing machine. This makes it easy to modify the design for sewing on different fabrics.

Not having a source file does not prevent you from modifying a sew file. I have tediously added underlay to files and done other modifications on designs that I really wanted to use in situations that were beyond the scope of the original design. Plus, there is a growing number of utility programs that have extended the usability of stitch files. My favorites come from Buzz Tools and Brian Bailie (BriTon Leap), most notably in his Designer's Gallery® products available through Baby Lock.

Chapter 2

The Physics of Embroidery

Notes

In This Chapter

- Why it takes two
- What are the bare bones principles of stitches
- How zoom levels affect your perception
- What if you "neaten up" a design

In this book, the focus is on digitizing theory and how stitches interact with fabric. To apply this theory, we'll create some "utility designs" to give you some real world designs to see how stitches impact the quality of your embroidery in various fabric/stabilizer/design situations. While simple to create, you'll find that by sewing these designs on a wide range of fabric types/colors with a variety of thread types/colors and then analyzing and applying the results, you can shortcut the time it takes you to become a master digitizer and/or embroiderer. I suggest you annotate and store your results in a binder or some sort of easy-to-access filing system. Don't discard the mistakes! We learn more from a mistake than by consistently doing everything perfectly.

If you use Generations™ software, a complete step-by-step guide is provided.

> ***Note:*** Don't panic if you don't digitize. You can download these files. (See the Resources appendix at the end of the book.)

In my opinion, a digitized design does not become an embroidery until it is sewn. A digital file is *not* embroidery! Test-sewing is a critical step in the digitizing process as well as the embroidery process. When you test-sew, *watch* the design from start to end. Until you become a competent digitizer, you should always test sew your own designs under close scrutiny rather than just relying on someone else's eyes and opinion.

You can watch a virtual sew-out in chapter 1, Putting it All Together.

Even if you didn't digitize a design, you'll still need to test it. For more information on how and why to test, refer to the following articles:

- Why Test Embroidery Designs? This article also has a link to a free pdf design tracking form.
- Troubleshooting Embroidery Quality Issues

2 Physics of Embroidery

Notes

Watch for any aberrations that may occur. Today's stitch processors are amazing feats of programming but they are not infallible! Analyze the efficiency of the design. Can you reduce trims or jumps? Can you reduce the number of color changes without compromising design integrity? What happens if you color sort? Does the design sew smoothly without jumping all over the place in a seemingly random pattern? Is the underlay appropriate? Can you flow the stitches for better fabric control?

If you don't know the answers to these questions now, don't worry because you've come to the right place! Also, some of these issues are really only correctable if you digitized or have the source file, appropriate software, and skills. It's not always necessary to change things in the design, knowing its weaknesses will allow you to compensate in other ways.

Of course, how much time and effort you put into the design should be relative to how it will be used. If you will be sewing the design once for a child's play garment, is it worth the effort? On the other hand, if you will be selling the design to many people or using it in a production setting where it will be sewn hundreds or possibly even thousands of times, then yes, it is worth that effort!

The more complex a design is, the more "unique" it becomes when sewn.

And just a word about perfection… From my experience, I have never produced what I consider to be "perfect" embroidery where every stitch is perfectly tensioned and in the exact right place—at least not when sewing on fabric. I have, however, produced a lot of *excellent* embroidery. As you sew your designs—even under the same conditions of fabric, thread, stabilizer, hooping, and machine—you will notice minor variations from sew-out to sew-out. As your eye becomes more trained to embroidery quality, learn to correct what you can and accept tiny imperfections and variations as "embroidery facts of life." Strive for perfection without making yourself crazy and you will get excellence.

In this book we'll cover two primary topics: stitch attributes, including underlay, and secondly, pull compensation. Together, they form the basis of what I call the "physics of embroidery."

Don't panic at the word physics! By the end of this book you will have a much greater appreciation for well-digitized designs and you will be armed with knowledge that will not only improve your digitizing quality (if you already digitize), but also your finished embroidery. Understanding how embroidery is constructed can make you a better embroiderer by increasing your understanding of how designs interact with fabric. Over time, you'll learn how to better match a design with an appropriate fabric—a key to quality embroidery.

Physics of Embroidery 2

Since there's no better place to start than at the beginning, let's jump right in and start with the very basics of embroidery—the humble stitch.

Notes

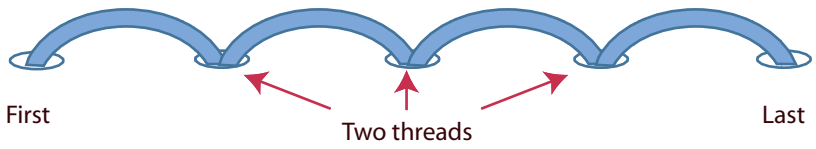
Bare Bones Basics of Stitches

If you were to look at the actual information that is sent to your machine to sew an embroidery design, you would see a list of numeric coordinates representing the position of each needle penetration, plus a few extra commands that tell the machine to stop or trim and other basic functions. Since stitches make up embroidery, let's look at the two basic foundation principles of stitch anatomy.

Principle 1: A Stitch Requires 2 Needle Penetrations

A single needle penetration is a zero-dimensional object in 3D space. It has a set of coordinates to define its location but it has no length, width, or height. To form a stitch, you must have at least two pairs of coordinates. So, an embroidery file is primarily composed of x, y coordinates for needle penetrations plus a few other simple commands to control a few basic functions like trims and color stops. OK, I admit it, that sounds pretty geeky.

As we examine a block of stitches in a design, notice that each stitch except the first and last has two threads in each needle penetration. Why is that important? While we often talk about "embroidery on" fabric, in reality we are embroidering through or into fabric.

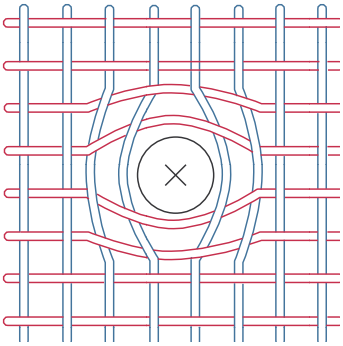


Technically speaking, you must have at least 2 pairs of coordinates (needle penetrations) to form a stitch.

Fabric—at least knits and wovens—is composed of thread. By embroidering a design, we are adding more thread to that fabric. The more tightly woven and less stretchy a fabric is, the less forgiving it will be of having a lot of thread crammed into it. Embroidery thread requires space and the more concentrated the stitches are in your design and the thicker the thread, the greater the impact will be on your fabric. Too much thread for the weave of your chosen fabric will cause the embroidery to push the fabric fibers apart. Have you ever seen an embroidery that caused rippling or cupping of the fabric? Too much thread is often the culprit. This is an important concept when we discuss stitch density later on.

2 Physics of Embroidery

Notes



On a tightly woven fabric, embroidery thread won't have enough breathing room and will push the fabric fibers out; this is called fabric displacement and ultimately results in cupping and puckering.

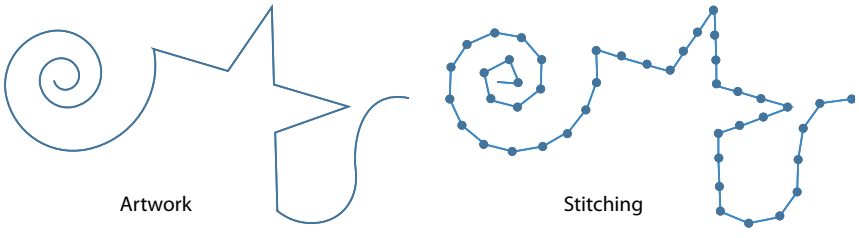
Principle 2: All Stitches Are Straight

A second basic concept is this: *all stitches are straight*. Due to the tensions set on the upper (needle) thread and the bobbin thread, all stitches are straight lengths of thread stretched between two needle penetrations.

> **Note:** While we often say "needle holes," a needle is really designed to separate and penetrate between the fibers of fabric. Unless you are sewing on something like metal, vinyl, leather, or paper—and you can!—your needle should not be punching holes in your fabric. If it is, check that you are using the right needle for the fabric and that the needle is undamaged. If in doubt, insert a new needle.

I know what many of you are thinking at this point, "Well, *DUH-HH!*" But be honest, have you really ever thought about this before? Stick with me though, because becoming conscious of these facts can improve your embroidery.

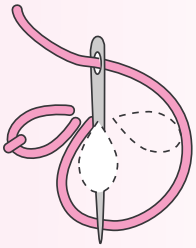
When you see curved areas, you'll notice on closer examination that they are simply a series of straight stitches. The eye easily makes larger curves into a smooth one but to create a smooth appearance on a tight curve requires shorter stitches. You will need to balance your desire for a perfect curve with the realities of embroidery.



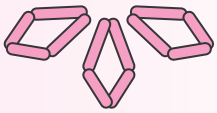
Always remember that all art forms are nothing but illusion. A good artist is aware of the attributes of the chosen medium and must know how to maximize the advantages while minimizing the

No Curved Stitches

If you were ever a hand embroiderer, more than likely you created your fair share of "lazy daisy" (technically known as the detached chain) flowers and leaves. By using a more loosely tensioned stitch you could create a "curved" stitch.

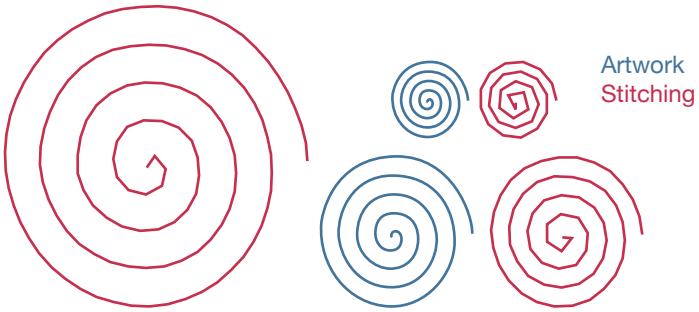


Embroidery machines can't arbitrarily change tensions to create such a stitch. Instead, a machine created version would look more like this:



disadvantages. A good digitizer knows how to leverage thread properties and perform feats of trompe l'oeil as well as a magician performs the illusion of pulling a rabbit out of a hat.

You can try this for yourself. If your software has a spiral tool, draw out a few in varying sizes, apply a run stitch and see what happens. The following illustration shows a 40 mm, 20 mm, and 10 mm spiral with a 2.0 mm single running stitch applied.



Notice that at the center of the spiral where the loops are small, the curves are not as smooth as the larger loops. Keep in mind that when your design sews out and the spiral is only a part of the design, the mind's eye will smooth out these short straight stitches so that you see a smooth curve. Don't be tempted to make the stitches really short to have a smoother curve!

Caution! Watch Zoom Levels...

It's very tempting to zoom in on tiny details to make sure they look just perfect. When I owned Cactus Punch, one of our first employees was a free lance educator for a major sewing machine company. She desperately wanted to be a digitizer and she would periodically bring in various designs she had created.

One day she brought in a bumble bee. It was about an inch and half square and it was so thick, I thought she had used 3D foam. She replied no, it was just stitches. She was obviously very pleased with her work. Amazingly, she hadn't broken a single thread or needle during the sewing process!

I don't remember the stitch count but I do remember that I was shocked that you could cram that many stitches into such a small space. As she waxed on about the virtues of this latest masterpiece, she proclaimed she had finally found the secret to getting precise detail. Curious, I asked if she'd share this amazing secret. She looked me in the eye and with a conspiratorial voice confided, "Just digitize at maximum zoom levels." (And no, she never became a digitizer!)

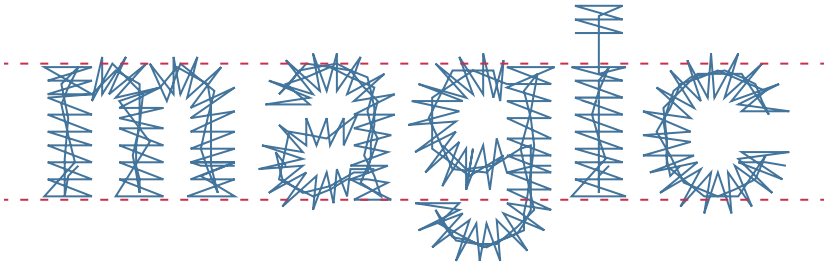
Notes

Rely on the mind's eye to create details that aren't there! You do not have to digitize every little speck. In fact, doing so is considered poor digitizing.

Notes

This is not the key to detail! Working at max zoom levels entices you into packing in too many very short stitches too closely together. However, this is how many novice digitizers work. If you see too many stitches packed into a small area—say a tiny little eye with a pupil, iris and a highlight—you're headed for trouble.

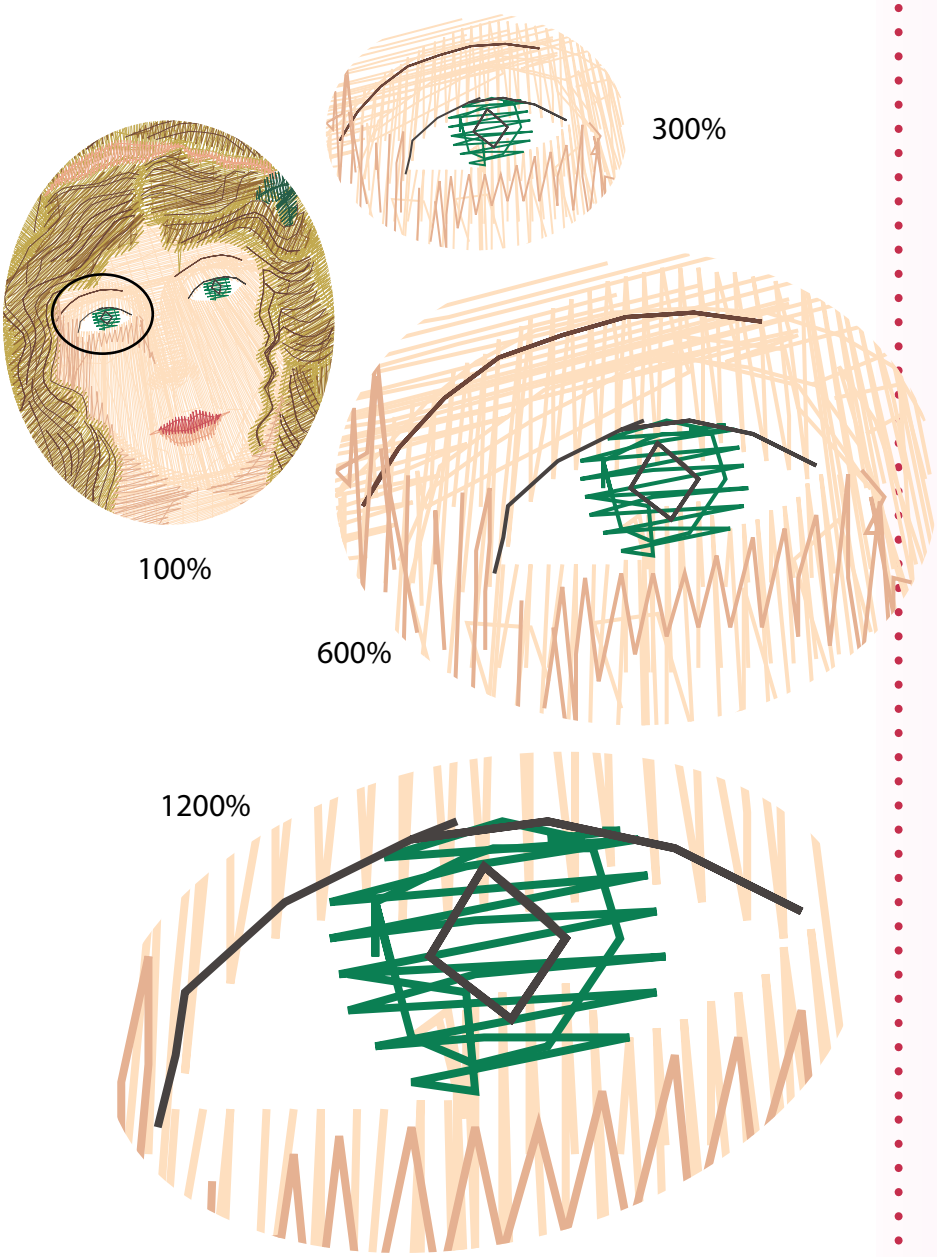
As a non-digitizing embroiderer, you need to be aware of zoom levels when you are checking designs. The farther you zoom into the design, the weirder it can look. If you "neaten things up," worst case you can destroy the integrity of the design (you'll learn why when we discuss compensation) and best case, have no impact on the design and simply be wasting your time.



There's a reason why these letters don't all perfectly line up on screen! Find out why in the chapter on compensation.

Notice in the following example how different the eye appears as we zoom in closer and closer. Traditionally, digitizers worked on a "cartoon" drawing of their design that was drawn at 600% of its actual size. Without computers and on-screen digitizing, punchers learned to gauge their stitch lengths and densities because they were always working at the same relative size, six times actual.

With the advent of on-screen digitizing, it became easy to zoom in to get a really close up view. One program I use has a max zoom of 10000%! Most machines only stitch in increments of one embroidery point (.1 mm) so the value of moving stitches at this zoom level is dubious. Even if the machine could sew at that accuracy and assuming you can control sewing distortion factors, will you be able to see the difference? Highly unlikely!



If you were working at the 1200% zoom above, you can see how tempting it would be to fill in that pupil and even add a highlight as a finishing touch!

Notes

A common cause of too many details is working at extreme zoom levels. Many programs let you view stitches at zoom levels of up to 3200% and higher. Working at this size can easily throw off your sense of scale.

2 Notes

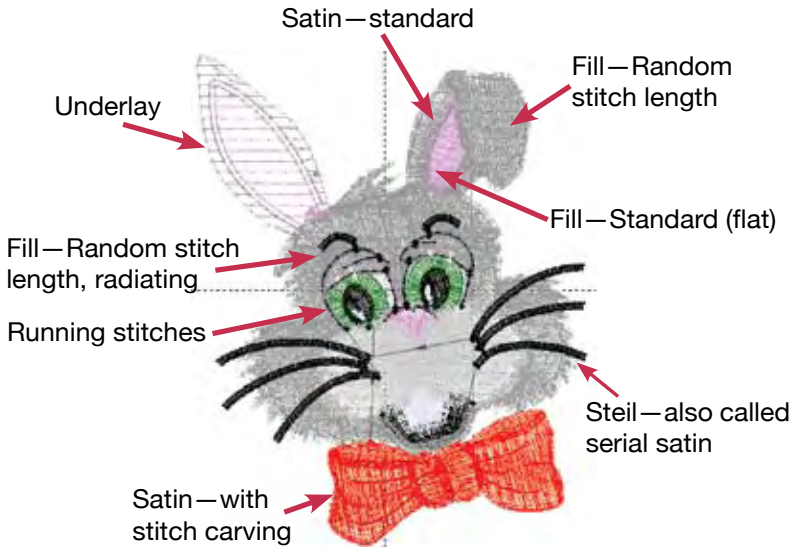
Chapter 3

Stitch Types

In This Chapter

- What are the three main categories of stitches
- How are they used
- Why there is infinite variety

From the simple basic stitch discussed previously, three main traditional categories of stitches are created based on how the stitches are placed in relation to each other: running stitches, satin stitches and fill stitches.



Running Stitches

Also called walking stitches or line in some programs, this type is not restricted to just a plain straight stitch but may resemble fancy decorative stitches found on sewing machines. Stitches in this group are applied to a path or line that may be open-ended or closed. Examples of running stitches:

Notes

All designs are composed of these basic stitch types.

Once you understand this, you can begin to analyze complex designs as just different combinations of these.

If you want to learn to digitize, the best way is to sew designs by artists whom you admire. Then look at the design in your software and find out what makes it tick. Everything the digitizer did is exposed in that design file, but to understand the "whys" behind it you need to understand what's in this book!

Visit your favorite website or drop into your local dealer and browse their catalogs for a design that uses a technique you'd like to learn.

3 Stitch Types

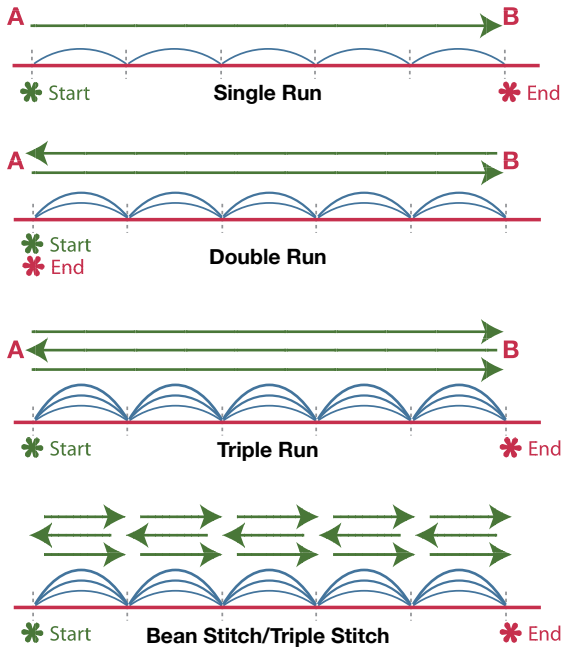
Notes

This image is an embedded QuickTime movie. Click on the design to play it in Acrobat. Use the sliders at the bottom to review areas you'd like to see at a different speed. (Note: None of the animations in this ebook have audio.)

This design is also included as part of the downloads so you can compare actual stitch effects.

- Single run
- Bean stitch (triple stitch)—it may look the same as the single run but compare the sewing pattern below
- Motif, chain
- Motif, chain on a curved path
- Motif, undulating blanket stitch
- Two motif combination

A single run is one line of running stitches, a double run sews from point A to point B and then returns. A triple run runs from point A to B, returns to A and then back to B. A triple stitch does the A-B-A-B one stitch at a time.



Do you see a pattern here? Even numbered passes start and end on the same side while odd start at one end and finish on the other.

RUNNING STITCH USES

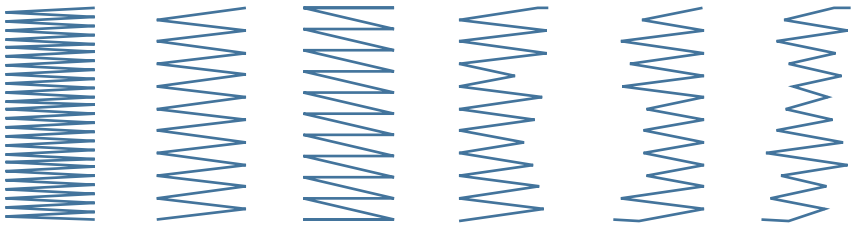
Running stitches are used for fine detail but are not limited to this function. Entire designs may be composed of just running stitches, like redwork, quilting, and smocking designs. An intricate redwork design may sew fast but I can guarantee it took quite of lot of thought to plan out and digitize! Running stitches have the least impact on fabric as far as fabric distortion.

Design composed of bean stitches.

Motifs are great fun to play with and I've spent days creating my own stitch patterns this way. In fact, creating decorative stitch patterns for my Pfaff 1475 was my first introduction to digitizing, although I didn't realize it at the time. With software, these designs are easy to create and can often be stored in libraries. Stitching in the hoop provides a much higher degree of stitch precision than regular sewing.

Satin Stitches

The basic or standard satin is composed of stitches that reverse direction on every needle penetration. Advanced options allow for splitting long stitches so that stitches do not exceed a specified maximum length; "satin fills," a special patterned effect not typically used in normal column areas; and carved satins, where needle penetrations occur on digitizer controlled points. Examples of satin stitches, described left to right below the graphic:



Satin | Zigzag | Sawtooth | Random right | Random Left | Random Both

- Closely spaced satin
- Open satin (may be called zigzag when both stitches are angled)
- Satin—one straight stitch, one angled (may be a called sawtooth)
- Random edge may also be called feathered

Notes

This rose is included as part of the downloadable files. (Original art by Kristie Walker.)

3 Stitch Types

Notes

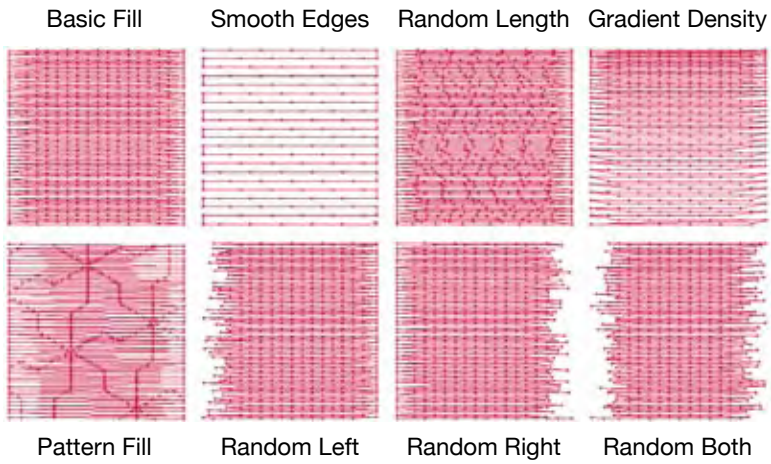
CAUTION! Only use smooth edges on open (light density) fills or you can perforate your fabric along the edges!

SATIN STITCH USES

Satin stitches are used to cover narrower areas. You'll find them in letters, flower stems, small leaves, and narrow stripes to name just a few. Satin stitches tend to be shinier and loftier than fill areas and give the appearance of advancing towards the foreground. A good digitizer can use them creatively to add dimension and interest to a design.

Fill Stitches

Your software may call this stitch type complex fill, tatami, or step stitches. Fills are essentially stacked rows of running stitches and used for covering large areas. Patterns are created in fills by the alignment of needle penetrations. Samples of fills (described below left to right, top row first):

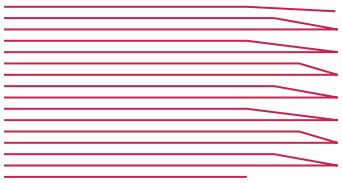


- Basic, standard fill pattern
- Smooth edges (see caution!)
- Random stitch length
- Gradient density—density changes value
- Pattern
- Feather left
- Feather right
- Feather right and left

CAUTION: Using smooth edges on a fill is not recommended for normal densities due to possible perforation along object edges!

A FEW CAUTIONS ON FILL TYPES

Smooth Edges—This type is best used on more open densities. Standard fill stitches can look somewhat raggy on the edges and this type keeps a neater edge. The down side is that it will double the needle penetrations on the edge of an object, resulting in a potential perforation problem if those stitches are too close together.



Close-up of a standard fill shows staggered edges.

Random Stitch Length—I love this option because it lends realism to nature objects like fur, feathers, foliage, and flowers. This stitch pattern may not be recognized by all resizing programs, which may change these fills to standard flat fills. The only way to know for sure is to compare a resized design to the original.

FILL STITCH USES

Fill stitches are used to cover large areas of fabric. By varying stitch parameters, the digitizer can create texture, dimension and interest. Fills are not limited to a uni-directional, big flat blob of stitches. Depending on the stitch attributes, fill stitches may appear to recede or advance.

Three Stitch Types, Infinite Variety

Each of the above stitch types can have different settings, parameters, or attributes that may be applied to them. By manipulating these attributes it is possible to create an infinite variety of "stitches"—all formed by connecting a series of the basic straight stitch together.

By learning how to select, combine, and manipulate stitch types, a digitizer can elevate a design from a flat cartoonish appearance to a true work of art. However, a design can also be destroyed through indiscriminate use of pattern fills and satins. You've probably seen designs that looked more like a pattern fill swatch test. Pattern fills can be interesting but they often look peculiar and artificial because they are too perfect. Imagine cutting out clothes from wallpaper for paper dolls and you get the idea!

Today's programs that offer advanced features blur the distinctions between these three basic stitch types. We can apply a satin to a line (your software may call this a steil stitch, serial satin, or even a

Notes

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satin border), we can have patterned fills or satins, motif fills, contour fills, gradient fills—well, you get the idea. Trying to fit an area of stitching into just one of the above categories may not always be possible.

Is it absolutely necessary to know if an area of stitches is a multi-step satin or a fill? No. There are ways to tell but for purposes of this discussion, we can skip that. Depending on how sophisticated your resizing software is, you may have some, shall we say, "interesting" and unexpected results when scaling designs with complex patterns.

If you don't digitize, you may only come into contact with selecting patterned fills and satins when working with larger keyboard letters. Watch with patterns that there are no excessively short stitches.

The best way to learn about the various stitch types is to make stitch swatches. We'll be doing that as part of the practical part of this book, but I encourage you to make stitch swatches to see the real effects of various settings. Remember, a design on screen is not an embroidery until it is sewn out!

Why You Need to Know

So if you have no intention of digitizing, why is it important to understand stitch types? By understanding stitch types and their impact on fabric, you can look at an image of a design and have a good idea whether or not it is suitable for your intended purpose. You'll have an even better idea with a closer, on-screen examination. More on that as we progress!

Running stitch designs create the least distortion on fabric. A redwork, design for example, is very open; it doesn't provide much fabric coverage. If you sew it on a textured fabric, like terry cloth, the design will simply be lost in the nap and on a highly patterned fabric it will be lost in the pattern.

Designs that use large areas of fills create the most distortion—especially if the fill objects feature many varying stitch directions. We'll discuss distortion in the chapter on compensation.

Chapter 4

Stitch Properties

Notes

In This Chapter

- Why there is no such thing as a one-size-fits all design
- What are default values
- What are the various stitch attributes of the three stitch types
- What if you push the limits

Stitch properties are the attributes that define the appearance of the stitch effect. A list of the primary attributes include the following:

Stitch effect: A stitch type—run, satin, fill—including attribute settings

- Length
- Density
- Angle
- Needle penetrations or patterns
- Shortening

Additional attributes are compensation, underlay, and tie-offs. These are considered secondary attributes; they may be part of the stitch attributes dialog or they may be controlled manually.

NOT ALL ATTRIBUTES APPLY TO ALL STITCH TYPES

As you can see from the chart below, some stitch types have fewer options than others:

Stitch Parameters Chart

Stitch Type	Primary				Secondary	
	Length	Density	Offset	Angle	Underlay	Compensation
Running	√			√		
Satin	√	√		√	√	√
Fills	√	√	√	√	√	√

Default Values

To generate stitches, the various stitch types must have attributes set with valid values. For example, a basic run stitch must have a stitch length. If this attribute has no value, then the run stitch cannot be generated. Default values are the initial "factory settings" assigned to the various stitch types so that a program can create the stitches without displaying an error message.

Default Values—A starting point; stitches must have some attributes set with valid values to avoid a program error.

4 Stitch Properties

Notes

A creative, artfully digitized design—even a simple one—often uses varied stitch parameters to achieve not only interest, but special effects. Less interesting designs maintain the same stitch parameters for every fill, satin, and running object.

It is important to understand that there is nothing sacred or special about default values. They are values that the programmer set—a programmer who may know little or nothing about digitizing—so that the digitizer has a successful result. In this case, "successful result" simply means no *software error* occurred; however, it could still result in a *digitizing error* in terms of an unsuccessful sewing result.

This dialog box illustrates various options for fill stitch attributes with the default settings. Your software will no doubt look differently. Lettering programs will offer similar settings so understanding the effects they have can mean better keyboard lettering results.

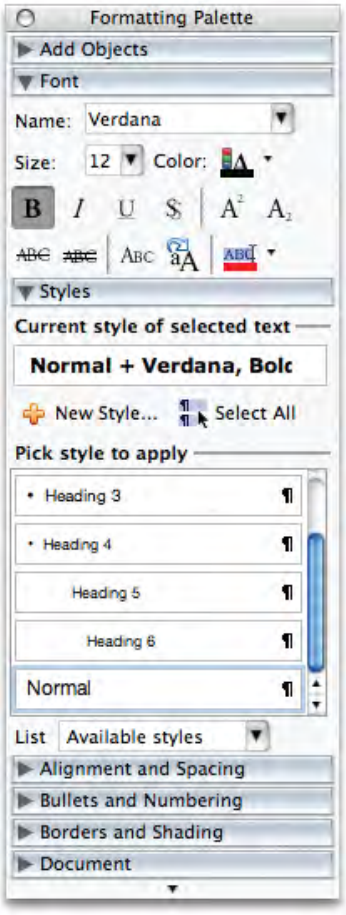
A running joke in the computer community is that "default values" are "faulty values." Instead, I think of them as an attempt at "one size fits all" values—in other words, seldom are they "optimal" values but they will work reasonably well in "average" situations. Consider them a starting point and learn to fine tune them for the task at hand.

Default values are generally some average value that will work reasonably well under average conditions. Think of default values as "one size fits all" and take them with a grain of salt. More experienced digitizers seldom stick to default values, instead altering them for any of the following reasons:

- Fabric type
- Thread type or size
- Desired effect (artistic effect)
- Personal preference
- Machine tensions
- Type and amount of stabilizer used

More About Attributes

If you've ever used a word processor, you've probably changed the typefaces in your document. For example, you set the title to 18 pt bold all caps, section headers within the document to 14 point bold, body text to 12 point plain. Special emphasis may have been applied here and there with italics. Furthermore, you may have used a serif font combined with a sans serif. You can equate the different fonts to different stitch types, while stitch attributes are the equivalent of bold, italic, and point size.



Think of stitch effects as similar to styles in word processing programs like Microsoft® Word.

As you become a more sophisticated word processor user, instead of simply applying attributes as you need them, you create a *style sheet*, which stores the selected attributes under a named group. Style sheets make it easier to make mass changes to your document and maintain consistency. If your document is twenty pages long and has 87 section headers and you decide to change the section headers to a different style, all you need to do is to update the style and every header to which you've applied the style will update as well.

Basic digitizing programs will require you to apply changes on an object by object basis and don't offer the equivalent of style sheets. Some programs are now coming with built-in "recipes" that you can use when working with specific fabric types. While you can often modify these and maybe create your own custom recipes, it's still not the equivalent of a style sheet, which you may only find in professional software. If you decide to pursue digitizing, this is something to look for in a program.

Notes

4 Notes

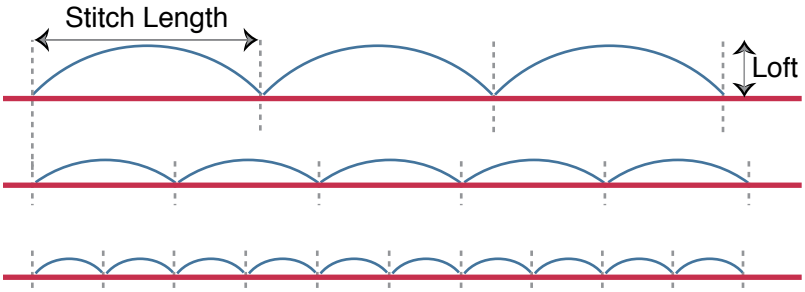
Chapter 5

Stitch Length

In This Chapter

- Why longer stitches offer better fabric coverage than short ones
- What are practical stitch length minimums and maximums
- How stitch length impacts fabric
- What if stitches are too long or too short

Stitch length is the distance from one needle penetration to the next. An interesting side effect of stitch length is *stitch loft*, which is the height of the stitch above the fabric. You can also view this as how tightly a stitch is pulled into the fabric. You might think this is solely a function of how tightly your machine is tensioned, in reality, the shorter the stitch the more tightly it is pulled into the fabric.



Longer stitches loft more; shorter stitches sink into fabric more.

Obviously an overly tensioned machine will pull all the stitches more tightly into the fabric. A final factor that contributes to loft is thread thickness; thicker threads loft more than thinner ones.

> **Note:** Loft as discussed here refers to the stitch loft achieved without any assistance. Creative use of underlay can increase loft and for maximum height, 3D foam can be used.

Stitch Length Minimums

Most industry experts agree that the minimum recommended stitch length is 1 mm, or about .04". Let's take a moment and look at the reasoning behind this recommendation.

Notes

Stitch Length—distance between needle penetrations

Stitch Loft—height of stitch from fabric; determined by:

- Thread thickness
- Stitch length
- Machine tensions

You might as well get used to working with millimeters. Because of their minute dimensions, stitch lengths and densities are much easier to handle when working in millimeters or embroidery points. A point is 1/10 of a millimeter.

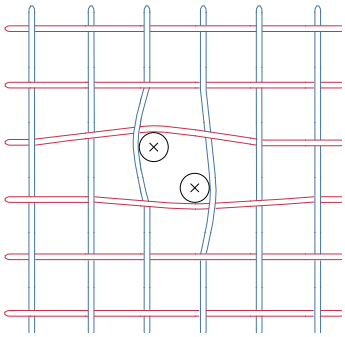
5 Stitch Length

Notes

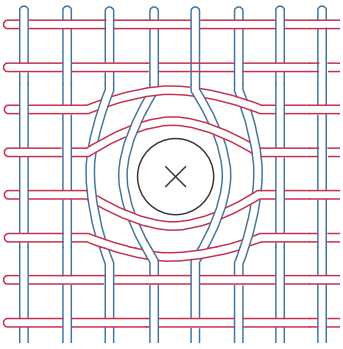
The most commonly used thread for embroidery is 40 weight polyester or rayon. Typically, the needle most often used is a size 80, although I recommend a 70 or 75 for more precise stitch placement. If you're unfamiliar with what these numbers mean, a size 80 needle is .8 mm in diameter. Forty weight thread is approximately .3 mm in diameter (impress your friends with this bit of trivia!). If you were to look at a close-up of a 1 mm long stitch made with a size 80 needle, this is what you'd see:

The two circles represent the opening the needle created in the fabric. On most fabrics, this "hole" is temporary and will close up around the thread after the needle is removed. Remember, too, that more than likely there will be two threads in each of those two circles. Notice the length of the thread relative to the holes. Not very long is it?

Now consider what could happen if you are embroidering on a relatively loosely woven piece of fabric. If the needle fails to move over a fiber in the weave, both needle penetrations will occur in the same space between the fabric fibers and no stitch will form but there will be a little loop of thread there.



If stitches are really short, and they both fall into the same space between the warp and weft of the fabric, no stitch will form.



Warp and weft are pushed aside when pierced by the needle thus closing spaces around this stitch and leaving inadequate space for the next stitch if it is very short. If stitches are short, weave tight, and thread heavy, fibers must be pushed apart; this results in more push. (Push will be discussed more in the chapter on compensation.)

Tip: You can use a smaller needle and thread for fine details.

Needle Notes: The Golden Rule of Needles

Use the smallest needle to carry the thread through the fabric without damage to the thread, fabric, or excessive flexing of the needle.

Stitch Length 5

Use Short Stitches with Discretion!

Short stitches are best used for tie-offs and small details. For the digitizer, it is easy to change stitch length on selected sections. If you are working with very fine details, such as very small letters in a monogram, try switching to 60 weight thread with a size 65 needle.

Excessive use of short stitches runs up stitch counts, packs more thread into your fabric, creates stiff "bullet proof" patches, causes warping and puckering, increases the likelihood of thread breaks, and, worst case, can damage fabric. Avoid too many short stitches!

Keep in mind this 1 mm minimum may be too short under the following circumstances:

- when working with specialty threads, including metallics
- when using larger needles
- when embroidering on "non-average" fabrics, such as open weaves and knits; high loft, thick, or heavy fabrics; leathers, vinyls, and other "non-fabrics"

I can't think of a single instance where you'd use a stitch length this short in a fill. In addition to the effects listed above, remember that shorter stitches are pulled into the fabric more tightly. Since fills are generally used to cover large areas of fabric, you will get much better coverage when the stitches can loft up a little more and that requires longer stitches.

Consider using 1 mm wide satin columns with care; needle penetrations this close together—especially when combined with a sharp needle—can cut fabric fibers.

When creating designs based on running stitches—think of redwork designs—consider using 1.5 mm to 2 mm long stitches in smaller designs and intricate details. Although still very short, a 1.5mm long stitch is 1½ times as long as a 1mm stitch.

Stitch Length Maximums

Now that we know how low you can go, what about the other end of the spectrum? If you were to query the pros on this one, you'd get a much wider range of answers.

For most machines, 12.7 mm (1/2") is considered a jump stitch; stitches greater than or equal to this length should be avoided. This means that on a machine with automatic thread cutters, your machine may be trimming after every stitch that meets the prerequisite jump length.

Notes

The number one mistake new digitizers make is combining overly short stitches with excessive density. If you feel hard, knot-like areas in your embroidery after sewing, check for the following:

- Short stitch lengths
- Tight density settings
- Excessive layers of stitches

Contrary to what you might logically think, more stitches via shorter stitches and higher densities is not the way to better fabric coverage.

Satin stitches are the least likely stitch formation to loop. The reversing stitch direction creates a more even tension than when the machine is moving and forming multiple stitches in a line as for runs and fills.

Loop stitches can also occur if the needle fails to pick up the bobbin thread.

5 Stitch Length

Notes

In general, 6-8 mm is a good practical maximum stitch length for satins while 5-6 mm is the max for fills and runs.

Long Stitches

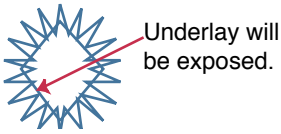
As with short stitches, longer stitches also have their share of advantages and disadvantages.

ADVANTAGES

- **More loft.** This translates into better fabric coverage. A longer stitch "floats" above the fabric, providing a more solid appearance.
- **More shine.** Longer stitches reflect light better than shorter ones. An artistic digitizer controls stitch length to create the illusion of dimension and texture in her work.
- **Reduced stitch count.** Reducing the stitch count while increasing the coverage results in softer embroidery, faster sewing times (to a point; see note under disadvantages), less thread usage, and less fabric damage.

DISADVANTAGES

- **Increased tendency for looping.** Since longer stitches loft more, there is a possibility they can loft too much, resulting in a loose stitch referred to as a loop stitch. Looping occurs more often in running stitches and fill areas. The longer the stitch, the harder it is for the machine to maintain perfect tension, especially at high machine speeds. Therefore, you may find longer stitches require closer attention to machine tensions to prevent looping. Some machines are better than others at creating consistently tensioned stitches.
- **May cut off corners.** Since all stitches are straight, applying a stitch effect that is too long attribute may cause corners and curves to be cut off. If you see an odd stitch hanging out on the inside of small or tight curves and corners, chances are you need to shorten the running length or the underlay length.



You may see this when you shrink a design or when creating small letters in your lettering program. In the latter case, try shortening your underlay a bit.

- **Decreased machine speed.** Most machines have a length threshold at which they slow down. This only makes sense; the pantograph has to move the hoop a greater distance. Decreased speed is generally not a factor except in tight manufacturing situations.

- **May snag.** Long stitches are not a good candidate for items that will receive heavy wear or repeated launderings, such as children's items. Long stitches are also more likely to catch on jewelry and other objects and snag.

Short to Moderate Stitches: Advantages and Disadvantages

By keeping the bulk of your design in the moderate stitch length range, you can balance the effects of extremely long and/or short stitches. Short to moderate stitches are good for:

- **Small details.** Shorten your stitches as necessary in areas of intricate details. Don't go overboard with small details or you will have an overly dense and busy design with no focal point. Instead of adding that teeny highlight to a small eye, leverage the reflective properties of thread to create it.

- **Deflecting light.** Shorter stitches break up light and create a duller, rougher appearance as opposed to the shinier effect produced with long stitches. Exploit this for artistic effects.

- **Increased machine speed.** Some commercial digitizers determine the maximum stitch length before their machine speed drops so they can create the fastest running design. Even though the stitch count may be a bit higher, it can still sew faster. Saving a minute or two can dramatically increase production thereby reducing cost in large embroidery runs. Home machines tend to be more variable in speed and are not used in high production environments so this is not a major consideration in that arena. However, it is conceivable that while you may have a home machine you could be creating designs for a commercial embroiderer in a production environment. In this case, ask them if they have a maximum stitch length preference (it will make you sound smarter!).

- **Better stitch formation.** More consistent tensioning (less looping) and fewer dropped stitches (where the needle does not catch the bobbin thread) occur in the moderate stitch length range. Reducing machine speed further enhances stitch formation.

Notes

The pantograph is the part of the machine that moves the hoop.

How does two minutes translate into something significant? Imagine a 15-head embroidery machine—a machine that sews 15 items at once. A two minute reduction on each run could save enough time to sew an additional 15, 30, or even 45 items in an 8 hour shift depending on how long the run was.

5 Stitch Length

Notes

- **Fewer thread breaks.** Moderate stitch lengths are especially beneficial for more temperamental threads such as metallics.

Keep in mind the previously discussed disadvantages of short stitches. A good digitizer uses a wide range of stitch lengths and customizes this attribute based on need. By avoiding extremes in stitch length, chances improve for good results under a wider range of sewing conditions, including fabric, thread, and needle variations. You also increase the chances of being able to scale the design up or down with a favorable result.

The Long and the Short of It

For you digitizers, by understanding how stitch length affects the look of your embroidery as well as how it impacts the fabric on which you are sewing, you can elevate both visual appeal of the design and the quality of the sewn embroidery. Yes, it takes more work and more thought, and it may not be necessary in every design situation. And if you auto-digitize, as you raise the bar on your embroidery expectations, you need to move beyond the 5-step click and sew process.

REVIEW

Resizing designs can change stitch length so pay attention to how your program changes stitches to avoid stitch length problems.

To summarize, let's do a quick review:

- Shorter stitches
  - Sink into fabrics more tightly
  - Excessively short stitches are the #1 cause of thread breaks (stitch length less than 1 mm)
  - Rapidly and radically run up stitch counts
- Longer stitches
  - Tend to loft up more
  - Excessively long stitches can snag
  - Longer stitches in fills and runs can result in looping if machine tensions aren't well controlled
- Avoid extremes in stitch lengths
  - Improves tension tolerance
  - Increases range of suitable fabrics
  - Increases range of usable threads
  - Improves design scalability

Apply Your Knowledge: Test Your Machine

Some machines are better than others at creating consistently tensioned stitches in fill areas. If you will only be sewing the designs you create on a particular machine, you can optimize your settings for that machine. However, if the designs you create will be sewn by others, then you must become familiar with how a wide range of machines control stitch quality. After the section on density, we will be creating another swatch chart that will allow us to compare stitch length and density settings in fills. By test sewing this chart design on a variety of machines, you can gauge stitch quality and determine a threshold for stitch length in fill areas. Store the charts in a notebook along with details such as program used to create the swatches, machine brand and model, any adjustments in tensions, thread type, needle, and stabilizer(s) used.

Creating the Swatch Chart

Since I've already written these directions for creating a swatch chart with Generations™ digitizing software for another project, I will include them here. If you don't use Generations™, you should be able to get the idea of how to do this for your own system. Or, download the sample I made (see link in Resources appendix). Keep in mind that the idea is to learn how *your* software creates stitches; using my samples will only give you an idea of how various densities in my software affect fabric.

The swatch chart shown here was created for a 150 mm x 240 mm hoop. If your machine's sewing field is smaller, you will need to make multiple files. Do not make the squares smaller or your swatches will be too small to represent your machine's stitch quality or for you to gauge fabric coverage.

> **Note:** While this sampler looks easy to create, please follow the step-by-step instructions following. By doing so, you can save yourself a number of repetitive steps and learn how to streamline simple tasks.

Notes

Downloadable Swatch Chart

You can find a link in the Resources appendix that will take you to the download area. For the swatch chart, there are some sample sew files plus artwork for a template you may use to create your own.

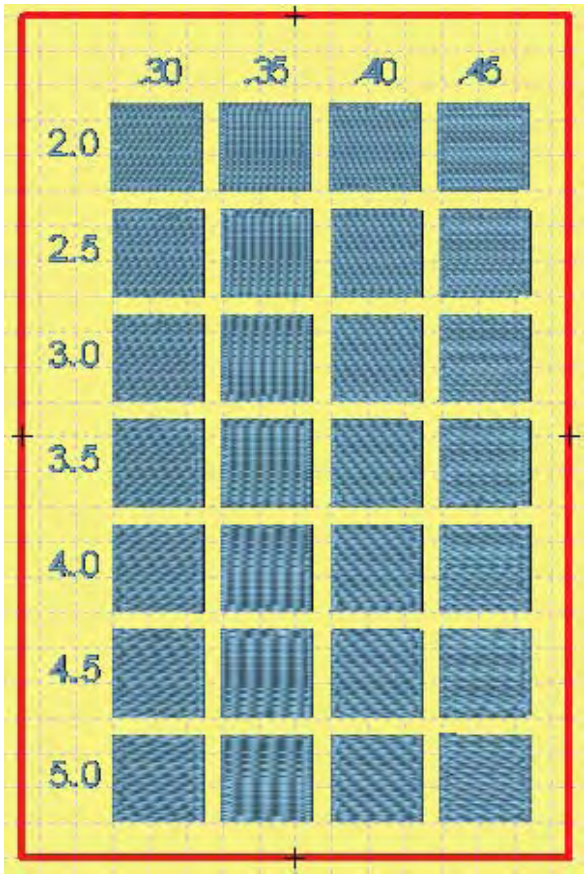
5 Stitch Length

Notes

Note that the stitch lengths and densities used in this swatch test are for demonstration purposes only and should not be used as samples for "ideal values." I personally seldom run standard satin or fill density less than .38 mm and more often closer to .42 mm.

Use this file as a template to test other variations. What happens with less density? How does underlay affect the coverage and feel? Does sewing it with a sticky back stabilizer make it feel different than when sewing with a no-show cutaway mesh backing? How do different types and weight of thread react? Seeing results first hand is a great way to jump start your understanding of embroidery.

It does take machine time to sew but there are no color changes so there's little operator time involved once the designs are created.



The numbers across the top of the swatch chart represent density, while the numbers down the left side correspond to stitch length.

1. Open Generations™ and set your hoop size to 150 mm x 240 mm, or a size your machine can handle.

2. Create the density labels across the top: Select the lettering tool, select the Arial font, and set the size to 7.5. Create four labels: .30, .35, .40, and .45.

   Tip: You do not need to generate after each little bit you create. After creating all of the above labels, right click in a blank area of your document, then click generate  and all the labels will be created.

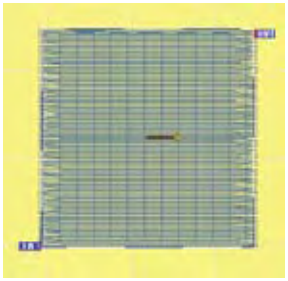
   Use the  alignment tool to align along the bottom edges across the top of the hoop. We'll fine tune the alignment in a few moments.

   Save the file as Fill Stitch Length Sampler.

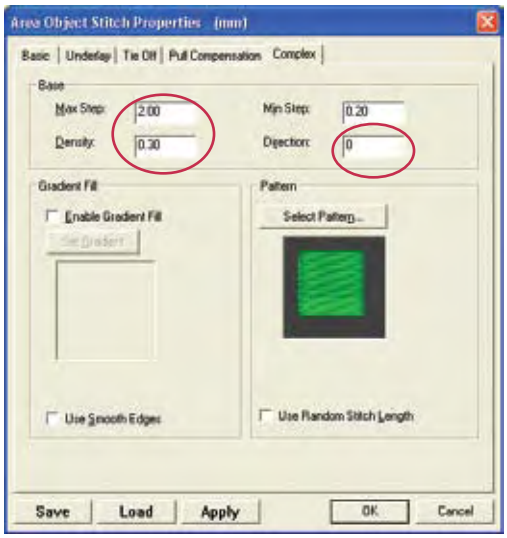
3. Create the first stitch length label using the same settings as above and move to the left side of the screen.

4. Create the first row of squares and adjust stitch attributes:

   - Using the rectangle tool, drag a square that is 2.5 grids wide by 2.5 grids tall (25 mm square).
   - Change the "in" point to the bottom left and the "out" to the upper right.



   - Change the stitch angle by dragging it so that the green square is at the 3:00 position and the line is horizontal, OR, change it in the Area Object Stitch Properties window.
   - Bring up the **Area Object Stitch Properties** window and select the **Complex** tab. Set the **Max Step** (stitch length) to 2.00, **Density** to 0.30, and make sure the **Direction** is set to 0.
   - Set the underlay to tatami.



   - Click **OK** and then generate.

This is now your "master square template." For the rest of the swatches, you will simple copy and paste this square, modify the In/Out points and update the max step and density settings as needed.

Notes

We've only used the default underlay here. As we'll see shortly, judicious underlay settings can improve fabric coverage.

Recall that "tatami" is another term for fill. Your program may use a different term.

Design snooping on screen does not get you a free pass around test sewing; it only alerts you to potential problems. Sewing may uncover other hidden problems.

Notes

- Copy and paste this square, moving the new version to the right of the previous square. Change the In to the bottom left and the Out to the top right (you are making what is known as "closest point connections"). Change the density to .35 (max step remains the same for this row.)
- For the final two squares, copy and paste both of the previous squares and move them to the right. The In/Outs are already positioned properly so simply change the density to match the top label row.

5. Align this first row: Move the right most square near the right edge of your sewing field and the stitch length label near the left side. Select all four squares and the label and  align horizontally along the centers. Visually distribute the squares horizontally. I found half a grid square's width between the rectangles worked well.

   Now is a good time to align the top row of labels centering each one over its corresponding swatch column.

6. Make the remaining rows: Select the previous row—label and squares—copy, paste, and drag down so that there is a half a grid (5 mm) space between the rows of squares.

   - Edit the label from 2.0 to 2.5.
   - Change the max step for each square to 2.5. Since you set the densities in the first row, you will not need to change these again.
   - Repeat this process for the remaining rows, modifying the label and max step for each row.

WARNING! Do not "optimize" your file or all your entry/exit points can change!

WARNING! Do not "optimize" your file or all your entry/exit points can change!

Save the file but don't close it yet.

Right click the first square (density 3.0 and stitch length 2.0) and note the stitch count in the info bar at the bottom of the screen. Mine is 1815 stitches. Compare that with the last square (density .45 and stitch length 5.0). I have a stitch count of 1152 stitches for that swatch. These are relatively small areas; imagine the savings when you double the size from 25x25 mm to 50x50 mm. If math is not your thing, the first one would swell to 7260 stitches, while the second would increase to 4608. It is easy to see from this example how mismanagement of stitch lengths, densities, and even underlay, can over-inflate stitch counts for a design.

Stitch Length 5

Now that you have the swatch chart, you may want to make a copy and extend it to test more stitch length and density combinations. I can't stress enough the value of sewing these types of utility files to test how various stitch length and density combinations react on various fabrics. Sew this design on several fabrics you commonly use.

> **Note:** Although this is a relatively high stitch count design, it will require little interaction on your part once you've hooped your fabric and pressed start on your sewing machine. Sew swatches while you are working through this book!

For this exercise, sew the swatch first on "average fabric." What is average fabric? It is firmly woven (but not too tightly woven), neutral color (white, or off white) fabric with a fair amount of body to it. I often use unbleached muslin. Hoop it with a medium weight tearaway or cutaway and make sure it is hooped with the grain of the fabric running up and down. In other words, the selvedge would run parallel to the sides of the hoop. Hooping the fabric straight gives better results and provides better stability than hooping in a random, willy-nilly fashion. The hoop, is after all, part of the stabilizing process.

Next, sew the swatch test on sweatshirt fleece and then again on terry cloth toweling, choosing any color that you have available. Or swap in a heavy piece of denim for one of these. Try different thread colors. What happens if you use a two-color twist? These threads are often 35 weight and you should notice a difference in thickness.

Feel each swatch. Which swatches adequately cover the fabric and still feel soft and supple? Are any of the squares distorted? For example, are any rippled or cupped indicating too many stitches for the fabric? What happens if you have a strong contrast between your thread and your fabric? Does it make a difference if you are sewing a light or pastel color on a dark or intense fabric versus a dark thread on a pale fabric? How does fabric texture affect the result? Look carefully at the swatches from various angles. Do any squares exhibit looping?

Be sure to label each swatch with the machine it was sewn on and any settings you may have adjusted at the machine. Other helpful information to include: thread type and weight, needle type and size, and any stabilizers including backing, topping, and adhesives. Store in a notebook for easy future reference.

Notes

You can make similar swatch tests for patterned fills/satins.

Color choice for your swatch chart does not matter, just pick a color that is easy to see on the screen. You'll use the same color for the entire file. When sewing, use a color that contrasts well with your fabric and one that is easy to see (a mid-tone works best). You can then experiment with high contrast combinations and tone-on-tone. Compare your various swatches to each other to see how color and fabric type affect preferred density for a desired coverage.

5 Notes

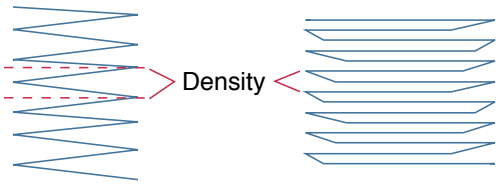
Chapter 6

DENSITY

In This Chapter

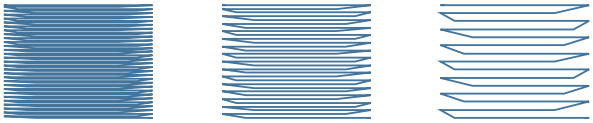
- What density is and how it affects your design
- Factors that impact density
- How to measure density in a stock design
- What if densities need to be changed

Density seems to confuse new digitizers, but it is simply nothing more than the measurement of the space between two rows of stitches.



Notice how the "rows" are determined—the rows of stitches in between are known as *return rows*. Density only applies to satin and fill objects.

The confusion probably arises from the fact that when density is *increased*, the distance between rows is *decreased* and the value assigned to density is *lower*.



More Dense (less space)

Less Dense (more space)

Increasing density increases the number of stitches in a design, increases sewing time, and decreases productivity. Here's a helpful little chart to sort it out for you.

Density	⬆	⬇
Value	⬇	⬆
Spacing	⬇	⬆
Stitch Count	⬆	⬇
Sewing Time	⬆	⬇
Productivity	⬇	⬆

As density goes up, the density value, spacing and productivity decrease while stitch count and sewing time increase.

As density goes down, the density value, spacing and productivity increase while stitch count and sewing time decrease.

Notes

Here's how I think about return rows. Did you ever use a typewriter? Remember the carriage return bar or button that zipped you back to the left side of the page so you could continue typing? The in-between rows are like the carriage returning to the other side to make a new row of letters, or in our case, stitches.

Another way to measure density is to count the number of stitches per inch (SPI).

6 Density

Notes

"Normal" Density

New digitizers often ask what density should be used or what is "normal" density. The answer to that is "it depends." (You'll find this a common answer to many digitizing questions…)

Remember when we discussed defaults? Satins and fills need a value for density so that stitches can generate without triggering an error. For example, Generations™ sets the default density for satins and fills at 0.4 mm, which is a commonly used value by many digitizers. Punto, the program I most often use, has a default value of .45 mm. As default values these are both good starting points but there are plenty of excellent reasons to change this setting. I find that for general use, I prefer .42 combined with a stitch length that is longer than the default value of 3.5 mm.

Knowing what's considered reasonably normal will help you when looking at a design on-screen and trying to decide what problems, if any, it may have. We'll see how you can measure density shortly.

Density Determinants

Are you beginning to see why there's no such thing as a one-size-fits all design? A design that works well on every known item you might put under the needle is next to impossible!

Factors that affect appropriate density settings include:

- Fabric—Weight, texture, tightness of weave or knit, color, pattern
- Thread—Weight, type, and color
- Stitch type and length
- Machine tensions
- Underlay—Amount and type
- Effect—full coverage, light coverage, artistic blending
- Personal preference

FABRIC AND THREAD

As previously mentioned, 40 weight rayon and poly are the most commonly used embroidery threads. While polyester thread is slightly thicker than rayon of the same weight, no density changes are required for interchanging these threads. Heavier or thicker threads such as 30 weight poly or rayon; specialty threads, including 2-color twist (generally 35 weight), glow-in-the-dark, color-changing, and wool/acrylic blends will provide a more solid coverage with less density.

Unless otherwise noted in their color sequence information, you can expect to use 40 weight rayon or poly with success. If you use a different weight or type of thread—including metallic—your results will vary.

Darker thread colors require less density to cover light colored fabrics, while the opposite is true for light thread colors. Monochromatic designs where the thread closely matches or blends with the fabric can still look good with significantly reduced densities.

STITCH TYPE AND LENGTH

Due to their lofting effect, longer stitches will provide better coverage than the more tightly tensioned short stitches (provided the machine tensions are not set overly tight). In fill areas—especially large ones—you can maximize productivity while minimizing stitch count by increasing the stitch length (try 4.5 mm to 5 mm) and decreasing the density slightly (.42 to .45 mm for most thread and fabric colors). This will also result in a much softer embroidery area.

Satin columns are trickier. As the column widens and narrows, the density should adjust. Longer stitches (wider columns) require more density, while short stitches (narrow columns) require less. Maintaining high densities in narrow columns will create hard embroidery and possibly fabric damage.

Here's a little digitizer trivia for you. In the past, digitizers who were meticulous about their work had to break up varying width columns into multiple segments and apply different densities accordingly. Fortunately, most programs make this easy via automatically adjusted density options.

UNDERLAY

We'll discuss underlay in detail shortly. Underlay is the stitching that runs underneath areas of fills and satins to provide structure and support to the design. Instead of increasing the density in the cover stitching, try manipulating the underlay first. Adding more underlay or additional density to the current underlay can improve coverage at a lower "stitch cost" than increasing the top fill or satin density.

EFFECT

In a well-digitized artful design you will often find that density varies for two main reasons: interest and purpose. Light fills make great backgrounds, skies, and water allowing the eye to focus on the main subject, creating depth and perspective, and permit the design to more gradually transition into the fabric—thus avoiding the "patch" look.

Notes

Notice that selecting appropriate densities for satins is the opposite of those for fills.

6 Density

Notes

Goldilocks & the Three Designs: A tale about density

I once received three emails in one week on a particular dog design I had digitized. One complained, "This design doesn't cover my fabric." The second raved, "This design sews like butter!" while the third moaned, "It's so thick it breaks needles." All claimed to sew the design at actual size and with 40 weight embroidery thread. I can only chalk up the differences to skill, stabilizer choice (sticky-back stabilizers make any embroidery feel thick), and personal preference.

PREFERENCE

How do you like your pizza? Why do some people take their coffee black while others add sugar and/or cream? Why are there so many flavors of ice cream? Personal preference. Some people prefer more coverage in a design than others. I suggest that as you become more skilled, that you take the "low cal" approach and lighten up on all that excessive density!

DENSITY GUIDELINES

Too much density combined with overly short stitches is one of most common mistakes made by novice digitizers. In their quest for absolute total coverage, densities are increased and the result is bullet-proof embroidery. Recall from the beginning of this book that fabric is made up of thread and by applying embroidery, more thread is added into and between those fabric fibers; embroidery does not simply rest on top. Embroidery should be soft and pliable.

What settings should you use if you digitize or can adjust settings? The values will vary, as discussed above, but here's your guideline: use the least amount that will provide adequate fabric coverage. Density definitely falls into the "more is not necessarily better" category; use the least amount to achieve the desired effect. For most applications, density settings in the range of .38 to .45 will provide excellent coverage.

If you find you are not getting the fabric coverage desired in fill areas, try increasing the stitch length. For satins and fills, increasing underlay density can also improve coverage while lessening the impact on stitch count and maintaining embroidery softness as compared to simply beefing up density in the top stitches.

While too little density results in more fabric show-through, too much density has a much greater detrimental effect on quality and production. Excessive density can cause:

- **Design distortion.** Too many stitches crammed into too little space results in excessive push (we'll discuss this more when we cover compensation), rounded and/or bulky corners, fabric cupping and rippling, and thick, stiff, and hard embroidery.
- **Thread breaks.** Metallics and other specialty threads work better with a little more "breathing room." (Longer stitch lengths can also improve runnability of specialty threads.)
- **Fabric damage.** Density is relative. What works well on a knit or woven can easily result in "cutwork" on vinyl and leather as the needle penetrations form a perforation line.

An easy way to eliminate excess density in a design is by using a specialty utility program. My favorite is Density Works, which is part of Baby Lock's Designer's Gallery®. This program works with most common file formats and is a great addition if your software cannot perform this specialized function.

- **Higher production costs.** As density increases, so does stitch count, time to sew, and thread usage. Even if you are not in the business of selling embroidery, your time and resources are still valuable.

Applying What You've Learned

OK, all this talk about density and you're asking what's this got to do with me if I don't digitize or I'm working with a purchased design? Would you like to know the secret to avoid wasting time sewing bullet-proof designs?

You've learned what some average densities are and you've learned a few things about stitch length. In case you've forgotten, default densities are often in the range of .4 to .45 mm. Recall that .45 is more open or less dense than .4 because we're measuring the space between rows.

Stitch lengths in satins will fall mostly between 1.5 mm and say, 8mm, while stitch lengths in fills are more likely to be 3.5 mm to 5.5 mm.

In fills, less density is required with a longer stitch; with satins, there should be less density with shorter stitches (narrower columns.)

How To Measure Density and Stitch Length

With software, you can poke around in a design and see what it's made of.

Open up a design in your embroidery software. Look for areas of heavy stitch concentration and scan for long and short stitches. Once you spot a suspicious area, zoom in quite a bit so you can easily see the stitches and accurately measure these tiny distances. This is one case where high zoom levels are recommended!

Use a measuring tool to measure the length of stitches and the density. The distances should show up in your status bar (often at the bottom of the window). Remember when measuring density to skip over a row to account for the mysterious "return row." The following graphics show what it looks like in Punto.

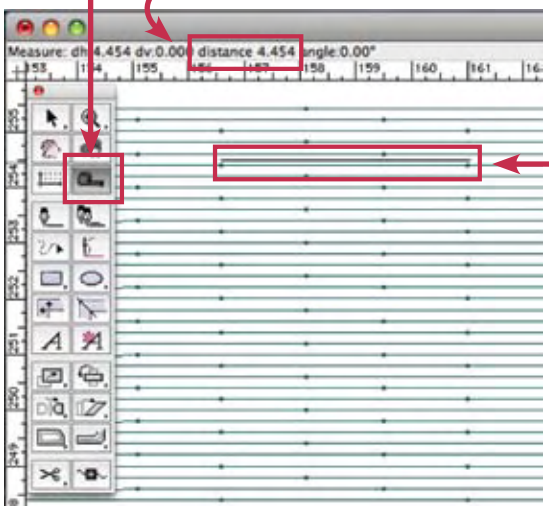
Notes

Keep this in mind when working with keyboard lettering programs!

6 Density

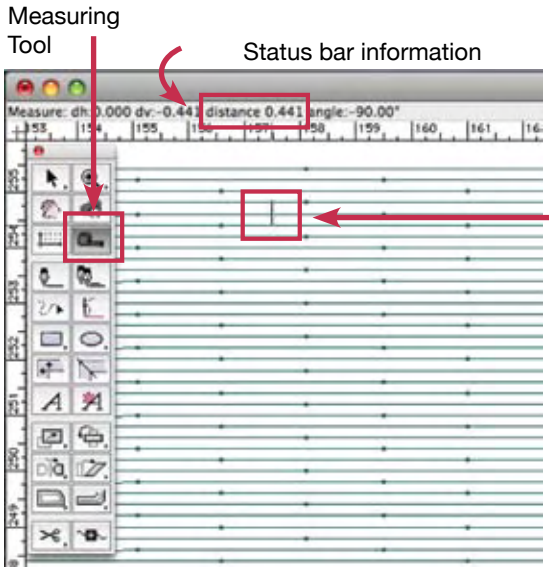
Notes

Having trouble seeing these images clearly? That's another great thing about an ebook—you can zoom in with Acrobat and see the detail you'd like.



Use your measuring tool and drag it from one needle penetration to the next. When working with fills, select one that is fairly representative of the area, not one along the edge. The status bar should display the stitch length; this example is 4.454 mm. (Your status bar may be at the bottom of the window.)

If you are using a program that instead of using a standard measuring system uses an arbitrary numbering scale, create a swatch with each value and measure to get an estimate of how your system sets density values. Be sure to record your values for future reference!



Use your measuring tool and drag it from one row, skip the return row, and then down to the next row. The status bar should display the distance; this example displays .441. (Your status bar may be at the bottom of the window.)

What If I Find Problems?

Good question! If you find problems, you'll need to ask yourself the following questions:

- Is this the original design or a modified version? Resizing the design, no matter how minute, is a modification and can radically change stitch attributes and formations.
- How extensive and severe are the problems? The bumblebee mentioned earlier? Just trash it!
- How much time am I willing to spend on fixing it?
- What software tools and skills do I have to modify the design?
- Can I make the design sew acceptably by changing the fabric, stabilizer, or thread?

Notes

- Is it truly a problem or is it just not what I prefer? Stock designs have a finite range under which they work well. Digitizers of stock designs cannot anticipate every possible way you might use the design, nor can they guess your preferences. For special designs, you may need to digitize it yourself or contract a digitizer who can.
- Is there a "thread tumor"—a pileup of stitches—in an unexpected area? Sometimes stitch processors have a hiccup. You may not even be able to see this on the screen unless you're working with a program like Density Works (Designer's Gallery®). You'll definitely see, feel (and probably hear!) it on a test-sew.
- Where did the design come from? If this is a purchased design and there is a legitimate problem, do contact the company and explain the situation. Attach the design file and be specific about the problem you are having.

  Warning: If you changed the design in anyway, including resizing, don't expect any free help or corrections!

As you can see, volumes could be written on problems and their cures! The point is, you may not be responsible for the design itself but you are responsible for what you sew. You can choose not to sew a bad design—and a "bad design" may only be incompatible for your current project. If it really is a bad design, delete it! Bad designs don't get any better with time and in fact may get worse simply as you become more finely attuned to good digitizing.

Revisiting the Swatch Chart

Revise your swatch chart to test for changes in density values. I can't emphasize enough how much you can learn from this seemingly mundane exercise! If you figure in all the permutations of stitch type, length, density, underlay, pattern, and angle, you could be creating samples for a long, long time. Start with a few basic ones and then keep a file handy that you can modify and save under a new name to test new variations.

6 Notes

Chapter 7

Shortening, Angle, & Pattern

Notes

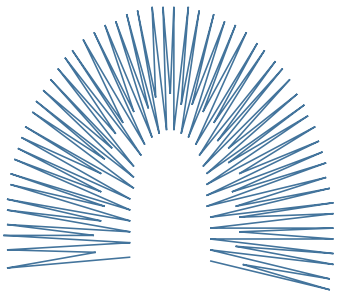
In This Chapter

- What is shortening and why is it important
- What part does stitch angle play in fabric distortion
- How stitch angles can make a design more interesting
- What if you really, really, really like pattern fills

I've combined these three topics into one short chapter. These are attributes you need to be aware of but unless you have an object file and the appropriate software or some other specialty program, chances are you won't be able to alter them on an attribute level.

What is Shortening?

Shortening, which is also confusingly called short stitches, should not be confused with really small stitch lengths. This feature shortens stitch lengths on the inside of curves and corners to prevent stitch pile-ups. You can think of it as a way to ease stitches around the corner. The result is that it balances the density by maintaining coverage on the outer edge of the curve and reducing needle penetrations on the inside.



7 Shortening, Angle, Pattern

Notes

Why Should You Know About It?

Shortening is a sign of good digitizing when used on corners and curves. Some stitch processors will also erroneously insert a short stitch on a straight section, usually at the exit point. This is seldom noticeable, but if it happens to bother you, you can easily remedy it by simply moving the stitch in the stitch file.

If you have inside corners or curves without shortening, you will probably experience fabric damage. Once again, just edit the stitch file and move every second or third stitch in a bit as illustrated in the previous example.

Here's an advantage of working with the stitch file: modifications to individual stitches "stick" and are not modified if the stitches are recalculated.

The important thing to know about shortening is that there is a purpose for these shorter stitches and rarely should you "correct" them by dragging all the stitches out to the edge of the object.

Angle

Angle is called pitch in some programs.

By angle, I mean the angle of the stitches relative to the fabric. When I was first learning to digitize, the preponderance of available stock designs at that time used large areas of plain, flat, horizontal fills finished off with a black running stitch outline. In fact, the prevailing wisdom of the time was "a design is not complete without an outline." Sewing such a design produced a boring, ordinary result and sewing it monochromatically looked pretty much like a silhouette. But the advantage was reduced fabric distortion.

Designs produced by today's top digitizers are infinitely more interesting with more variation in stitch densities, lengths, patterns, and angles. The more variety in stitch angle, the more the fabric is pushed and pulled in different directions and the more attention has to be paid to compensation by the digitizer and hooping and stabilizing by the embroiderer.

Compare the following screen captures of two rendered designs. Both were digitized from the same artwork, yet each is a completely different interpretation. Which would your rather sew?

Shortening, Angle, Pattern 7

This is a typical design composed of flat fills and running stitch outlines. It is an exact interpretation of the original artwork with no added creativity by the digitizer.

Here's the same design interpreted with a little artistic flair. Not only is it more interesting, but you don't have to deal with the registration issues that plague designs outlined with running stitches.

Pattern

I have a distinct recollection of when pattern fills were introduced in the Brother Palette software. Seemingly overnight the free design sites were overrun with embroideries that used a different pattern fill in each stitch area.

I have to admit, playing with pattern fills and pattern motifs is addictively fun. However, unless you are creating swatch samples, control your compulsion to get overly creative. A good designer knows how to control the focal point of a design. Too many fill patterns creates too many focal points causing the eye to jump all over the place rather than be drawn to the central point.

Pattern stamping software is available to add texture and creativity to flat fills—just don't go overboard!

WHAT CREATES PATTERN?

The patterns in fills, satins and motifs are controlled by needle penetrations. When sewn, these needle penetrations create a little shadow adding to the dimensional effect of the pattern.

Notes

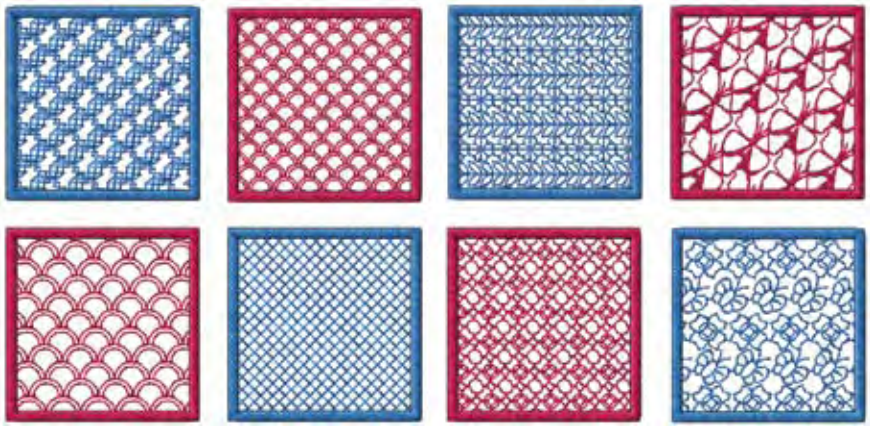
You can download and sew these designs and compare them side by side. Find the link in the Resources section.

Too many focal points results in no focal point!

Notes

EXAMPLES OF PATTERN AND MOTIF FILLS

Samples of patterned fills and satins. Patterns can have a wide range of stitch lengths, which can cause problems when sewing with metalllics.



Samples of motif fills. Don't be fooled by their open patterns—depending on the pattern, motif size, stitch length, and repeat stitches these lacy effects can be deceptively high in stitch count, even higher than a standard full coverage fill.

PATTERN CAUTIONS

In addition to overuse, some patterns may create too many short stitches and you should know the implications of that issue by now. Also, examine patterned areas after resizing. Some stitch processors may not recognize the fill pattern at all or may scale the pattern rather than maintaining the original stitch length values. Also keep in mind that pattern and motif fills can really run up stitch counts to truly exorbitant levels.

Pattern Sample Swatch Chart

Still learning your software? Don't know what to digitize? Test out those fancy fills and see what they really look like. Some programs will let you create your own via adjusting slider bars. Create some you like and test sew to see what they're really like.

Chapter 8

UNDERLAY

In This Chapter

- Why underlay is necessary
- What are the purposes of underlay
- How is underlay used
- What if you remove underlay

While not technically a *stitch attribute*, with automatic underlay features available in most programs, various types of underlay can be specified for fill and satin objects and therefore become an attribute of the stitch effect.

In the past, digitizers punched underlay separately. Even in today's automated world, there are times when this is the best solution. We'll reserve that discussion for an advanced topic so as not to get too bogged down. Besides, if you're working with a stitch file instead of an object file, it makes no difference to you whether it was automatic or not in how you handle the design.

In most designs—running stitch or redwork style designs are the notable exception—underlay is the first layer of stitches in the design. Good underlay forms a framework for your embroidery, providing support and structure for future layers of stitching. Imagine it like the framing in a house or the bones of your skeleton; it is invisible but vital!

GUIDELINES

While there are many *guidelines* for good embroidery, there are seldom any hard and fast *rules*. There is no "cookbook" approach for digitizing all designs; there are simply too many variables involved. Instead, guidelines are balanced against the task at hand and the conditions under which a particular design will be sewn. The following should be considered as you determine underlay requirements:

- Underlay must serve a purpose
- Underlay must be consistent
- Underlay must be orderly
- Underlay must be appropriate

Notes

As with painting a portrait, embroidery digitizing is an art form and simply can't be defined by any universal step-by-step formula.

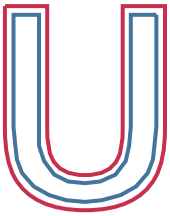
8 Underlay

Notes

Purpose

The two primary purposes of underlay are to stabilize the fabric by attaching it to the stabilizer and to support the top stitching.

Think of underlay as a way to initially baste the fabric to the stabilizer. The best way to do that is with what is known as an edge walk, which is simply an "outline" of the design set within the edges of the cover stitching. On very small objects, it may simply be a line of running stitches up the center, known as a center walk. On larger areas, this edge walk is followed by a light fill or zigzag as required by the fabric. In extreme cases, this light fill will be replaced with a mesh or grid of stitches.



Artwork
Underlay

Some digitizers prefer to run the edgewalk after the fill underlay.

In this respect, underlay reduces fabric shifting during the sewing process, thereby also reducing puckering. Proper selection and use of underlay reduces the push and pull distortion resulting from machine thread tensions. By attaching the fabric to an appropriate stabilizer, the fabric—even very unstable ones—acquires the stability qualities of the backing used.

> **Caution!** There are other causes of fabric puckering that won't be cured with underlay. These include poor hooping techniques, poor or inadequate stabilizing choices, and tight machine tensions, especially when combined with polyester thread. To read about puckering see my article entitled **Why Does My Embroidery Pucker?**

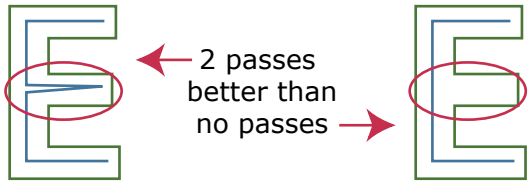
Underlay supports the top stitching by maintaining a crisp, well-defined edge between abutting areas of stitches. Underlay also prevents stitches from sinking into the fabric. Highly textured fabrics like terry cloth towels can benefit from a light "net" of underlay to hold down the nap and provide a smooth even surface for later stitches.

Digitizers also employ underlay creatively to add additional loft to some sections of embroidery to add interest, depth, and realism.

Consistent and Orderly

Underlay should be applied in a neat and orderly manner, which occurs automatically when applied as an attribute option; it should not look like random scribbling. Consistency does not mean that the same type or amount of underlay should be applied to every object in your design. Where inconsistency is most obvious is in

small letters. It can be impossible for every segment of a letter to have the same amount of underlay; but make sure no segment is devoid of underlay.



Appropriate

This one is tricky and is learned primarily from experience and testing. Selecting the right combination of underlay is relative to:

- Fabric type, color, and stability
- Design size, stitch count, density
- Desired effect

Smooth, hard, stable fabrics like nylon, supplex, cordura, and some polyester blends may require nothing more than an edge walk. Leather, vinyl, paper, and metal should have no underlay in most cases to avoid "unintentional cutwork." Textured fabrics and unstable goods will require more underlay. Are you beginning to see why there is no such thing as a one-size-fits all design?

As the design size increases, stitch count increases and the potential for fabric distortion increases. Simply using a larger hoop decreases the stability of the fabric. A design with large areas of fills, particularly if these fills run in many directions, radically ups the chances for fabric push and pull. Underlay can help control design distortion, but keep in mind other factors that affect distortion:

- Proper embroidery setup—stabilizer selection(s); fabric, thread, and needle selections; hooping technique; machine tensions
- Proper use of density—refer to cautions on density
- Proper use of compensation—to be discussed shortly

Creative use of underlay can dramatically change a design. If a satin or fill area is sewn over an area of stitches with both areas having the same stitch direction, the top stitches will "fall into" the previous layer. This can be a good thing if you want blending or a bad thing if you want sharply delineated objects. Adding underlay prevents blending. Strategically placed and/or extra underlay adds loft to satin stitches. A good digitizer leverages underlay to her advantage.

Notes

Absolute consistency is impossible. If you have parts of letters that don't look as clean and crisp as others, inconsistent underlay may be to blame. Keyboard lettering is not exempt from these problems—somebody had to digitize those fonts!

8 Underlay

Notes

Fashion Update. This underwear rule seems to have changed in recent years and visible underwear is no longer considered a fashion faux pas. However, for most of us, that is a secret better kept than exposed.

Scaling designs can impact stitch lengths in underlay so check carefully before and after resizing.

Cautions

As with every topic discussed in this book, you need to be aware of some issues digitizers consider when applying underlay.

Color—Underlay, like underwear, should not be visible, so it is advisable to use the same color as the covering stitches. When using the auto underlay settings, you won't even have to think about this. If an initial global underlay is applied, consider setting it as a separate color so that it can be sewn in color that matches the fabric.

Stitch Length—Use a moderate stitch length to prevent the looping of longer stitches and to keep the stitch count more reasonable than would result with short stitches. Use shorter stitches only as needed to prevent exposure problems.

Density—Use only enough density to meet the needs of the job.

Placement—Underlay should never show or bleed through to the covering embroidery. Make sure underlay never runs in the same direction as the top stitches. Pay close attention to placement and consistency in small objects, especially tiny letters.

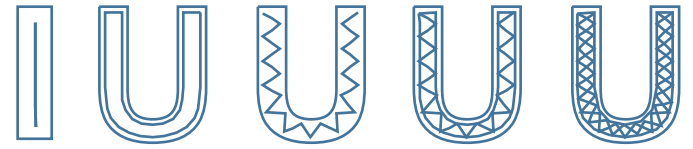
Amount—Use underlay judiciously when and where needed; don't use it in excess, which can unnecessarily run up stitch counts. Too little underlay, on the other hand, can result in poor registration, fabric puckering, "fuzzy" or jagged edges on objects, and fabric show-through. At minimum, use enough underlay to securely and smoothly tack backing to fabric when working with wovens and knits.

Types of Underlay

Like the decorative stitches that we see in the design, underlay is categorized into three basic types: run, fill, and satin. Let's take a look at the most common types of underlay you are likely to see in a design.

SATIN UNDERLAY OPTIONS

In the following illustration, you can see the common types of underlay used under satin areas.

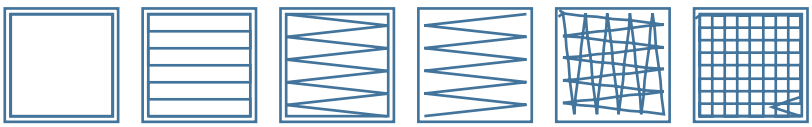


Center Edge Zigzag Edge + Zigzag Edge + Grid

- **Center Run/Walk.** Perfect for narrow columns. Can also provide a little additional loft when run under a zigzag underlay.
- **Edge Run/Walk.** My favorite for columns greater than 2 mm wide. Edge walks create crisp edges on satins and can reduce jaggy edges on satins sewn on uneven fabrics or over other layers of stitches. They can also make the outer edges of curves and corners look smoother. On wider columns, I often combine this underlay with a zigzag following the edge walk for good coverage and some nice loft.
- **Zigzag**. Zigzag provides extra loft for the covering satins, thereby improving fabric coverage and adding dimension. I recommend using it on a satin column that is at least 2.5 mm wide. Zigzag on narrow columns may restrict the range of size reduction.
- **Grid.** Also known as mesh or double zigzag, this type is great for holding down nap or texture (think terry cloth) and stabilizing stretchy, distortion prone fabrics. It's also perfect for providing a more solid thread coverage while not running up densities excessively.

COMPLEX FILL UNDERLAY OPTIONS

Underlays for fill objects are slightly different. Since fill objects are typically larger than satins, we need different stitch types.



Edge Edge + FIll Edge + ZZ Zigzag Zigzag Grid Edge + Grid Fill

- **Edge Run/Walk**. Useful alone for small areas, maintaining crisp edges and a good preface to either fill or grid.
- **Fill or Tatami**. Very useful for stabilizing larger areas.

Notes

Check the underlay and column widths to see if scaling will cause a problem.

If you ask me, "How much underlay and what kind should I use?" my answer is sure to be, "It depends."

8 Underlay

Notes

- **Zigzag**. You may also see a zigzag pattern for underlay under fills. Fill and zigzag underlays are often combined with an edge walk to keep object edges crisp. Zigzag in underlay is a multi-step stitch, not a long side-to-side stitch seen in regular satin columns.

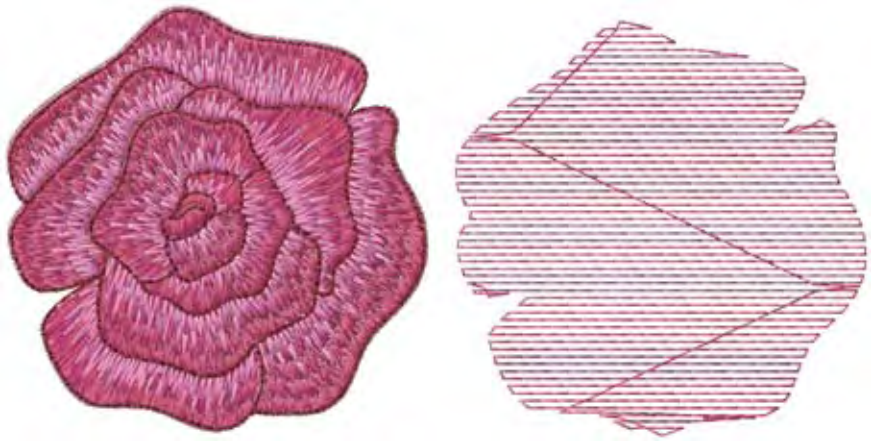
- **Grid**. As with the satin version, a grid underlay is useful for creating a "mesh work" of underlay and is particularly helpful at smoothing out uneven textures, such as corduroy. Grid underlay may be formed from zigzag or fills.

How Underlay is Used

Underlay is most commonly placed object by object. In some cases you may find a global underlay to initially stabilize an area. In the rose design shown below, each individually digitized petal has a radiating fill. As the petals sew, their spiraling stitch pattern causes a lot of fabric distortion. Furthermore, to simulate a real rose, the outside petals sew before the inner ones. Sewing from the outside in on an area pushes fabric towards the middle rather than the preferred direction of towards the hoop. To better control distortion, underlay has been run under the entire rose petal area:

The complete rose design is included in the digital download for this ebook. When you sew it, compare it to the redwork rose illustrated in the Stitch Types chapter in the running stitch section. Both roses were digitized from the same art.

You can watch a movie of the design sewing at the end of this chapter.



Even though each petal is individually digitized and has it's own underlay applied as needed, a global underlay has been applied to reduce fabric movement due to the changing stitch angles on the petals.

What If Underlay is Removed?

Unless you know what you are doing, I do not recommend removing underlay. Worst case—think free-standing lace—your entire design will just disintegrate into a wad of thread once the stabilizer is removed. Most often, you will have varying ranges of lower qual-

ity embroidery depending on a range of factors. Design, fabric, and stabilizer choices along with hooping techniques will have the most influence.

I have heard educators in classes recommending the removal of underlay to reduce design thickness, stitch count, and sewing time. However, unless you are sewing on a "non-fabric"—leather, unbacked vinyl, wood, metal, paper—where needle penetrations actually puncture the material and leave a hole, this is rarely wise on a professionally digitized design. Experienced, professional digitizers know that more underlay is not necessarily better and that it should be precisely, concisely, and strategically placed. If the underlay in your design appears random or scribbled, I'd question the quality of the design.

When Is Underlay not Required?

You won't find underlay on designs that are composed of just running stitches like redwork designs or quilting design. Running stitches create minimal distortion compared to fills and satins. Even if you wanted underlay in a running stitch area, there would be no way to hide it. You can however, use your machine's baste function to run some initial stitching to attach your fabric to the stabilizer.

As mentioned previously, any extra stitches should be eliminated when sewing on non woven/knit articles. Underlay is also counter-productive in shading layers, where the desired effect is to have the layers of thread bleed into each other.

When to Add More Underlay

If you are sewing on a lofty, textured fabric, you may need to add more underlay. This is really only easy if you created the design yourself in your digitizing software or lettering program or if you have the original design and it was created in the same software you have—unlikely with stock designs. Adding underlay is beyond the scope of this book, I just wanted to point out that it may be necessary and can be done.

> **Tip:** I have to confess, I got this idea from the Land's End catalog. On some of their monogrammed items, I noticed a barely visible light fill sewn in thread that matched the fabric behind the monogram. This fill smoothed out textures and provided a more even surface for the monogram. Creating a lightly filled rectangle and placing it behind lettering on pique golf shirts and terry cloth towels is easy enough for a beginner. If Land's End does it, why can't we?

Notes

8 Underlay

Notes

The Underlay Golden Rules

As we wrap up this topic we can summarize with this rule of thumb: The less stable the fabric, the more underlay is required. And it's corollary: The more pull in an area of stitching, the more underlay is required.

Do you recall the four underlay guidelines? Underlay must:

1. serve a purpose
2. be consistent
3. be orderly
4. be appropriate

Make it Sew… Or You Won't Know!

Remember when I suggested purchasing designs to pick up new techniques? The outline on this rose is not a standard run or bean stitch. Instead, it is sort of a sketchy look. I noticed this in one of John Deer's designs and decided to try the technique on this rose.

I have to admit I'm a Star Trek fan and every time I heard Captain Picard tell Commander Riker, "Make it so, Number One," I secretly thought that it was an excellent command for us to remember about embroidery. You truly never know how a design will turn out until you sew it on fabric. Watching it sew in simulation in your software will reveal a wealth of clues—if you know what you are looking for! By the end of this book, you should be able to read those signs.

Here's our rose we saw just a few pages back. You can watch a virtual sew out in Acrobat and see how the design builds. Notice the underlay under the larger objects is a horizontal fill to stabilize the fabric. Each fill object on top of that is defined by an edge walk.

The rose image is an embedded QuickTime movie. Click on the rose to play it in Acrobat. Use the sliders at the bottom to review areas you'd like to see at a different speed.

Download the design and sew it yourself!

Chapter 9

Tie-Offs

Notes

In This Chapter

- Why tie-offs are vital for permanent embroidery
- What are the two types of tie-offs
- How to make a secure, invisible tie-off
- What if you add extra colors to a design

Tie-offs, tie-downs, or lock stitches are vital to permanent embroidery. Their purpose is to anchor the thread at the beginning and end of a segment, or wherever a thread will be cut:

You may hear beginning lock stitches called "tie-ins" and ending lock stitches called "tie-offs."

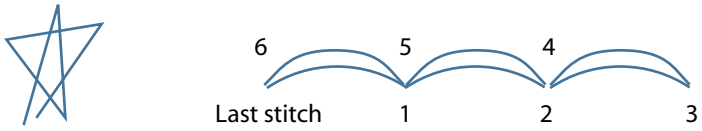
- At the beginning and ending of a design
- Before and after a jump, trim, or color change

Tie-off stitches are generally short, typically 1 - 1.5 mm; never longer than 2 mm. *They must always be invisible.*

Some of today's digitizing programs allow you to enable tie-offs as a secondary stitch attribute. Setting this option is definitely a time-saver and works great on larger stitch objects. Once again, this is a feature that in the past was only done manually. I still recommend manual tie-offs on small letters (at the beginning and ending of words; do not tie off every small letter!) and other tiny objects.

Lock stitches on tiny objects can double the object's stitch count, cause knots, and increase thread breaks.

Another place to check how a tie-off was automatically generated is on run stitches. If the auto-created lock stitch is visible, disable the option and create your own by manually placing four to seven unobtrusive, short overlapping stitches. Do not place these stitches in a zigzag pattern; this is not a secure lock stitch. A star shape makes an excellent manual tie in under satins or fills but is too obtrusive for a tie off.



Examples of manually created tie-offs

Tip: Check the security of tie-offs, especially on wider satin objects. Long satin stitches are more susceptible to pulling out or raveling. This would be an ideal place to add a few extra manual stitches for added security.

9 Tie-Offs

Notes

Caution 1: Don't allow yourself to get carried away with tie-offs and trims between small letters within words. In very tiny letters, tie-offs are hard to hide, create tiny knots, and can actually double the stitch count in some simple letters! Trimming between small letters in a word is not necessary; travel stitches can be made reasonably inconspicuous especially when using closest point connections. If it does become necessary to trim between *some* letters, only trim the top thread and apply a drop of seam sealant or fusible interfacing on the back to prevent raveling. (Obviously this is not a production efficient technique!)

Caution 2: Ties-offs are short stitches. Refer to the cautions on short stitches; excessive use of tie-offs can have the same effects.

Golden Rule of Tie-Offs

As you've learned with other stitch attributes, more is not better. Use tie-ins and tie-offs as needed. Judicious settings can keep your embroidery free of lumps and bumps, reduce sewing time by eliminating unnecessary stitches and thread breaks from very short stitches, and guarantees long-lasting embroidery.

Reminder For Editors

A simple change to make in a stock design is to insert or delete color changes. Most embroidery software makes this task easy—just remember to add the appropriate tie off stitches when you do!

Chapter 10

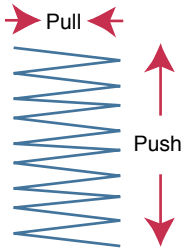
COMPENSATION

In This Chapter

- Why doesn't my design sew out right????
- What is compensation
- Why embroidery is a partnership between the embroiderer and the digitizer
- How to control stitching distortions
- What if compensation needs to be adjusted

Probably one of the most shocking things that happens to a new digitizer is when she sews out her first design and discovers that what looked so perfect on her computer screen has suddenly morphed into something quite different. Outlines aren't where they were placed, gaps appear between areas of embroidery, objects that were round on screen are now oval and squares have become rectangular.

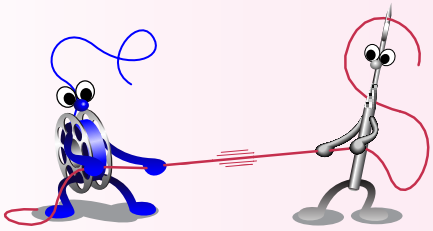
What's going on? The action of machine tensions when applying stitches to fabric causes distortion during sewing. Stitches are "pulled" in causing a shortening effect when the stitch direction reverses. Conversely, stitches are "pushed" out along their length. Note, however, that these are not equal, opposing forces. This phenomenon is known as "push and pull." You may also hear push called "pooch."



Counteracting this distortion is done through *compensation*. You'll often hear compensation referred to as "pull comp." The effects of pull can be controlled through attribute settings in most programs. However, there are no such similar corresponding settings for controlling push. Push is controlled by managing densities and reshaping stitch objects.

Running stitches have the least impact on distortion while fills have the most, with satins falling in between.

Notes



Tug of War

Imagine the needle and bobbin threads playing tug of war where the amount of pull is controlled by the machine tensions and sewing speed.

10 Compensation

Notes

Caution: Large areas of fills that radiate and/or multiple areas of fills running in many directions cause even more distortion due to multi-directional pushing and pulling of the fabric. In this case, appropriate underlay is critical to avoid excessive rippling and puckering of fabric (and don't forget the stabilizer!).

Successful Embroidery is a Shared Responsibility

Before we continue with compensation, I'd like to side step for a moment. A well-digitized design cannot reach it's potential without proper embroidery techniques. On the other hand, no amount of embroidery skill or technique can overcome a badly digitized design.

An old maxim passed down through generations of digitizers is, "Digitize distortion, don't punch perfection."

If you digitize, your responsibility is to create a design worthy of sewing. You do this primarily in the drawing of objects and the application of stitch effects. Distortion is controlled through proper exaggeration of shapes, controlling stitch densities, thoughtful planning of stitch object entry and exit points, stitch directions, underlay, and how stitch objects butt or join together.

Pull-comp only offsets pull; it has no effect on push. Push can only be controlled by redrawing the object.

Notice I said "proper exaggeration of shapes" not "application of proper pull comp settings." A professional digitizer draws the area or reshapes the stitch object to achieve proper pull and push compensation. Use the pull comp adjustments for fine-tuning or modifying a design for a different fabric. Auto-digitizing programs don't redraw objects and can only compensate for pull—there are no "push-comp" settings.

As an embroiderer, you, too, have certain responsibilities. First of all, you must select a fabric that is suitable for the design. Stabilizers can make a wider range of fabrics *more* suitable, but it can't compensate for a totally inappropriate choice. Proper hooping technique is vital! You must also control machine tensions and sewing speed; the faster a machine sews, the more distortion is created.

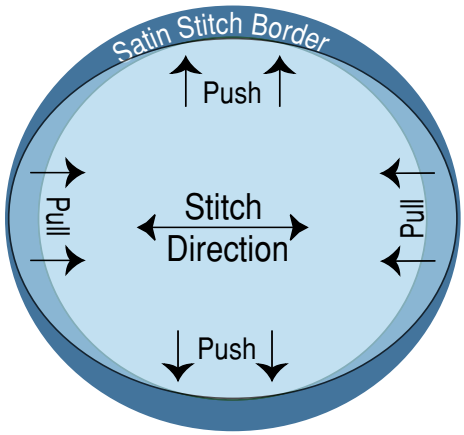
Terminology: Unintended gaps in designs, as well as misaligned outlines, letters and other objects are referred to as registration problems.

Caution: Gaps may be a symptom of inadequate compensation *or* poor hooping, inadequate stabilizer, stretchy fabric, tight machine tensions, inappropriate or insufficient underlay, excessive stitch densities. Great embroidery is a shared responsibility. Embroidery can be compromised by either the digitizer or the embroiderer—or both!

How do you know when a problem is a digitizing problem or a sewing problem? If you are an experienced embroiderer sewing under optimal conditions, check the design. On the other hand, if you have successfully sewn the design in the past, check your embroidery technique. This is why it is important to have excellent embroidery skills before learning to digitize. Otherwise, how will you know where the problem is?

Distortion in Action

Let's look at what happens when a design is sewn. The following illustration shows a filled in circle bordered with a satin stitch. Notice that the satin border is a perfect circle but the center is an oval. This demonstrates the proper way to draw for the desired result. Although you can't determine it from this illustration, the satin border is also drawn slightly wider than the desired finished result. The goal when digitizing is to account for the distortion when creating the design so that the sewn result is the same as the original artwork.



Since stitches *push out* along their length, the inner circle has been pulled back a bit from the border, resulting in a flattened circle that is shorter than it is wide. As this object sews and the push occurs, the edge of the circle will end up under the border. If, on the other hand, the circle had been drawn as just a larger round circle to account for the pull, there's a chance that stitches could have been pushed out beyond the outer edge of the border. Push amount is *usually* 2-4 rows of stitches depending on density.

Stitches *pull in* on the ends where the stitch direction reverses. To compensate for this shortening effect, the circle has been drawn wider than the original artwork. In some cases, you will need to extend the circle to the outer edge of the satin border. With a running stitch border, the center would actually extend *beyond* the outline.

Notes

Embroidery Fact of Life

If it looks perfect on screen, it won't look that way when sewn!

The goal of compensation is to have the design look like the original art work after sewing.

10 Compensation

Notes

Satin stitch borders are always more forgiving and easier to digitize than running stitch outlines. On the downside, satin stitch borders add a lot more stitches to your design and may be too prominent. Contrary to what some people believe, not every design—or every object in the design—needs a border!

This is a screen capture of a filled circle with a running stitch outline. Note that the outline is drawn right on the artwork, and the fill area is redrawn plus has some pull-comp applied. When it sews, the outline perfectly aligns around the perimeter of the fill.

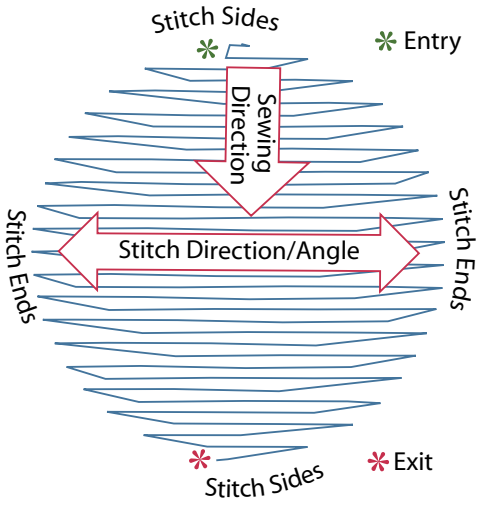
Since running stitch outlines cause minimal distortion, any registration issues should be corrected by modifying the fill or satin, not the outline!

A key point in the sample above is that since running stitches result in very little distortion, this outline is *exactly on the border* of the original artwork. What this means is, if after test sewing, you find that the outline does not line up properly—either there are gaps between the outline and the fill or the fill extends beyond the outline—*you need to adjust the fill and not the outline.* Most novice digitizers will attempt to adjust the outline, but since this is the part that will sew where it is supposed to, it is the fill that must be compensated and therefore adjusted.

How much do you compensate? As with other digitizing issues, compensation is relative. In other words, "It depends." The less stable the fabric, the more distortion is required. By maximizing the distortion values, you can create a more forgiving design. However, don't go overboard or you will have lumps and ridges where sections overlap as well as a higher stitch count design.

More on Push and Pull

The patch design illustrated previously was pretty simple. But there's a little more you should know. For example, during the sewing process fabric is pushed in the *direction of sewing*. Sewing direction is different than stitch direction. If a fill's stitch direction is horizontal, and the entry point is at the top with the exit at the bottom, then the sewing direction is vertically from top to bottom, as illustrated here:



Did you ever sew a design where it looked like a row of stitching was missing in the middle? If you inspect the design on the screen, you can't see the problem; it looks perfect. Chances are you had a fill that finished right at the point where the missing row appears. During the sewing process, half of the design sewed from the outside toward the middle, then the stitch processor traveled to the other side of the design and once again sewed toward the middle. As the machine sewed toward the middle, it pushed a tiny, possibly invisible, wave of fabric ahead of it, which caused an unsewn area at the end of the second segment of sewing—and that shows up as a "missing row" of stitches.

HOW CAN YOU FIX THE MISSING ROW?

Well the bad news is that unless you digitized the design, you probably can't. I have sometimes been able to overcome it by better stabilization techniques. Using a temporary embroidery spray adhesive to hold the backing (usually a cutaway) to the fabric helps by reducing fabric movement during sewing.

Digitizers have two ways to correct for this. The best one is to change the entry and exit points so that they are on opposing sides of the sewing direction. This is especially true in a patterned fill since often times the pattern does not properly match up. Unfortunately this may make it more difficult to get to the next area of stitches easily and efficiently.

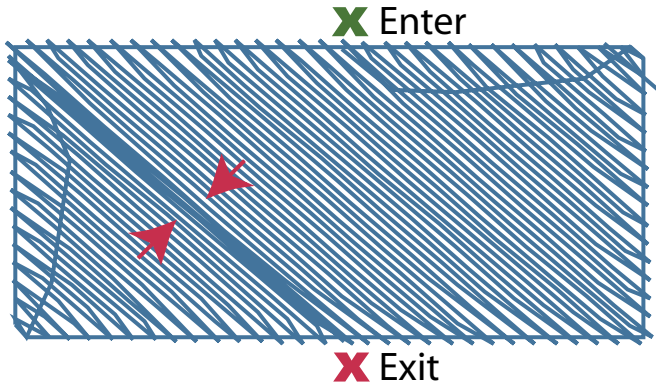
The second is to set an attribute for overlap. Overlap is an advanced software feature in most digitizing programs and it will add a row or so of extra stitching at this point. You probably can't adjust overlap, but it's good to know about this feature—you may find some funky bulky areas in your design and you can check to

Notes

You could draw in 2 lines of running stitches in a stitch length that matched the fill but you won't be able to match the pattern.

Notes

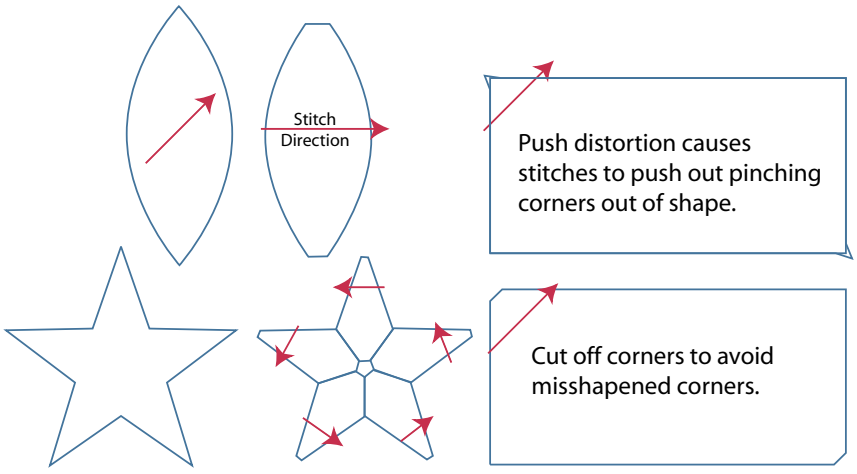
see if it is at an exit point. If it is, then don't try to remove the rows or you will probably create a gap. Make a practice of comparing sewouts to on-screen views and you'll rapidly advance your skills.



This example illustrates what you'll see on screen when overlap is enabled.

How to Compensate

Now let's look at what happens in corners and sharp points. Notice the two simple leaves shown following. Each leaf is drawn slightly differently to account for the angle of the stitches. We'll assume these leaves are small enough to apply a satin stitch to each. Although the pull compensation is drawn the same, the push adjustment is more dramatic on the second leaf, which has its pointed ends cut back.



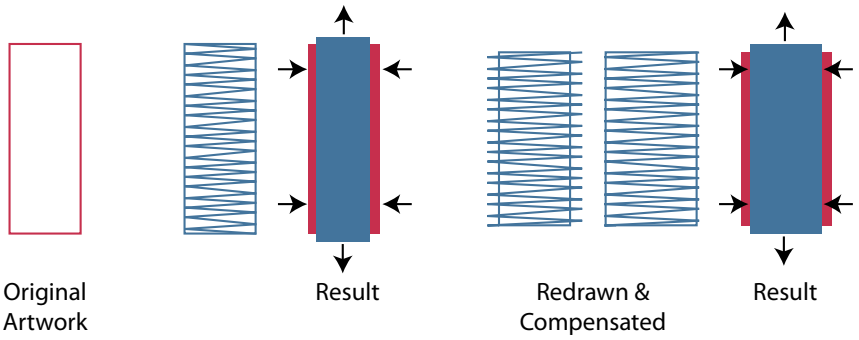
There are two reasons for this. One is stitch length; the stitches at the very point would be too short. The second is that those stitches at each end of the leaf are going to push out. By cutting off the

points, we've solved two problems. The other way to avoid the short stitches and the push issues is to simply change the angle of the stitches, as illustrated by the leaf on the left.

The star has been separated into five diamond-shaped points. By leaving an opening in the center, excessive bulk as well as short stitches are avoided. Notice that the outer points are cut off similarly to the right-hand leaf.

A similar problem occurs with the rectangle. If the artwork was digitized as shown with fill stitches running on the diagonal from upper left to lower right, the sewn result would be a distorted rectangle. Again, by cutting back the corners as we did for the leaf, we can solve the problem.

If we change the stitch direction to vertical, the rectangle will sew shorter and wider than the artwork; we need to adjust the shape to match the artwork after sewing. Similarly, if the stitch direction is horizontal, without proper compensation we'll have a taller, narrower rectangle:



In the example above, the far left rectangle illustrates the original art. If stitches are simply applied to it as is, the actual sewn version will be taller and thinner. If this were the letter "I" then it would be taller than a letter "C" next to it (and extend below the letter C). The next pair of stitch samples shows the rectangles shortened on each end. The left hand sample uses pull comp settings while the right hand side was redrawn with no pull comp. In most cases. the digitizer does a bit of both. When you're looking at a stitch file, it makes no difference; you won't know how the digitizer applied compensation.

Recall that pull causes a satin column or fill to shorten along its length. Pull is more difficult to predict than push and is more dependent on:

Notes

You may notice that rectangles that have a diagonal stitch direction distort the fabric more; your rectangle tends to sew more like a parallelogram if not adequately stabilized.

10 Compensation

Notes

Stable fabrics—or fabrics made stable—stand up better to the forces of stitching.

- **Fabric type**—Thicker, softer fabrics absorb more of the stitch width than thinner, firmer fabrics. Not only does the stitch go across the fabric but it goes through, causing some of the stitch width to be sucked up; thicker fabrics absorb more of that width than thinner fabrics. Ever notice that smaller letters look thinner on thick sweatshirt than on a thin t-shirt?
- **Width of the area**—The larger the area, the more pull is applied.
- **Thread and bobbin tensions**—The tighter the tensions, the greater the pull.

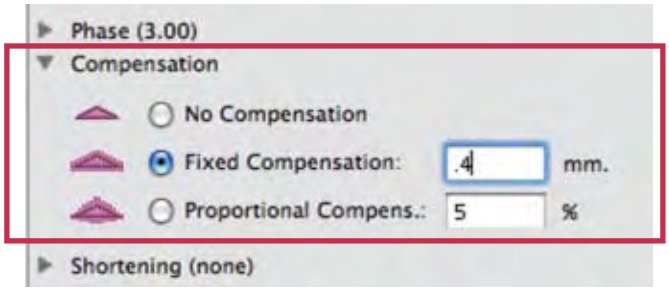
While pull is more relative than push—the larger the area, the greater the pull—it is not a predictable value. To counteract *pull*, the digitizer draws the shape *beyond* the artwork boundaries. To counteract *push*, she draws the shape *within* the artwork boundaries. Of course, when you are looking at the design, you won't know what the artwork looked like so you won't have a way to measure this.

Pull Comp Settings

Auto digitizing programs and compensation

So what about pull comp settings? Pull comp settings are the values you can add via the stitch attributes panel. In auto digitizing software, this is the only distortion control option available. Based on what you've learned so far, I think you might realize that this is not the best way to go.

Think of pull-comp settings as a sort of "fudge factor."



Sample pull-comp settings in the fill stitch palette (Punto). You can see I have a very small value set: only .4 mm. In this program, .2 mm will be applied to each end of stitch object.

I view pull comp settings as auxiliary or secondary settings; a way to tweak the design for various fabrics when working with object files. I prefer to control compensation through the manipulation of the object; this is my primary method of handling distortion. I then add a small amount of pull comp. Treat pull comp settings as a fudge factor.

Notes

Pull comp extends stitches on the edges that normally pull in to offset that distortion. If you visualize a sans serif capital "I," pull comp "fattens" up strokes but does not make them taller. Pull comp applies the amount specified equally to both sides of the object. This means that any small openings can easily fill in; a particular hazard with small letters.

5 mm letters, default settings

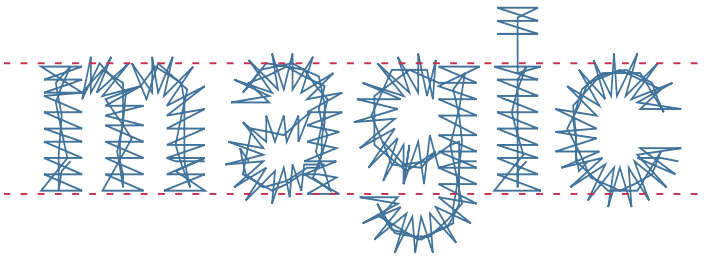
With moderate compensation

With maximum compensation

A good use for pull comp settings is to adjust for different fabric types. If you digitized a design or created keyboard lettering for "average" fabrics, but later want to sew on a thick, fleece sweatshirt, instead of reworking the design or performing extensive edits, you may be able to simply adjust the pull comp settings. There are limits to adjusting designs in this manner to suit other fabrics. Pull comp does not cure all distortion problems; it will do nothing to modify push issues. Treat it as a "fine tuning" option rather than attempt to dial in a whole new set of distortion correction.

MAGIC REVISITED

Remember back in chapter 2 when I introduced the following image?



We've covered a lot of material since then and you now understand that the fact that all these letters don't align perfectly top and bottom along the dashed lines is a good thing. In fact, if you see letters that do line up on screen, they won't after sewing. Instead, you'll see what is commonly known as a "dancing baseline."

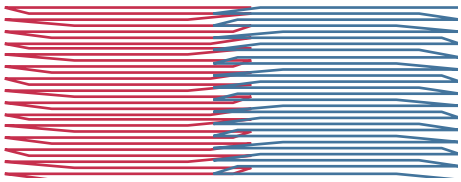
Notes

Tip: If you are combining lettering with a stock design, add the lettering to sew last. All the push-and-pull of sewing can also cause a dancing baseline if the letters sew first. Why? Recall that we said larger objects create more distortion. Letters are usually small compared to the rest of the design. If they sew first and the fabric gets distorted during the sewing of the rest of the design, the letters can be pulled out of alignment.

What to Look for On-Screen

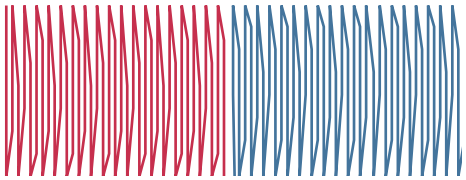
So if you're poking around doing some exploratory work on a design on-screen, what should you look for as far as compensation? Since objects push and pull depending on stitch direction, you should not expect to see the same amount of overlap of every stitch angle combination. Let's look at just a few examples.

When objects meet so that their stitches are running in the same direction and meeting end-to-end, the digitizer needs to counteract the pull on both objects. This is the combination where you'll see the most overlap.



However, it should be slightly more than the exact amount required so that the objects just meet after sewing. Why? If two objects just meet, there will be too many needle penetrations lining up with a high potential for fabric damage. Worst case, your fabric may be perforating; at the least, fabric weakness.

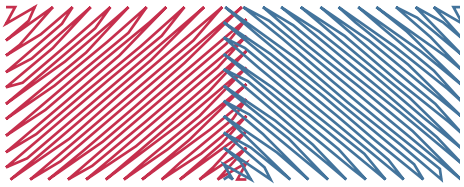
When abutting objects have their stitches running parallel to each other, they can be separated by about two rows to account for the push factor. As each object pushes out toward the other, this tiny gap is filled in.

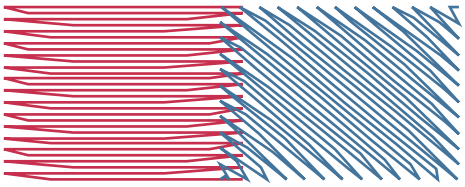


Abutted objects that have their stitch directions in opposing directions have another set of problems. Too much compensation can create a ridge or a "seam" where the objects overlap.

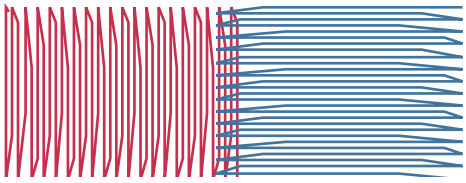
Also, depending on the layering of the objects, the topmost one may pull the stitches of the lower object causing fabric peak through. In the bottom pair illustrated below, if the blue sews last, it will pull the red stitches apart because the blue stitches are "biting into" the red and pulling the red stitches. The longer the stitches in the fill, the more they can be pulled and expose underlying fabric.

However, if the red sews last, there will be no pulling because the red stitches will simply "bridge over" the blue ones. To avoid seeing fabric, a good digitizer will add some extra underlay, usually in the form of a random edge, light density satin column under the "seam." When the top stitches are pulled, you see the underlay instead of fabric.





If the red layer sews first, the blue layer will pull the red stitches slightly from this angle, causing some fabric peak-through. This effect is maximized with long fill stitches.



When layers are perpendicular to each other and the red layer sews first, the blue layer will pull the red stitches and fabric exposure is increased even more.

How Much Compensation?

How much should these objects overlap? As with underlay and density, use the amount needed for the current circumstances. Be sure to consider *all* the variables—fabric type, width of the area, machine tensions, stitch types, underlay, density, and stitch direction of adjacent objects. As you gain more experience as a digitizer, you will become better at anticipating compensation requirements. In the meantime, create some simple samplers to run on new fabric/stabilizer/hooping combinations.

Notes

10 Compensation

Notes

Inadequate compensation typically results in registration problems. Primary symptoms to watch for include gaps and letters that "dance" along a wavy baseline. If adjacent stitch objects share the same needle penetrations, fabric perforation is a possibility.

Excessive compensation can increase stitch counts, create thick areas of thread build-up, and cause distorted objects, registration problems, and illegible text.

What If Compensation Needs Adjusting

If you're working with a stitch file, chances are you can do nothing. If the problem is the outline is a little off here and there, you can move the individual stitches. But manually moving mass areas of stitches, while possible, is tedious and difficult. If your visual inspection shows inadequate or non-existent compensation, contact the digitizer. If you paid for the design, it should be corrected if it was a freebie, just trash it.

If you have the right file format, software, and skills, you can redraw shapes and/or adjust pull-comp settings. Good lettering programs let you modify compensation on previously created text as long as the file was saved in the correct format.

Always keep in mind a little bit can go a long way when adjusting pull-comp settings.

Summing Up Compensation

The important thing to realize is that there will *always* be some pull when sewing with thread on fabric. Thicker fabrics absorb more thread and require more compensation. Unstable fabrics distort more and require more attention to compensation (and stabilization). Since distortion is relative to the stitch angles and sewing directions, you need to plan ahead to know where push and pull will occur.

Chapter 11

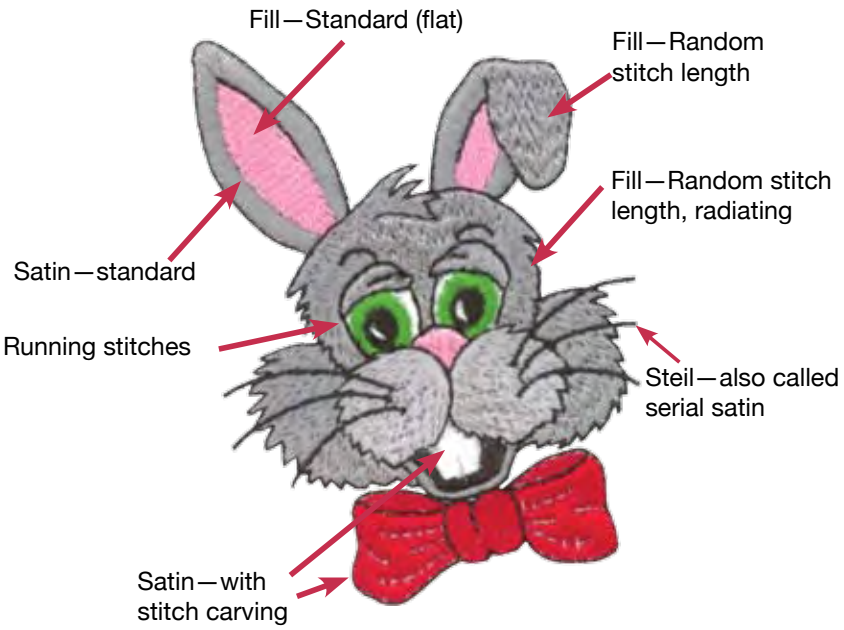
Putting It All Together

In This Chapter

- Why radial fills with running stitch outlines are a red flag
- What to look for when inspecting a design
- How color sorting can degrade quality
- What if you resize?

Are you still with me? Because now we're going to take all this technical stuff and put it together!

For example, let's take another look at the bunny design, You saw this design as a screen capture in chapter 3, Stitch Types. Here he is sewn out:



Just because this bunny is a cartoon character, doesn't mean he has to be composed of flat horizontal fills and running stitch outlines. I've created a "fur fill" by simply setting my stitch length slightly longer than normal and giving it a random stitch length to lend a little realism. On the face, this fill radiates out from the nose area to simulate a real rabbit's fur direction. Thinking back to what you learned about push and pull in the compensation chapter, you now know that this shifting stitch angle is going to impose a higher degree of distortion. And with that running stitch outline,

Notes

This design is available as part of the digital download. You may want to open it up and look at it in your software as we discuss it.

Notes

you will need to make sure you control it or you will most certainly have registration problems. How you ask? Pay careful attention to the stabilizing process (hooping technique; backing, topping, and adhesive selections; and hoop size).

I used a standard flat fill in the ears (pink) to make that area recede a bit while the gray satins around the outer part of the ear create loft and visually, as well as physically, add dimension and make that area appear to advance forward.

Stitch carving, also called embossing, is an advanced software feature and allows you to control needle penetrations and therefore patterns in both satin and fill areas. I carefully planned the carving to prevent excessive stitch length in the bow. The longer stitches here are shinier and give his bow tie a more realistic appearance.

There is also a bit of subtle stitch carving in the muzzle to resemble "whisker dots" which were in the original artwork. Tiny black polka dots would not only have been distracting but would have been too small and too hard to trim between. Instead, there are small round satin areas embedded in the fill pattern.

The teeth also feature a carved satin with a split right down the center to break the object in half. This is smart digitizing because it results in a stitch reduction compared to digitizing two individual teeth. Granted, this is a small reduction but learning to reduce stitch counts without impacting design quality is smart digitizing.

There are no pattern fills in this design; in fact, I seldom use them in any of my designs. I prefer stitch carving over patterned fills because they are more realistic. Pattern fills are only two-dimensional in appearance; they don't wrap around an object or display perspective.

The running stitch outline is a bean stitch rather than the traditional two-pass run. I find that it gives an ever so slightly heavier appearance and much better registration since it reduces hoop movement. Stitch deflection seldom occurs on a bean stitch whereas it can be a problem on a double run. Ever see outline stitches that don't sew on top of each other yet look perfect on-screen? That can be caused by deflection, hoop movement, or fabric instability.

Watch it Sew

Remember back when I was explaining the advantages of an ebook? Well check this out, you can watch how the bunny sews:

Notes

Help! The movie won't run! You need to have QuickTime installed on your computer to run this movie. Quicktime can be downloaded for free here: http://www.apple.com/quicktime/download/ Yes, I realize that's Apple's website and you are probably using a PC (instead of Mac like me) but there is a Windows version.

When viewing this book in Acrobat, click on the bunny to watch it sew in simulation mode. You can use the video controller sliders to move back and forth in the design. While it is a little difficult to see the white sew, there are no jumps or trims in this color.

Color Sorting

Color sorting is a software feature that "optimizes" color sequencing. I put optimizing in quotes because while it may reduce the number of thread changes, it can also reduce the quality of your design—which to me is anything but optimal.

Color sorting programs are usually smart enough not to resequence colors if there is a layering issue. For example, in our bunny, pink is used twice and black is used three times. Depending on the program used, color sorting may reduce the black to two, but leave the pink as is. The pink ears run under the gray fur while the nose sits on top and most color sorting programs will detect this.

Be careful when color sorting! The digitizer may have intentionally repeated a color for any of the following reasons:

- **Layering**. In this bunny the pink in the ears runs behind the gray fur but the pink nose sits on top.

11 Putting It All Together

Notes

- **Registration optimization.** Particularly on larger designs and designs with registration critical elements, one area of a design may be completed before moving to another. Color sorting may indeed significantly reduce thread changes but at the cost of design integrity.
- **To permit variety.** Sometimes I'll repeat a color so that I can swap in a different color or even a different weight thread. For example, on a logo I did for my brother, the lettering is very small and works better when I sew it with 60 weight thread. In this design, I have two blacks, one labeled black 40 and the second labeled black 60. It also gives me a way to stop the design early (the lettering sews last) for items that can't tolerate the tiny stitching.
- **Special techniques.** Appliqué designs often run the same color twice to trigger the appliqué stop. Compress these colors into one and there will be no stop.

Another time to avoid color sorting is if you combine multiple designs, whether at the machine or in software. Yes it will take more time to change those extra threads but you will get better results. Embroidery lasts the lifetime of the garment, what's a few extra minutes of sewing time worth?

Color Sorting Warning!

At least one new top of the line machine—the Bernina 830—provides built-in color-sorting when combining designs on-screen at the machine—and this automatic "feature" cannot be over ridden! (At least in the current version of the software at the time of this writing; I'm hoping that will be remedied.)

If your machine does this, you will get better results with complex design combinations by building the design in your computer program and sending the finished result to the machine.

Resizing

Let's examine some resizing issues we might face with the bunny. Do you see any stitches that might be pressing the recommended stitch length guidelines?

Check the whiskers… that's a 1 mm wide steil stitch with no added compensation. (Note: I wouldn't normally do that, I'd use a 1.5 mm width; it is set that way specifically for this exerise.) If I scale the bunny in the source program, that's not a problem. Steil stitches and serial satins will maintain their width setting when scaled up or down. This is not true in other sizing programs, which will treat this like a standard satin. Based on the whiskers, we can't successfully reduce the size of this design.

Next, where do you see long stitches? Check the bow tie. I measured a few stitches in there at 8.6 mm. Because they are in a satin area, they would only get longer if scaled up, which might be problematic.

Another issue with scaling is the use of custom fills and carved satins. Over the years, scaling software has gotten a lot smarter and recognizes fill patterns much better. Carved satins are a different case and you'll only know for sure by trying it and comparing the results. You may find a need for two different resizer programs.

There are no motif run patterns in this design and they can also be troublesome for resizing. Should the stitch processor add more stitches, take away stitches or just stretch or shrink the pattern? Resizing programs have a lot to think about!

Whenever you resize a design, only work on a copy and do verify the design before putting it into production—even if production means sewing it only one time.

Notes

Using Other Threads

The bunny was digitized for 40 weight rayon or poly thread. You might decide that a two-color twist would add more realism to the gray fur. Keep in mind that two-color twist threads are usually 35 weight. While this size difference might seem inconsequential if you run a strand through your fingers, it will definitely make this design feel thicker and stiffer. Is that a problem? Depends on your fabric, the intended use, and your preferences.

Although its highly unlikely that you'd choose to use metallic thread in the bunny, let's look at some design considerations. Metallics work best with longer stitches, less density and a more gradual transition between short and long stitches. So there are areas that metallics would sew acceptably, however, overall this design was not created with that intention.

Summary

In this book, we've gotten "down to the real nitty gritty" as the old song says, and looked into the world and mind of a professional digitizer. Understanding and applying this information can truly set you apart from the average embroiderer.

It may also help you realize that you may not want to digitize every design you want, or for that matter, at all! For complex or richly detailed designs it is more cost effective and time efficient to purchase one if it matches your requirements. Most individual designs cost $8 – $12 at on-line sources—compare that to the hours it can take to find or draw your art, digitize, and test sew. The more complicated your designs become, the more times you will need to test sew—and it can easily take more time to sew than edit!

Digitizing can be fun and rewarding, but unless the design is being sewn, it is not really an embroidery. "Virtual reality" not withstanding, you can't get the full effect of a design without seeing and feeling it.

11 Putting It All Together

Notes

If you're now thinking, "Wow, I didn't know there was so much to think about!" then great, I've accomplished my goal. Professional digitizers expend a lot of time and effort honing their skills. Hopefully you aren't feeling too overwhelmed; we've covered a lot of territory in this book. As you advance in your embroidery skills, reread this book and you'll find that it makes a lot more sense!

Appendix A

GLOSSARY

3D foam—A material used between the stitches and the fabric, which gives a three dimensional effect to the embroidery.

A

Angle—Editing function to rotate the pattern in a counterclockwise direction. Angle can be programmed in 1 degree increments up to 359.

Anti-aliasing—A process of blurring a jagged line to give the appearance of a smooth line.

Appliqué—A pattern that includes a piece of fabric to replace a block of stitches. This fabric area will be "tacked" down with column stitches to outline the appliqué area.

B

Backing—Woven or nonwoven material used underneath the item or fabric being embroidered to provide support and stability. Can be hooped with the item or placed between the machine throat plate and the hooped garment. Available in various weights and in two basic types—cutaway and tearaway.

Bean Stitch—Three stitches placed back and forth between two points. Often used for outlining because it eliminates the need for repeatedly digitizing a single running stitch outline.

Birdnesting—Collection of thread between goods and the needle plate, resembling a birds nest. Birdnesting is normally caused by insufficient top tension or excessive bobbin tension.

Bobbin—Spool or reel that holds the bobbin thread, which helps form stitches on the underside of the fabric.

Bobbin Case—1) The unit holding the bobbin thread of a sewing machine; 2) adverse medical condition that arises from over-exposure to embroidery; usage—e.g., "She was a complete bobbin case."

Buttons—Icons that activate a specific function when engaged (selected by using the left and right mouse button)

C

Cap Frames—Specialized embroidery frames (hoops) designed to hold finished caps for embroidering. Available in a variety of styles for various machines, with two basic styles being to sew the finished cap flattened out (for use on a flat machine) or sewing the finished cap (for use on a tubular machine) in its natural curve.

Card—Small, flat machine-specific media for storing embroidery and decorative stitches used for transferring designs to and from home machines.

Card Reader/Writer Box—A peripheral device attached to a computer or embroidery machine to enable the transfer of designs from the computer to the machine.

Creeding Stitch—See fill stitch.

Color Change—Code embedded in a design that tells the machine to change to a different needle, to sew with a different color thread.

Column Stitch—Formed by closely placed zigzag stitches. Often used to form borders. Stitches are typically same length. Also known as steil stitch. See satin stitch.

Complex Fill—A technique performed by the software in which complicated outlined areas are filled with individual blocks of stitches all joining seamlessly to act as a single block.

Condensed Format—Design format in which the design data is saved as outlines. These outlines contain information such as the stitch type, density and other parameters that the software will use to produce the stitch data. Since each stitch of the design is not saved in the file, storing designs in condensed format results in a lower file size.

Conversion Software—Stand alone utility program to convert one embroidery format to another.

Converter Box—Peripheral device for translating one card to another or from disk (hard disk, diskette, CD, Zip) to card.

Glossary

Copyright—The right of ownership to an original work of art. Automatically granted to the creator but transferable to another party by law or by contractual agreements.

Cupping—Concave distortion that occurs when designs are too dense for the target fabric and/or the fabric is inadequately stabilized.

Customizing—Basic design modifications including scaling, rotating, skewing, combining of designs, and/or the addition of lettering. Does not involve direct manipulation of stitches or objects.

Cutwork—Technique in which parts of the base fabric are removed, either by cutting, etching, or aetzing. Stitches cover raw edges of fabric.

D

Default—Settings for various options that are built into the system or software or designated by the programmer. New work will appear with these default setting unless changed by the designer.

Denier—Unit or weight used to measure the fineness of thread with low numbers representing finer sizes and higher numbers representing heavier yarns. Equal to the weight in grams of 9,000 Crepe meters of thread. Deniers are represented by the weight of the strands of thread, a slash and the number of strands per thread--120/2Den.

Density—The distance between stitches. Generally measured in millimeters or embroidery points.

Design Library/Catalog—A computer program which catalogues a collection of digitized designs kept by embroidery shops that allows an embroiderer to access the design by subject, stitch count, number of colors or icon.

Design Origin—The starting point of the design- the position of the pantograph when the Start button is first pressed.

Design Transfer—The process of moving designs between the computer and the embroidery machine.

Digitize—Modern term for punching, reflecting the computerized method of converting artwork into a series of commands to be read by an embroidery machine's computer.

Digitize/Punch—The act of creating an embroidery design with the help of a specialized digitizing software system. The term "punch" originates from the first systems designed to create embroidery patterns. On these early systems, the design data was "punched" into a card or tape to be read into the machine.

Dongle—A small security device or key for your computer that attaches to either the parallel, USB, or ADB port and is used to protect software from being illegally shared.

Downloading—1) Transferring a design from the internet or a server to local storage (hard disk or diskette). 2) Transferring a design from local computer to card or directly to machine memory.

E

Editing—Changing aspects of a design via a computerized editing program. Most programs allow the user to scale designs up or down, edit stitch by stitch or block by block, merge lettering with the design, move aspects of the design around, combine designs and insert or edit machine commands.

Embroidery—Decorative stitching on fabric. Generally involves non lettering designs but can also include lettering and/or monograms. Evidence of embroidery exists during the reign of Egyptian pharaohs, in the writings of Homer and from the Crusaders of the 12TH century. Embroidery evolved from handwork to manual sewing machines and from handlooms and schiffli machines with hundreds of needles to high speed computerized multi head machines.

Embroidery unit—The machine part that contains the pantograph that holds and guides the hoop so you can embroider.

End Point—Last stitch of an object or block; exit point of a section.

EP—Embroidery Point. Unit of measurement, with 10 points equal to 1 mm, which is the minimum distance the pantograph can move.

Expanded Format—A design format in which individual stitches in a design have been specially digitized for a certain size. Designs punched in this format cannot generally be enlarged or reduced more than 10 or 20 percent without distortion because the stitch count will not change.

F

Feather Stitch—A type of stitch in which short stitches project at right angles from a main line of stitching formed similarly to coiling. Also known as ray stitching.

File Extensions—Characters (usually 3) following the period ("dot") at the end of a file name which designate which programs can read the file. Windows programs may not read a file without an extension. Not normally in used on Macintosh prior to OS X.

Fill Stitch—Series of running stitches commonly used to cover large areas. Different fill patterns can be created by altering the angle, length and repeat sequence of the stitches. Also known as geflect stitch.

Flagging—Up and down motion of goods under action of the needle, so named because of its resemblance to a waving flag. Often caused by improper framing of goods. Flagging may result in poor registration, unsatisfactory stitch quality and birdnesting.

Frame—Holding device for insertion of goods under an embroidery head for the application of embroidery. May employ a number of means for maintaining stability during the embroidery process, including clamps, vacuum devices, magnets or springs. See hoop.

Format—A specific file type used for the designs created by the program.

G

Grain—The yarn directions on woven fabric. The lengthwise or straight grain follows the warp. The crossgrain or crosswise grain follows the filling. Off-grain describes the fabric when the filling is not at right angles to the warp.

H

H Test—Method of testing thread tension. Stitch a one-inch block letter H with each needle bar. The reverse side of the completed embroidery should show a ratio of two-thirds top thread to one-third bobbin thread.

Hook—Holds the bobbin case in the machine and plays a vital role in stitch formation. Making two complete rotations for each stitch, its point meets a loop of top thread at a precisely timed moment and distance (gap) to form a stitch.

Hoop—Device made from wood, plastic or steel with which fabric is gripped tightly between an inner ring and an outer ring and attached to the machine's pantograph. Machine hoops are designed to push the fabric to the bottom of the inner ring and hold it against the machine bed for embroidering.

J

Jump—There are two types of jump stitches. In the first, the Jump stitch is provided to allow a machine to sew a stitch longer than it would normally be able to sew at the given speed. This is performed by a mechanical operation of the machine. The second type of jump is used to allow the machine to move to a new location in the pattern to begin sewing.

L

Lettering—Commonly known as "keyboard lettering" or monogramming. Created by using an embroidery/lettering program on a computer or from a machine automat. Most lettering software allows the user to select from various fonts and provides the ability to select letter height, density and other characteristics.

Line Carving—Line carving is a split or break applied to stitches to produce an effect. This is normally applied to Satin Stitches where it will produce the most effect.

Lock Stitch—1) Commonly referred to as a lock-down or tack-down stitch, a lock stitch is formed by three or four consecutive stitches of at least a 10-point (1 mm) movement. It should be used at the end of all columns, fills and any element where jump stitches will follow, such as color changes or the end of a design. May be stitched in a triangle or in a straight line. 2) Lock stitch is also the name of the type of stitch formed by the hook and needle of home sewing machines, as well as computerized embroidery machines.

Looping—Loops on the embroidery surface are generally caused by poor top tension or tension problems. Typically occurs when polyester top thread has been improperly tensioned. Excessive density can also cause looping.

M

Memory Card—See card.

Glossary

Motif—A specialty pattern, generally stored in a library and applied to running stitches for creative effects. Looks like built in specialty stitches on domestic sewing machines.

N

Nap—Nap is the "fuzzy" part of a fabric that is usually directional in nature. Corduroy and velvet are good examples of fabric which has a nap or a pile. If smoothed with the hand in one direction, nap is typically shiny in one direction and not shiny in the other.

Needle—Small, slender piece of steel that penetrates the fabric, carrying the thread through into the hook assembly. The needle has an eye for carrying the thread, a groove for holding the top thread as the fabric is pierced and a scarf to allow free passage of the hook point. Machine embroidery needles come with sharp points for piercing heavy, tightly woven fabrics; ball points, which glide between the fibers of knits; and a variety of specialty points, such as wedge points, which are used for leather construction.

Needle Bar—Bar which holds the needle and regulates the distance to which the needle is driven into bobbin assembly.

Needle Plate—The metal plate located above the hook assembly of an embroidery machine. This plate has a hole in the center through which the needle travels to reach the hook and form a stitch. Also known as a throat plate.

O

Offset—1. The distance from the beginning to the end of the design. 2. The distance between needle penetrations in a fill pattern. 3. The distance from the edge of an object that the underlay is placed. 4. The ability to move the pantograph out of the design with a specific movement and then return to the original point. Used for placing appliqués.

Origin—The starting point of your design. Also called home.

Overlap—1. When one color block or stitch sews on top of another. 2. The amount rows of stitches sew over each other at a junction in a complex fill.

P

Pantograph—The drive mechanism on the embroidery machine to which the hoops are attached. The pantograph has the ability to move in two directions, according to the X Y positions of the stitches of a design.

Pile—A fabric with a surface of upright yarns, cut or looped, as corduroy, or terry towels.

Piqué—A medium-weight fabric, either knit or woven, with raised dobby designs including cords, wales, waffles, or patterns. Woven versions have cords running lengthwise, or in the warp direction. Knitted versions are double-knit fabric constructions, created on multi-feed circular knitting machines.

Pitch—Degree of slope or angle of stitches in relation to a base line.

Points—See EP.

Pooching—See cupping.

Presser Foot—Metal device that touches the goods being embroidered while the needle is in the goods. The main function of the presser foot is to hold the material being embroidered until the hook point catches the thread loop formed by the needle rise.

Puckering—The result of fabric being gathered by stitches. Many possible causes include incorrect density, loose hooping, lack of backing, incorrect tension (especially when combined with polyester thread) or dull needles.

Puffy Foam—Trademarked name for 3D foam.

Pull Compensation—Digitizing technique that takes into account the distortion of the design that will occur because of the interaction of the thread with the goods.

Punching—Conversion of artwork into a series of commands to be read by an embroidery machine's computer. Derived from an early method of machine embroidery in which a part of the machine called an automat reads paper tapes or Jacquards punched with holes representing stitches, pantograph movements and other commands. While still capable of producing paper tape, many computerized digitizing systems now store this information on disk formats.

Glossary

R

Registration—Correct registration is achieved when all stitches and design elements line up correctly.

Running Stitch—Consists of one stitch between two points. Used to travel within a design or create outlines or detail on a design. Also known as walk stitch.

S

Satin—A type of stitch comprising of only two needle penetrations alternating sides to sew a column forming closely arranged zigzag stitches. Can be laid down at any angle and with varying stitch lengths.

Scaling—Ability within a program to enlarge or decrease the size of a design. In expanded format, most scaling is limited to 10 percent to 20 percent because the stitch count remains the same despite the final size of the design. In condensed or outline formats, scale changes may be more dramatic because stitches are recalculated at the new size at the pre determined density resulting in a proportional change in stitch count.

Selvedge, selvege, selvage—The outer finished edges along the length (warp) of piece goods. These edges are usually a little stiffer and firmer than the crosswise cut edge of the fabric and these edges will not ravel.

Shortening—A digitizing technique that places shorter stitches in curves and corners to avoid an unnecessarily bulky build-up of stitches.

Special functions—Codes programmed into a pattern designed to cause the machine to perform a specific function such as Stop, Trim, or Color change.

Specialty Fill—Born of recent technology, a fill stitch capability that produces a fill with a "relief" or motif design within the fill stitch area.

SPI—Stitches per inch; system for measuring density or the amount of satin stitches in an inch of embroidery.

SPM—Stitches per minute; system for measuring the running speed of an embroidery machine.

Step (length)—The length of each stitch in a step stitch fill block or for step underlay stitches.

Step—Method of filling an area where the stitches are divided into smaller increments of a predefined length.

Step Satin—Type of step stitch where all stitches of the fill are of the same length providing a smooth, flat appearance. The most common of the Step Fills, this stitch type is often referred to as simply Fill Stitch or Tatami.

Step stitch type—Various stitch types created by altering the division of stitches in the step area. These stitch types are used to give the appearance of different textures within the fill area.

Steil Stitch—Small zig zag stitching, straight or curved with the stitches laying close together. See column stitch.

Stitch Editing—Digitizing feature that allows one or more stitches in a pattern to be deleted or altered.

Stitch Formation—The process of making one complete stitch. The eye of the needle carries the top thread through the fabric, as the needle reaches its lowest point and begins to rise, a loop is formed behind the needle. As the needle rises, the point of the hook approaches and grabs the loop off of the needle. The thread is then carried around the bobbin by the hook, twisting it around the bobbin thread. The take up lever then pulls the thread up pulling the stitch tight.

Stitch Processing—1) The calculation of stitch information by means of specialized software allowing scaling of expanded format designs with stitch count compensation. 2) A trademarked software feature developed by Wilcom Pty. of Australia.

Stock Designs—Digitized generic embroidery designs that are readily available in sets through design companies.

T

Tatami—See fill stitch.

Tension—The stress a sewing machine applies to the thread during stitching to regulate the balance between the top (needle) and bottom (bobbin) threads. Proper thread tension is achieved when about one third of the thread showing on the underside of the fabric on a column stitch is bobbin thread. Generally, a looser tension is desirable to minimize sewing problems and enhance sewing performance.

Textured Threads—Threads that have been false-twist textured to entangle the parallel continuous filament.

Glossary

Thread—Fine cord of natural or synthetic material made from two or more filaments twisted together and used for stitching. Machine embroidery threads come in rayon, which has a high sheen; cotton, which has a duller finish than rayon but is available in very fine deniers; polyester, which is strong and colorfast; metallics, which have a high luster and are composed of a synthetic core wrapped in metal foil; and acrylic, which is purported to have rayon's sheen.

Tie in/Tie off (stitches)—Very small stitches that are sewn at the beginning/end of a block to tie the thread to the fabric to avoid thread pullouts. These stitches are also used before and after cutting thread or changing colors on the machine.

Troubleshooting—The process of locating and solving problems either in the embroidery or digitizing process.

Two-Ply Stitch—A two-ply stitch is a double running stitch. The stitch is formed by the machine sewing a complete running stitch area and then coming back over the same area and stopping where it started. Sews from point A to point B and then from point B to point A.

U

Under thread—Bobbin thread used to tie the top thread of the embroidery.

Underlay (stitches)—Stitches that sew before the fill area, which stabilize the fabric. This ensures that the original shape and look of an embroidery design will be preserved from the effects of the push/pull effect of a fabric. There are three basic types of underlay (central, outline, zig zag).

Uploading—Transferring from a smaller device or media to a larger one such as sewing machine to computer, computer to internet.

V

Verify—Sample sew out of a new embroidery design to make sure the pattern is correct.

W

Walk Stitch—See running stitch.

Warp—Threads running the length of a woven fabric, sometimes known as the lengthwise grain (little to no stretch) (see weft and grain)

Weft—Threads running at right angles to the length of a woven fabric, sometimes known as the cross grain (very little to some stretch) (see warp and grain)

Wire Frame—A view mode where only the outlines of a block are shown. This is especially useful for placement and editing where a transparent view of the frame will provide more accurate placement.

Z

Zigzag—Type of satin stitch where both stitches lie on an angle to the stitch direction.

Appendix B

Resources

I always recommend supporting your local dealer whenever possible, but when you need something your dealer doesn't carry, here are a few of my favorite places plus links to some of the products I mentioned.

Recommended Websites

ECHIDNA CLUB

Looking for a community of like-minded people to share projects and ideas with? No matter where you live in the world, you can find friends at EchidnaClub.com. Plus, if you live in Australia or nearby, it is *the* source for embroidery supplies, designs (including mine!), and machines. Sign up for a free newsletter to keep in the loop to know when an event will be coming to a city near you.

EMBROIDERY.COM

Embroidery.com is an amazing resource for embroiderers! Any design you can imagine, embroidery products, free videos, and webinars taught by a wide range of guest teachers (including me!). If you'd like to try a free one month trial to e-Club, go here for full details: lindeegembroidery.com/eclasses-learning-from-home/

LINDEE G EMBROIDERY

The youngest site of the three, this is my website and since I'm a staff of one, it doesn't get all the attention I'd like. I'm working hard to add new content and have a site that offers designs and education. Watch my events calendar to see when and where I'll be doing live seminars and e-classes. Until my shopping cart goes live, purchase my downloadable products from EchidnaClub.com or Embroidery.com. Packaged versions of my designs are available from AdorableIdeas.com (U.S.) and EchidnaClub.com (Australia).

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Notes

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Resources

Notes

Where to Find Other Products

MACEMB.COM

Are you a Mac user? Would you like to work natively in Mac OS? Convert It Mac lets you color, convert, and view all your embroidery files without ever having to do Windows. Before Convert It Mac, I used far fewer designs because it was simply too hard to see what I had on my computer. Another cool thing is that if you use a different thread brand from those recommended in the color sequence sheet, Convert It will tell you the closest match (by percentage) thread in other brands. Not a Mac user? Then Color It, part of Designer's Gallery offers similar features.

DESIGNER'S GALLERY

Designer's Gallery products are available through Baby Lock dealers. In Australia, a version of Density Works called Density Repair Kit is available through EchidnaClub.com. You can download trials of Designer's Gallery programs at http://www.designersgallerysoftware.com/

ADORABLEIDEAS.COM

John Deer's site offers a huge array of masterfully digitized designs, which can be purchased as downloadable files or physical packages. These designs are also available in Australia at EchidnaClub.com

Appendix C

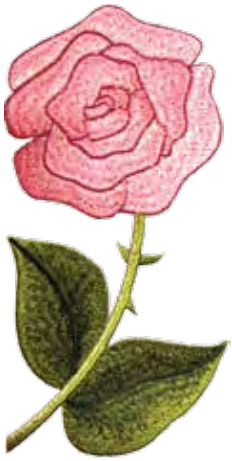
Color Sequences

Design Info for Downloadable Files

Most of the designs require a 5x7 hoop to sew. Color sequences are included here. All color numbers are Hemingworth.

bunny.*
70.60 mm x 91.00 mm : 9840 Stitches

1: Inner Ears 1003 Baby Pink, 640 st. 3.9 m.
2: Mouth 1000 Classic Black, 180 st. 1.5 m.
3: Eyes, teeth 1001 Pure White, 518 st. 2.5 m.
4: Iris of eyes 1089 Leafy Green, 345 st. 2.1 m.
5: Eyes 1000 Classic Black, 178 st. 1.3 m.
6: Fur 1074 Sea Storm, 4459 st. 20.0 m.
7: Nose 1003 Baby Pink, 95 st. 1.2 m.
8: Muzzle 1147 Moonlight, 1165 st. 5.7 m.
9: Bowtie 1270 Christmas Red, 1217 st. 6.9 m.
10: Details 1000 Classic Black, 1052 st. 2.6 m.



RoseFill.*
95.40 mm x 175.20 mm : 19887 Stitches

1: Leaves 1251 Dusty Green, 5239 st. 28.5 m.
2: Leaf shading 1252 Bush Ivy , 1850 st. 9.6 m.
3: Stem 1251 Dusty Green, 992 st. 5.5 m.
4: Stem highlights 1049 Dried Banana, 262 st. 1.6 m.
5: Rose 1008 Sweet Pea, 8925 st. 46.8 m.
6: Rose highlights 1005 Whisper Pink, 1022 st. 6.4 m.
7: Rose detail 1165 Winter Rose, 1603 st. 4.1 m.

RoseBean.*
97.60 mm x 177.40 mm : 5583 Stitches

1: Rose 1270 Christmas Red, 5583 st. 17.1 m.

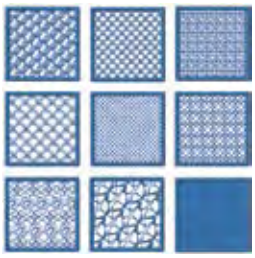
Color Sequences

Flowr1.*
53.80 mm x 53.80 mm : 4788 Stitches

1: Leaves 1089 Leafy Green, 1270 st. 5.8 m.
2: Flower 1046 Sun, 2535 st. 11.9 m.
4: Center 1023 Marigold, 206 st. 1.6 m.
4: Outline 1000 Classic Black, 780 st. 2.4 m.

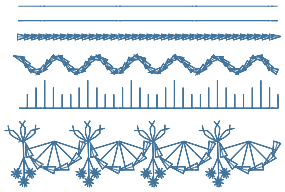
flowr2.*
53.60 mm x 54.40 mm : 5141 Stitches

1: Leaves 1089 Leafy Green, 1041 st. 6.6 m.
2: Leaf shading 1252 Bush Ivy , 232 st. 1.7 m.
3: Petals 1043 Lemon Drop, 2310 st. 12.2 m.
4: Petals 1047 Dandelion, 655 st. 4.1 m.
5: Petal shading 1023 Marigold, 264 st. 1.7 m.
6: Center 1001 Pure White, 610 st. 2.7 m.
7: Center shading 1043 Lemon Drop, 35 st. 0.8 m.



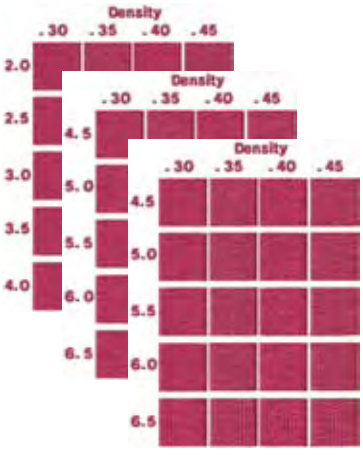
Motifs.*
129.20 mm x 129.60 mm : 46907 Stitches

1: Design 1196 Dark Aquamarine, 46907 st. 111.4 m.



Runs.*
73.20 mm x 48.00 mm : 1629 Stitches

1: Design 11196 Dark Aquamarine, 1629 st. 6.7 m.



swatch1.*
119.80 mm x 160.40 mm : 28176 Stitches

1: Design 1014 Carnation, 28176 st. 109.4 m.

swatch2.*
121.20 mm x 160.40 mm : 17229 Stitches

1: Design 1014 Carnation, 17229 st. 110.4 m.

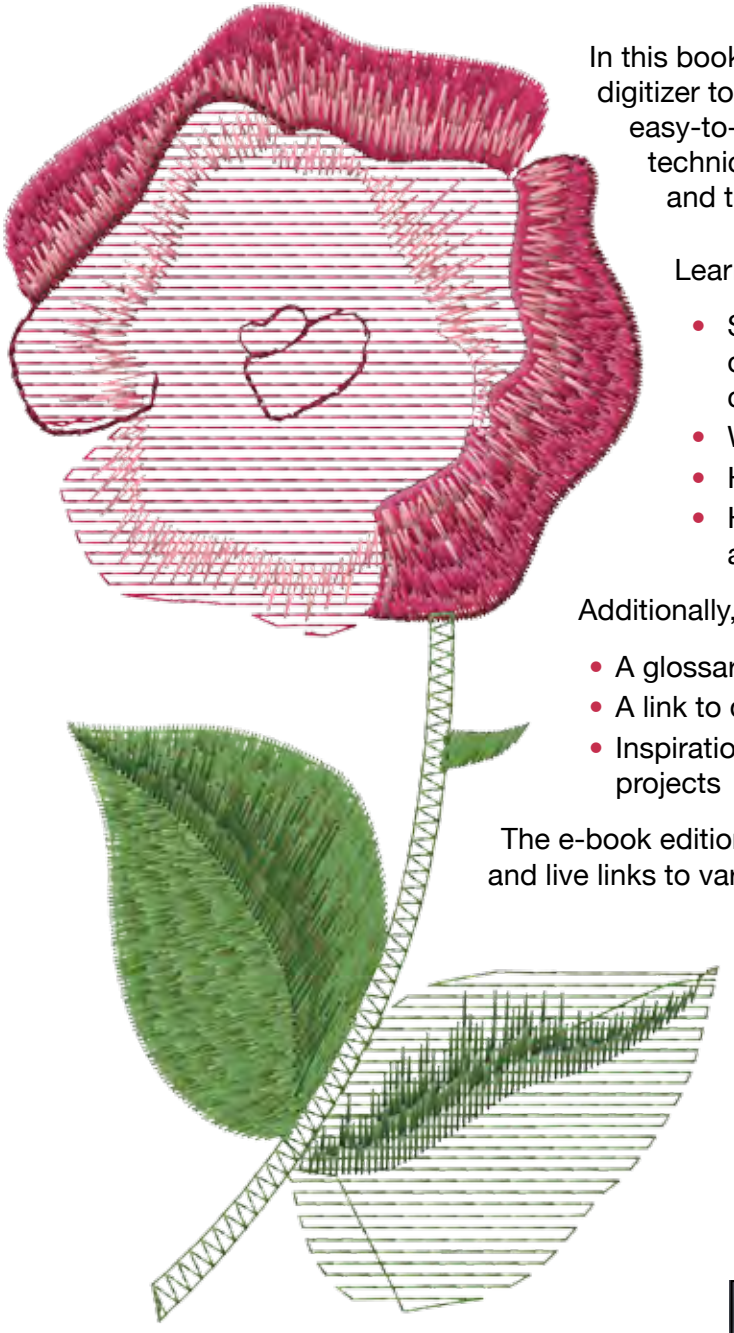
swatch3.*
Same as swatch 2 with underlay added
121.20 mm x 160.40 mm : 25299 Stitches

1: Design 1014 Carnation, 25299 st. 130.4 m.

ANATOMY of a DESIGN

How to Think Like a Digitizer & Become a Better Embroiderer

Would you like to become a better embroiderer? The secret is understanding how designs are constructed and how that impacts fabric. In other words, you need to learn how to think like a digitizer.



In this book, readers will step into the mind of an experienced digitizer to learn how designs are composed. Written in an easy-to-understand conversational tone, Lindee explains technical jargon and how it applies to both the embroiderer and the digitizer.

Learn about

- Stitch properties including stitch types, length, density, angle, shortening, underlay, tie-offs and compensation
- Which properties are easy to change and which aren't
- How to analyze a design and what to look for
- How various stitch properties affect fabric, thread, and stabilizer selections

Additionally, **Anatomy of a Design** provides:

- A glossary of common terms
- A link to downloadable embroidery and graphic files
- Inspiration for moving beyond the basics into more advanced projects

The e-book edition provides virtual sew-outs to support chapter topics and live links to various web sites.

Lindee Goodall, a recognized expert in embroidery digitizing, teaches aspiring digitizers and embroiderers, as well as experienced embroiderers everything they need to know about how a design is constructed in order to achieve excellent results.