Tutorial

How to Use Search Engine Optimization Techniques to Increase Website Visibility

—Feature by
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Abstract—**Research questions:** *This tutorial aims to answer two general questions: (1) What contributes to search engine rankings? and (2) What can web content creators and webmasters do to make their content and sites easier to find by audiences using search engines?* **Key concepts:** *Search engines' rankings are shaped by three classes of participants: search engine companies and programmers, search engine optimization practitioners, and search engine users.* **Key lessons:** *By applying three key lessons, professional communicators can make it easier for audiences to find their web content through search engines: (1) consider their web content's audiences and website's competitors when analyzing keywords; (2) insert keywords into web text that will appear on search engine results pages, and (3) involve their web content and websites with other web content creators.* **Implications:** *Because successful search engine optimization requires considerable time, professional communicators should progressively apply these lessons in the sequence presented in this tutorial and should keep up to date with frequently changing ranking algorithms and with the associated changing practices of search optimization professionals.*

Index Terms—*Hyperlinks, keywords, organic search, search engine optimization, search-ranking algorithms, social media, websites.*

Most professional communication practitioners and researchers can point to some content on the web that they themselves have authored, such as on their employers' or clients' websites, or on sites they maintain for professional, personal, or community interests. As a simple experiment, they might try to find that content using only a general web search engine. If, as is likely, they can compose a carefully worded search query by recalling very specific features of the content, such as its title, a distinctive key phrase, the name of the website or of the organization that owns it, and so forth, they stand a reasonable chance of success, with their content appearing on the first page of the search results. On the other hand, if they ask someone else to find the content, someone who does not already know it very well—and that, after all, is typically the condition under which we seek out web content—the chances of success likely diminish. The content may well be found, eventually, perhaps after attempting various search queries and scrolling through many pages of search results.

Regardless of the intrinsic merits of professional communicators' web content, its visibility to prospective audiences often depends on how well the webpage or site ranks in a search engine's results pages, a seemingly enigmatic arbiter of popularity. As a consequence, professional communicators, long accustomed to crafting the information architecture, content, design, and usability of websites and pages for their human audiences, should also orient their web work to the enigmatic intermediate audience of search engines. To help them do this, this tutorial aims to answer two general questions: (1) What contributes to search engine rankings? and (2) What can web content creators and webmasters do on their pages, sites, and the web in general to make their content and sites easier to find by audiences using search engines?

To answer these questions, this tutorial focuses only on general web search engines and delivers lessons that professional communicators can readily implement without specialized technical know-how and without a web marketing budget.

The Key Concepts section introduces a theoretical framework for the tutorial's approach to search engine optimization, describes how the tutorial's literature was selected, defines search-related terminology, and explains how three classes of participants shape search engine rankings. In the heart of the tutorial, professional communicators will learn three key lessons they can apply to make it easier for audiences to find their web content and websites through search engines:

(1) Consider the web content's audiences and website's competitors when analyzing keywords.

(2) Insert keywords into web text that will appear on search engine results pages.

(3) Involve their web content and websites with other web content creators.

Two additional lessons are available in the appendices, shown in downloadable documents at http://ieeexplore.ieee.org: Appendix A: Optimize website content and structure for both human and search engine audiences, and Appendix B: Emphasize keywords in key spots on webpages.

To manage these lessons and their sublessons over the time required for successful search engine optimization, the closing Implications for Practice section recommends that professional communicators progressively apply these lessons in the sequence presented in this tutorial and keep up to date with frequently changing ranking algorithms and with the associated changing practices of search optimization professionals.

KEY CONCEPTS

Search engines dominate among America's and the world's most visited websites [1], [2] and, hence, provide a common intersection for the otherwise distinct interests of web users, search marketing practitioners, researchers, and of course the search engine companies themselves. These classes of search stakeholders contribute in distinct ways to search engine rankings and/or to our research and insight into how to optimize sites to boost those rankings. Their contributions will become evident throughout this section, starting with this tutorial's theoretical framework, which incorporates three classes of these stakeholders, and continuing with a description of how its literature was selected from a slightly different set of three classes of these stakeholders. Then, after introducing basic search-related terminology, this section explains how, from these stakeholders, three classes of participants shape search engine rankings.

Theoretical Framework In principle, the web, hosting a seemingly endless population of content creators and their web content, would appear to have overcome the kinds of hypercompetitive conditions that have restricted aspiring content creators contending for an audience in the traditional mass media. In practice, however, prospective audiences of web users can

meaningfully visit only a tiny fraction of the web's sites, a condition that has led sociologist Alex Havalais to characterize the web's ecosystem as an "attention economy" driven by competition for the scarce commodity of users' attention [3, pp. 57, 68–71].

In such an economy, the key logistic role of channeling users' attention is played by search engines [3, p. 71], which set the competition's rules and judge its winners from among the contending websites. Nevertheless, two other classes of stakeholders indirectly contribute to the competition's rules and results: contending web content creators themselves, and search engine users [3, p. 83].

Search rankings enable web content creators to continually monitor the exact measure of their competitive fitness, or lack thereof: for any given search query, precisely one site ranks in the coveted top spot, and one other in the less coveted second spot, and so on down the steep slope of increasing obscurity. For the vast masses of the web's sites ranking beyond the first page of search results, a search engine like Google, according to Havalais, operates as "a technology as much of ignoring as it is of presenting" [3, p. 57]. Accordingly, some content creators orient their sites not just to directly attracting and maintaining the attention of their prospective human audiences but to accommodating and even taking advantage of search engines and their ranking rules, to the extent that orienting a site to search engines has become a professional specialty: search engine optimization (SEO). In response, search engines conceal the competition's rules and frequently redefine them in order to prevent agonistic content creators and their SEO specialists from gaming the system and thereby undermining search engines' exclusive logistic roles.

Search engine users of course hold the attention economy's key commodity, their own attention, and confer it not only among the sites of contending web content creators but also among search engines themselves, thereby compelling search engines to try to better accommodate users' interests. Since the end of the search is usually more interesting than the search itself, it is in users' interests that search engines serve up among their top results only those sites that best meet their perceived needs, which entails that search engines must rank sites with increasing accuracy on such criteria as their authenticity, topicality, and quality, but especially popularity.

This tutorial explores in concrete detail how each of these three classes of stakeholders contributes to influence search engine rankings in the Three Classes of Participants Shaping Search Rankings section. More generally, it is this perspective of search rankings as an outcome of the symbiotic relationship among various stakeholders that guided how this tutorial's literature was selected and that frames its search optimization lessons.

How Literature was Selected   Because a thorough training manual in SEO strategies and tactics would encompass several volumes, this short tutorial limits itself to SEO advice that would seem to be the most broadly relevant to, and readily applicable by, professional communication practitioners. Accordingly, it focuses its lessons on the subset of SEO strategies and tactics that are:

- applicable to popular, general-purpose search engines, such as Google and Bing, as opposed to those specializing just in news, shopping, or scholarship, and so forth;
- applicable to a broad range of websites, as opposed to sites requiring specialized search functionality, such as libraries and e-commerce sites;
- free, as opposed to paid search options such as Google AdWords;
- ethical, as opposed to the deceptive tactics used by spammers; and
- nontechnical, applicable by practitioners with expertise in professional communication, not necessarily in website coding.

SEO strategies and tactics meeting these criteria are of interest not only to professional communication practitioners but also to three classes of stakeholders—overlapping with those introduced in the Theoretical Framework—whose long-standing involvement with web search outcomes has led them to share their SEO insight. Accordingly, this tutorial draws its SEO lessons from the literature disseminated by these three classes:

(1) published advice from search engine companies;
(2) empirical studies from the research community;
(3) much experience-based collective wisdom and occasional empirical studies from SEO practitioners.

Search Engine Companies: The ranking algorithms of search engines companies like Google are their most valuable pieces of intellectual property and,

hence, withheld from public scrutiny. However, some search engine companies publish SEO advice to webmasters, in part in a self-interested attempt to promote "**white hat**" (authentic, audience-directed) SEO practices that would ease their efforts to accurately read websites and to discourage webmasters and web marketers from resorting to "**black hat**" (deceptive) SEO tactics that seek to game the ranking system. Though such advice typically re-states what has long been known by experienced SEO practitioners, this tutorial frequently cites advice from the top two search providers in the market—Google and Microsoft (which serves both Bing and Yahoo searches)—because these two would have to be judged the most authoritative sources on their own search engines and because their advice is so fundamental. Google, in particular, publishes extensive advice for webmasters not only on its own site but also on YouTube, and these sources as well as Microsoft's more limited offerings were combed for insights into the search engines' algorithms and advice on how webmasters could improve their sites' rankings with such algorithms.

Research Community: Whereas much research has explored issues related to search principles and functionality, research conducted primarily for the purpose of re-discovering what Google and other search engine companies already know has understandably remained peripheral to fields like computer science. Hence, this tutorial draws as well on research from fields inquiring not so much into what goes into search engines' algorithms but what comes out, in particular the fields of marketing, library and information science, and internet studies. Searches were conducted on the keywords "search engine optimization" and, to a lesser extent, just "search engine(s)," in such academic databases as Business Source Premier and SciVerse/ScienceDirect, in Google Scholar, and in specific scholarly journals known to focus on web-related issues. Works found through such means were examined for their citations and, using academic databases and especially Google Scholar, for later research that, in turn, cited them, a process that led to other works. Works found through Google Scholar—an especially bountiful resource for web-related research—were carefully examined for their scholarly provenance and were selected only if they exhibited a credible research foundation, such as through their authorship credentials, prior presentation in a scholarly venue, or research methods.

SEO Practitioners: Unlike researchers, SEO practitioners have a very strong incentive to re-discover what Google and other search engine companies already know about their ranking algorithms. From their daily experiences monitoring the websites' rankings and analyzing their websites' logs, SEO practitioners and webmasters are typically well attuned to the algorithms' frequent changes. Such experiences are disseminated through various online discussion forums, on the websites of SEO companies, and in popular press books written by the experienced SEO practitioners—and turn up copiously in searches for "search engine optimization." The main criteria applied in selecting from such discourse of uneven quality was its credibility. Accordingly, this tutorial draws, in particular, on books whose success has earned them recent second or third editions [4]–[6] and, hence, whose extended exposure in the commercial marketplace would have somewhat tested their SEO advice. It also draws extensively on the latest in a series of biennial surveys about SEO techniques conducted by the SEO software company and community hub SEOmoz [7]. This latest survey, conducted in March 2011, asked 134 SEO industry professionals to rank more than 100 suspected SEO factors according to their estimated influence in Google's ranking algorithm.

Search-Related Terminology This section introduces general search-related terminology that reappears throughout this tutorial. More specialized terms are defined and/or described at points where they are introduced in the key lessons below.

According to the Search Engine Marketers Professional Organization, the main American-based organization that represents practitioners in the field, **search engine optimization (SEO)** is "the process of editing a web site's content and code in order to improve visibility within one or more search engines" [8]. The similar term **search engine marketing (SEM)** includes SEO plus various paid advertising options that involve search engines, options that are beyond the score of this tutorial. SEO is typically understood not to include—or at least not to overly rely on—these paid options in its aim to achieve high rankings among search engines' **organic** ("natural") **results**, listings of webpages that a search engine derives by "appl[ying] formulas (**algorithms**) to its search crawler index, combined with editorial decisions and content weighting . . . " [8]. These ranked listings appear on **search engine results pages (SERPs)**, often surrounded by **sponsored results** (paid advertising), after users enter a search

query. For their organic results, SERPs typically default to listing ten webpages, featuring for each its title hyperlinked to the webpage, a "**snippet**" of text often excerpted from the page, and the page's **URL** (web address).

Search engines collect their search **index** (corpus of web content) in the first place mainly by using a **spider** (a program, also called a bot or a crawler) to repeatedly **crawl** (surf) the web link by link and record new and updated pages, defunct links, and so forth. The index includes the words on the crawled webpages along with their location and accompanying web coding. While this tutorial focuses mainly on nontechnical means of SEO, those responsible for websites ought to know some **HTML** (hypertext markup language), the most fundamental form of web coding, in which various **tags** and their **attributes** are used to encode the structure, design, and functionality of a webpage.

Three Classes of Participants Shaping Search Rankings This section draws on the literature to explain how search engine rankings are directly and indirectly shaped by the three classes of interdependent participants introduced in the Theoretical Framework section above:

(1) search engine companies and programmers
(2) webmasters and SEO practitioners
(3) search engine users.

Search Engine Companies and Programmers: Searchers using more than one search engine will likely have noticed that for a given query, the competing SERPs tend to show different rankings, and indeed often show different sites entirely, an observation confirmed by researchers [9]–[11]. Each search engine company has wittingly or unwittingly programmed its own biases. One study observed that in comparison with their competitors, search engines tended to favor sites and services that their own companies owned, with Google's SERPs listing Google-owned YouTube more often than its competitors did, and Yahoo listing Yahoo Answers more often [12]. Another study found that Google tended to return more commercial results among its top ten than did its erstwhile competitors Yahoo and MSN [13].

Perhaps the most distinctive and successful feature of Google's algorithm is **PageRank**, which (then) Stanford University doctoral candidates Sergey Brin and Lawrence Page introduced in a 1998 article about what was then their prototype search engine [14]. PageRank is a measure of the popularity of

a webpage as determined by the hyperlinks from other pages leading to it, as well as the popularity of those linking pages themselves. It is now just one of more than 200 factors that figure in Google's algorithm [15]. Google's Matt Cutts, a frequent spokesperson on SEO issues, conceptualizes these 200-plus into two general classes [16]:

(1) Trust—of which PageRank is only the most well-known component—an assessment of a site's authority and reputation
(2) Relevance—an assessment of how well a site topically matches a particular query.

Google's, and other search engines', emphases on popularity, authority, and reputation have raised alarm at least as far back as Introna and Nissenbaum's much-cited critique of search engine rankings' inherent, undemocratic "political" biases [17]. Introna and Nissenbaum, as well as others (e.g., [18]), argued that search engines systematically promoted some sites, such as those already popular or benefiting from SEO tactics, and effectively denied or restricted public access to the vast proletariat of the web's sites by ranking them poorly or indexing them only partially or not at all. For instance, a 2008 study, drawing on a dataset of a search engine's top 100,000 queries, found that Wikipedia was listed in Google's first SERP for more than one-third of such queries, placing first for almost one-sixth of such queries [12]. More recently, two 2012 studies found that Wikipedia's dominance had increased to the point where it ranked first in approximately half of Google and Bing searches [19], [20]. Such "rich-get-richer" predispositions accentuate the challenge faced by webmasters and SEO practitioners trying to attract attention to new or less popular sites. On the other hand, some researchers have argued that search engines promote a more democratic, "egalitarian" access to a wider range of sites [21], at least in certain fields [22].

Though Google's rankings and those of other major search engines are automated, they are not necessarily consistent. For instance, entering the same query into Google from different web browsers (e.g., Internet Explorer, Firefox, Chrome, Safari, etc.) can produce different SERP rankings, as Google monitors the "sociological" patterns of each browser's community of users. Entering the same query at different locations can produce different SERP rankings, as Google maintains different data centers throughout the world, not always fully synchronized with each other [23], [24].

Entering the same query at different times, even minutes apart, can produce different SERP rankings, as Google tweaks its algorithm as many as 500 or more times per year [25], [26]. The SEO software company and community hub SEOmoz has cataloged more than 50 major changes over the past dozen years, many of enough consequence to have been dubbed with a nickname from Google itself or, more commonly, from the SEO community [26].

Also, different search queries are thought to trigger somewhat different Google ranking algorithms [27]. According to the SEOmoz survey of SEO industry professionals introduced before, these algorithmic differences lead to Google SERPs that are thought to sometimes favor recently updated webpages, or a greater diversity of webpages, or well-established "brand" websites. The same survey question revealed that Google is widely thought to apply specific ranking factors to queries within specific topical categories, such as travel, e-commerce, real estate, and so forth [7]. Hence, though this tutorial will follow convention and refer to Google's algorithm in the singular, it may be more accurate to conceive of its algorithms in the plural.

Webmasters and SEO Practitioners: Complicating the efforts of search engines to serve what searchers are looking for is the work of webmasters—not all of whom have the motivation, time, communication skills, or technical skills to optimally communicate their web content to search engines—and of wily SEO practitioners, who are well motivated to devote their time, communication, and technical skills to achieving rankings higher than their site content might otherwise merit. Perhaps revealingly, SERP rankings for commercially oriented queries—the kind of queries for which companies would hire SEO specialists—have been found to be more volatile over time than rankings for queries without a direct commercial intent [28].

In the intense competition to achieve higher rankings, some SEO practitioners resort to black hat techniques conceived to game search engines' algorithms. Among the many such techniques are **keyword stuffing**, in which excessive keywords are inserted within the coding or cloaked behind the content of a webpage; and **link farming**, in which sites filled with outbound links are posted for the purpose of making the destinations of those links appear popular to search engines [29]. Such tactics have led search engine companies to publish guidelines listing do's and don't's that specify what they deem to be ethical SEO practices,

and to penalize websites that violate the guidelines with lower rankings or exclusion from the search engine's index (e.g., [30]). Also, search engines have frequently changed their ranking algorithms, as mentioned before, in their ongoing whack-a-mole attempts to overcome black hat techniques.

Search Engine Users: Finally, web users' search engine preferences and behaviors, in turn, influence web marketers' SEO strategies and search engines' rankings. For years, Web users have been favoring Google by wide margins over such competitors as Yahoo and, more recently, Bing [31]–[33]. As well, as a result of a 2009 agreement between Yahoo and Microsoft, Yahoo's search results are now served by Bing's algorithm. Accordingly, SEO industry professionals, following their users, optimize their sites primarily for Google's algorithm and secondarily for Microsoft's Bing and others, and so this tutorial frequently focuses on optimizing for Google, though the SEO lessons detailed below also apply in varying degrees to most other general web search engines.

In a 2012 survey by the Pew Internet and American Life Project, majorities of searchers reported that they trusted search engines as a "fair and unbiased source of information" and that, in their experience, search engine results had been "getting more relevant and useful over time" [33, pp. 10–11]. Also, majorities reported that they were confident in their search abilities and that they found what they were looking for most or all of the time, though a large minority also reported that they felt overwhelmed by the volume of search results [33]. In line with such attitudes, many studies have observed that searchers tend to limit themselves to the first SERP [34], [35], and often to just the top-ranked results on that SERP [36], even when the order of those results has been experimentally reversed from top to bottom [37], [38]. Accordingly, SEO industry professionals are driven to earn not just a good ranking but a top ranking.

Google acknowledges in its new privacy policy that it tracks the history of individual users of its various services, including its search engine, so that it can serve up a more targeted experience to each user [39], though a majority of respondents to the Pew Internet Project survey introduced before objected to such tracking of their search engine queries [33].

Searchers' behavior patterns are thought to influence not just their own search results but those of everyone else. According to the SEOmoz survey of SEO industry professionals introduced

before [7], among the collective user behaviors thought to be among the more influential in Google's ranking algorithm are the following:

- The "**click-through rate**" (CTR) from Google to a webpage—that is, for a given search query, the percentage of times searchers click on the link to a particular webpage listed in Google's SERP. A high CTR indicates to Google that searchers entering that query judge that webpage to appear highly relevant, and accordingly Google's algorithm is thought to weigh that in its favor in future searches.
- The "**bounce rate**" from the webpage back to Google—that is, for a given search query, the percentage of searchers who return from a "clicked-through" webpage back to Google's SERP to try some other webpage. A webpage's bounce rate has the reverse effect of its CTR: a high bounce rate indicates to Google that searchers entering that query are disappointed with that webpage and, accordingly, Google's algorithm is thought to weigh that against it in future such searches.

Other survey responses indicated that such measures of user behavior for one query and one webpage are somewhat contagious across rankings for a site's other queries and other pages. When asked in yet another survey question whether the collective weight of these user behaviors in Google's algorithm would decrease, stay the same, or increase over the subsequent twelve months, almost 70% of the respondents predicted that it would increase [7]. If these assumptions are valid, webmasters and SEO practitioners have an additional reason to ensure that the brief bits about their sites that are featured on SERPs are not only inviting but also accurate in order to encourage a higher CTR while discouraging a correspondingly higher bounce rate—the focus of lesson 2 in the next section.

KEY LESSONS

The interests and interplay of these three classes of participants have led to search engine ranking algorithms that remain relatively unpredictable. To optimally ensure that their audiences can nevertheless find their web content, web developers can guide themselves with heuristics as they compose and maintain their web content and engage with other web content creators. These heuristics are detailed in three key lessons, in

which web developers will learn why and how they should:

(1) consider the web content's audiences and website's competitors when analyzing keywords;
(2) insert keywords into web text that will appear on SERPs;
(3) involve the web content and website with other web content creators.

In two additional lessons in this paper's online appendices, web developers will also learn why and how they should, in Appendix A, optimize website content and structure for both human and search engine audiences and, in Appendix B, emphasize keywords in key spots on webpages.

Consider the Web Content's Audiences and Website's Competitors when Analyzing Keywords Before optimizing web content or a website, web developers should first analyze the keywords—the search engine queries—for which the site will be optimized. In this lesson, web developers will learn why and how they should

- analyze keywords that their target audience will use
- target long-tail keywords that are competitive.

Analyze Keywords That the Target Audience Will Use: Within the fields that technical communicators serve, keywords often emerge from the communities of subject matter experts who conduct a field's research, patent its innovations, and engineer its applications. However, a website's targeted audiences may well use different search queries than the specialists responsible for the content and site would themselves use. One study found that without even clicking on any of the search returns, searchers revised their query more than half the time [38], suggesting that searchers may struggle through an iterative process to formulate an optimal query. In particular, among a website's targeted audiences, it may be those least knowledgeable about the site, its content, or the organization behind it who would turn to search engines. Accordingly, whereas the name of the site or the organization, its trademarks, or the specialized lingo used by the subject matter experts or other insiders who contribute to the site ought to be considered as potential candidates for keywords, they may not be the sole or best candidates.

The best keyword candidates are, of course, distinct to each organization and each website.

But good candidates commonly recommended by SEO practitioners include, for instance, words and phrases naming the problems or needs that the organization or site resolves [6], and terms identifying the organization's off-web location [5], [6]. A survey of US consumers found that, in searches for local businesses, few said that they enter a query based on the business name, presumably because it is their lack of familiarity with the business that is prompting their search [40]. By contrast, at least half said they enter a query that describes the kind of service they seek, and almost half also enter a geographical term to localize their search. Similarly, a study of search queries related to travel accommodation found that the destination city was included in almost half the search queries, and the state or country were each included in more than a tenth of the queries [41]. By contrast, even though many travelers are no doubt concerned about the cost of their accommodations, price-related terms figured in fewer than 1% of the queries. Such a contrast suggests that web searchers might be adopting a terse search query genre that does not necessarily describe what they are seeking in the same way they might describe it when, say, speaking with an industry specialist like a travel agent.

What query might nonspecialist audiences enter when searching for general information about the field of technical communication, for instance? Among specialists within technical communication's research, academic, and professional communities, the term *technical writing* is generally recognized as having been supplanted by the term *technical communication*, a more contemporary and more accurate representation of the field's diversity, but that should not necessarily imply that the latter term is the better keyword for a site about technical communication to target. A recent search in Google Trends [42], a tool showing the relative popularity of a query over time or in contrast with another query, revealed that *technical writing* is still more commonly used than *technical communication*, though the popularity gap between the two is closing. (See Fig. 1.)

A useful tool for discovering other potential keywords is Google's Keyword Tool, which returns not only the estimated search volume of a keyword but also hundreds of related keywords and phrases, in particular marketable ones [44]. For instance, a search on the keywords *technical writing* and *technical communication* listed, among the hundreds of related keywords and phrases, several
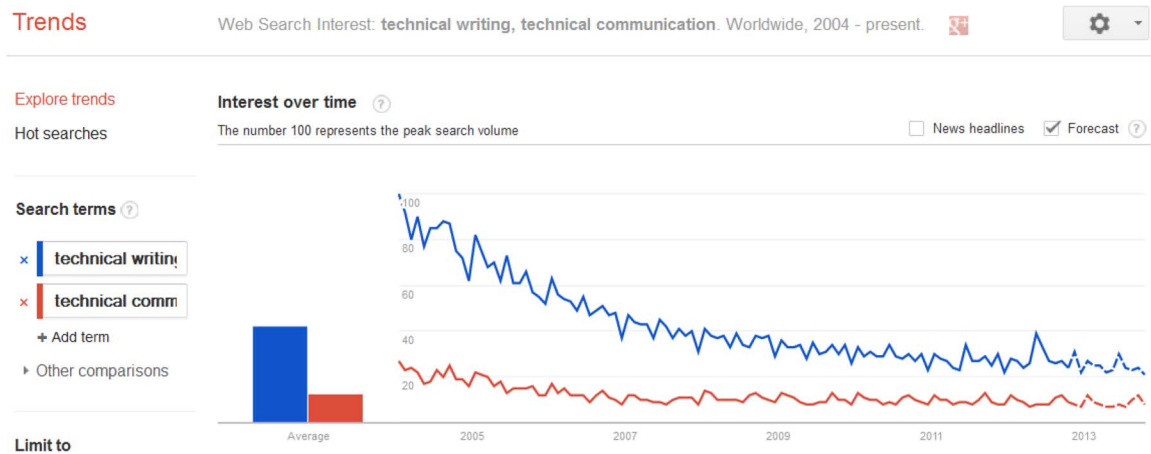
Fig. 1.   Google Trends results comparing the relative search volume of the queries *technical writing* and *technical communication*. According to Google, the graph shows an approximation based on only a sample of data [43].

phrases related to education, like *technical writing courses.* (See Fig. 2.)

Along with researching the keywords that their own site's targeted audience would use in a query, web developers are recommended to research the keywords that their competitors are targeting by examining their webpage titles and text [6], [45]. For instance, an examination of the websites of journals that share overlapping interests with IEEE's TRANSACTIONS ON PROFESSIONAL COMMUNICATION (IEEE TPC) will turn up some that feature the keyword "technical" in both their names and throughout their websites; that keyword is not featured prominently on IEEE TPC's own webpages. Not surprisingly, whereas IEEE TPC's website typically ranks among the top for Google queries based on parts of its title, such as "professional communication journal," it remains buried in obscurity for near synonymous queries like "technical communication journal." In general, examining competitors' sites enables web developers to discover search queries that might be relevant to their own sites, to find search niches in which competition might not be so intense, and to discover strategies for phrasing their own sites' text.

Target Long-Tail Keywords That are Competitive: SEO professionals generally distinguish between "**head**" and "**tail**" keywords: the former are more generic and typically just one or two words long (e.g., *writer* or *technical writer*), whereas the latter are often subcategories of the former and typically three or more words long (e.g., *Silicon Valley technical writer*). The *head* and *tail* nomenclature was inspired by statistical graphs plotting a line starting at a peak (the head) and tapering off as it moves farther away (the tail). The popular "long

tail" metaphor was first proposed by Anderson, who argued that, especially with digital media, companies can cost-effectively market not just their most popular products and services (the head) but also the many lower-volume niche products and services (the long tail) [46], [47]. As an example, he described Google's search advertising model, in which marketers can effectively target the small numbers of searchers who enter various tail queries [47].

A meta-review of previous studies of queries logged with search engines listed average query lengths ranging between 1.6 and 3.3 terms [34], with queries of 1, 2, or 3 terms in length being the most common [35], [48]; many of these are likely head terms. However, because head terms attract so much competition, SEO professionals generally recommend that most sites, especially new sites, target some tail keywords and phrases (e.g., [4]–[6], [49]), where competition is less intense and fulfilling matches with users' specialized interests are more likely. More specifically, they recommend that a site's homepage target the most popular head keyword for which the site might be competitive, whereas the site's more specialized pages each target a related tail keyword. It is generally advised that each webpage target no more than a few keywords or phrases (e.g., [4]–[6], [50]).

For instance, consider a hypothetical site offering various handy resources for technical communicators, such as trial versions of the field's software, reviews of such software, as well as relevant books, tutorials for using such software and for composing various technical communication genres, sample technical communication documents and document
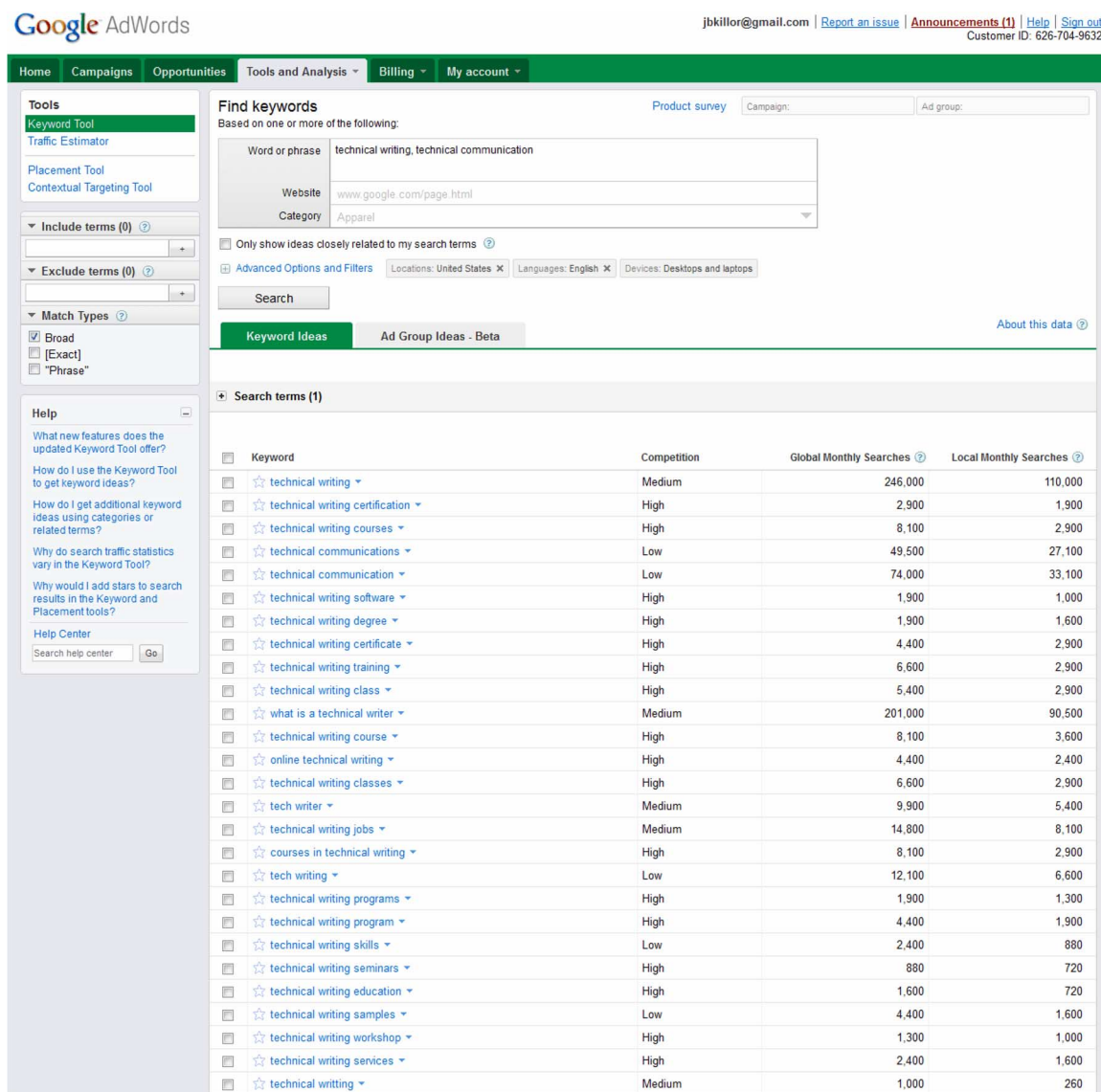
Fig. 2.   Excerpt of Google's Keyword Tool search results on the keywords *technical writing* and *technical communication*, showing a partial list of related keywords and phrases, bidding competition for each in Google Adwords, and the approximate monthly Google search volumes of each both globally and within the U.S. The full list included hundreds of related keywords and phrases.

templates, and so forth. Judging that the site would be particularly popular and competitive for its software downloads and reviews, its web developers might target for its homepage such head keywords as "technical communication software" and "technical communication reviews," whereas a specific tutorial page within the site might target the tail key phrases "how to usability test websites" and "website usability testing tutorial." The next lesson as well as the lesson in online Appendix B, available online at http://ieeexplore.ieee.org, detail how webpages can be optimized for particular keywords and phrases.

Insert Keywords into Web Text that Will Appear on SERPs   Terms from a user's search query are shown in bold type wherever they appear in SERP's listings of webpage titles, snippets of text, and URLs. Aside from acting as strong visual cues to users who let their eyes skim down the list of results [38], these three features are thought to be among a webpage's most influential keyword features in Google's algorithm. When asked to rank 21 possible characteristics of keywords on a webpage—such as their placement, encoding, formatting, repetition, and so forth—according to the weight that Google's algorithm allocates to such

characteristics, respondents to the SEOmoz survey introduced before ranked as first and second keywords placed anywhere in the title tag, and placed first in the title tag. Also ranking near the top were keywords within the page's URL string [7]. In this lesson, web developers will learn in greater detail why and how they should:

- name web domains, directories, and files based on keywords
- prioritize keywords in webpage titles.

As for the snippets, search engines typically excerpt these from text within the webpage; lessons for composing webpage text for SEO purposes are presented in online Appendix B.

Name Web Domains, Directories, and Files Based on Keywords: The first tasks in creating a site include securing a domain name (web address) and creating (and, hence, naming) files. In the SEOmoz survey mentioned before, SEO industry professionals asked to apportion the weight that Google's algorithm accords among various clusters of SEO factors allocated approximately 11% of the weight just to keywords in a site's domain name. However, when asked in another question whether that allocation of weight would decrease, stay the same, or increase over the subsequent 12 months, a majority of respondents predicted that it would decrease [7]. Similarly, others have long suspected a decreasing allocation in a domain name's weight [4].

When choosing a domain name, SEO practitioners generally recommend choosing a name based either on an existing keyword or phrase or a new brandable name that, in either case, the site will be optimized for (e.g., [4]). Common keywords and phrases have long since been claimed, leading webmasters developing new sites to choose domain names based on newly invented brand names or longer key phrases, sometimes rendered readable by hyphens. However, SEO practitioners recommend minimizing the length of a domain name because future audiences would have to type the long URL string to visit or to create inbound links [5]. They also recommend minimizing hyphens in the domain name as these have been a feature common among the multiple domains created by spammers and could raise the suspicions of both prospective audiences and search engines [4], [5].

In a URL string, after the domain name comes the names of directories and, finally, a file name, and these too provide opportunities for keywords.

Both Google and Bing encourage webmasters to incorporate keywords into their URL strings, and Microsoft has confirmed that such a tactic can improve a page's Bing ranking [50]. For file names based on two or more words, Google encourages webmasters to insert hyphens, but not underscores, to separate words (e.g., "technical-writing.html"), explaining that it finds the resulting file names easier to read than nonhyphenated, fused key phrases [51].

Google recommends against using generic file names ("page1.html"), repeating keywords ("seo-seo-seo.html"), and relying on computer-generated alphanumeric codes, parameters, and session IDs that are meaningless to search engines and offputting to searchers and web developers creating inbound links [52]. Because SEO techniques contribute to a page's ranking cumulatively, it is generally recommended that each file be named using the same keyword that is used in the page's optimized title (see next subsection) [4], thereby reinforcing that page's relevance for that particular keyword.

Prioritize Keywords in Webpage Titles: Among the page elements extracted on SERPs, perhaps the most important for human users is the page title. In one study, student collaborators evaluating sites listed on SERPs were found to rely largely on the titles, even though the SERPs, of course, also featured snippets, URLs, and direct links to the sites they were ostensibly evaluating [53]. Aside from being hyperlinked in SERPs—thereby drawing the focus of users as they navigate—titles also appear at the tops of the browser windows or tabs and in bookmark lists when the pages are bookmarked. Titles should not be confused with headings that appear in the browsers' main windows (headings are discussed in online Appendix B) as titles are encoded within an HTML file's "head" section, not the "body" section that is made visible to web browsers.

In general, web developers are advised to title their pages with keywords referring specifically to the page content rather than with generic words [6], [54], avoiding, in particular, such generic words as "home" (whose homepage?), "products and services" (which products and services?), and so forth. SEO practitioners generally recommend that each page title focus on the keywords or phrase that page is targeting (e.g., [6]). In the case of the organization's name, which would presumably apply indiscriminately to all of a site's pages, Grappone and Couzin recommended including it to

distinguish a SERP listing from its competition [6], whereas Rognerud recommended omitting it if that name does not reinforce the keywords and phrases that the organization's pages are targeting [5]. In a study of the business websites of companies and individuals offering technical communication services, Killoran reported that a very large majority of his sample's homepage titles included the name of the company or individual, which he observed did not always appear to be good candidates for queries about technical communication services [55]. Similarly, other common but unlikely search candidates in his sample's homepage titles were *home*, *welcome*, and what are known as "stop words," words like *the* and *and* which search engines typically disregard.

If slipping a keyword into a title can boost a page's ranking for the matching query, then web developers might reason that repeating the keyword might boost rankings even more. In a study involving several search engines including Google, Zhang and Dimitroff achieved increasingly better SERP rankings with each successive repetition of a keyword in a title, but with the keyword's fourth mention, rankings declined sharply to below the level with no repetition at all [56]. It is possible that at that fourth mention, search engines imposed a penalty; Google explicitly warns that multiple appearances of the same keyword or phrase, including slight variants (e.g., "technical writer, technical writers, tech writers"), can look like spam to its algorithm [54].

If just one mention of a keyword in a title boosts a page's ranking for the matching query, then web developers might reason that packing titles with many different keywords might boost a page's ranking for the many matching queries. On SERPs, however, titles get truncated after approximately 64 characters and spaces, with an even more severe truncation in browser tabs and bookmarks lists, leaving the ends of long titles ordinarily invisible to their human audiences. Some SEO practitioners claim that search engines do not even bother indexing the excess portion of long titles that would never appear on their SERPs anyways [5], [57]. In contrast, many practitioners believe that search engines' algorithms prioritize a title's opening word [7], [57].

Research touching on the issue has not isolated the independent variable of title length and, hence, remains inconclusive. For instance, in the study introduced before concerning the business websites of companies and individuals offering

technical communication services, Killoran found that principals of these businesses reporting more success attracting prospective clients through search engines had sites with significantly longer homepage titles than their less successful peers, though such an association would not imply causality [55]. On the other hand, in an SEO action research project, Malaga described how a title with 104 characters and spaces, oriented more to users who had already found the site, was chopped to include only the key phrase that the e-commerce site was optimizing for, with just 25 characters and spaces. This change, along with a few other changes in the site text, led to a sharp jump in SERP rankings for searches on that key phrase [45].

Google recommends short titles [54], as do some SEO industry professionals (e.g., [57]), which can reinforce a page's focus on just the one or two keywords for which that page is optimized. Indeed, Google says that it displays on its SERPs an alternative title if a page's title is absent, uninformative, hard to read, or unnecessarily long [58].

If a concise, apt, keyword-rich title boosts a page's ranking for the matching query, then web developers might reason that repeating the same boilerplate title across their site's various pages might boost the whole site's ranking for that query. However, it is generally recommended that each page feature a unique title focused just on that page's content [6], with Microsoft explicitly indicating that doing so would improve a webpage's Bing ranking [50]. Repeating a title across many pages is viewed as a spamming technique and may result in a search engine penalty [4]. When repetition is necessary, such as repeating the site name for branding purposes, Google recommends that the repetitive portion of the titles remain concise and be distinguished from the distinct portion of each page's title with punctuation, such as a colon or hyphen [54].

Involve the Web Content and Website with Other Web Content Creators Since the advent of Google's PageRank, the general trend in search algorithms has been to progressively decrease the influence of a page's or site's intrinsic features, which are easiest for webmasters to manipulate, and correspondingly increase the influence of extrinsic factors, most notably inbound links from other websites. In one question in the SEOmoz survey introduced above, SEO industry professionals asked to apportion the weight that Google's algorithm accords among various

clusters of SEO factors allocated approximately half the weight to various extrinsic factors related to inbound links, including various features of inbound links directly to a webpage, of inbound links to the site that hosts that webpage, and of social media signals pointing to the webpage or to the entire site [7]. Put another way, all of the lessons discussed before and in the accompanying online appendices about what webmasters can do to their own sites, plus other onsite SEO tactics that are not explored in this tutorial, plus surfer behaviors that have been briefly discussed before, are estimated to contribute only about half of the weight in Google's ranking algorithm, whereas the other half derives from what happens on other sites, typically beyond a webmaster's direct control. That other half is the focus of this lesson, in which web developers will learn why and how they should:

- earn inbound links from other websites
- develop a community following in social media.

Earn Inbound Links From Other Websites: An association between the quantity of inbound links and various measures of search engine success has been observed in a number of studies [7], [21], [23], [55], [59]. However, both Google and Microsoft emphasize the quality of inbound links over their sheer quantity, specifically the authority of the linking sources and the topical relevance of the linked sites to each other (e.g., [50], [60], [61]).

To attract such inbound links, both Google and Bing encourage webmasters foremost to draw on their expertise to create high-quality, useful content that will induce others to link to it [52], [62]. As examples, Google suggests [52], [62], [63]:

- providing a useful product or service
- posting new, insightful, entertaining information
- maintaining a blog with regular, original, interesting posts
- engaging the community of related websites and web 2.0 social media sites that might, in turn, elicit back links or other connections.

Along with similar suggestions, Microsoft suggests [50], [60], [61]:

- offering to guest post an article or blog entry on someone else's site in exchange for a link back to one's own site
- joining relevant associations that post links to their members' sites, or approaching business partners about posting a hyperlinked notice about the partnership

- participating in online forums related to the site's field
- engaging the media by issuing online press releases or pitching a story to a reporter
- informing leading and active figures in the field about the site and its content in hopes of earning their attention.

Any of these approaches could indirectly induce inbound links and boost search rankings, though not necessarily immediately, for aside from inbound links' quantity and especially quality, their age is also thought to be relevant [27].

Both search engines warn webmasters against soliciting inbound links for the purpose of quickly and artificially boosting their own PageRank score or search ranking [52], [60]–[62], such as by:

- purchasing links from sites with a higher PageRank, which these sites sometimes sell for monthly intervals but which attract the suspicion of search engines when the links turn over every month
- arranging for links supplied by link farms, which exist mainly to supply hundreds or thousands of links—sudden surges in inbound links trigger the suspicion of search engines
- indiscriminately exchanging mutual links among other sites, especially those not thematically relevant to their own site.

Search engines will penalize such activities by downgrading a site's rankings or even excluding it from their index [61]. Whereas links included in comments posted to discussion forums, blogs, and so forth are usually not harmful, they are not particularly helpful either. In part to discourage spam, such forums tend to encode a *no-follow* attribute indicating to search engines not to factor in such links.

Since spammers can easily generate many inbound links from such low-quality sources, especially link farms, SEO practitioners tend to reaffirm the advice of search engine companies about quality over quantity [4], [6]. For instance, Grappone and Couzin [6] recommended seeking out quality inbound links from sites of organizations and individuals with which one already shares some relationship, such as sites of one's:

- clients, customers, and fans
- service providers, vendors, and partners
- business and professional associations and accrediting organizations.

Jones [4] recommended seeking out quality inbound links from:

- sites that themselves are recipients of many inbound links relevant to their content, as such links are a sign to search engines that they are authoritative sites in their field
- sites with older domains, to which Google grants more credibility [64]
- sites with .edu and .gov top-level domains, which search engines assume would link only to other high-quality sites
- sites with PageRank scores or Alexa rankings (see online Appendix C for further details, shown at http://ieeexplore.ieee.org) as high or higher than those for one's own site
- sites that already rank well for one's targeted keywords.

In a study of websites created for an SEO competition, Evans [23] observed that some SEO competitors had gone through the trouble of registering their sites with the DMoz Open Directory Project [65] and Yahoo directory [66]. Both are moderated and the Open Directory Project is considered of such high quality that, for their snippets, both Google and Bing sometimes use its annotations [50], [54]. But apart from these two, both Google and Bing caution about relying on the web's many low-quality directories as sources for inbound links, especially directories that are not thematically relevant, not moderated, or poorly structured, saying that they would add no value to the destination site's visibility [60], [62].

Killoran cataloged several ways that companies, consultants, and independent contractors offering technical communication services generated links to their business websites, including securing inbound links from professional communication organizations and general business organizations with which they were affiliated [55]. As well, some used their specialized technical communication knowledge and skills to induce links, such as by:

- creating informative technical communication content for their own sites that would tempt others, such as the EServer Technical Communication Library, to link back to theirs
- constructing websites for other organizations and including a webmaster's link back to their own
- posting their writing, such as articles and wiki contributions, on other sites, accompanied by a back link
- being quoted as an expert in someone else's writing.

Develop a Community Following in Social Media: In recent years, **social media optimization** (SMO) has emerged as an increasingly important means of attracting not just human visitors but also search engine rankings. The concept of SMO was apparently originally proposed in 2006 by marketer Rohit Bhargava, who described SMO strategy as

> optimiz[ing] a site so that it is more easily linked to, more highly visible in social media searches on custom search engines … , and more frequently included in relevant posts on blogs, podcasts and vlogs. [67]

In 2010, he re-styled SMO as marketing by disseminating sharable content in social media to elicit others to engage and participate [68]. Bhargava originally recommended five SMO practices, which he updated in 2010 [67], [68]:

(1) frequently posting useful new content that would invite not only inbound links from traditional websites but also sharing throughout the audience's social networks through "likes" and tweets
(2) rewarding inbound links, comments, discussion, sharing of content, and other forms of engagement, such as by listing recently linking sources in a blog scroll
(3) adding one-button functionality to readily enable content to be relevantly tagged, bookmarked, embedded, tweeted, and so forth in social media
(4) proactively posting content to social media sites, such as documents on Scribd, slides on Slideshare, videos on YouTube, and offering embeddable versions of such content, and finally publicizing the content such as by tweeting, with a long-term goal of inducing links back to one's own site
(5) facilitating "mashups," content that is open for others to adapt, modify, and recombine with other content, such as by syndicating one's content with RSS feeds.

In a study of websites created for a 2006 SEO competition, Evans observed that high-ranking sites were more likely to have been bookmarked with the social bookmarking site Del.icio.us (now Delicious) than their lower-ranked competitors, though he was cautious in attributing the association to Google's algorithm, pointing instead to the assumptions of the SEO competitors themselves as a possible alternative explanation [23]. At the time that study was conducted, social media sites were just emerging, and some now-popular services, such

as Twitter, had yet to be launched. In a couple of case studies conducted in 2007, Malaga relied just on RSS feeds and social bookmarks to publicize two sets of small, similar sites he created in just a matter of hours on Web 2.0 hosts (a wiki, a blog, and two webpages). In one of these case studies, he was able to attain relatively high rankings with an e-commerce search query; the other case study, targeting a more competitive e-commerce search query, produced much less impressive results [69].

Because of the fast-growing popularity of social media, search engines are now thought to be increasingly factoring in social media "signals," such as links and even the more ephemeral "buzz," into their rankings. When asked whether the weight that Google's algorithm allocates to social signals directed to a webpage, such as inbound links from tweets and from Facebook, would decrease, stay the same, or increase over the subsequent 12 months, 90% of SEO industry professionals responding to the 2011 SEOmoz survey introduced before predicted that the algorithmic weight would increase [7]. Survey respondents ranked the authority of tweeters linking to a webpage and the quantity of such tweets as the social media signals thought to carry the most weight in Google's algorithm. Ranking behind Twitter was Facebook, for a comparable set of signals. A 2010 survey of more than 10,000 SEO industry practitioners found that more than 70% used social media as part of their SEO efforts [70]. Among the social media most frequently used for marketing purposes, majorities of respondents chose Facebook and Twitter, and large minorities chose YouTube and LinkedIn.

Google's Matt Cutts confirmed in 2010 that Google uses some social media signals, explicitly mentioning Twitter and Facebook links as well as the reputation of the linking authors [71]. Also in 2010, influential search engine guru Danny Sullivan published both Google's and Bing's confirmations that their algorithms factor in links in tweets as well as the author's authority, based on such factors as how many people follow them [72]. Both also affirmed that they factor in Facebook links but could not access Facebook's private areas to determine authority based on such potential factors as friends and wall data.

Duane Forrester, who manages Bing's Webmaster blog and discussion forums, projected that social signals would play an increasing role in search rankings. He mentioned easy-to-tally "crowd-sourced" data such as "likes" and tweets and offered the example of a new content posting

that, in the interlude before accumulating static links from traditional websites, could earn a quick boost in rankings from the endorsements of the more responsive social media. However, he also underscored that web content creators must invest the time to develop a social following that, in turn, would establish their authority in the eyes of social media participants and search engines [73].

IMPLICATIONS FOR PRACTICE

With this tutorial's three general lessons and various sublessons, as well as the lessons and sublessons in the online appendices, web developers have heuristics for how to optimize their web content and website. If applied diligently, these lessons ought to contribute positively to their pages' and site's search rankings, at least over the medium to long term it takes for a site to develop evidence of trust and authority.

To best plan and manage this medium-to-long-term commitment, SEO practitioners typically recommend implementing an SEO strategy in stages following the same general sequence as the three lessons presented in this tutorial, with the lessons in online appendices A and B applied at roughly the same stage as lesson 2 [4]–[6]. With minor exceptions, successful case studies documented in the literature also generally follow this sequence. For instance, in the successful action-research project mentioned before, Malaga implemented his set of SEO tactics in a sequence roughly comparable to the sequence of this tutorial's lessons, though unusually he reached out to other sites with a couple of easy-to-implement lesson 3-type tactics relatively early in the process, even before his project's site was itself optimized [45]. In a case study of the website of a research institute, Deoghuria, Sinha, and Sinha implemented an SEO strategy following a sequence of steps roughly comparable to this tutorial's sequence of lessons, though they relied heavily on tactics discussed in the online appendices and omitted lesson 3-type tactics. Nevertheless, they achieved a high degree of visibility for their site in Google and went on to recommend the kind of lesson 3 type of outreach tactics that they had omitted [74]. In a case study of the website of a museum, Espadas, Calero, and Piattini likewise implemented an SEO strategy following a sequence of steps roughly comparable to this tutorial's sequence of lessons, though they emphasized more analysis of the kind introduced in lesson 1. Their strategy led to increased site visibility in Google and increased site traffic [75].

Despite such successful cases, this tutorial's sequence of lessons ought not to be relied upon as a static strategy or a guarantee of high rankings. In the time since these case studies were conducted, the bar for successful SEO has continued to rise. As described in the opening sections of this tutorial, three classes of participants contribute, directly or indirectly, to search engine rankings. The dynamic interplay of search engines' ranking algorithms, SEO practices of one's competition, and web users' searching behaviors guarantees that search algorithms and a site's ensuing rankings will continue to evolve. As search engines' algorithms evolve, the relative importance and composition of these three SEO lessons and other SEO tactics will inevitably shift. For instance, the influence of on-page keywords (discussed in online Appendix B) has been decreasing over time, whereas the influence of inbound links (lesson 3) has been

increasing, and the fast growth of social media has been driving new ranking and optimization methods that did not exist at all a few years ago. In general, SEO algorithms have been evolving in a direction that grants more weight to offsite factors beyond web developers' direct control and into the hands of websites' audiences. Such a trend will increasingly challenge web developers to devote more time and resources to cultivating a following for their sites.

To ensure that their audiences can continue to easily find their work through search engines, web developers should expect to keep up to date with the evolving search algorithms, SEO practices, their website's traffic, and their competition. Along with some of the sources cited in this tutorial, web developers can keep up to date by regularly drawing on the dynamic SEO resources featured in an annotated list in online Appendix C.

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