

# EVALUATION OF SEARCH ENGINE OPTIMIZATION

## *Experiments for a Business Site and a New Evaluation Measure*

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Keywords: Search Engine Optimization, Internet Marketing.

Abstract: This paper reports experiments on search engine optimization (SEO) for a business site. Several search terms have been optimized for three web search engines. From the business site, 300 pages have been selected for optimization. In three phases several on- and off-page modifications have been carried out and the results have been monitored. The results show that search engines do react to modifications and that the target pages are ranked higher on average. The variance of the improvements is extremely large which means that there is no guarantee that SEO activities are beneficial for one single page. We suggest a new evaluation measure for the success of SEO which takes typical Web user behavior into account.

## 1 INTRODUCTION

Search Engine Optimization (SEO) is practical information retrieval from the perspective of the information provider. Web site authors and providers are interested in attracting many visitors mostly for economic reasons. They want that their pages are ranked at top positions in search engine results for relevant keywords. Relevance is defined from the perspective of the provider in this case. Usually, the user is considered as central for the definition of relevance in information science.

SEO has become a prosperous business branch for information professionals. Many companies have been established and many guide books have been published (e.g. Grappone and Couzin, 2006). There is much anecdotic evidence on the effects of SEO on single pages. However, surprisingly little reliable empirical research is available for the topic. We conducted an empirical study which showed the effects of several SEO activities. The analysis showed that new measures for analyzing the success and value of SEO activities are necessary.

Search engines are ambivalent toward SEO. On the one hand, they do not publish their algorithms which would make SEO a more transparent task. The search engines argue that such a step would lead to much spam in the search results. On the other hand, search engines companies give hints on potential optimisation potential. In such suggestion

lists, the search engines clearly distinguish between desired and undesired practices.

This makes SEO an information ethical issue. Search engines draw the borderline between tolerated and forbidden SEO activities. The regulations are not publicly discussed but simply proposed by the companies. The discovery of the violation of these regulations may lead to consequences. This can take the form of removal from the index or lead to lower ranking positions. Punishment in such a form is obviously problematic. They are not transparent, information providers are not properly notified and no appeal is possible. Much rather, the violator needs to rely on the mercy of the search engines.

Meanwhile, the internet is extremely important for finding information and for being found from the perspective of information providers. Search became a basic service. There are even calls for a public provision of search services (Maurer, 2007). From the perspective of SEO, it would be preferable to achieve a more democratic decision process for regulations than to simply accept the regulation of the search engine businesses.

## 2 EXPERIMENTAL SETUP

In an experiment, the effect of typical SEO services were analyzed systematically. As a target site, a e-commerce shop of a present vendor was selected

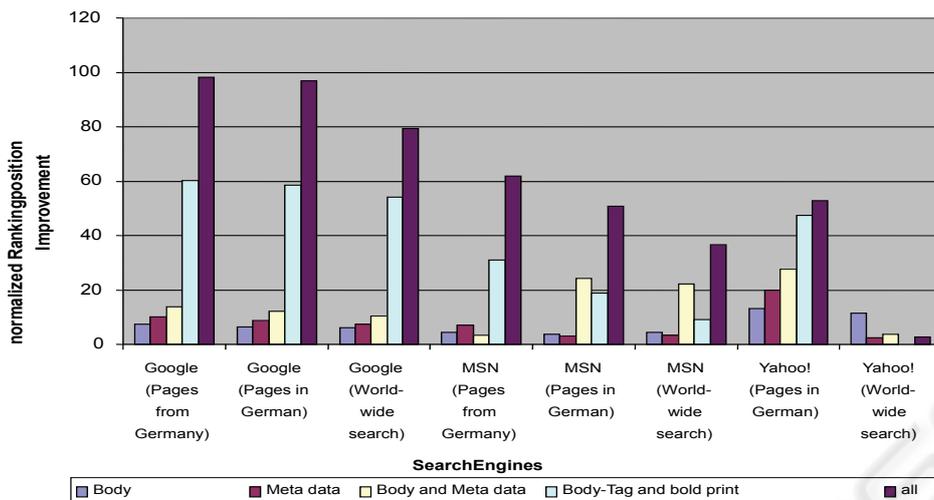


Figure 1: Results of phase 1: average precision.

(<http://www.yamando.net>). The presents are from many different areas which allows the optimization for many different keywords. Three search engines with a high market share in the target market were chosen for the optimization study: Google, MSN and Yahoo. Phrases of two and three keywords were identified as queries which should lead the user to the pages of the company. The ranking positions before and after the page modifications were obtained by the SEO tool WebCeo ([www.webceo.com](http://www.webceo.com)). The tool also determined the competition for a search term. The competition is later used for normalization It gives a measure for the competition of providers for a specific term or a phrase. The competition is measured as the number of web pages including the keyword and can be seen as an indicator of how many people want their content to be found under this keyword.

No practices considered as spam were applied during the study in order not to endanger the business site with removal from the search engine index.

The optimization experiments presented in this paper were carried out in three phases. The first two phases applied on page practices and the third phase applied the central off page practice link optimization (Fischer, 2006, Grappone and Couzin, 2006).

The first phase increased the keyword density to a level of up to 3% and the second up to 5%. Higher keyword densities are often considered as spam by the search engines.

The phases included the following modifications:

- Phase 1
  - Increasing the keyword density (frequency) of the terms or phrases to 2-3%
  - For 50 pages in the page body
  - For 50 pages in the Meta-Tags (Description and Title)
  - Using layout to emphasize the term (bold print) for another 50 pages
  - Using all above measures in one page for another 50 pages
- Phase 2
  - Increasing the keyword density (frequency) of the terms or phrases to some 5%
- Phase 3
  - Increasing the number of internal incoming links to the page by adding links between product pages

The results for the three phases are given in the following section.

### 3 RESULTS

The first phase led to large improvements for some pages. Figure 1 displays the normalized arithmetic average of all practices for all search engines. A considerable improvement in the ranking position of the target pages can be seen. The improvement reaches up to 100 positions on average when several measures are taken simultaneously.

The variance between pages is quite considerable as figure 2 shows.

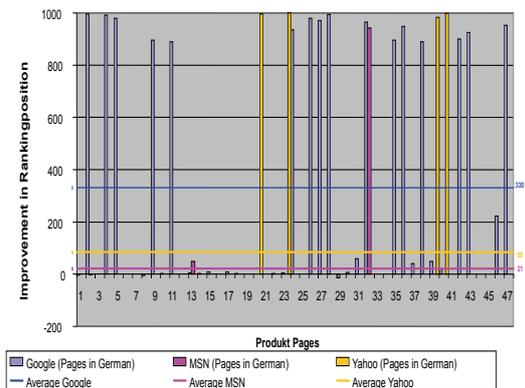


Figure 2: Results of phase 1: results for pages.

Phase two led to similar results. The large variance in the improvements between different pages can be observed again. Increasing the keyword density beyond 4% is still beneficial at least for Google.

Applying all measure in one page leads to a larger improvement than the sum of individual practices. The cumulative effect is shown in figure 3.

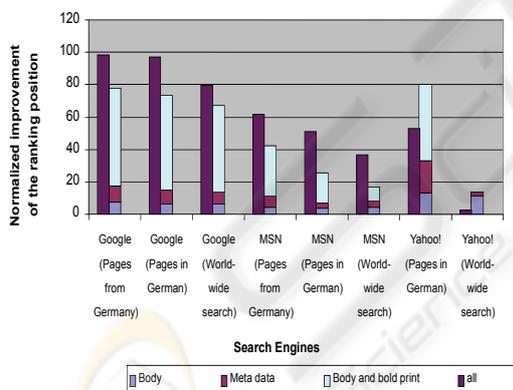


Figure 3: Cumulative effects compared to all practices.

Phase 3 also led to considerable improvement. For Google, there is an improvement in the average ranking position. The number of incoming links does not show a clear relation to the improvement for Google. For seven incoming links there is a considerable enhancement in the rankings. It seems that search engines still use the internal link information. Link based authority measures have been discussed as a means to judge the quality of Web pages and this information has been used in rankings (Baeza-Yates, 2006, Mandl, 2006).

However, because search engine providers do not publish their algorithms it is never clear to what extent they apply which factor to the ranking.

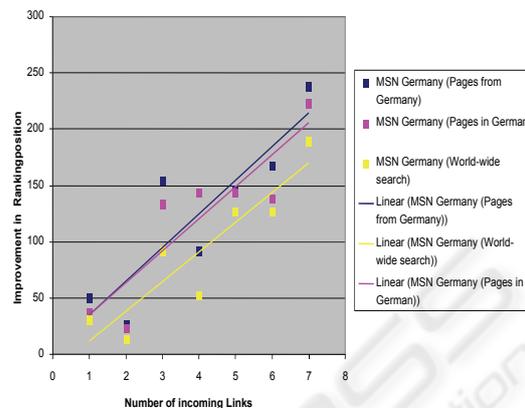


Figure 4: Results for phase three for MSN and Yahoo.

The other search engines exhibit a linear trend for the improvement. Figure 4 shows the improvements with trend lines. The more links point to a page, the better is the ranking. This is true at least for up to seven in-links.

It can be seen that especially Google reacts quickly and very sensitive to SEO activities. Links pointing to a page are beneficial for the ranking of pages even if they origin form the same site.

#### 4 NEW EVALUATION MEASURE

The users of search engines do not view very many results. A study of an Altavista Log found that 97.7% of all users only view the first page of results in the search engine

This finding has been confirmed in user tests (Cutrell & Guan, 2007). An improvement of 100 pages in the ranking is not of the same value for the information provider if the final position is five or 300. Consequently, the target position needs to be used as a factor in the evaluation of SEO. We developed a new measure for evaluating the success of SEO activities which takes this user behaviour into account.

In the formula for the new success measure,  $p_1$  and  $p_2$  are the position of the target page in the ranking before and after the application of SEO. The sign function merely extracts the sign of the difference. It assures that negative success values are obtained when the target page drops in the ranking. The success  $s$  is obtained b dampening the

difference in the ranking with a logarithm and dividing it by the resulting position.

$$s = \text{sign}(p_1 - p_2) \frac{\log_a(|p_2 - p_1| + 1)}{\min(p_1, p_2)}$$

The effect of this new measure is displayed in figure 5 for several target positions. We used  $e$  as the basis of the log. Ultimately, the user interest decay function should be based on empirical evidence on how many pages are typically viewed in the domain.

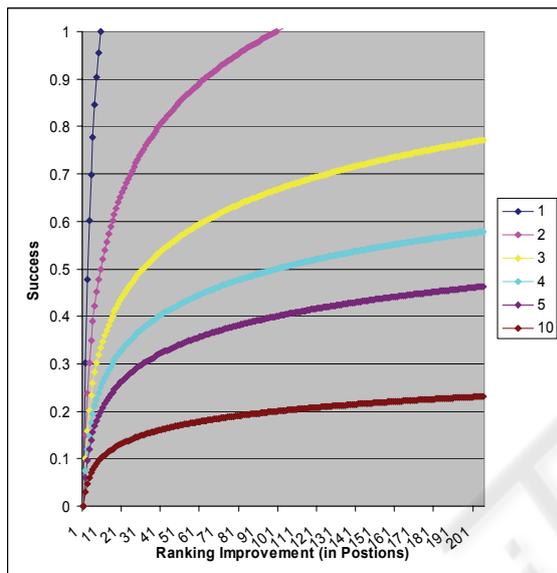


Figure 5: Effect of new measure for six target positions.

## 5 CONCLUSIONS

SEO provides effective ways to improve the ranking position of target pages in search engine result pages. So called on-page improvements like increasing the frequency of the keyword density improve the ranking with a large variance between pages. Increasing the keyword density even further up to 5% still is beneficial. The modification of the internal link structure can also greatly improve the ranking for pages which receive in-links. Obviously, the effect of activities needs to be monitored over a longer period of time.

The business success obtained is obviously the ultimate quality indicator for SEO activities. It can be measured by the sale or the traffic on a web site. However, it is difficult to measure and to separate effects from other advertisement or business decisions. Consequently, new means of evaluating the success of SEO needs to be discussed. Such

measure like the one presented here might be applied to estimate the value and costs of SEO services in the future.

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