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Research Paper Business Analytics

Adwords Optimization

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Preface

This research paper is written as part of the curriculum of the master program Business Analytics at the Free University of Amsterdam. The purpose of this paper is to focus on the business-oriented aspect of the program, in addition to mathematical and computing aspects. This paper is also a preparation for the final Master thesis. The aim of this research paper is to find out more about Google AdWords, focusing on optimizing the number of conversions for the lowest possible costs, by use of several methods and settings. I would like to thank my supervisor Ger Koole for his help and support throughout the whole process of researching and writing this paper.

Esther Weusthof
Amsterdam, Januari 2015

Introduction

If a person is selling products or services on the internet, Google AdWords can be a really helpful tool, when aiming for reaching a broader audience. While browsing the internet, one will soon find out that a lot of information is available about AdWords. It is not easy to start using AdWords.

This paper may help (potential) advertisers that want to start using AdWords. A lot of general information is provided in this paper, as well as explanation about some basic settings or options. Further, all different types of keywords are explained, as well how to deal with them efficiently. Also, three different roadmaps on checking your bidding method, organizing the account structure and organzing keywords will be presented.

When the (potential) advertiser gained enough knowledge about AdWords in general, one may start optimizing their AdWords account. Optimizing an AdWords account can be done in different ways, in this paper optimizing implies generating the highest number of conversions for the lowest cost. Generating a high number of conversions will be done on the basis of a mathematical model, presented and explained in this paper.

At last, some tools and techniques to further optimize an AdWords account will be presented.

Contents

1 Description of Google AdWords

1.1 What is Google Adwords?

Everyday more and more people are using the internet to shop for consumer goods or services they need. This new way of shopping offers advertisers a new way of advertising. An excellent way of advertising online is by using Google AdWords. AdWords offers the possibility to buy ads. These ads include short texts and a link. The ads appear on the page where Google shows all search results. The combinations of words users are typing in to find the product or services they are looking for are called "Search Terms". Depending on the search terms of the user certain ads may appear.
According to Google Search the definition of 'Google AdWords' is the following:

> "Google AdWords is the system Google has developed to assist you (the advertiser) in marketing your products or services in the Google Search Engine, and its affiliate sites, via the use of a placed text ad that appears when people search for phrases related to your offering, this appears as a "sponsored link".
> [1]

In contrast to other advertising methods the advertiser is only charged when a visitor clicks on their ad, not if it only appears. Advertisers also have the ability to decide the maximum they are willing to pay-per-click (PPC) on their ad. The position at which the ad will be shown, in the Google search results, depends on the price an advertiser is willing to pay and the "Quality Score". A high quality score means the system finds the ad and landing page relevant and useful for a visitor looking at this specfic ad. For more information about the quality score see section 2.2.

1.2 The goal of the advertiser

The main goal of an advertiser using Google AdWords is making their business grow, as well as to attract new potential customers. One wants to find the perfect balance between revenues and expenses. Different business goals can be set, for example creating brand awareness or generating more traffic to their website [2]. Also, a user wants to spend the least amount of money to generate the highest amount of revenue. To use the money invested in Google AdWords efficiently, a lot of strategies and methods exist, from which some depend on the specific goal of the user. This paper addresses different methods and strategies to optimize an AdWords account, but the focus will be on generating a the highest number of conversions for the lowest cost.

1.3 The ad

All ads shown on the results page have the same structure. The results page is defined as the listing of results returned by a search engine in response to a combination of search terms [3]. In this paper we take Google as the default search engine. An example of an ad is shown in figure 1.

An ad consist of four lines up to 130 characters. The first blue headline can show up to 25 characters. The URL appears in green, this shows the website one is promoting (maximum of 35 characters). Next, two description lines are shown, both lines can also show up to 35 characters.

Figure 1: An example of an ad.
source: http://www.google.nl/ Search terms : "scapino schoenen"

1.4 Basic AdWords terms

It is useful to know the most used defenitions in order to completely understand Google AdWords and the topics that will be discussed in this paper. The list below contains some relevant terms that will be explained [4].

- *Impression*: Impressions are defined as the number of times an ad is shown. An impression is counted when an ad is displayed on the results page of a visitor.

- *CTR (Click-Through-Rate)*: This ratio shows how often visitors seeing an ad, end up clicking it. It is expressed as an percentage.

  The formula: $ClickTroughRate = \frac{TotalClickOnAd}{Totalimpressions}$

- *Average CPC (Cost Per Click)*: The average price one is paying per click at an ad.

- *PCP (Price-per-click)*: The price the advertiser is paying when a click on the ad occured.

- *Cost*: The total amount of money the advertiser has spent on clicks.

- *Campaign*: A campaign is used to organize a specific group of products or services.

- *Ad group*: An ad group is a subsection of a campaign. It consists of keywords, ads, bids and landing pages.

2 The goal of this paper

In this paper we assume the goal of an advertiser is to get the highest possible number of conversions for the lowest cost. A conversion happens when someone clicks the ad of the advertiser and performs an action that is defined as valuable to the business of the advertiser. Examples of valuable actions are: an online purchase or a call to the business of the advertiser. [5] An advertiser can also have other goals, for example creating brand awareness, but other goals are out of the scope of this paper.

Getting a high number of conversions starts with getting a high amount of impressions. It is not enough just to have a high number of impressions, the ads also need to be shown to the right audience. Getting clicks from visitors who are likely to buy the service/product is something the advertiser wants (called 'relevant clicks'). Also, when the ad is shown to visitors searching for this specific product / service they are more likely to perform an action that is valuable to the business of the advertiser when visiting the website. This results in a higher number opf conversions. This process is shown as a funnel in figure 2.
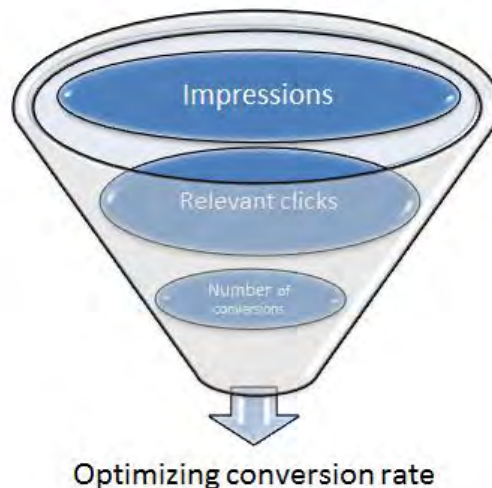
Figure 2: Process of maximizing number of conversions

In figure 3 it is shown how to use AdWords more effective, from this figure one can see that a high CTR (The ratio showing how often users seeing the ad end up clicking it) results in a higher quality score (for an explanation see section 2.2) which in turn results in a higher ranking on the results page as well as lower costs per click. A high CTR can be obtained by showing the ad to the right audience. A higher ranking on the results page, usually implies more attention from people searching on the internet. When the

quality score is getting higher the bid prices will decrease, and therefore the campaign will be more effective. Both these effects ensure a more efficient use of Adwords [6], [7].

Figure 3: Process of optimal Adwords use

2.1 The auction

Using Adwords is basically the same as participating in an auction. Advertisers place bids on words users might use as search terms. The words advertisers bid on are also called "Keywords". The amount of the bid influences the position of the ad and therefore the number of clicks it receives. AdWords has the possibility to set a maximum daily budget and when this budget is reached the advertiser stops participating in the auction.

2.2 The Quality Score

The quality score is determined by the relevance of the ad and the relevance of the keywords for the user. This score is used to determine the cost per click (CPC) one needs to pay for a specific keyword. The quality score, the maximum bid and the amount and the expected impact of extensions results in a score, called "Ad Rank". The quality score therefore influences in what position that ad will be shown at the results page [8].

Components of the quality score are:

- CTR (Click-Through-Rate)

- Relevance and the quality of the landing page

- Relevance of each keyword to its ad

- Relevance of the ad text
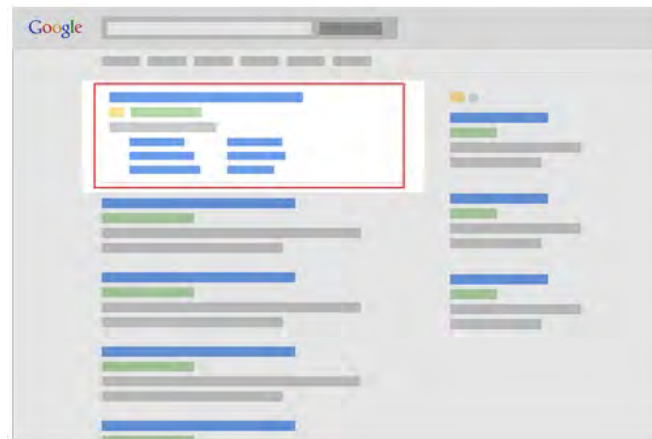
Figure 4: Caluculation of the Quality Score

Figure 5: Positions of the ads

- The historical performance of the specific Adwords account

Note: Google keeps the Quality Score algorithm of the "weights" of each component secret, although we know the click-through-rate is the most important factor. [9]

To be among the top ads the ad rank needs to meet a minimum threshold. In general, the minimum ad rank required to appear at the positions at the top of the search results is greater than the minimum ad rank to appear besides the search results. The place where "top position ads" occur is indicated by the red box in figure 5.

Ads positioned above the search results could have higher CPCs compared to the ads positioned besides the search results. Although, one may be paying more per click for "top ads", these ads bring several advantages with them. They usually have higher click-through rates and give advertisers access to certain ad extensions. Examples of such extensions are: app extensions, sitelinks and call extentions. There are more features only available for ads at the top positions, but that is beyond the scope of this paper. Up to three ads can be shown at the top of a search results page. One will never pay more than the max CPC bid set. "Top position ads" usually have the following properties [10]:

- High relevance: The text of the ad and landing page are relevant to the person seeing the ad

- Good performance over time: The ad generates clicks consistently

- Competitive bids: The ad is competitive with other advertisers bids and exceeds the top of page bid estimate (for more information about "first page bid estimate", see section 3.9)

3 Starting with AdWords

As stated earlier, the goal of AdWords is to get users to click on the ads of an advertiser and eventually buy their product/service or otherwise, perform an action that helps the advertiser, such as signing up for a service or receiving an email address or phone number. To get the desired results one can optimize their AdWords ads by improving the quality and performance of the ads. In this chapter some steps and schemes are provided to help advertisers with optimizing their Google AdWords accounts.

3.1 Check if Google Adwords is needed

Before one starts using Adwords to promote their service / product one should decide if it makes sense to use this 'tool' of Google. The following points should be taken into consideration [4]:

- **Check if people are making money in this market.** If no one is making money in this market it is a highly probable the market is not ready for Google AdWords yet.

- **Are customers willing to spent money?** If customers are not willing to spent money on your product / service, there is no point in offering it.

3.2 Structuring an AdWords Account

When starting Google AdWords a lot of trouble and money can be saved by organizing an account well [11]. What the structure of an well-organized Adwords account looks like is shown in figure 6. First one should create an account, which can be divided into different campaigns that in turn should be divided into different ad groups.

Suppose an advertiser has its own business. This person is selling books, CDs and offers tailored advice. It is probably convenient to have different campaigns for selling books, CDs and tailored advice. It might be clever to subdivide these campaigns into ad groups. Because different products, and therefore different ads, have different keywords that are working well for those specific ads. For example, one is selling study books as well as reading books. Keywords working for study books might not work for reading books. It is also likely that the ad for selling study books looks different than the one for selling regular reading books. So by using ad groups, the campaigns and therefore the account remains clear. A last advantage of working with ad groups and campaigns is the ease to manage the budget and bids as well to view the reports that are created or to make changes.

3.3 Writing good ad texts

An ad is qualified as good, when the right people are attracted to the website of the advertiser. In fact an ad has three goals:

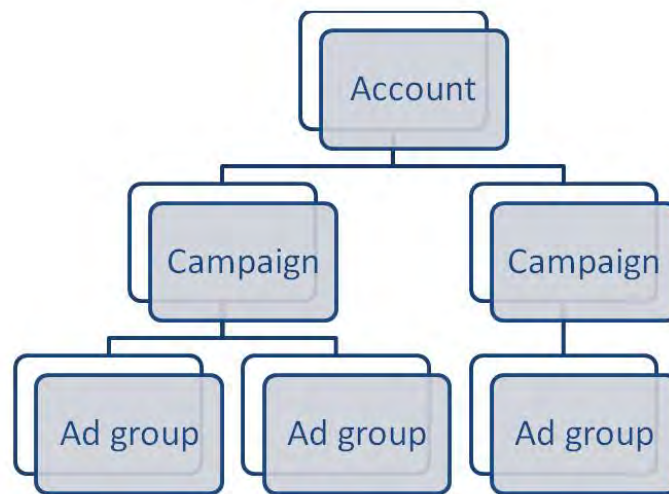- It wants to receive clicks from the right customers.

Figure 6: The structure of an AdWords Account

- It wants to discourage people who are unlikely to buy.

- It wants to meet the expectations of the customers. In other words, the website needs to show what the customer is expecting.

3.4 Creating new ads

After one creates a new AdWords account the first step is to fill in the text boxes to create an ad. In figure 7 those empty text boxes are shown. Below a list is shown, that can be used as a guide for filling in those boxes.

- Headline: Here comes the problem / opportunity

- First description line: Big benefits of the product or service one is offering

- Second description line: A short description of the product or service

- URL: The name of the website (Not the exact destination)

- Destination URL (also called the landing page): Here comes the destination a customer will vistit after clicking on the ad

Once logged in to the AdWords account, a lot of settings need to be finetuned in a campaign. One also has the ability to let the ad appear for selected locations and specific audiences. For example there is a setting, called "Audience", whereby one is able to choose locations, languages and visitors demographics. There is a wide range of options regarding the locations to advertise. Depending on the audience the advertiser wants to reach, the possibility exists to specify the locations where to advertise extremely precise.

Figure 7: The empty boxes that need to be filled to create a new ad

The same holds for languages and demographics. Another setting is called "Bidding and Budget", where the advertiser is able to set the maximum he/she is willing to pay for a click as well as the maximum amount per day. By setting this maximum the advertiser has control over the amount of money he/she is spending on a campaign.

The ads are not only shown in the Google Search results, an advertiser also has the possibility to let the ads appear on different places. A few examples of such places are: other search websites across the web, specific websites customers visit, mobile phones and devices. It depends on how one wants to target their ads, to whom one wants to let the ad appear and what type of ads one has created.When dealing with these settings, try to think like the customers. What do they like? Where do they live [12]? This paper won't elaborate on the different locations and specific types of audiences.

4   Keywords

4.1   Different types of keywords

There is a function called, "Keywords Match Types", which helps the advertiser with controlling who is seeing their ads. It also helps with using the budget of the advertiser more effectively. Keywords Match Types give the advertiser the ability to decide how close the search term of a visitor should match the keywords before the ads will be shown.
There are two types of keywords, positive keywords and negative keywords. The former are keywords that trigger the ad and the latter has the opposite function, to prevent the ad from showing. There are four distinct categories for the positive keywords.

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- Broad match: The type a keyword is by default. The ad is not only showing the search terms that exactly match the keywords but also the search terms that are closely related to the keywords. For example, synonyms, common misspellings, longer phrases that contain the keywords. Broad match is used to reach a broad range of potential customers.

- Broad match modifier: This option creates keywords that reach more potential customers than phrase match but ensure more control than broad match. It contains the modified search term (or with slight variations, but not synonyms). Order does not matter.

- Phrase match: With this option the advertiser can be a little bit more specific about who can see an ad. Phrase match is like broad match except that it does not include synonyms or search terms that contain in the middle of your keyword phrase.

- Exact match: This is the most selective option. A search term must match a keyword almost exactly.

An example of all different types is shown in figure 8. Using the right keywords matching option is an important way to ensure the advertiser is reaching the right audience, which leads to more sales.

Keyword	[Broad Matching]	[Broad match modifier]	[Phrase Matching]	[Exact Matching]
Men's pants	Men's pants	Men's pants	Men's pants	Men's pants
	Buy guys pants	~~Buy guys pants~~	~~Buy guys pants~~	~~Buy guys pants~~
	Mens trousers	~~Mens trousers~~	~~Mens trousers~~	~~Mens trousers~~
	Pants for boys	~~Pants for boys~~	~~Pants for boys~~	~~Pants for boys~~
	Mens pants	Mens pants	Mens pants	Mens pants
	Buy blue pants for men	Buy blue pants for men	~~Buy blue pants for men~~	~~Buy blue pants for men~~
	Men's sport pants	Men's sport pants	~~Men's sport pants~~	~~Men's sport pants~~
	Buy men's pants cheap	Buy men's pants cheap	Buy men's pants cheap	~~Buy men's pants cheap~~

Figure 8: Examples Keyword Matching

When an advertiser just started using Google AdWords the possibility exists that the advertiser does not generate enough traffic to start using exact matches. When selecting an appropriate match type for a keyword a good strategy is a "broad-to-narrow" strategy. Start with broad match keywords to maximize your potential to show the ads on relevant searches. Always monitor the performances of all keywords. When the adveriser discovers that a particular keyword is showing too often for too many irrelevant keywords he/she can decide to change the match type into a more specific one. [13] After a while, depending on the traffic the advertiser should review the search Term Report

in AdWords to discover which keyword variations triggered the ad. Below some tips on how to use the information from this report.

- In the column "Match type", have a look at how close the search terms that triggerd the ads are related to the keywords used. Noticing most variations in the search term report are irrevant to the product / service the advertiser is selling, he/she should consider a more specific match type option.

- Try adding new search terms, they are high potential keywords

- If some search terms are irrelevant to the products or services the advertiser is selling add those search terms as negative keywords

Broad matching has two effects: it helps discovering (and bidding) on useful, new broad matched keywords. The advertiser is probably not be able to come up on their own. But it could also be the advertiser is bidding on totally irrelevant broad match keywords. Therefore he/she needs to find a way to implement broad match without wasting money on irrelevant keywords and therefore clicks. A good way to do so is by using "negative keywords". When combining broad search and negative keywords one is able to expand the reach of keywords while restricting that reach to only relevant combinations of keywords. [14] A negative keyword could be interpreted as saying to the search engine "do not show this ad against these search terms". As well as it is hard to find the right positive keywords this also holds for negative keywords.

4.2 Keywords groups

Keywords can be devided into two groups. One needs to apply a different bidding strategy for both groups. The groups are:

- Broad Keywords: Those keywords are used by a lot of people. Usually these keywords consist of one or two words, these are short-tail keywords.

- Niche keywords: Those keywords consist of at least three words and can also be considered as long-tail keywords. Those keywords are specific for a certain industry or audience. An advertiser should always think about niche keywords and not only use the broad, popular terms, a lot of advertisers are using. Separately, these keywords do not make a big difference for a campaign but all together they may be doing better than any of the top performing keywords.

For good results on a Adwords account it is important to optimize the website and campaigns for niche keywords. The broad, popular keywords are often to difficult to rank for, especially when someone is new on AdWords. It can be really hard when one just started marketing a new product / service or when one is completely new to AdWords to predict the impact of a new AdWords campaign. It is crucial to perform effective keyword grouping because this is the key to creating high-performance PPC campaigns. The reasons are the following [15].

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- Higher Quality Score: See section 2.2 for more information about the Quality Score

- Lower Costs: Minimum bids will be assigned to the keyword, this in turn plays a major role in the total costs.

- Increased exposure: Greater exposure is generated when the ad is shown higher in the resulting page, this depends on the Quality Score

To get more ideas for new keywords several tools are available, one of these tools is a free tool from AdWords, the Keyword Planner. With this tool the advertiser is able to see how keywords are performing, more about monitoring keywords will be explained in the next section.

4.3   Managing keywords

Keywords are really important to optimize an AdWords account. The main goal of keywords is to create a connection between people searching for something and finding the right ads. It is also wise to have a look in the Google Search Term Report to see which keywords lead to the most clicks and sales and to add these keywords to the keyword list as exact matches. The advantage of this modification is that the ad is now shown to a more specific group and not to people actually searching for something else. This results in a higher CTR and therefore a better quality score. Also the bid prices for clicks will decrease.

From all the keywords in a campaign several are best performing, we call these keywords, "star keywords". Star keywords are those that bring in customers and profit on regular basis. These keywords should be given their own campaign, so they are practically always visible. The advertiser needs to find out what the best ad looks like by use of "Split testing". (More about split-testing in section 6.1). It is not difficult to find these star keyword in an AdWords campaign by looking at the impressions, which can be sorted really easy in AdWords.

Keywords that perform a bit less compared to the star keywords, but still attract a certain amount of traffic are called "Solid performers". At last, there are keywords which are performing poorly, which we call "bad performers". A good approach is to split the keywords into two groups, the first group contains the star keywords and solid performers and the other group consists the bad performing keywords. Because the money invested in AdWords is not used optimal when keywords are performing bad, one wants to turn these keywords into solid performers or even better, star keywords. By giving these star keywords their own campaign one can make sure the ad is always visible, by assigning a different budget to these keywords. When a keyword is performing badly, one can try to change it into a solid performer or star keyword, by performing the following actions.

- Adjust the content of the ad

- Assign a different landing page to the ad

- Adjust the amount of the bid

- Assign the ad to a different ad group

When the actions above are taken and the keywords are still performing bad, one can choose to delete those keywords from the list. The other option is to be satisfied with the less performing keywords because this does not cost much money. This decision differs per advertiser. [16] In the Search Term report it is shown which Search Terms are associated with which keywords therefore this helps the advertiser with excluding Search Terms.

5 Bidding strategies

5.1 Different campaign types

In general there are three main bidding strategies in AdWords, all for a different type of campaign. It depends on the goal of the user, which strategy is best. The main types are: "Search network only", "Display Network only" and "Search Network with Display Select", these types determine where the ads will appear (See figure 9). Depending on the chosen network by the user, a strategy will be selected.

Figure 9: Different types of Networks

One should choose the option "Search network only" if one wants to let their ads appear next to Google search results. This option is most valuable when one only wants to reach customers searching for a specific product/ service the advertiser is offering. The corresponding strategy is to drive users to the website of the advertiser with "Cost-per-click-bidding", this can be done manually or automatically. This is the option that will be highlighted in the next section. The "Display Network only" is used when users are browsing online and the advertiser wants to build brand awareness. At last, if one wants to combine advertising on Google search but also wants to reach users surfing the web "Search Network with Display Select" is used.

5.2 Bidding Strategies

As can be read in the previous section it depends on the network which strategy is best to apply. Examples of strategies are: "Cost-per click bidding", "Cost-per-impression bidding" and "Cost-per-acquisition bidding". In this paper the focus is on the first strategy. So the goal is to generate traffic to a website. CPC bidding can be done manually or automatically as stated earlier. When not knowing anything about AdWords it is advisable to use automatic bidding. But after reading this paper or when the user already has some knowledge about AdWords it is better to use the manual bidding option. The other option is CPC bidding which gives the ability to set the amount of bids, so the maximum cost for each click can be controlled. The advertiser starts with

setting a maximum CPC bid for the whole ad group, but it is also possible to set bids for single keywords or placements. In general it is a good method to allocate more of the advertising budget to keywords that are profitable.

5.3   Tips to help the ad appear amoung the top positions

Advertisers might want to have their ads among the top positions to get a higher click-through-rate (CTR), see figure 10 [17]. If so, the following tips may help advertisers [4]:
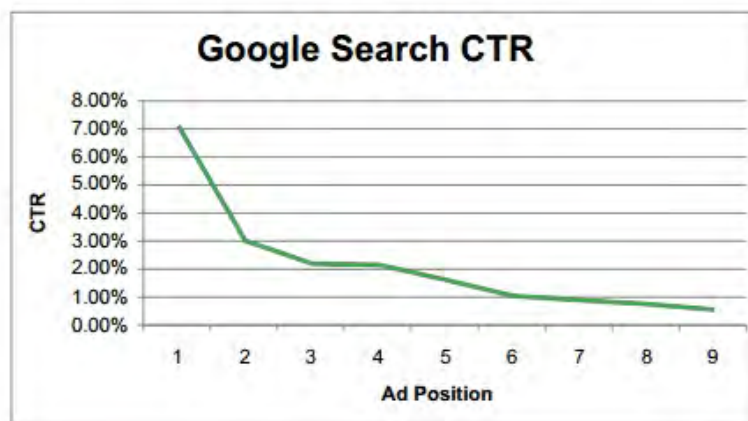

Figure 10: Effectiveness positions

- Focus on relevance: Make sure keywords, ads, and landing pages are relevant to what visitors are searching for. When an ad is not relevant it might show, but it won't get as many clicks which results in a poor performance over time

- Keep the keyword list up-to-date: Use the right keywords for the potential customers. Try to use the Keyword Planner to get ideas for new keywords one may decide to add those keywords to the list

- Keep the bid competitive: Try to keep the bid sufficiently high, therefore it remains competitive with other advertisers who are also bidding on those keywords. Also have a look through the top of page bid estimates, this helps with figuring out how much one probably need to bid to compete for a top position on the results page

- Check the account frequently: Regularly making improvements may have a positive influence [18]

6 Roadmaps to optimize an AdWords account

This paper provides several steps and tips for optimizing an AdWords account, some of these tips can be sumarized into the following three roadmaps presented below. Using the first scheme an overview of the different bidding methods are shown, a user can also check if the bidding method he / she wants to apply is in line with the one described in this paper.

6.1 Check the bidding structure

Checking if the bidding method of the advertiser is in line with the one presented in this paper can be checked in figure 11.
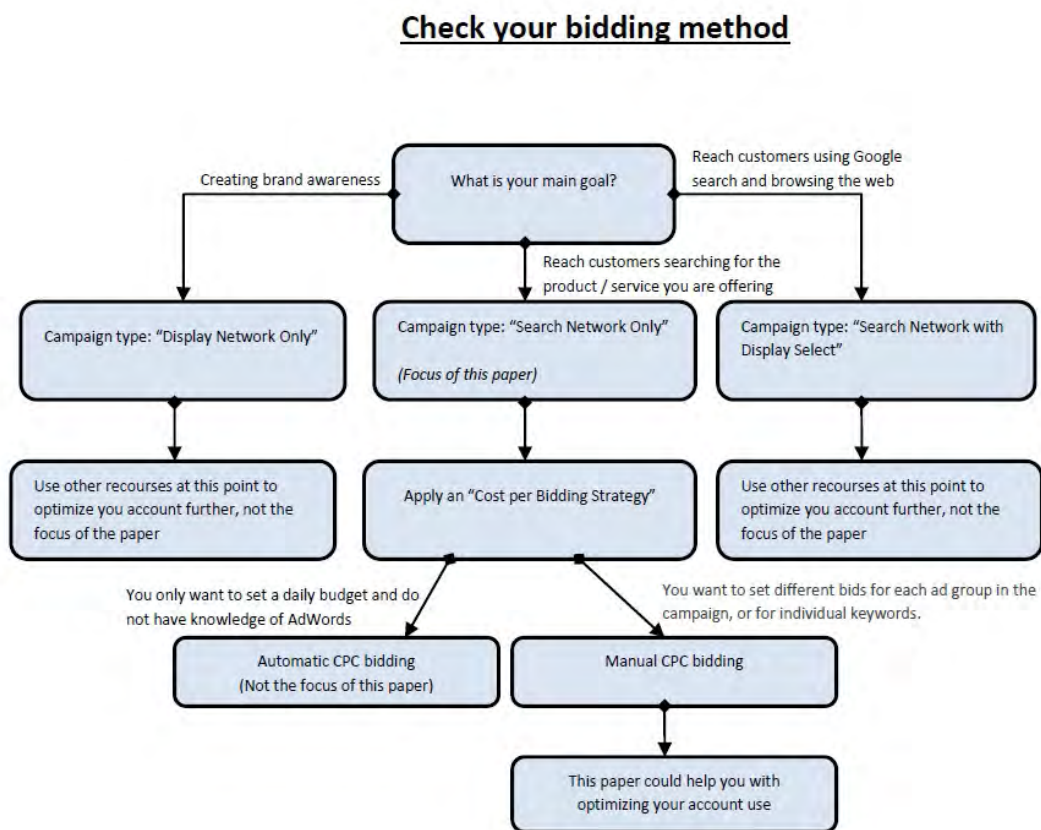

Figure 11: Step by step choosing of your bidding structure

6.2 Roadmap to optimize the account structure

It is really important to have a well-structured AdWords account. If the user wants to check if his/her acccount is structured well, the scheme below may be used. Once an account is well-structured it is easier to focus on the areas that need to be improved in the ad content and placement. Go through the diagram below to make sure the account is well-structured.
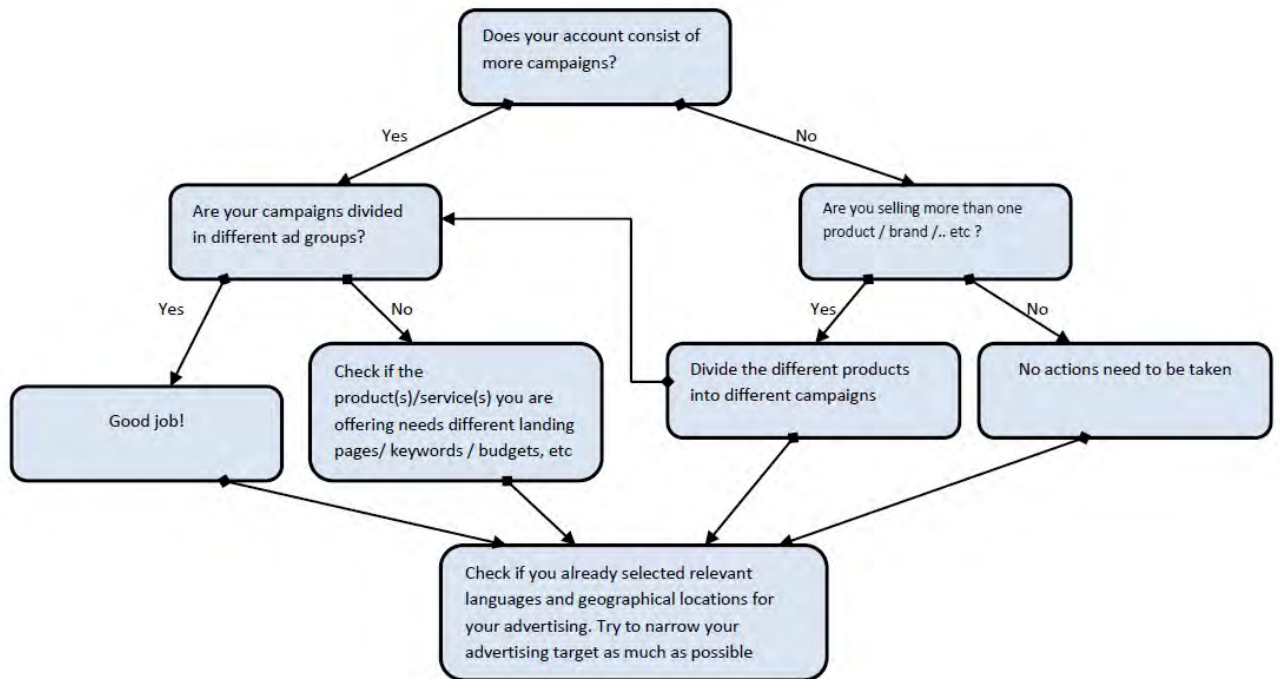
Figure 12: Step by step organization of your account structure

6.3 Organization of the keywords

Also, the advertiser has to pay attention to the keywords used in the campaign and ad groups. Roughly those steps are:

- Start with creating a list of obvious keywords

- Replace some keywords by searches that are related or synonyms. (Use the Google Keyword Tool, more about this tool in section 9.3.'

- Slightly change some keywords and delete the ones that are underperforming. Always keep searching for new keywords.

The following scheme guides one through the more exact process of using keywords as well as possible.
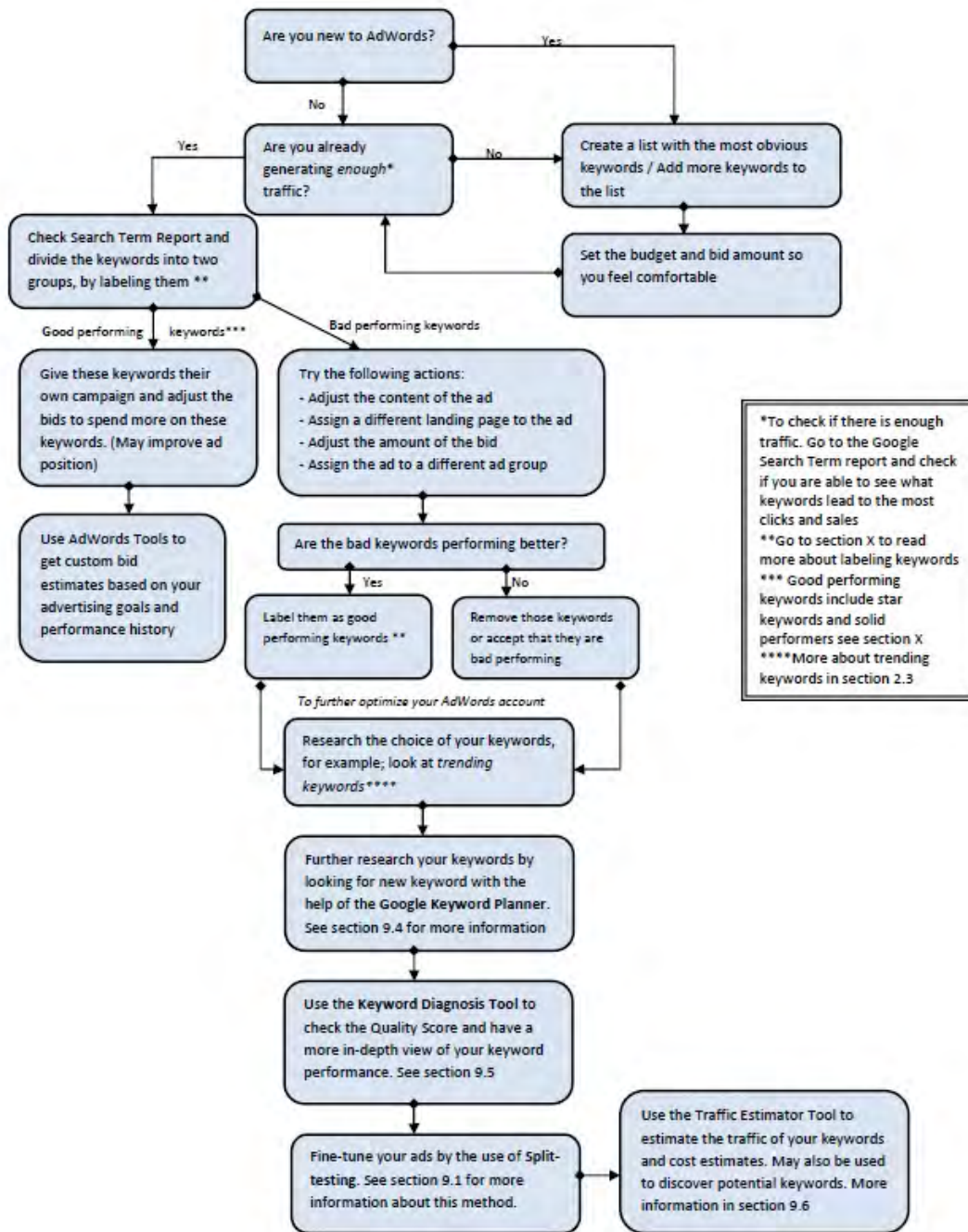
Figure 13: Step by step organization of your keywords

7 Mathematical optimization problem

7.1 Introduction to the problem

The goal of this paper is to get the highest possible number of conversions at the lowest possible cost. From figure 2 one can see that getting a high number of conversions among other things, depends on the number of clicks. To make sure clicks are relevant and the ad is shown to the right audience, one should manage its keywords right (see section 4.3). When clicks are not relevant, it is likely that the number of conversions will decrease, but this will not be modeled mathematically. The model presented in this section assumes the advertiser is managing the keywords right, and is able to select a list of relevant keywords or a combination of keywords, he /she wants to use in this model. Some papers are also discussing bid optimization from the perspective of the advertiser, Feldman et al. [19] propose bidding techniques on keywords. We will replace the objective of getting the highest possible number of conversions by maximizing the number of clicks on an ad, since this is a step towards optimizing the number of conversions.

The advertiser selects a set of keywords useful for their business and places a bid on each of these keywords, to participate in the auctions. (For more about auctions see section 2.1) The bid of an advertiser affects their position on the results page, which in turn affects the number of clicks received and therefore the number of conversions.

One should realize there are some uncertainties in this optimization problem, for example: impression rate, CTR and cost per click (CPC) are not known exactly. Therefore, the optimization problem is defined as a constrained integer programming problem based on Ahmad Zainal-Abidin et al. [20]. The constraints are defined as the following:

- The overall budget the advertiser is willing to pay

- The maximum average cost per click the advertiser is willing to pay

The advertiser needs to place a bid to participate in the auction. Joachims et al. [21] argue that for each ad, the position of the ad influences the CTR significantly. Still, the bids of other advertisers, on similar keywords, are unknown. Because ads positioned higher on the results page, are having a higher CTR in general, advertisers usually compete to bid for keywords that they think are relevant to user search terms. This increases the probability that their ad will be placed at a higher position. The CTR influences the minimum bid for an ad to remain in a certain position. Actually, the CTR is a random variable, whereas its value is uncertain. However, one can estimate this value by investing a small amount of money on keywords to experiment the traffic that they possibly attract. The CPC is determined through the auction. Before using the method [20], presented below, the following variables need to be specified:

- An overall daily budget, B

- A maximum average CPC the advertiser is willing to pay, $MaxCPC$

We assume, by specifying the maximum average CPC, the need to specify a bid for each keyword will be eliminated. Next, we assume the keywords that are selected

by the advertiser are the ones they are most interested in. This method [20] uses the CTR for the estimation of clicks, because an accurate CTR provides the advertiser with meaningful information about the probability that an ad will be clicked. The by the user specified average CPC, represents the limit to bid on each keyword or combination of keywords, aiming to maximize the total number of clicks.

7.2 The optimization model

Clicks and costs are defined by the following formulas: [20]

$Clicks_{ij} = CTR_{ij} * Impression_i$

$Cost_{ij} = Click_{ij} * CPC_{ij}$ where:

- $Clicks_{ij}$ = The number of clicks at position j for keyword(s) i

- CTR_{ij} = The CTR at position j for keyword(s) i

- $Impression_i$ = The number of impressions for keyword(s) i

- $Cost_{ij}$ = is the cost at position j for keyword(s) i

- CPC_{ij} = Is the cost-per-click at position j for keyword(s) i

- x_{ij} = The decision variable which either has the value 0 or 1. Which represents if a keyword will be assigned to a certain position or not.

The daily budget B is taken as a constraint. The variable x_{ij} is either 0 or 1, because at most 1 position can be assigned per keyword or combination of keywords. Given this budget B, for all keywords or combinations of keywords in the portfolio of the advertiser the problem is formulated as follows: [20]

Maximize: $\sum_{i=1}^{m} \sum_{j=1}^{n} x_{ij} * clicks_{ij}$

Subjected to: $\sum_{i=1}^{m} \sum_{j=1}^{n} x_{ij} * cost_{ij} \leq B$

Constraint: $\dfrac{\sum_{i=1}^{m} \sum_{j=1}^{n} x_{ij} * CPC_{ij}}{\sum_{i=1}^{m} \sum_{j=1}^{n} x_{ij} * clicks_{ij}} \leq MaxCPC$

Constraint: $\sum_{j=1}^{n} x_{ij} \leq 1$

$x_{ij} \in \{0, 1\}$

$$\forall i, i = 1, ..., m \text{ and } \forall j, j = 1, ..., n$$

This algorithm does not bid uniformly on keywords. It uses the specified CPC which is within the control of the advertiser, as a limit to bid on each keyword or combination of keywords.

7.3   Illustration of the algorithm

An ad does not have to be described by multiple keywords, although it increases the likelihood of the ad to be clicked on. This illustration will explain how the algorithm works [20]. Suppose the advertiser A, has an ad which is represented by the keywords or combination of keywords, X, Y and Z, see figure 14.

(a) Keyword(s) X, I =10000			(b) Keyword(s) X, I =5000			(c) Keyword(s) Z, I =3500		
Position	CPC	CTR	Position	CPC	CTR	Position	CPC	CTR
1	3.75	0.10	1	5.15	0.09	1	4.55	0.12
2	3.15	0.07	2	4.75	0.07	2	3.65	0.10
3	2.61	0.05	3	3.95	0.06	3	3.33	0.09
4	1.59	0.03	4	3.35	0.05	4	2.75	0.07
5	1.21	0.02	5	2.75	0.04	5	2.41	0.07
6	0.98	0.02	6	2.35	0.03	6	1.95	0.06
7	0.59	0.02	7	1.65	0.03	7	1.55	0.05

Figure 14: Examples on statistics for phrases X, Y and Z [20]

Next, we assume that there are seven positions ad which the ad could appear. (This differs per search engine, In AdWords the highest position is "1," and there is no "bottom" position). In this example, an ad assigned to an position lower than seven will not appear on the search results page. Now we assume the total impressions for the different keywords X, Y and Z are 10000, 5000 and 3500 respectively. The CTRs are decreasing considering the positions. Ads appearing at top positions have higher CTRs than ads appearing on lower positions. The number of impressions per keyword or combination of keywords can be found on the AdWords account. To illustrate, the combinations of the possible CPC are shown in figure 15. This algorithm will adaptively select points on the optimal curve, given a maximum daily budget B and maximum CPC, $MaxCPC$.

Suppose the advertiser has a budget $B = 4000.00$, and he/she sets the maximum average CPC at 3.00. The optimal number of clicks, using the constraints B and $MaxCPC$ will be at the positions: 2, 4 and 6. $(700 + 250 + 210 = 1160)$. The total advertising cost in this case equals 3452 which is less than the budget B. The average CPC equals 2.98 which is also less that it's maximum value.
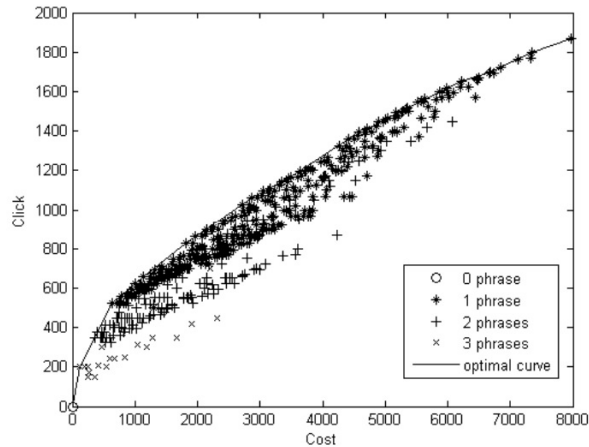
Figure 15: An example of combinations of cost-click data

8 Different Tools and Techniques to optimize your Google AdWords account

A lot of different methods to further optimize a Google AdWords exist, a few of these methods will be discussed in this section.

8.1 Split-testing

One way of testing which ad works best is split-testing. This means running one advertisement against another to see which one performs best. By the use of split-testing one is able to increase the change a user is clicking their ad and therefore increasing the CTR. An important thing to start with is that one should first get the big picture before focusing on the details. At first one needs to discover the right market and what customers want, from a broad perspective. One should also keep track of the results generated by split-testing. Before using split-testing one has to make sure there is a clear goal. What does one wants to achieve with the current split-test? Start focusing on the details when the broad perspective of the ad is clear by the use of split-testing. One can start creating small variations in the ad, for example a little change in the name of the heading. After the variations are made, again half of the traffic is sent to one ad and the other half is sent to the other ad. After this, one can see which of the two ads gets most of the clicks, so which of the two is most effective. In order to get reliable results one need a descend amount of time but the reliability of the results also depends on how much traffic is generated by the ads and how many people are seeing them. There is a rule of thumb which states: the ad that first reaches 20, 25 or 30 clicks (choose a prefered number), can be seen as the best ad. After this, one can repeat the process by first deleting the "losing ad", and make a change in the "winning ad". Again the "winning ad" is tested against the customized ad. One can keep on split-testing. Another word for the "winning ad" is "the control". One always tries to beat "the con-

trol" , this ensures one is constantly improving the CTR. The higher the CTR the more traffic one gets and the more cheaply. So each individual click costs less and less. This split-testing method can really help optimize advertising campaigns.

8.2 Trending keywords

Google has also developed a tool (www.google.com/trends) to measure which words are trending during a certain time period. In figure 14 a graph shows an example of such a trend. The graph is shown for the keywords "VU Amsterdam". The main goal of this tool is increasing the CTR by showing the ads to the right people.
When one observes a constant or increasing trend this is a good sign, but when the trend is decreasing you have to beware because less and less people are searching that keyword.
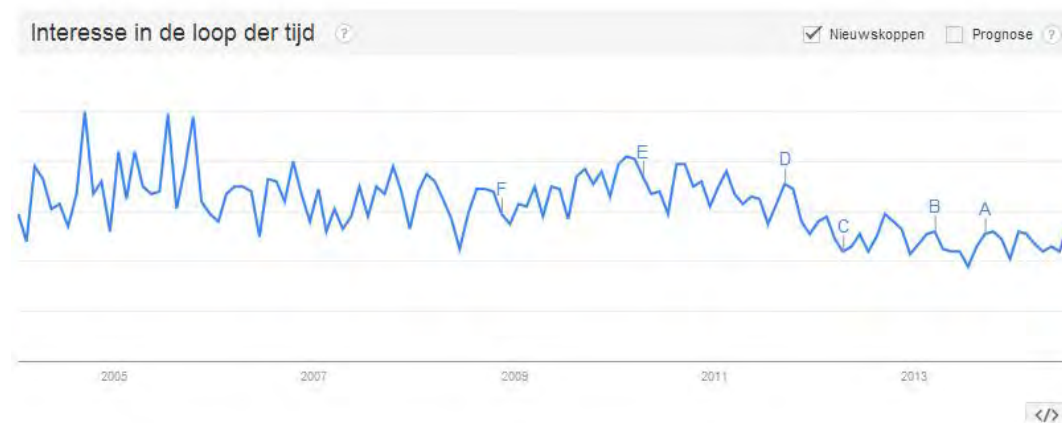

Figure 16: The trend history for the keywords "VU Amsterdam"

8.3 Google Keyword Tool

Another method to optimize your AdWords is by use of a tool created by Google, called "Google Keyword Tool". This method helps with discovering the popularity of search terms in the market one wants to advertise. When using this method, Google returns a list of the top keywords including the keywords entered by the users. It is convenient that one is able to see the number of times each keyword or combination of keywords, is searched on Google is shown. It can be shown from the previous month and the number of times the words are searched on average. The user should remove irrelevant suggestions from this tool for their market, by going through all options suggested in the rows.

8.4 Google Keyword Planner

The Keyword Planner is a tool that can be accessed by login on their AdWord account. Select the 'Tools and Analysis' menu option next select 'Keyword Planner'. With this tool one can only view exact matches on keywords (i.e. the average number of searches will be based on visitors typing in this exact combination of keywords). The Keyword Planner has three different options [19]:

- **Searching for keywords and adgroup ideas:** If one wants to perform regular keyword research, after selection this option Google will show the searches based on the selected keywords. Also, Google suggests adgroups, a selection of similar keywords, and some advertising information.

- **Check how keywords are performing:** Google provides one with details related to ads one could run based on these keywords. Some fact one could see are; the cost per click and the estimated number of clicks.

- **Multiple keyword lists** With this options Google comes up with a combination of keywords from two lists of keywords. For example, the first list contains locations and the second list is provided with activities that you can do at any location. One does not have to come up with all combinations of keywords, instead Google will match them up.

8.5 Keyword Diagnosis

This tool can be used to see an in-depth view of your keyword's performance, it includes its Quality Score. One might want to remove keywords with low Quality Scores and add more keywords that are more like those with higher scores. If one really wants to run on those keywords, consider moving them to another ad group and test them with a new ad. If they still don't perform well after one month, remove them.

8.6 The Traffic Estimator

With this tool one is able to find the traffic of a keyword as well as the cost estimates to identify potential keywords. This tool can be found in the AdWords Control Panel. By knowing the estimated traffic for keywords, one can also set appropriate keyword bids that will maximize the ad's exposure within the limit of your daily budget.

Bronnen

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