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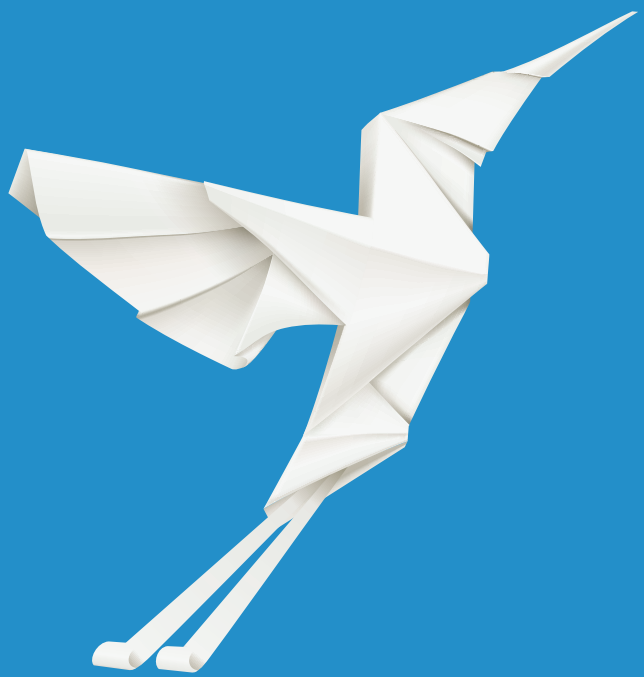
LEAN WEBSITES

BY **BARBARA BERMES**



BECAUSE WEB PERFORMANCE SIMPLY MATTERS

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About Barbara Bermes

Barbara has been an ardent performance advocate and web technologist for many years, working on a variety of web projects, most recently for the Canadian Broadcasting Corporation. As an international speaker, a contributor to jsmanners, and the organizer of the Toronto Web Performance Meetup, Barbara shares her passion and knowledge of web performance with the community.

About SitePoint

SitePoint specializes in publishing fun, practical, and easy-to-understand content for web professionals. Visit http://www.sitepoint.com/ to access our blogs, books, newsletters, articles, and community forums. You'll find a stack of information on JavaScript, PHP, Ruby, mobile development, design, and more.

To you, who thinks she can't do
it — you absolutely can!

Please trust and follow your heart.

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Preface

We've grown into a very impatient society—a culture of "survival of the fastest". Waiting is not an option any more. Search engines like Google, Bing, and Yahoo are competing to offer the fastest and best search results. Ecommerce sites like Amazon, Target and Walmart are competing with innovative delivery methods like same-day delivery drones[1]. And our everyday life is increasingly moving towards an online life, where slowness is not acceptable. We expect to be able to do more and more online, and to do it quickly—from ordering food to buying goods, or even finding relationships. If a site feels slow, we'll probably complain to the site owner, our friends and on social media, and possibly not visit the site again, but move on to find alternatives.

Although Internet speeds have increased, websites are getting bigger and more complex by the year, and so they inevitably need to be powered by more powerful technologies to satisfy the impatient users of today. But why is the overall size of websites increasing? Are we getting lazy and taking current, high-speed infrastructures for granted, no longer caring about clean, lean and performant code?

Technology allows us to "go bigger", but maybe not necessarily be better when it comes to performance. Servers and Internet connections are getting more sophisticated, and as a result, we feel the need to keep filling them. However, this isn't the time to become lazy. This is the time to utilize the amazing tools that are available for making websites faster, and to learn how to improve user experience and satisfaction. Because nobody likes to wait.

The charts in Figure 1 and Figure 2, sourced from HTTP Archive, show the size and number of HTTP requests of websites, and how both measurements have increased over recent years:

[1] http://en.wikipedia.org/wiki/Delivery_drone

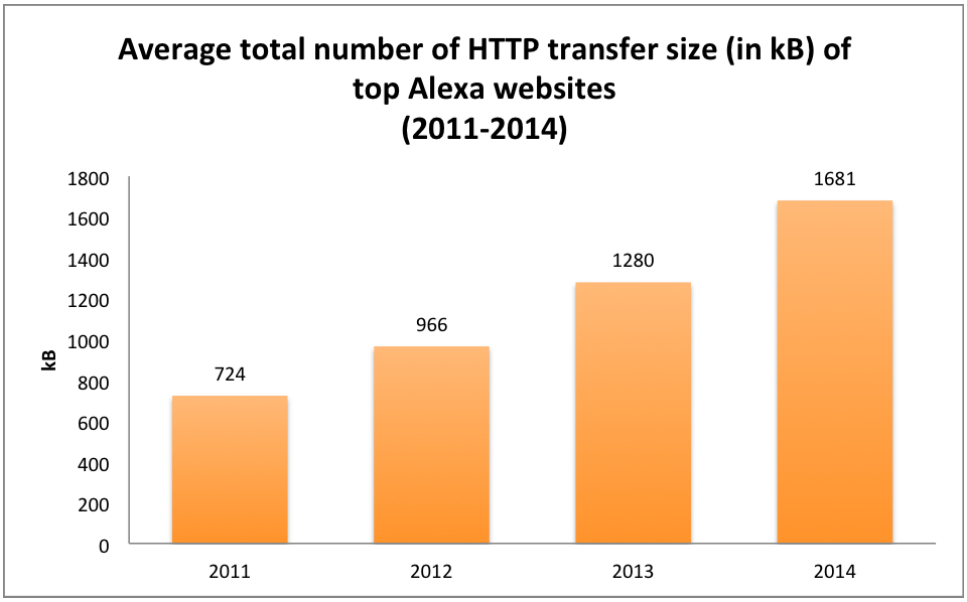

Figure 1. Increase in average website transfer size, 2011-2014

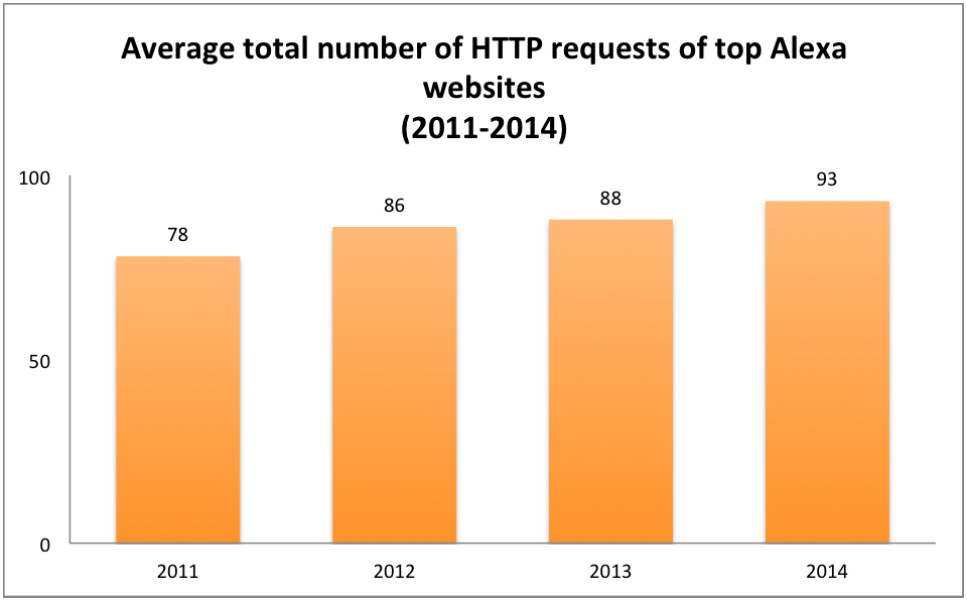

Figure 2. Increase in average number of HTTP requests per website, 2011-2014

From 2010 to 2014, the average total transfer size—basically the overall weight—of a website increased by 150%, compared to the total number of requests (all the assets

of the website that need to be loaded), which only increased by around 16%. We can clearly see a trend towards more complex web applications. Our code needs to be performant to handle the rise of sophisticated applications. This book will show you how to make your websites leaner and faster.

An Exercise Routine for Your Website

Throughout this book, you'll notice that I've used various references to exercise routines, notably the "Warm Up" and "Cool Down" sections in each chapter. Indeed, the title of this book, *Lean Websites*, also implies exercise. The primary reasoning behind that idea is that you'll want to make your sites slimmer in order to make them faster. However, additionally, by implementing the techniques discussed in this book over and over, like an exercise routine, you'll develop a web performance "muscle memory" that will become ingrained in your web development routine—establishing habits that will make building efficient, performant websites seem like second nature.

Who Should Read This Book

This book assumes experience of web development, and familiarity with HTML, CSS, and JavaScript. Some back-end experience would be useful.

Conventions Used

You'll notice that we've used certain typographic and layout styles throughout the book to signify different types of information. Look out for the following items:

Code Samples

Code in this book will be displayed using a fixed-width font, like so:

```
<h1>A Perfect Summer's Day</h1>
<p>It was a lovely day for a walk in the park. The birds
were singing and the kids were all back at school.</p>
```

If the code is to be found in the book's code archive, the name of the file will appear at the top of the program listing, like this:

example.css

```
.footer {
  background-color: #CCC;
  border-top: 1px solid #333;
}
```

If only part of the file is displayed, this is indicated by the word *excerpt*:

example.css *(excerpt)*

```
  border-top: 1px solid #333;
```

If additional code is to be inserted into an existing example, the new code will be displayed in bold:

```
function animate() {
  new_variable = "Hello";
}
```

Where existing code is required for context, rather than repeat all the code, a vertical ellipsis will be displayed:

```
function animate() {
  ⋮
  return new_variable;
}
```

Some lines of code are intended to be entered on one line, but we've had to wrap them because of page constraints. A ➥ indicates a line break that exists for formatting purposes only, and should be ignored:

```
URL.open("http://www.sitepoint.com/blogs/2015/05/28/user-style-she
➥ets-come-of-age/");
```

Tips, Notes, and Warnings

Hey, You!

Tips will give you helpful little pointers.

Ahem, Excuse Me ...

Notes are useful asides that are related—but not critical—to the topic at hand. Think of them as extra tidbits of information.

Make Sure You Always ...

... pay attention to these important points.

Watch Out!

Warnings will highlight any gotchas that are likely to trip you up along the way.

Supplementary Materials

http://www.learnable.com/books/webperf1/
The book's website, which contains links, updates, resources, and more.

https://github.com/spbooks/webperf1/
The downloadable code archive for this book.

http://community.sitepoint.com/
SitePoint's forums, for help on any tricky web problems.

`books@sitepoint.com`
Our email address, should you need to contact us for support, to report a problem, or for any other reason.

Acknowledgements

There are no words that can describe how thankful I am towards my family for supporting my career, and never making me feel guilty for leaving them. Thank you Papa, Anna, Kathy, Michael, my nephew Jan and nieces Antonia and Lisa, as well as all the beautiful family members who are not with us any more

My biggest thanks and appreciation goes out to Daniela, who has given me so much love. She was there when I was happy and ecstatic to be writing the book but also when I was down and exhausted, not knowing if the book would turn out the way

I (and the editors) wanted. Thank you for all the lost hours and weekends you had to sacrifice. Your ability to lift me up, and provide supporting and constructive feedback was invaluable.

Another big thanks goes out to Rebecca for always being available to proofread, and to comment on my second language adventures. I want to thank my "patchwork family" and life-long friend Alex for his great comments, love and support for keeping me going. Their constant support and encouragement was invaluable.

Thanks to SitePoint's Simon Mackie, and the extremely knowledgeable and honest Andrew Betts, for their constructive feedback, and for pushing me to form and shape the book as it is now.

Big thanks to my little friend Emilia for helping me focus and learn what matters in life. Babysitting her, and writing at the same time, was one of the nicest, most calming and productive activities during this journey. Thanks for the kisses and bedtime stories before my book writing night shifts began.

Thanks to all the great, smart and fun people in the web performance community for their knowledge and supportive camaraderie.

While many early mornings and late evenings have been spent on this book, not only the beautiful stars have always helped me continue but also my dear friends. I'm nothing without my friends (you know who you are), so the closing thanks goes out to them for letting me hide to write over several months, and for letting me be my true self, every day. Thanks to all of you for brightening my life, and for giving me a heart full of support, love, and laughter—every single day!

Thank you.

Want to take your learning further?

Chapter 1

Performance Simply Matters

A Lean Website

This book, *Lean Websites*, examines the causes behind bloated and slow websites, dissects which assets of your page are necessary, which are nice to have, and which are not necessary at all and can be removed to shed some weight. It will help you understand what causes websites to be slow, and how to look for efficiency while maintaining the quality originally envisioned for your site.

The title of the book includes the word **lean**. So what does the word mean?

"Lean" is used in this book to describe both the nature of the product we create and the process of creating it. Keeping a product lean means removing anything that might impede its performance. In the case of a website, this means keeping a clear focus on elements that add value to the site, and ensuring that these elements are optimized to provide the best possible user experience. Likewise, the more we practice building healthy, lightweight websites, the leaner and more efficient the process becomes—hopefully becoming part of our DNA when deploying sites.

But let's be clear up front: there's some bad news. From a performance perspective, there's *a lot* you can do wrong—and probably are doing wrong—when it comes to building websites! But hey, there's also good news: there are lots of relatively easy ways to fix those problems.

"The secret of getting ahead is getting started," as the saying goes. So let's get started!

The Psychology of Speed

Why do people leave a website? There could be many reasons, such difficulty finding what they are looking for. But there's a good chance users leave a site because it feels too slow to load. In this section, I want to draw some attention to psychology, and how it plays a big role in our perception of speed and performance.

What Is "Too Slow", and When Do Websites "Feel" Slow?

As psychologist Jeremy Dean points out, time doesn't fly when we are having fun[1]. When do we experience fun? Clearly, it's not when we have to wait. Who likes to wait, especially in this world of constant news and response? Nowadays, people desire instant satisfaction and have very little patience. Amazon offers one-day delivery; a cab shouldn't take longer than ten minutes to arrive. We've become a society where waiting is not acceptable anymore—especially when it comes to the online world. When we visit websites, if we don't get an instant response, a competitor's site is just a click away.

> A watched pot never boils. Minutes drag when we are bored.[2]

The problem with discussing website speed is that the perception of speed is very subjective and very context specific. What feels slow to me might not feel slow, say, to my father or my grandmother. We all have different expectations. For this reason, Chapter 3 will help us to formulate a definition of "too slow" with real numbers and data.

[1] http://www.spring.org.uk/2011/06/10-ways-our-minds-warp-time.php
[2] http://www.theguardian.com/science/2013/jan/01/psychology-time-perception-awareness-research

Maister's First Law of Service

David Maister, a former professor at the Harvard Business School, came up with a formula for the law of service. The formula—the outcome of several years of research—provides a measurement on how waiting for a specific service affects customers' perceptions of both the service provided and the actual product.

Maister's formula states that Satisfaction = Perception - Expectation.[3] In the context of web performance and serving content to site visitors, this formula raises the following questions:

- What was actually served and presented to the visitor, and did the content satisfy the user's goal?
- What was perceived by the visitor?
- What did the visitor actually expect?

Satisfaction

Imagine a situation where you visit a page and a loading indicator slowly moves from 5% to 10%. You'll expect it to take a while to hit 100%. If the percentage unexpectedly begins to rise quickly to 95% and then 100%, you'll be satisfied and happy, because your perception exceeded your expectation. Conversely, if the loading indicator goes up slower than you expect, you'll experience an unpleasant feeling.

In a nutshell, website visitors are satisfied when their perception exceeds their expectation, and dissatisfied when the opposite occurs.

Perception

We need to acknowledge that the perception of website speed is a *feeling*—something that is very subjective.

For example, perception refers to how fast the user *thinks* your website is, rather than how fast it *actually* is. Most of the time, that's almost more important than the actual speed of your website.

[3] http://faculty.haas.berkeley.edu/andy/blockhandouts/Queue%20Psychology.ppt

Generally, the perception of something being slow[4] carries negative associations—unpleasantness, boredom, irritation, confusion and so on. Speed, on the other hand, is associated with success, resulting in less frustration and irritation—especially where the user is kept informed of progress.

Given that your website's loading time can be perceived as slow, it's important to ensure that content is delivered as quickly as possible—or at least that, during any delay, the user is kept busy and distracted, so that the experience doesn't *feel* slow to them.

There's a great example[5] that illustrates the problem of perception. The Houston airport received a lot of complaints from passengers that it took too long to get their luggage. Instead of making the hard working airport personnel work even faster to get the luggage out, the airport decided to change the way passengers perceived the waiting time to pick up their luggage. They extended the distance from the arrival gate to the baggage claim sixfold. While the airport personnel were busy moving all the luggage to the baggage claim, passengers were kept busy by walking. The time for the bags to come out hadn't changed. However, as a result of perceived performance, complaints started dropping dramatically.

Expectations

In the context of performance, when servicing customers, it's important to manage and care about their expectations. Disney has done a fabulous job in managing expectations so the customer receives a positive outcome in their amusement parks. They have lineups that show you the expected waiting times, with a rather pessimistic estimate, so that customers get to the front of the line in a much shorter time than predicted. As a result, the customer feels more positive.

So, how does this translate to servicing website visitors? We should set clear expectations by keeping them informed about the progress of their task. Show them the content they want to see in the fastest possible way; and, if waiting is required, show progress bars or other indicators to reassure them the website is still responding, and that they'll receive the content that they requested.

[4] http://www.slideshare.net/stoyan/psychology-of-performance

[5] http://www.nytimes.com/2012/08/19/opinion/sunday/why-waiting-in-line-is-torture.html?pagewanted=all&_r=0

Respect

I'd like to mention "respect", as I believe it's an important factor in customer satisfaction. Ultimately, performance is about respect. Imagine you are made to stand in line for 20 minutes, only to find the cashier closing just before it's your turn to be served. Frustrating, right? Couldn't they have told you earlier? That's where respect comes into play: the greater the respect shown for customers, the more likely they are to experience satisfaction.

Abandonment Rate: When Your Users Decide to Leave

We've all abandoned a service before. Standing in an unmoving line will make us impatient, until we give up and quit. We leave the queue and don't finish the task we actually wanted to accomplish. We experience frustration and disappointment. The same can happen with websites. If users consider your website helpful and fast, they'll stay and finish their task. Otherwise, they'll leave your site without completing their task. Therefore, the **abandonment rate** is probably the safest and most honest judgement you can get from your users on how satisfied they are with your service.

There are many statistics and case studies demonstrating that abandonment behavior of users is due to poor performance. Ecommerce websites are hit the hardest. Stiff competition forces site owners to pay close attention to speed and execution. If your shopping cart doesn't load fast enough, your users might just move to a competitor's site.

Here are some real-world statistics and numbers[6] that prove how important speed is in a world of invaluable instantness:

- Amazon calculated that a page load slowdown of just one second could cost them $1.6 billion in sales each year[7]
- Almost 40% of online shoppers abandon a website that takes more than 3 seconds to load (Gomez[8])

[6] http://www.webperformancetoday.com/2010/06/15/everything-you-wanted-to-know-about-web-performance/

[7] http://www.fastcompany.com/1825005/how-one-second-could-cost-amazon-16-billion-sales

[8] http://www.mcrinc.com/Documents/Newsletters/201110_why_web_performance_matters.pdf

- 79% of online shoppers will not return to a website after a disappointing experience due to poor performance (KissMetrics[9])
- A 1-second delay in page load time equals 11% fewer page views, a 16% decrease in customer satisfaction, and 7% loss in conversions (Aberdeen Group[10])

Response Time

Perceived web performance involves how we, as humans, experience and respond to the performance of a system.

The following graph shows how different response times of systems effect our brain, and how our brain deals with them, resulting in different emotions:

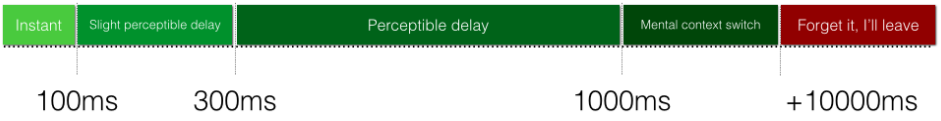

Figure 1.1. Perceived performance in milliseconds, and how our brain reacts[11]

- We feel **instant perception** around a **100ms** delay
- A **slight perceptible delay** occurs between **100ms and 300ms**
- We definitely feel a **perceptible delay** under **1000ms** (1s)
- After **1 second**, we feel that a **mental context switch** starts
- After **10 seconds** and more, the **abandon rate** goes up and the user tends to leave the site

[9] https://blog.kissmetrics.com/loading-time/?wide=1
[10] http://www.aberdeen.com/research/5136/ra-performance-web-application/content.aspx
[11] Source: Web Performance Today [http://www.webperformancetoday.com/2014/07/16/eight-tricks-improve-perceived-web-performance/] and High Performance Browser Networking [http://chimera.labs.oreilly.com/books/1230000000545/ch10.html#SPEED_PERFORMANCE_HUMAN_PERCEPTION]