Six Days to Success:

Mastering Facebook® Advertising

By Nathan Lorenzen

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Mastering Facebook® Advertising

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Nathan Lorenzen

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Acknowledgments

I’d like to thank my wonderful family for their support.

Introduction

The world of advertising is viewed as a club for the elite. From TV shows we have an image of smokey rooms and genius copy writers. From Madison Ave we have an image of studios spending millions on a perfect brand in a dog eat dog environment. Perhaps the advertising game is a binary affair, either you are successful or you are not.

This image has left little room for a small business to thrive. The advertisements available to a small business are now located in the phone book, newspaper or cable access channel. Why spend time and money on these antiquated ads when Facebook® has created a platform that allows you, the small business, to excel?

In 2012, Facebook has grown to nearly 901 million users[1]. Those 901 million users spend nearly 12 billion hours per month on the platform.[2] For scale, a billion hours ago humans were in the stone age! Best of all, each and every user can be precisely targeted.

No need to bet your entire advertising budget on one ad creative. No need to guess what show your clientele watches and pick an appropriate time to show your ad. In this world you can test hundreds of creative choices and speak directly to your exact clientele. They will listen. Facebook allows the small business owner the capability to play ball with those on Madison Ave.

You have already completed the hardest step - creating a product or service you believe in. Get excited! Now you have the unique ability to share your passion with the world. That's the goal of this game.

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[1] **User Funnel** - The process the user has to undergo to enjoy the product. A typical user funnel is impression, click, install/sign up, retain, pay. Each step of the user funnel will have some drop off rate which the advertiser/business owner would like to minimize.

[2] Bullas, Jeff. "20 Stunning Social Media Statistics Plus Infographic." Social Media Marketing and Blogging. Web. 20 Mar. 2012. http://www.jeffbullas.com/2011/09/02/20-stunning-social-media-statistics/.

Who is this Guide For?

- Are you a small business owner?
- Are you interested in running your own advertisements profitably?
- Are you tired of paying third party advertisers for sub - optimal results?

If yes, to any of these questions then this guide is for you. With the help of it you will be able to set up, manage and excel in advertising on the Facebook platform. The techniques shown to you will be easy to understand and implement.

I Know Where to Tap

A landlord had an issue with the plumbing in his building. He called his local plumber who quoted him $300 for his services. A fair price to solve the landlord's issue. The plumber showed up, went to the basement and fixed the issue in 5 minutes. When the landlord received the bill, he noticed that parts cost him $10 and the plumber's time cost $290. The landlord, upset by this bill exclaimed,

"You were only down there for five minutes, how can you justify that costing you $290!"

The plumber replied, "True, other plumbers would have taken longer but I know where to tap[3]."

This book could be as long as the competition but there is no need - this guide knows where to tap. Please don't confuse it's brevity with quality. It will show you the simple, industry vetted techniques that any small business owner can master without the fluff.

[3]Keeling, C. D. and Whorf, T. P., Scripps Institution of Oceanography (SIO), University of California, La Jolla, California USA 92093-0220.

With these techniques, you can conquer the Facebook advertising game and get a leg up on your competition. No need for sophisticated software, strategies or systems. Personally, I have beaten third party advertisers in both quality and price by using these techniques.

And unlike the plumber above, this guide is 1/5th the cost of the competition.

What's the Catch?

None.

My only incentive is to see you succeed. I am not involved monetarily in Facebook. My only profit is from the purchase of this book. If you like the information, make sure to refer your other business friends! If you have any questions or want to share your success, feel free to email me at customerservice@blackconellc.com.

Closing Arguments

This book covers both theory and application. I have organized the material into six, concise chapters. Feel free to read the whole book in six hours, six days or six months. Obviously, the choice is yours but I believe that six days is a comfortable pace to learn this material. We'll go over the following:

Day 1 - The Building Blocks

- Brand vs. Direct Marketing
- Important Metrics
- Why choose CPC over CPM?

Day 2 - Understanding Facebook

- Understanding Advertising Metrics within the Facebook Platform
- Targeting Options
- Important Limitations

Day 3 - Ideation

- Three Basic Tenants of Successful Advertising
- Generating Copy
- Finding/Designing Images

Day 4 - Statistics Review

- Basic review of statistics vis-a-vis coin tossing
- A/B Testing
- Our Creative Test Statistic

Day 5 - Setup and Execution

- Audience Selection and Market Research
- Bid optimization
- Creative Testing

Day 6 - Valuation and Automation

- Audience Valuation
- Designing a Bid Adjuster
- Automating Creative Testing

In addition to the prose, each chapter has a quick bulleted take away section. The epilogue contains the contents of each list in chronological order. You will also find a short section on the basic

graphical analysis techniques, a glossary and two quizzes. All four of these aspects will help tremendously in the application of your newly gained knowledge.

As a side note, the mathematics of this book will be distilled down to the very basics. Some important but higher level statistical points will be glossed over; namely, determining the Life Time Value, LTV, of a customer and some statistical rigor on *Day 4 - Statistics Review* . A more thorough discussion of statistical testing can be found in *Stat Labs: Mathematical Statistics through Application*[4].

I have spent millions of dollars profitably on the Facebook advertising platform to learn these vetted industry techniques. These techniques can be mastered and will give you the upper hand over your competition. Now that we're acquainted, let's start!

[4]https://www.facebook.com/help/?page=173642556024605

Day 1 - The Building Blocks

Goal

The goal of Day 1 is understanding the building blocks of advertising. This chapter will discuss the basics in broad strokes and be laden with definitions. It may sound boring but without such knowledge running a successful advertising campaign in 6 days will be near impossible.

What kind of Advertiser are we?

The world of advertising can be split between brand and direct advertisers. Brand advertisers are among the largest players in the space: Coca-Cola, Budweiser, Walmart, Tide Detergent, McDonalds, etc. Effectively, any company you have seen using billboards and prime time TV placement are brand advertisers. These companies do care about conversions but their user funnel[^foo] is much different than a direct advertiser's approach.

Alcohol commercials are a great example of brand advertisement. They typically link their drink to one of three qualities: manliness, fun, or sex. Some do a great job of combining all three into one ad. (Think of the Dos Equis "The most interesting man in the world" campaign.) Brand advertisers know that when you see their ad on a TV or a billboard, you won't interact with their product that minute, hour, week or possibly month. They are attempting to make a passive audience associate their product with a key base emotion. Next time you're at a store and have forgotten their billboard, you are still drawn to their product. This can only be done through a

repetitive viewing process. An aspect that can actually hinder the direct marketing you are about to embark on.

Direct marketers, especially on Facebook®, desire an active audience to click and connect immediately. If you are a fan page then you want likes. If you are a gaming company they you would want them to install that game. For your product, you may direct an advertisement to a splash page which will sell the user on buying the product at that moment.[5]

As you can see this differs from the brand marketers approach in two ways. First, a direct marketer wants her audience to stop what they are participating in on the platform and participate with their ad or service. A brand advertiser simply asks the user to view his advertisement. Secondly, repetition of a direct marketer's ad to the same person can actually hurt her business model. A phenomenon called CTR degradation. Conversely, a brand advertiser wants their ad to be seen over and over again.

In the end, both brand and direct marketers want the same thing - to move product. So why are there two different approaches? The answer lies in the pricing model used by each form of advertiser.

A CPC or CPM Model

CPM[ˆfoo2], cost per thousand impressions, advertising has been around for quite some time. In the real world, billboard advertising works on this model. The company which sells the billboard inventory knows roughly how many people view the advertisement in a given period. They set a price and sell the space for this amount. On Facebook, you will set a total budget you want to spend and a CPM rate. E.g. a campaign will have a daily budget of $200 and a CPM rate of $1.10. Assuming $1.10 is a market clearing price for

[5] "Anscombe's Quartet." Wikipedia. Wikimedia Foundation, 05 June 2012. Web. 09 May 2012. http://en.wikipedia.org/wiki/Anscombe%27s_quartet.

your audience, the campaign will be shown 181,818 times a day. (Please note that impressions do not have to be unique. A Cost per Thousand Unique Impressions will be higher than CPM.)

CPC[^foo3], cost per click, advertising came around with the Internet. Mathematically, it is a very simple equation of (Total_Cost)/(Total_Clicks). What is important to notice here is that the advertiser pays for clicks and not impressions. E.g. if you have an ad campaign with a daily budget of $200 and the ad has a bid of $0.65, then you could get upwards of 307 clicks. I say upwards because Facebook may not show the ad if its CTR, click through rate, or CPC bid is too low. Conversely, if the CTR is very high you may lower the bid of your ad. (CTR is clicks/impressions.)

The variability in the CPC market reach is due to RPM[6], revenue per impression. RPM is the product of an advertisement's bid and its CTR. In practice, what this means is that an ad will be shown more by Facebook if either its bid is increased or CTR improves. Since we want to keep our marketing budgets low, we will focus extensively on how to improve CTR and how to decrease our bids.

Facebook even takes this optimization one step further. Ads which are bid via a CPM model are shown to people who typically click less frequently. While ads which are bid via a CPC model are shown to people who interact with ads more frequently. This means, under a CPC model of advertisement we want to optimize an advertisement's CTR.

Why Choose CPC Marketing for your business?

Unlike brand advertisers who care about impressions, you care about a user interacting with your product or service. Unless they click on the advertisement, it doesn't matter how many times

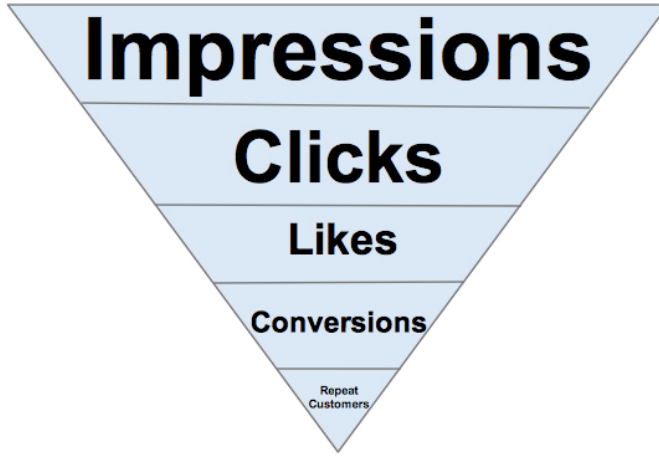
[6]https://www.facebook.com/ads/manage/reports.php?act=19626816

they see a particular advertisement. With CPC advertising, you and Facebook have a similar interest in having high CTR advertisements. As we can see by the RPM, a higher CTR means you may decrease your bid and receive more clicks for less. With a CPM model, having a high CTR doesn't allow you to lower the advertisement's bid.

The User Funnel

Mentioned briefly above is the helpful image of a user funnel. Let's explore this idea further and fully explain this process. (It will be helpful for this example and the remaining ones in this book if we create a fictional company. Poof! Our company will be an online vitamin and supplement retailer named Vitamin Surplus.)

Let's imagine Vitamin Surplus has been running a successful advertising campaign for the past month. (We will discuss precisely what success means in later chapters.) In a meeting, the ad manager shows the following slide to explain the process of user acquisition.



A User Funnel, not to scale

An upside down pyramid is a classic way to model the user funnel. Users see numerous ad impressions everyday. Based on the quality of an advertisement, a user will click on the ad. Here we see that Vitamin Surplus has a business model to first have the user like their page. After which they will attempt to convert this user to a purchaser. Some business models simply move the user from a click to a splash page and attempt a conversion of the product there. Depending on the product, a like can be counted as a conversion but one should not assume the opposite. If you sell a product, a conversion should denote as a purchase. Finally, out of the pool of customers who make one conversion a smaller proportion will become repeat customers. (This is an important demographic for any business but methods to retain such customers will not be discussed in this book.)

Impressions, clicks, conversions, and repeat purchases decrease in size by a rather large factor when moving down the user funnel. For example, an great advertisement for Vitamin Surplus could receive 1,000,000 impressions, a 1,000 clicks and 50 conversions.

The important rates to consider are CTR, conversion rate and conversion per impression. CTR, mentioned above, is calculated as Clicks/Impressions. The advertisement above had a 0.1% CTR. Which is a very good CTR for the industry. The Conversion Rate here is 5%. Since we are counting a purchase as a conversion we take 50/1000. (It's tempting to abbreviate this as Conversion per Click or CPC but this is never done as CPC denotes Cost per Click.) Finally, we can divide conversions by impressions to get a Conversion per Impression rate of 50/1,000,000 of 0.005%.

If you are a more visual person, refer back to the simple user funnel diagram to remember how to calculate CTR, Conversion Rate and Conversion per Impression rate. These metrics all refer to dividing a smaller group by a larger one. E.g. Clicks is divided by impressions as it is smaller.

Diffusion of Innovation[7]

Diffusion of Innovation is a topic popularized by Evett Rogers in 1962 in his aptly titled book *Diffusion of Innovations*[8]. You may hear this concept associated within in a user funnel related discussion. If a user funnel models how a new user is acquired, then diffusion of innovations models how groups of users are acquired.

The model is not extremely complex but it is extremely informative. It assigns the population into one of five buckets, each of which have specific characteristics. Due to the natural variation in an audience, some people will adopt a product more quickly than others. Essentially, each progressive user is marginally harder to acquire than its predecessor. This is helpful to understand as your product matures and advertising rates degrade. Advertisement's will typically have the best rates on day 1, not day 60 because they have already convinced the earlier buckets to click.

The five buckets are as follow:

- Innovators - 2.5% of the population
  - Innovators are the first individuals to adopt an innovation. Innovators are willing to take risks, youngest in age, have the highest social class, have great financial lucidity,[are] very social and have closest contact to scientific sources and interaction with other innovators. Risk tolerance has them adopting technologies which may ultimately fail. Financial resources help absorb these failures. (Rogers 1962 5th ed, p. 282)
- Early Adopters - 13.5% of the population
  - This is the second fastest category of individuals who adopt an innovation. These individuals have the highest

[7] R code for the graph: *plot(mtcars[,1]∼mtcars[,4], xlab="Horsepower", ylab="MPG", main="Scatter Plot MPG vs. Horsepower", xlim=c(0,300), ylim=c(0,50))*

[8] R code for the graph: _plot(mtcars[,1]∼mtcars[,4], xlab="Horsepower", ylab="MPG", main="Scatter Plot MPG vs. Horsepower", xlim=c(0,300), ylim=c(0,50)) "On a New Line" abline(lm(mtcars[,1]∼mtcars[,4]))

degree of opinion leadership among the other adopter categories. Early adopters are typically younger in age, have a higher social status, have more financial lucidity, advanced education, and are more socially forward than late adopters. More discrete in adoption choices than innovators. Realize judicious choice of adoption will help them maintain central communication position (Rogers 1962 5th ed, p. 283).

- Early Majority - 34% of the population
  - Individuals in this category adopt an innovation after a varying degree of time. This time of adoption is significantly longer than the innovators and early adopters. Early Majority tend to be slower in the adoption process, have above average social status, contact with early adopters, and seldom hold positions of opinion leadership in a system (Rogers 1962 5th ed, p. 283)
- Late Majority - 34% of the population
  - Individuals in this category will adopt an innovation after the average member of the society. These individuals approach an innovation with a high degree of skepticism and after the majority of society has adopted the innovation. Late Majority are typically skeptical about an innovation, have below average social status, very little financial lucidity, in contact with others in late majority and early majority, very little opinion leadership.
- Laggards - 16% of the population

  - Individuals in this category are the last to adopt an innovation. Unlike some of the previous categories, individuals in this category show little to no opinion leadership. These individuals typically have an aversion to change-agents and tend to be advanced in age. Laggards typically tend to be focused on "traditions", likely to have lowest social status, lowest financial fluidity, be

oldest of all other adopters, in contact with only family and close friends, very little to no opinion leadership.

Closing

Now you have been introduced to the basics of advertising. If you are still confused by the terminology please review the glossary section for more detail. This next section will take these concepts and apply them to the Facebook platform. These will be hard to understand without a firm grip on the preceding pages.

- Brand advertisers want influence, direct advertisers want interaction
- CPM is paying for impressions, CPC is paying for Clicks
- Facebook measures ads based on their RPM, Revenue per Impression
- CTR, Conversion Rate and Conversion per Impression are key to measuring an ad's success
- A User Funnel is a helpful way to explain and remember the important rates to optimize.
- Diffusion of Innovation can be helpful in explaining the maturity of your audience

Footnotes

Day 2 - Understanding Facebook®

Goal

Congrats on getting through day 1. The basics of advertising are rather simple to understand. Day 2 will focus on how those basics apply to advertising on Facebook™. This section is designed to teach you about the basics of the platform and Facebook's greatest strength, targeting.

Dimensions of a Facebook Advertisement

A Facebook ad has three dimensions to optimize on: title, body and image. The term creative can refer to the entirety of the ad or just the image. The term copy is applied to the text portion of an advertisement.

Facebook constrains its advertisment's copy to 25 characters long for the title and 135 characters long for the body. The image is constrained to 110x80 pixels. Even though this is a surprisingly small amount of room, a lot of variation can be introduced. And where there is variation, optimization can occur!

A Facebook Advertisement

Important Metrics on Facebok™

It was a rather simple procedure to compute CTR, conversion rate and Conversion per Impression. Parroting back their definitions is simple also. What may be harder is understanding what these metrics mean on Facebook. Having an intuitive understanding of them can be helpful in diagnosing problems later.

CTR

CTR measures an advertisement's charisma. Does the image attract the user to read the ad and does the copy convince them to click? There are ways to boost CTR very easily. The typical example is to show a buxom woman to a male audience. CTRs will predictably increase tremendously. Later we will see how this can be, "penny wise, but dollar foolish."

Conversion Rate

Conversion rate measures how close was the ad to the product. In other words the honesty of the ad. If you convinced someone to click on an ad to watch a trailer for a hit movie but lead them to buy a spaghetti strainer, your conversion rate will be extremely low. It is my opinion, that in direct marketing honesty matters. It simply makes sense from the business standpoint.

Conversion per Impression

Conversion per Impression is a helpful metric to judge the overall effectiveness of the advertisement. Mathematically, it is also the product of CTR and Conversion Rate. Which is helpful, since you can find situations where CTR is very high but Conversion Rate may be very low.

Sex Sells but be Wary

As mentioned above, it is very tempting to increase an ad's CTR by simply using a buxom, scantily clad woman to sell your product. There are two reasons that you may want to avoid this temptation. First, it will most likely go against Facebook's terms of service; however, if you advertise in very small volumes you will still be able to slide it pass these restrictions. If it's cheaper then why follow the rules anyways?

The more important reason is that it can hurt your bottom line. Increasing CTR will llower the CPC you pay for an advertisement. Meaning, you receive more clicks for any given budget. Since this is rather false advertising your conversion rate will be rather low. Meaning your cost per conversion can be very high. This cost per conversion is very important to monitor as it represents the profit from your advertising ventures.

Other metrics to consider

Retention and engagement can also be very important metrics to optimize for certain business models. (These would be related to the bottom triangle of the user funnel diagram.) For our Vitamin Surplus business, we could set a second order as our retention metric. For a gaming business, you may track the retention as the proportion of installs who return one, three or seven day(s) after install.

These are extremely important metrics to consider for your own business. There are tested strategies for optimizing engagement and retention for any business model; however, the techniques from this book focus on solely the advertising side. The good news is that math is universal and the tests from later sections can be easily adapted to optimize any key business metric. There are many paths to failure but few to success.

How Facebook chooses to show an advertisement

Facebook's advertising ecosystem works via an auction.

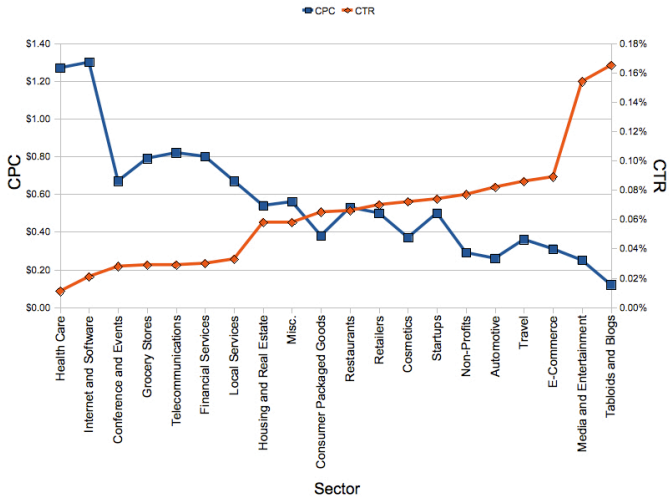
On the side of a page, there are a certain number of slots in which an ad can appear. Some slots have higher value associated with them because of page placement. How Facebook chooses an ad for each slot is based on a second price auction system[^foo4].

Lets look at a simplified system where only the advertisement's bid matters. (In reality, RPM is used here.) Your ad and hundreds of other advertisements all have a bid associated with them. The maximum bid signifies the highest price you will pay for someone to click on your ad. If your ad has the highest price in any given auction, then you pay the 2nd place CPC rate. This is why the CPC you see for an advertisement will always be lower or the same as the associated maximum bid.

On the reporting end, Facebook does not offer information about the advertisement's average position. This would be extremely helpful information to know. E.g. if you had extra budget you could increase the advertisement's bid to be featured in a better slot and not worry about its inherent CTR. Since this information is not known, we must only worry about the information we can change.

Typical Ad Rates

Depending on the industry, ad rates will be inherently different. It is important to know how well your advertisement is doing relative to the industry you are representing. Luckily, a lot of effort by others has been put forward to understand these differences. Webtrends put together a study focusing on the differences in average CPCs and CTRs in various industries.[9]



CTR and CPC based on Industry

CTR has a tremendous influence on CPC. What is missing in this chart is a discussion of which demographics viewed these advertisements. We can assume that the various horizontals will be biased in gender and age.

[9]Henderson and Velleman (1981), Building multiple regression models interactively. Biometrics, 37, 391â€“411.

Example

We've discussed a lot of different metrics. Let's go over a brief example and quickly calculate all the important ones.

An advertisement for Vitamin Surplus received 4,279,840 impressions, 6,021 clicks and 215 conversions. We set a maximum bid for the advertisement at $0.95 but only spent $4,329. What do we know about the performance of the ad?

> CPC - Cost per Click $4329/6021 clicks = $0.72
>
> CTR - Click through Rate 6,021 Clicks/4,279,840 impressions = 0.14%
>
> Conversion Rate 215 conversions /6021 clicks = 3.6%
>
> Conversion per Impression 215 install/4,279,840 impression = 0.14% * 3.6% = 0.005%

Overall, we can see that given this advertisement's great CTR, we were able to dramatically lower the CPC we paid for the advertisement. Depending on the industry, a 0.005% conversion rate would be rather low for some industries but could be fine for ours. The important thing to notice here is that it does not effect how Facebook serves the advertisement. We will learn though that it directly influences the bid we set for a given advertisement.

What can we Target?

The power of Facebook advertising is its ability to blend keyword advertising with demographic information. Since keyword advertising on Facebook is based off a user's own volunteered likes and

interests, we can assume a stronger affinity towards those brands and products.

Facebook allows the advertiser to target users based on the following:

- Location
  - Country
  - State/Province
  - City
  - Zip Code
- Age
- Gender
- Precise or Broad Interests
- Sexual Preference
- Relationship Status
- Language
- Education
- Workplace
- Connections

Facebook also offers a very helpful estimated reach calculator on the side of the screen to showcase the current audience size. (More on this shortly.)

Location Targeting

Location targeting is one of the most important options. Facebook offers four types of location based targeting: country, state/province, city and zip code are rather self explanatory. The important feature of this targeting, and all targeting options in this section, is that once defined the ad will only show to that subgroup of Facebook users.

There is a very neat secondary feature to city targeting. Facebook allows you to advertise to a radius around the city you wish to

target. The options there are 10, 25 or 50 mile radius. If you were running an advertisement for a local event or your store has an audience outside of your city, this feature could be very helpful.

Rarely do you want to mix countries in a selection unless you are sure they have relatively similar metrics. To see why, consider the true story of one advertiser who was targeting the USA, Great Britain and Bali. He believed that he arbitraged the system by setting the bid low and was happy to see that ads were receiving impressions. Upon further digging, we saw that Facebook was serving 100% of the impressions to the Bali audience and not the other two countries. Conversely, if he set the bids high then he could have been over spending on Balinese users.

Age Targeting

Facebook offers two ways to age target people: exact and non-exact. With exact age targeting, the bounds you place will be directly followed. With the non-exact option, these boundaries are blurred. I.e. If you set up your targeting options to be between 25 and 30, they may advertise to 31 year olds and 24 year olds as well. They argue that the edges of any selected age bucket will be similar in terms of performance. True, but it is the opinion of the author that having clean and well defined groups is more helpful when running any performance analysis. The exact age buckets that an advertiser will use are entirely based on how those cohorts act with the product or service.

Gender Targeting

Very often advertising rates will vary greatly between the genders. It is always a smart decision to test and optimize ads to both gender options. If you do not specify a gender, Facebook will show ads to both genders purely depending on bid and ad rates. This can

make it rather difficult to understand what is working in your advertisements

Precise and Broad Interests

In other advertising platforms, this is analogous to keyword targeting. Facebook allows two types: precise and broad. Precise targeting allows the advertiser to use specific likes and interests. Broad targeting allows the advertiser to target users by a general category.

For example, an advertiser who is selling a baseball related product could target people who have liked the San Francisco Giants (TM) fan page. (Facebook also offers a helpful keyword generator when using their UI.) On the other hand, instead of adding all MLB teams you can simply target the Sports > Baseball broad targeting category. This would target all users who have liked baseball related fan pages.

As a side note, the ">" symbol here refers to Facebook's categorization of items. In the example above a user would select Sports with a sub list containing baseball among other sports.

Sexual Preference and Relationship Status

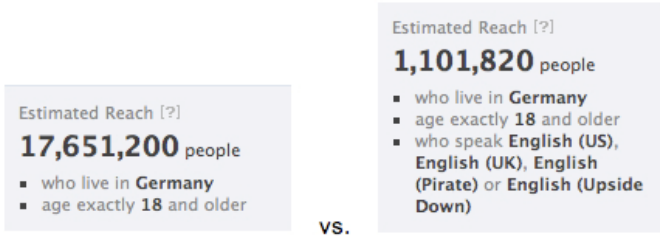
I believe these two targeting options have very limited effectiveness. If you're managing a dating site - sure, a hot sauce product - probably not. You'll see in the following sections that limiting your targeting options can make management much easier.

Language

Language targeting can have an important impact on your advertisements. By language targeting, Facebook offers the ability to only show ads to those who have selected that language. There is an interesting discussion here about selection bias. By targeting a

specific language you reduce the reach of your advertisements. On the other hand, by not targeting a specific language the CTR can be hurt.

Running an advertisement in English to a German audience may be OK. This is due to the fact that a lot of Germans speak English. By not selecting a language option, your ad would be shown to all of Germany, rather than purely the German Facebook users who have chosen English for their profile.



Using Facebook's Audience Estimator, we see that English targeting drops your reach by more than 16 MM people

On the other hand, running an advertisement in Chinese to the USA would most likely produce a horrible CTR. We'd only assume those who understand Chinese to click on the advertisement which is a very small percentage of the population. (Roughly 0.2% of the United States Facebook population.) Remember, Facebook cares about maximizing its RPM. Under a CPC model, the CTR for this ad would predictably be very poor. Resulting in the advertiser having to set a high bid. Due to this, the advertisement should be targeted to only those who have chosen Chinese as their Facebook profile.

Education and Workplace

These two types of targeting can be useful in certain products and not needed in others. Like the other types of targeting, by selecting these you can drastically limit your audience size. I have seen a very

clever use of this for an individual advertising his job application. He selected the businesses that he wanted to apply to and ran an advertisement for himself. For very little money, around $100, his resume was seen and he did acquire several interviews from his experiment.

Connections

Connection targeting is a very important aspect for any advertising test. When you are advertising for an application or Fan Page on Facebook you should have either administrative or advertiser rights. This allows you to advertise specifically to the audience which has already liked or installed your fan page, application, etc. Conversly, you are able to only advertise to those who have not interacted with it already.

These two options allow an advertiser to run growth or retention advertising. For some services, like an application, you may use both types of advertising. In the first phase of advertising, an application only needs to attract new users. In the latter stages when users are dropping off but new features and tweaks have debuted, targeting people connected to the product can boost retention. For a fan page connection targeting could be useful if newsfeed posts are not generating the type of buzz you want. (Although this is a much pricier option than optimizing your newsfeed.)

Use this feature wisely. Users can end up using connection advertising as a bookmark instead of as a re-engagement tool. This would mean that you are paying for users who would already come back for free. Analysis of user behavior would need to be undertaken to figure out if this is the case.

Facebook's Suggested Bid

When uploading your first ad, the Facebook UI, you may have noticed that Facebook offers a suggested bid price. This calculation is proprietary knowledge but we know Facebook wishes to maximize their RPM. Thus, we can suss out some details behind it.

The knowledge they have is previous account, campaign and individual advertisement performance. They also know the market rates for the audience you are targeting. Combining this information, most likely by some sort of averaging formula, Facebook will offer a suggested bid. It is in Facebook's interest to have this suggestion on the higher end as that would mean a higher RPM for themselves.

In practice, you should be able to bid at 60%-80% of this suggested bid and still have the advertisement shown. (These percentages are fairly anecdotal. We'll discuss a more precise way to determine a proper bid shortly.)

I find that there are two very beneficial uses to this suggested bid tool; comparing audiences and tracking the market.

Comparing Audiences

When determining your audience you could pick out specific elements of a category or simply target the category broadly. If you believe that these are relatively equal. You can use the suggested bid tool to see the rough increase or decrease in bid price between these targeting options.

Let's assume targeting option A gave a suggested bid price of $0.60 and targeting option B yielded a suggested bid price of $0.67. As an advertiser, if you believe audiences A and B are equal in terms of value then the 12% premium to target audience B would be ill advised.

Market Tracking

The suggested bid tool can be used to track market fluctuations in your key demographic. A single company can largely shift the prices in a market due to their aggressive marketing. While advertising for a gaming company, we witnessed on multiple occasions market increases correlated with a competitor's game launch. This allowed us to know our conversion costs and bids were increasing due to market forces and not poor creative choices.

Understanding how your market is evolving is extremely important to reducing your advertising costs. An easy pattern to witness is the increase in bid prices during the holiday season, especially around "Black Friday" and "Cyber Monday". The increase is obviously driven by a retail holiday sales push. As a small business owner, it may be worth while to pause advertising during these times and worry about garnering market share during cheaper intervals.

Overall Limitations

Facebook has a nasty habit of over optimizing ads within a campaign too quickly. When ads are initially uploaded to a campaign, Facebook does not know which ads are better than any others. All ads will get an initial seed volume of impressions to allow Facebook to determine the ads CTR. The issue here is that the seed volume of impressions can be too low to truly determine the ads real CTR. I.e. Facebook's estimate of the ads CTR is incorrect. Since there is feedback in the system, small differences early on in performance can create large differences later on.

To see this in effect, upload 5 ads to the same campaign that are identical in creative, targeting and bids. Let it run for some period of time and the advertisements will have different CTRs. These are the same exact ads but performance can be significantly different! We must be aware of this issue when designing a test.

To this end, to get the best read on a creative test let each unique ad be in it's own campaign. Make sure that your daily budget caps and demographic targets are the same. This can and will affect performance. The downside to testing like this is it limits the the number of tests you can have at one time. Facebook caps the numbers of campaigns per account to 250.

Closing

A common complaint in regards to Facebook is their rather low CTRs in comparison to Google Adwords®. Adwords is a great advertising platform as well but better suited for different products and services. Going through them to get Facebook Likes would be a poor choice. Although Facebook has lower CTRs, I believe strong targeting balances this out. The ability to target a specific market via all of the above levers makes Facebook so attractive.

In the physical world, the USPS recently released a program called Every Door Direct Mail® which delivers mail to all residences in a localized area. This is great but why bother? Upload an advertisement, no printing or overhead required, target it within 10 miles of the town you want to reach and add in numerous other features regarding demographics. It will cost around $100 - $200 for a properly run advertisement. You will only advertise to those who enjoy your product and only have to pay for those interested enough to click. The USPS program is the closest real world equivalent to advertising on Facebook and it falls completely short.

I hope you can see the strength of Facebook's platform. Tomorrow we will discuss the most enjoyable part of advertising, ideation.

- A Facebook advertisement is made up of a three components: title, body and Image.

- Facebook offers many targeting options based on location, demographic and keyword variables.
- As a small advertiser, begin by acquiring quality customers rather than quantity
- Facebook's suggested bid is typically inflated, adjust accordingly

Footnotes

Day 3 - Ideation

Goal

Welcome to my favorite part of advertising, ideation. Technically, this could be called brain storming, copy generation, image selection, or numerous other terms. Simply put, today is when you write copy and select/design the images you will use in your advertisements. This may seem daunting to some but with the help of this section hopefully the process becomes simple. If this sounds easy, please refer to this section as a guide to the multiple levers which can tweaked.

Generating Copy

Copy writing can be a difficult skill to acquire. There are some professions built solely on generating great copy. As a small business owner, you will be tasked with creating your own. Instead of a chore, think of it as an opportunity to acquire a new skill.

The first couple iterations of copy you write will be poor. The important aspect of this process is to continually improve over your past attempts. After several iterations, you'll start to get a grasp on what is working with your audience and what is not. (This honing process is extremely important and will be discussed later.)

As a side benefit, anything you learn from this process can help in other marketing aspects of your company. Need a new name, slogan, short product description, etc? Test them all before making a new sign. You will see in the following sections, that testing multiple iterations of an ad is a straightforward process. Before discussing

proper testing procedures, let's discuss three basic tenants of advertising.

Honesty

Rarely do you here about honesty associated with advertising. However, using the CPC model described previously, honesty is a quality which will be valued. Remember that you can easily increase metrics like CTR with false advertising and decrease CPC. This will also cause your conversion metrics to drop precipitously which will cost you more on the back end.

Be Direct!

Directness can be hard to achieve. Luckily, Facebook® limits you to 25 characters in the title and 135 characters in the body. Rarely, does longer copy perform better than direct copy. Why? My personal theory is that people do not enjoy reading. Not only can being longwinded hurt you but also too much cleverness can as well. Remember, your audience is not on Facebook to look at the ads. If it is not direct and to the point they have plenty of other real estate to interact with.

Why, How, What

People don't buy what you do they buy why you do it. - Simon Sinek

Before sharing a brief style guide on ways to improve your copy writing skills, we first need to discuss your product's pitch. Paul Sinek has a wonderful 18 minute Ted Talk in which he discusses how the great brands of our time pitch their products. (I highly recommend watching the talk. Go ahead, I'll wait.)[^foo1]

Great brands market from Why to How to What. Poor brands market the other way: First what, then how then why. Let's take

his key example from the talk about how Apple could market themselves and how they actually market themselves.

> "We make great computers. They're beautifully designed, simple to use and user friendly. Want to buy one?"

vs.

> "Everything we do, we believe in challenging the status quo. We believe in thinking differently. The way we challenge the status quo is by making our products, beautifully designed, simple to use and user friendly. We just happen to make great computers. Want to buy one?"

The latter is clearly more effective. Clearly in the confines of a Facebook advertisement, you can't be this verbose. But it is worthwhile to take some time and decide why you are in the business you're in. **Passion**, **not logic**, **drives sales**.

Copy Style Guide

For writing your own copy, the following list can be a helpful starting point.

Sentence Structure

A great place to start with brainstorming is syntax. You may be tempted to start your title with a subject or pronoun. This can work but typically beginning with a verb adds an imediacy to the copy. Although more testing is always OK, try to start with the most whittled down version and build up from there.

Example: Maybe you have a travel agency which has a deal on a trip to Borneo. The key message you wish to evoke is "You can travel to Borneo!". The simplest copy to try is "Travel to Borneo!" With easy changes of "Vacation to", "Adventure to", etc. With a longer version of "Your Borneo Trip Awaits!"

Use Simple language

Poor Faulkner. Does he really think big emotions come from big words? - Ernest Hemingway

I believe larger words are typically skipped over when scanning a page. Remember, you must make your audience interested in looking at your ad. Small, two syllables or less, words are easy to read quickly and if employed well they can grab the user's attention.

Example: For Vitamin Surplus, it may be tempting to grab the user's attention with, "Conspicuously Great Deals". Let's instead keep it simple and start with "Profoundly Great Deals" or even "Great Great Deals".

Choose Emotive Language which fits the Brand

Look at the language choices between two beer company billboards. For Stella Artois their slogan is "A Thing of Beauty" and features a gorgeous model drinking a Stella. Bud Light on the other hand simply has a board with a beer bottle and the slogan "DRINKABILITY". It's pretty obvious what these brands are trying to influence. Stella wants to be seen as a high class product, Bud Light wants to be viewed with the intention that you can drink them in mass.

These slogans share extremely emotive language even if one is a fabricated word. You know exactly what audience they are targeting and trying to influence. In a glass, they are essentially the same type of lager, on a billboard they are entirely different products.

Brevity Counts

Simply put, people do not enjoy reading. Simple, short, concise copy should always be the goal. Again testing long copy can be worth your time but rarely does it outperform its shorter brethren.

Don't be Punny!

See how annoying this section title is? Nobody likes puns, please avoid.

Are you Creative?

Questions can be a helpful way to stand out from other advertisements. People also have a hard time not answering questions after reading them. It's in our nature, so use it to your advantage.

Vary Your Punctuation

A simple, ! or ? or . or , can actually have an impact on copy performance. Be wary though, as Facebook does have guidelines about punctuation use.

Image Selection

It's very important to brainstorm great, honest, and direct copy but without an image, your advertisement will never be shown.

Choosing an image for your product can be a difficult task. First, look for inspiration in other's work. Following that, refer to the *Image Style Guide* below for common ways to vary and improve your images.

Look for Inspiration!

The best way to create top image and copy is by studying other advertisements. Look at them with a discerning eye and test the features you like about them. Notice a general trend? Test your best copy against it and see which one wins.

After some time marketing a product to 40+ women in the US we discovered a general trend of images that kept performing rather well: very suave, soft focused male avatars with exotic backgrounds. Remind you of anything? The same technique is used to market romance novels to the same demographic.

Understand your demographic and think of other products they buy. Look at the images those products use to entice and allure their audience. It will most likely be a helpful springboard to coming up with ideas about your product's image.

Unlike what is shown in Madmen, discovering the best advertisement doesn't come from a brilliant flash of creativity. It's an evolving process. What worked in the past generation is mutated and tested against new variants to see which will survive. The more you test, the more efficient your advertising will become at acquiring quality users for the cheapest amount. And isn't that the goal?

Image Style Guide

Color scheme

Facebook's color scheme is blue and white. ColorSchemeDesigner.com can be very helpful in picking color schemes which both match or contrast with the advertisement's backdrop. Spend a little amount of time understanding how different colors interact with each other. Due to the nature of the book, the image[ˆfoo2] below is most likely

in black and white. This takes the wind out of its sails due to the wonderful color experimentation which is accessible via this tool.

ColorSchemeDesigner.com Color Wheel Sample

Image Direction

Images have a focal point based on the object which it shows. Facebook's content is always to the left of the advertisement's. Playing with the interaction with the user's focal point on the advertisment can add a little extra to the image.

Avatars

Avatars can be a helpful addition to an advertisement. Even the direction the image faces can have dramatic effects on its performance. If the image contains an avatar, an easy test to run is simply mirroring the image and comparing.

Text and Buttons

Images can also contain text. Make sure it's readable at a small scale! Known symbols: play, pause, bio-hazard, etc. can be helpful variants to test as well.

Closing

This may be a short segment but don't let that fool you. Writing great copy and finding the best image is truly an iterative project. Always be thinking of other copy and images which could sell your product. Not refreshing creative, will cause advertisements to go stale. This will happen to all advertisements at various rates. Keeping stale advertisements means you will pay more for less. Essentially, those who don't test and iterate will perish. Don't be afraid to try the zany either. Sometime the craziest ideas are the most fruitful.

What follows this section is the first of two quizzes contained in the book. It should not take you too long to finish but will be very helpful in cementing what you have learned so far. Have fun with it, and answers can be found in the back of the book.

- A Facebook advertisement is made up of a three components: title, body and Image.
- Continually test and update copy
- Copy should be both honest and direct
- Passion, not logic, sells product.
- Copy Style Guide
  - Vary sentence structure
  - Use simple language
  - Emotive language that fits the brand
  - Brevity counts
  - Don't use puns
  - Questions can be helpful
  - Vary punctuation
- Image Style Guide
  - Color scheme
  - Image direction
  - Avatars

    - Text and buttons
- Look elsewhere for inspiration

Footnotes

Quiz Number One

Goal

This quiz shall serve as a review of the past three days. Not all questions will have correct answers, as they will depend on your business. As this is a book, you can take the quiz mentally but it will be more helpful to pull out a pen and paper and write your answers down.

Questions

1. Define the following
    a. CTR, Conversion Rate, CPC, CPM
2. How does a brand advertiser differ from a direct marketer?
3. How does Facebook® decide to serve an advertisement?
4. Organize the following Diffusion of Innovation categories and give a rough estimate of the proportion of the population in each.
    a. Late Majority; Laggards; Innovators; Early Adopters; Early Majority
5. Name at least three targeting options.
6. For your business, write five iterations of copy. This means 5 separate titles and 5 bodies. Be wary that titles can not exceed 25 characters and bodies can not exceed 135 characters.
7. You are advertising for an upcoming off broadway show in New York City. Describe three ways to target a potential audience.
8. Why can artificially boosting your CTR hurt your bottom line?

9. For your own business, write two pitches. The first pitch go from What to How to Why. For the second pitch, go from Why to How to What. Do not worry about length.
10. Now worry about length. Take your second pitch and attempt to whittle it down by half.

Day 4 - Statistics Review

I'll be honest with you, I have met only several people who find discussing the merits of statistical testing interesting. Some may even dread the idea of participating in such a conversation. I insist this chapter will be painless and distilled down to the bare essentials. The information in this section is extremely helpful to understand and will save you money.

For those wanting more...

The following texts have been extremely useful to me in the past. They are ordered by difficulty.

- *The Drunkard's Walk* by Leanord Mlodinov[ˆfoo4] - A wonderful introduction to the approach and execution of statistical thought and problem solving.
- *Stat Labs: Mathematical Statistics through Applications* by Debrah Nolan[ˆfoo5] - This book is a wonderful, concise read to various statistical tests and how to perform them properly.
- *Mathematical Statistics and Data Analysis* by John Rice[10] - A great resource for a thorough and rigorous discussion of Statistics. This text is definitely for the mathematically inclined but it's real world examples are extremely helpful.

[10] R code for the graph: *boxplot(mtcars[,1]∼mtcars[,2], xlab="Number of Cylinders", ylab="MPG", main="Boxplot of MPG vs. Number of Cylinders")*

Statistical Testing

In this chapter, we will go through an example which expounds on the major buzz words of a statistical test: significance, sample size, confidence, variance, etc. But before going into these let's step back for a moment and speak in plain terms about what we wish to accomplish.

Any statistical test wishes to answer a question. Now, this means something completely different to a laymen than a statistician. For example, take the following, "Ad A has a conversion rate of 30% and Ad B has a conversion rate of 40%. Which advertisement performed better?" To a laymen, the answer is of course, "Ad B." However, the answer to a statistician is, "it depends." Now why is that? (Sorry, no more trick questions for the rest of the book.)

This question relies on the fact that when comparing two proportions we need to know our sample size. Did only 10 people see Ad A or did 1000 people? This matters immensely. But why, the laymen may protest? Advertisement B's conversion rate was a huge improvement over advertisement A. True, but a statistician would retort that we must know whether this difference was due to chance or an actual improvement.

To this end, statisticians have produced a wide array of tests for various types of situations: t, F, Z, and Chi-squared tests to name a few. The theory motivating these tests is rather complicated but actual implementation is a simple plug and chug formula. All of these tests have a similar operating procedure: ask a question, calculate a test statistic, and finally determine its significance.

These three aspects of testing will frame the rest of the section. To further illustrate the points we will work through the following example: you find a coin on the street, how do you prove it is fair? Coin tossing is intuitively easy to understand, comparing advertisements can be more difficult. Each sub-section will relate this foundation of coin tossing back to creative testing.

Ask a Question

In creative testing, the obvious question is did this advertisement perform better than this other advertisement? Although it's not completely necessary, it will be nice to spend a little more time on this issue to lay out some helpful terminology. Without it, speaking about testing can be difficult. Also, if you ever are presented with a unique situation that requires a different type of statistical test, then you are already familiar with the jargon.

The Null Hypothesis

The starting point of our coin tossing test is a simple question; what is fair? For the coin to be fair, we would like the proportion of heads tossed to equal that of tails. This occurs when both proportions equal 50%.

We now have our our null hypothesis. Which is a jargon word for the default position of a test. I.e. if the coin was fair, or had not been tampered with, what would we expect to observe. In mathematical terms, we write *H0* = P(Heads=50%) .[^foo1] Where *H0* stands for the null, or zero, hypothesis and P(Heads=50%) is the proportion/probability of heads is 50%.

Now what would be our null hypothesis for our two advertisement test from above. The default position would be that conversion rate of A is equal to the conversion rate of B. Another way to say that is the conversion rate of A minus the conversion rate of B is equal to zero. Thus, our null hypothesis in creative testing is that there is no difference in performance between our creative.

$$\text{Conversion Rate}_A - \text{Conversion Rate}_B = 0$$

Creative Testing Null Hypothesis

The Alternative Hypothesis

Fair is intuitively easy to understand as the point at which the proportion of heads equals the proportion of tails or 50%. Unfair on the other hand needs a little discussion. We would like to test the opposite of our null hypothesis or in simple English where the proportion of heads does not equal 50%. This alternative would be symbolically referred to as *H1*.

$$H_1 = P(Heads \neq 50\%)$$

Correct Notation for H1

We could also test if the coin was tampered with to produce more heads than tails, *H2*, or if the coin was tampered with to produce less heads than tails, *H3*.

$$H_2 = P(\text{Heads} > 50\%)$$

Correct Notation for H2

$$H_3 = P(\text{Heads} < 50\%)$$

Correct Notation for H3

Hopefully, you will see that *H1* is a combination of *H2* and *H3*. If not, think of the two ways that the proportion of heads could not equal 50%. Either the proportion of heads is below 50% or above 50%. For this reason, we say that H1 is a two-tail test since we are testing two different scenarios at once. H2 and H3 only have one direction of unfairness so are called a one-tail test.

H1 , *H2*, and *H3* are all called an alternative hypothesis. For our example, I will focus on testing *H1* and *H2*. You will soon see that testing *H3* is trivial once the basics are understood.

For our advertisement test, what would it's alternative hypothesis be? Remember, the null hypothesis is that the conversion rate of A minus the conversion rate of b is zero.

$$\text{Conversion Rate}_A - \text{Conversion Rate}_B = 0$$

Advertisement Null Hypothesis

Like the coin toss, our advertisement test alternative hypothesis could have three possibilities. For our purposes however, we only care about the two-tailed alternative hypothesis: the conversion rate of A minus the conversion rate of b does not equal zero.

$$H_a \equiv \text{Conversion Rate}_A - \text{Conversion Rate}_B \neq 0$$

Advertisement Alternative Hypothesis

In both coin tossing and creative testing, we will run a test which will produce a test statistic. This test statistic will allow us to say if we have enough evidence to reject the null hypothesis. If we have insufficient evidence, we would failed to reject the null hypothesis.

Calculate a Test Statistic

If you have never heard of a test statistic, do not fret. A test statistic is simply a number produced via a statistical test. When testing our creative, we will use a pooled two-proportion Z test. (More on this later.) In our Z test, we plug in certain numbers to a formula and produce a Z score. This Z score is our test statistic. The beauty of a statistical test is that we can now use this one number to determine if our result was due to chance or an actual difference in performance. This is accomplished because each type of test statistic has an associated table which will tell you the chance of that particular value occurring.

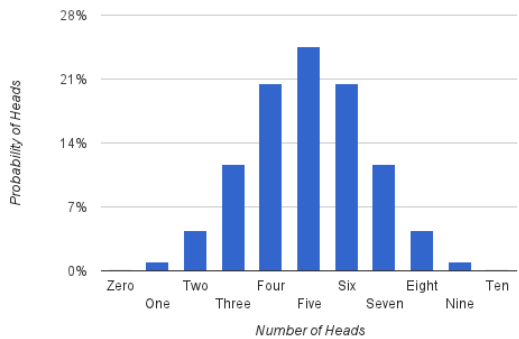
But before revealing what our test statistic is, we must first go over two topics: chance events and sample size.

Chance Events

So far we have our null hypothesis, *H0*, that the coin is fair, P(Heads=50%). We also have an alternative hypothesis, *H1*, that the coin is unfair, P(Heads=/=50%). We also have another alternative hypothesis, *H2*, that the coin was tampered with to produce more heads that tails, P(Heads>50%). (Similarly, for our advertisements, we have the difference between them is zero as the null and not equal to zero as the alternative.)

To test these hypotheses, we must first understand a little about coin tossing. If the coin was fair, and tossed ten times, we would expect to see five heads and five tails. Experience tells us that this is not always the case. If we observed 6 or 4 heads it would be difficult to say that the coin was unfair. On the other hand, if we observed 0 or 10 heads we'd be more likely to say that the coin is unfair. But why is that?

This is due to the probabilities associated with viewing these occurrences. If we chart the probabilities associated with viewing the number of heads in ten tosses we see the graph below.



Distribution of Heads in 10 Tosses

Tossing a coin is denoted as an independent trial, the previous toss

has no effect on the next one. The distribution of tossing a coin above is calculated via a formula named after Bernoulli. No need to memorize this formula but in simplistic terms, it calculates the total permutations of each event and the chance of observing each individual permutation. I.e. There is only 1 observable sequence of events for observing 0 heads in 10 tosses: TTTTTTTTTT. On the other hand there are 252 possible permutations of observing 5 heads in 10 tossess: HHHHHTTTTT, HHHHTTTTTH, etc. (For the mathematically inclined, this is determined by either Pascal's triangle or more simply the *N choose K* calculation.) Under fair circumstances, each of these events, observing one head or tail has 50% probability.

How did I produce the above bar graph? Below you can find the equation used to calculate such an occurrence. These are included for the curious and are not a pre-requisite to advertise properly. Yet, it does complete the lesson on calculating chance events.

$$(\text{Number of Permutations}) * (\text{Chance of Heads})^{\text{Number of Heads}} * (\text{Chance of Tails})^{\text{Number of Tails}}$$

Binomial Equation Written Out

$$252 * (\frac{1}{2})^5 * (\frac{1}{2})^5$$

Plugged and Chugged from Example Above

$$\binom{n}{k} p^n * q^{(n-k)}$$

Binomial Equation for the Mathematically Inclined

From this chart, we observe that we have around a 25% chance of observing exactly 5 heads and around a 20% chance of observing 4 heads or 6 heads. In total, we have a 65% chance of observing between 4 and 6 heads.

For our advertisements, we know that the conversion rate is bounded between 0 and 1 but our question is ever so slightly different from the coin tossing example. In the coin tossing example we are asking

if a coin varies greatly from the hypothesized population proportion, 50%. For our advertisements, we are asking if the difference between them varies greatly from our hypothesized difference, zero. Surprisingly, if we graphed the expected differences between the two advertisements it would produce a graph extremely similar to the coin tossing graph.

This is not an accident. Coin tossing and advertisement comparison are related by the binomial distribution. This is a fancy term for what is more commonly called a bell or normal curve. In our case, we assume that each impression and conversion for an advertisement is independent. Meaning, one conversion does not affect the next conversion. This independence, among other aspects, links this comparison to the normal curve.

Sample Size

The above chart shows the probability of witnessing a specific number of heads in ten tosses. The issue with only performing 10 tosses is one of sample size. Even though observing 2 or less heads has a probability of 5%, I would be hard-pressed to say that a coin is unfair if we only tossed it 10 times. By way of comparison, observing 42 or fewer heads in 100 tosses has a probability of 6.6%. I would be more likely to say the coin is unfair in the latter circumstance even though the probabilities of witnessing those two events are essentially equal.

This is due to the increase in trials, or our sample size, between the two separate tests. Sample size is related to the confidence interval of the proportion we are measuring. Any measurement we take will exhibit a natural amount of variation around our measured result. For processes that follow a normal distribution, coin tossing, we can estimate this wiggle room by using the following ad hoc formula.

$$\frac{\sqrt{\text{Number of Trials}}}{\text{Number of Trials}}$$

Confidence Formula

For 1000 trials, we expect any measured result to be within 3% points of the actual outcome. If we witnessed 517, 51.7%, heads out of 1000 tosses, we would expect the real proportion of heads to be somewhere between 48.7% to 54.7%. (Mathematically, "expect" here is defined as being 95% sure that the real result is between these two bounds.) Using our formula, 10 tosses yields a 30% error bound. So a measured 60% head rate, 6 heads observed, we'd expect the actual head rate for the coin to be between 30% and 90%. (This is skimming over a lot of rigor but all you really need to know for the tests we will be performing.)

Simply put, the more trials you have the more accurate you will be. The common problem arises that more trials equates to more time and money. You will have to weigh these two options when performing any of your own tests.

Our Test Statistic

Both examples, coin tossing and comparing advertisements, are related by the normal distribution. For coin tossing, to see the rarity of any one event I can use a the following formula.

$$Z = \frac{\hat{p} - p_0}{\sqrt{p_0 * (1 - p_0) * \frac{1}{n}}}$$

One Proportion Z-Test

This formula is called a one proportion Z-test. It is one of the simplest test statistics used. It may look daunting now, but you have all the necessary information to understand its various parts.

In the numerator, we have the following term.

$$\hat{p} - p_0$$

One Proportion Z-Test Numerator

The numerator is a simple procedure which subtracts our observed value, p_hat, with our hypothesized population proportion. In our case, the hypothesized population proportion is 50%. As you can see this is our null hypothesis that the proportion of observed heads will be 50%. This is by no means a mistake as what we are trying to measure the distance from our null hypothesis to access an event's rarity.

In the denominator, we have the following term.

$$\sqrt{p_0 * (1 - p_0) * \frac{1}{n}}$$

One Proportion Z-Test Denominator

Although it may look a little odd, this is how you calculate the standard deviation of our sampling distribution in a one proportion test. Standard deviation is a numerical value used to show the dispersion of individuals in a group. More simply, the higher or lower the value the rarer it will be to see the event. We will revisit this shortly.

In terms of naming, the tests that we will deploy call a standard deviation a Z score. This is a situation analogous to the following saying, "all poodles are dogs but not all dogs are poodles." Applying it to our situation all z scores are standard deviations, but not all standard deviations are z scores.

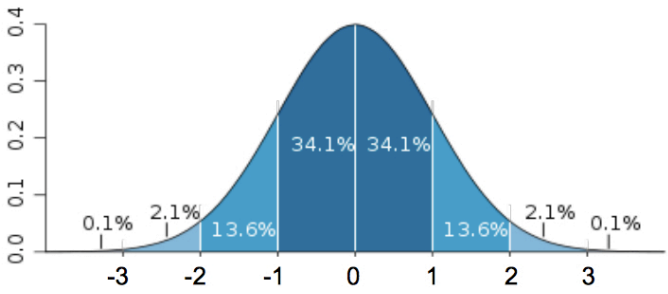
After breaking apart the equation, we have arrived at something rather logical. To test the rarity of viewing a certain event we simply divide the observed difference by the predicted amount this event is

suppose to deviate. The larger the difference between our observed and hypothesized event is then directly proportional to the rarity of observing the event.

Determining Significance

In statistics, a significant event is defined as only being observed 5% due to chance. A highly significant event is one that we would predict is observable 1% of the time due purely to chance. This allows us to reject or fail to reject our null hypothesis with some certainty. This does mean that if we repeated our test 100 times, we would expect to incorrectly reject the null hypothesis 5 times. In statistics this is called a false positive or Type 1 error.

After doing the calculation above we will produce a Z score. This Z score is standardized and allows us to look up it's value in a table. (This is easily accessible in Excel via the *NORMSDIST* function) This value directly relates to the chance of viewing a specific event.



Z Score and Normal Distribution with Percentages

The above graph[11] has z scores as the x axis and their probability as the y axis. As you can see this our familiar friend from before,

[11]R code for the graph: *interaction.plot(mtcars[,2], mtcars[,9], mtcars[,1], ylab="MPG", xlab="Number of Cylinders", main="Interaction Plot MPG ~ Manual Gearbox and Number of Cylinders", trace.label="Manual")*

the normal curve. This is a standardized graph, so 0 is the mid point and the z scores deviate from this in both negative and positive directions. In the above graph, we predict that 68.27% of our observations will fall between -1 and +1. Furthermore, we predict that 95.45% of our data will fall between -2 and +2.

If we conducted 100 coin tosses, we expected 68.27% of the time to observe between 45 and 55 heads. We also expect to see 95.45% of the time 40 and 60 heads. These values were arrived at from the equation introduced above.

$$Z = \frac{0.60 - 0.50}{\sqrt{0.50 * (1 - 0.50) * \frac{1}{100}}} = 2$$

One Proportion Z-Test

At the beginning of this section, we said a significant event has a value of 5% and a highly significant event has a value had a value of 1%. For a two sided test, more on this shortly, this equates to a Z score of -1.96 or +1.96 and -2.58 or +2.58 respectively.

And we're there

We have so far defined our hypotheses, determined how to calculate various outcomes and understand the importance of sample size. Now let's determine if our fictional coin is unfair. From the above data we see that we'd like to perform at least 100 coin tosses and time permitting - more. Let us assume after 100 tosses we witness 59 heads.

Our first alternative hypothesis, *H1*, asked if the proportion of heads did not equal 50%. Meaning was it significantly below or above this value? Due to this we also have to consider what is the chance of observing 59 or more heads or the opposite of this as well. Meaning witnessing 41 or fewer heads. We can use our equation from before

with plugged in values to arrive at a Z score of 1.8. Using a Z score calculator, we predict this type of deviation around 7.2% of the time. Thus, it is close to a significant event but not enough deviation to reject the null hypothesis.

What may be confusing here is that our second hypothesis, *H2* , which asked if the proportion of heads is greater than 50% actually is significant. This is due to the probability of seeing the event as 3.6%. Since *H2* is one directional it requires less evidence to prove. It simply only asks if the proportion of heads is significantly greater than 50%. *H1* is harder to prove as it asks whether the proportion of heads is both greater than 50% or less than 50%. Also, you may notice that 7.2% is double 3.6%.

H1 is more useful for our purposes and the test we perform will be a two directional test. This is due to how we compare ads. We'd like to have enough evidence to understand if an advertisement is significantly worse or significantly better than a competitor.

For our creative tests, we will use a two-tailed system as well. Remember, our alternative hypothesis was the generalized one: the difference in performance of advertisement A and advertisement B is not equal to 0. There are two ways the test can be proven, thus a two-tailed test. This means a significant event has a z score less than or equal to -1.96 or greater than or equal to 1.96.

A/B Test

A/B testing has become a jargon word in the technology industry. Amazon® and Google® are well known for continually performing such tests. The name itself derives from simply comparing two separate items, in our case advertisement A versus advertisement B.

For our purposes, we will use the framework to compare our advertisements. The key aspect to any A/B Test is to make it univariate,

i.e. only comparing one aspect at a time. This could be title, body, image, time uploaded, demographics targeted, budget, etc. This is opposed to multivariate testing, which can be accomplished, but the math behind it is a little more complex. Intuitively, if all else is equal, we can assume that the change in performance we see in a univariate test is due to the one lever. In a multivariate test we need to control for differences tested and see their relative effects. (The section of graphical analysis found in the Epilogue has a brief description relating to this type of analysis.)

]

A Pooled Two - Proportion Z test[^foo2]

For our A/B testing purposes we will use the follow test statistic, the pooled two - proportion Z test. This may sound challenging but you will shortly see it as a simple plug and chug formula. To begin, let's define the terms individually.

A pooled test means that instead of comparing the metrics individually throughout the formula, we use a combination of their performance to measure the variance within the test. We perform the test this way because we are assuming that the difference between the advertisements distribution is zero.

As you may have guessed there is a one proportion test as well. Proportion here simply means that we are comparing percentages. Naturally, this limits the numbers we compare between 0 and 1. This test would then be invalid if we were to compare numbers greater than 1. That is, if you were to look for a statistically meaningful difference between CPA, which as a dollar amount is not bounded by 0 and 1, then a different test would need to be used.

Z test refers to the type of statistical test we are to perform. From the formula introduced below, we derive a Z score which is a measure of the difference between our advertisements. Then we refer to a standardized table that relates a Z score to the rarity

of the event observed. What this means is that statistical tests are independent of the data analyzed. The purpose of these tests is to have a standardized process that applies to any data set if it meets certain requirements. For other situations a T, chi squared, F, or other tests may be appropriate.

The Equation

$$Z = \frac{(y_1 - y_2) - d_0}{\sqrt{\hat{p} * (1 - \hat{p}) * (\frac{1}{n_1} + \frac{1}{n_2})}}$$

Pooled Two Proportion Z Test Equation

Where *Yi* is a defined as

$$y_i = \frac{x_i}{n_i} \text{ where } i \text{ is either } \{1,2\}$$

Definition of Yi

Where *p hat* is a defined as

$$\hat{p} = \frac{x_1 + x_2}{n_1 + n_2}$$

Definition of p hat

Defining terms we see that *p hat* is our pooled proportion. *y1* and *y2* are the observed proportion of the two advertisements we are testing. As mentioned earlier, *d0* is defined as 0 here due to an assumption in the distributions being similar. *x1* and *x2* represent the numerator of our proportion and *n1* and *n2* represent the number of trials.

For instance, if we were to compare CTR the clicks would be represented by *x1* and *x2* and the number of trials in CTR is impressions. For IPC, *x1* and *x2* would be installs while clicks would be the number of trials. For Conversion per Impression we have impressions as the trials again and conversions being *x1* and *x2*. For those mathematically inclined you can see why we must use proportions due to the (1-*w*) term. Which would invalidate the square root if it exceeded 1.

Hopefully you notice a strong similarity between this Pooled Two-Proportion Z test and the one proportion Z test from before. Stepping back they have a similar design. Each test divides the difference we are testing in the null hypothesis by the predicted amount of deviation in the system. For two proportions, the standard deviation calculation is a little more complicated but has a similar flow to the one proportion test. The left side of the square root now uses a pooled proportion instead of the hypothesized population proportion. The right side of the square root now has two 1/n variables. Both of these aspects are due to the fact that we are comparing two proportions instead of one observed proportion.

In the next section, we will go through an example using the pooled two-proportion z test from start to finish.

Closing

Some may argue that this was a lot of statistics to go through to show a plug and chug formula. It would be akin to teaching someone the entire workings of an internal combustion engine before simply letting them turn the key in the ignition. Granted, this knowledge may not be needed to turn the key but I believe it is extremely helpful if any problems arise while driving. Similarly, the overview of statistics allows you to drive your testing with confidence.

An objection may also be given regarding why bother with all of this rigor? Given a large enough sample, a simple stack ranking and deletion of underachievers could be conducted. This may work but has several flaws:

1. It doesn't allow you to automate a creative testing system
    - It is extremely hard to program a human judgement call into a spreadsheet. It is much easier to use a standardized test as the decision maker.
2. Raises the chance of overspending
    - If you always wait for a large enough sample you might be overspending on poor performing advertisements. If you compare the advertisements earlier with a standardized test that factors in sample size, it allows you to cut bad advertisements early.
3. Inadvertent dismissal of great ads
    - If you leave creative decisions to eyeballing, it is very hard to correctly promote advertisements which are in the middle of the pack. With a statistical test, you know the significance of the difference in each measurement. This allows you to more confidently draw a line in the sand between great, good, mediocre, bad, and horrible advertisements.

Closing List

- For a more thorough statistical discussion, please refer to the books provided
    - *A Drunkard's Walk* by Leanord Mlodinov
    - *Stat Labs: Mathematical Statistics through Applications* by Debrah Nolan
    - *Mathematical Statistics and Data Analysis* by John Rice
- Examining a normal coin toss can be helpful understanding the basic statistics

- More data means more confidence in test statistics but will cost more money
- The A/B test is the most common advertising testing procedure
- Univariate tests are easier to analyze than multivariate
- The Pooled Two - Proportion Z test can be used for any measurement with a bound of 0 to 1.

Footnotes

Day 5 - Setup and Execution

Goal

We have so far covered a lot of information in a short period of time. The remaining days will focus on using this new knowledge and applying it.

There are two main branches of advertising: bid optimization and creative testing. This chapter will focus on test set up and execution. After understanding these processes, you will have all the necessary knowledge to run a successful advertising campaign! The following section will focus on audience valuation and automation within Excel.

As a side note, bid optimization math is more simple than the math relating to creative testing. Oddly, it will take longer to describe this proper process than testing creative as the latter is a plug and chug format.

Bid Optimization

Understanding the market you are advertising in is the first step for bid optimization. Thusly, we will begin with a discussion of designing a supply curve test. It should be noted that if your budget does not permit this test, it is quite alright to skip it. The benefit however of running such a test is an ability to understand your market.

The Formula

The basics of bid optimization begin with figuring out a bid for an advertisement. This is extremely simple - take the product of your target audience's LTV and their conversion rate. Given sufficient data this will give you a break even bid. (LTV, Life Time Value, will be discussed in the following chapter. If you are unable to discern an LTV, be conservative on valuation. Remember the higher you value your audience the more money could be at risk!)

For example, if your target audience had a $2.00 LTV and the advertisement had a conversion rate of 50%, you could bid the advertisement at $1.00 to break even on acquisitions. If you wished to "bake in" a profit margin to these acquisitions then simply multiply the above product by one minus your desired profit margin. In the example above, a 20% profit margin would yield a $0.80 bid.

$$(\text{Audience's LTV} * \text{Conversion Rate}) * (1 - \text{Desired Profit Margin})$$
$$or$$
$$(\$2.00 * \ 0.50\%) * (1 - 20\%) = \$0.80$$

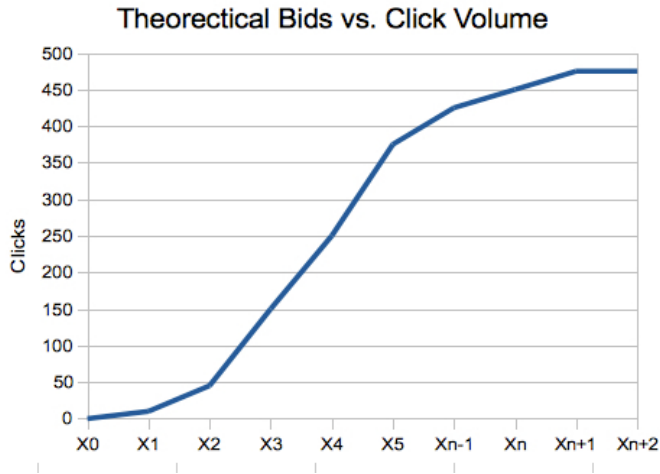
Bid Formula

This formula is extremely simple but bidding an ad properly requires understanding some nuances about the process. Due to the simplicity of the math, your goal should be to automate this process as much as possible. This means more time devoted to creative ideation and testing.

Creating a Supply Curve

As mentioned above, a worthwhile bid optimization test is a supply curve test. The objective is to establish a relationship between an advertisement's bid and volume produced. Understanding the incremental returns for an increase in an advertisement bid is very helpful. Graphically seeing a bid increase's marginal returns allows you to better understand a proper starting point to advertise at.

Typically, an advertisement's bid and click volume exhibit an S curve relationship. Between some minimal values of 0 to *X1* the advertisement will receive a negligible amount of clicks. Between *X1* and *Xn* an increase in the advertisements bid will increase the amount of clicks it receives. After some point this increase tapers off, such that any increase in *Xn* to *Xn+1* yields little to no improvement in click volume.



An Hypothetical Supply Curve

Setup and Execution

Desinging one of these tests is quite simple. If you haven't tested any creative yet, use your simplest ad which you think best represents the rest of the advertisements. If you have been testing creative, use an advertisement which has average performance. (Designing a supply curve off your best creative will make it's predictive power limited. All else being equal, an average performing ad will show your expected increase in purchasing power.)

After choosing your advertisement, pick a list of demographic targets and select your audience in the Facebook® UI. Facebook

will offer a min, median and max suggested bid price. Let's use the min suggested bid price as a starting off point. Typically, I will start at 30% of the min suggested bid and create duplicate ads with a 10% increase in their bid price till 100% of the min suggested bid. In this format, your test will consist of eight duplicated ads which only vary on bid price. Each ad created should also be placed in their own campaign. (Discussed later.)

Suggested Facebook Bid (SFB)	**1.25**
X0 - 30% of SFB	$0.38
X1 - 40% of SFB	$0.50
X2 - 50% of SFB	$0.63
X3 - 60% of SFB	$0.75
X4 - 70% of SFB	$0.88
X5 - 80% of SFB	$1.00
X6 - 90% of SFB	$1.13
X7 - 100% of SFB	$1.25

Depending on your budget, you may wish to bid over the min suggested price. This can be beneficial if you ever want to max out your coverage on Facebook. It is also pricey. To this end, make sure you have small budget caps on all of your campaigns in this test. Since the market clearing price is unknown, a high bid can result in a lot of money spent in a very short amount of time. Small daily budget caps will address this concern.

Why did my CTR increase?

You may also notice that CTR improves as an advertisement's bid is increased. This is also caused by Facebook's optimization algorithms. Facebook understands that some audiences are better to advertise to than others, even within the same demographic bucket. When increasing a bid your ad is shown in more competitive buckets that will increase revenue for Facebook. Due to this, your ad's CTR can increase.

Using the Data

After the test runs, determine the lowest bid/volume point that will generate a steady flow of traffic to your product or service. It is important to remember that an advertisement's metrics will degrade over time. Picking the lowest bid that received impressions will be a fool's errand as your ad will be shut off quickly. (Remember, Facebook wants to make money on your advertisements.)

To reiterate, this is a completely optional test but the learnings can be very valuable. To run it for every demographic would be overkill but having a keen understanding about the market for your key audiences is a valuable tool. Markets also mature and change overtime, so it may be necessary to repeat the test at select time intervals (months not weeks) to update any previous findings.

Lastly, always document your findings! Google Docs® is a great way to keep an easily shared record.

Selecting your Audience

We have spoken in great detail about Facebook's targeting options and gathering information about a market. Usually, running one supply curve test for a very general audience is sufficient. But running an advertisement campaign to a general audience would not be utilizing Facebook's wonderful targeting options. Essentially, you need to answer one of two questions: who wants your product or who has the problem your service is solving?

These can be difficult questions to answer for certain business models. For a small advertising budget, starting narrow then broadening is very effective. For a large advertising budget, starting broad then narrowing is most likely more appropriate. Why?

A large company, will typically have in place aggressive growth objectives. Also, they should have decent internal data regarding demographic valuations. Not to mention, rapid growth can usually

afford them additional press from industry blogs/publications. With these factors combined, a slow and methodical approach is most likely ill-suited even if a rapid growth plan sacrifices some profitability.

As a small business owner, early stages of advertising should be focused on acquiring quality users for as cheaply as possible. Although growth may initially be slow, this allows you to systematically value your audience. Which will pay huge dividends in constructing profitable and efficient campaigns.

Example

Your great new vitamin business, Vitamin Surplus, has recently hit the market. You love the product, but are perplexed about a key audience. The following is a process to discern this information.

1. Start by running an advertising campaign focusing on both genders, 22 to 65. Along with these selections, you add likes and interest targets related to competitors or vitamin based keywords.
    a. Users under the age of 22 are harder to monetize; however, they can be very viral. Please consider carefully though when spending on groups who can not directly pay you back! As a reminder, make sure the age groups chosen make sense for the product.
2. After reaching enough test volume you pull a responder profile report. This allows you to see the distribution of your audience.
3. Set up a second test, pitting advertisements using demographic information versus advertisements using both demographic information, likes, and interest targeting
4. Compare these two groups to answer these two questions. (More on this type of analysis later)

   a. Is the hit in volume worth the increase in advertising rates?
   b. Can a value between the audiences be determined? I.e. Are keyword targeted people more engaged with the product?
5. Continue refining and adding in other groups until satisfied. Common ways to expand are to both genders, other age buckets and international markets which speak the same language. All of these expansions should be judged on a case by case basis and only used when appropriate.

Case Study: Bid Optimization

After managing your ads manually for some time, you may want to build a more automated system. Even if you do not have access to the Bulk Uploader or API, having an automated bid system is a good idea to be able to track results and budget.

The hardest part of constructing an automated system is being able to have an accurate estimate for the value of your target audience. For this section, let's walk through a fictional example. We'll start with a brief discussion of valuation and move on to creating an automated system.

The Business

We are selling a vitamin product worth $100 to the following audience: US, both genders, 35 to 50 who are interested in fitness. Via Facebook's Estimated Reach tool, we discover that our audience is roughly seven million, with 40% of which is male.(Interests targeted were Activities>Outdoor Fitness Activities and Interests>Health and Well Being). Repeat business for the product is not null but difficult to track. Thus, for our model we only care about the conversion rate for both males and females.

Separation is Key

Using Facebook's bid tool we see that the min suggested bid for both genders is roughly $0.55 with a max bid of $1.00. Even though the suggested bids between the genders are roughly equal we will still create two separate campaigns. (In practice, you may even want to separate the age bucket above to two or more buckets.) Why? After running the advertisements, it will be much easier to determine gender based conversion rates. If we ended up using the averaged conversion rate, we'd lose money. For example, let's say males have a 5% conversion rate and females have a 10% conversion rate. At $100, this gives us a $5 LTV for males and $10 for females. In bids this would yield break even bids of $0.25 for males and $1.00 for females.

If we did not separate our advertisements we could be easily led astray in finding a break even bid. Assuming our purchases were 60% female and 40% male we'd have a conversion rate of 8%. Which would give a break even bid for the population of $0.64. Which means we'd lose 39 cents on each male sale and make 36 cents on each female sale.

By keeping the advertisement's separate, we're able to reap the profit on the female sales without offsetting it with loss on male sales.

Variation in Estimations

The above section assumed we knew the conversion rates. In practice, this takes some time. What we should do, given the suggested bids above is start advertising to males and females separately at 80% of the 55 cent bid, roughly 45 cents. Monitoring this price point, we can see if volume is a steady rate. If it is, we could lower our bids. If it is not, then simply increase bids till we hit a steady volume.

Since we have no knowledge about the market a priori, these first

advertisements are a guessing game. Essentially, we are flying blind. Assuming a normal distribution, we would need 1000 clicks per gender to have a 3% error bound on the conversion estimate. (More on this later.) Given a true rate of 10% for females, this means we would be 95% sure that the female conversion rate is between 7% and 13%. I like to assume the conservative estimate and become more aggressive with more data. Using the conservative estimate we are given a proper bid of $0.49. Which is great since our starting bid was $0.45.

The Waterfall Process

To formalize the process on adjusting bids, I like to create a waterfall process. We will have many advertisements that all have various conversion rates. At regular intervals we will want to adjust these bids to maintain profitability. The easiest way to accomplish this is by creating a waterfall process.

In the above section, we observe that the female conversion rate most likely falls between 7% and 13%. This establishes a bid of $0.45 as a great starting point. After some analysis we discover that after 500 clicks, an advertisement will show a fairly stable conversion rate. The waterfall process:

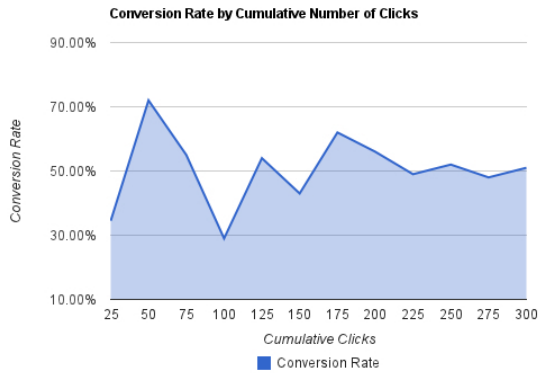
1. Upload a new campaign of ads with an established starting bid
2. If an ad has enough data after one day, adjust bids based on previous day's conversion rate
3. If an ad previous day's data does not pass some data threshold, use ad's previous week of data
4. If the ad doesn't have enough data in the past week to adjust then use average conversion rate for the demographic

Waterfalling from day to week to demographic allows the advertiser to keep an advertisement running and producing conversions but at

a desired ROI value. The natural question here is how to establish a threshold value.

What we are assuming in the above example is yesterday's advertising rates will be similar to today's. If this is not the case then some precautions will have to be taken to minimize variance.

The easiest way to view this is to graph the conversion rate for each successive n number of clicks. At some point you will see that the conversion rate will level off. Using the waterfall process above, you can use an observed threshold value to make sure your advertisements are consistently performing within your ROI value.



Visual method for threshold value

Creative Testing

Test Design

The easiest way to test creative is to perform combinatorial testing and then compare the ads univariately afterwards. Let's unpack this last sentence. By combinatorial we mean to say that if you wanted to test 2 titles, 2 bodies and 3 images we would have created 12

unique ads. (2x2x3=12). If you also want to test these 12 ads to various demographics then that would also add a mulitplier. Both genders means your test now has 24 unique ads. And so on. This is why it is extremely helpful to define your key audience before testing. Setting up a test, especially without the use of the Power Editor or the Bulk Uploader, can be tedious. Remember, running a proper creative test in Facebook typically means making each ad variant a unique campaign due to over optimization issues.

Use the above methods to figure out bids for the advertisement bids. After running the ad variants you will now need to compare them to eachother. Since the test we will be performing is univariate we must compare ads that are similar in all regards except one. Stack rank the advertisements and compare them using a pooled two-proportion z test.

Case Study: Creative Testing

Look at the table of data below for ad A and ad B. Which ad performed better?

Ad	Imps.	Clicks	Conversion	CTR	Con. Rate
A	2,061,994	1450	653	0.07%	45%
B	2,303,223	1730	519	0.08%	40%

From this table we see that Ad B had better CTR but worse Conversion rate than Ad A. To understand if Ad B had a statistically significant better CTR follow the steps below.

- Find the pooled conversion rate of both ads

$$\frac{1{,}430+1{,}740}{2{,}061{,}994+2{,}303{,}223} = 0.0728\%$$

Step 1

- Plug in the numbers to produce the answer

$$\frac{0.07\%-0.08\%}{\sqrt{(0.0728\%*(1-0.0728\%))*(\frac{1}{2{,}061{,}994}+\frac{1}{2{,}303{,}223})}}$$

Step 2

- This yields, a test statistic of **-1.85**

This is great that we arrived at this answer. We have found a test statistic of -1.85. Since we did not know which ad would perform better before running, we convert this number using a two tailed normal distribution. We find a p value of 0.064, or roughly 6% of the time we would observe this happening if no difference actually existed.

In terms of significance, there is a standard practice that a p value of 0.05 is significant and one of 0.01 is deemed highly significant. Although, it is not uncommon to use a p value of 0.1. Even though we are off by a percentage, I would feel comfortable saying that the results are significant in practice due to the typical constraints of budget and time.

A standard p value of 0.05 to determine significance is at a z value >=1.95 or <=-1.95. As you can see with the test, depending on the order tested we either make it positive or negative. It is completely up to you which way to perform the test.

Performance: A tricky Word

It's wise to start any test with defining an objective. Our assumptions before a test will affect our analysis after it is performed. What becomes tricky is how we actually define performance.

As mentioned earlier, we can easily boost CTR with risque images or copy. Usually this will be at the detriment of the advertisement's conversion rate. Conversely, you may stumble upon a technique which increases conversion rate but lowers the advertisement's CTR. Both situations are not helpful as they both contribute to an increase in Cost per Conversion. Why? The former will lower the bid price of the ad but will also lower conversion rate. A lower conversion rate means a higher price paid per conversion. The latter will raise the advertisement's bid price and thus its Cost per Acquisition.

Due to this issue, I like defining performance of an advertisement by its Conversion Per Impression. Mathematically, it is the product of CTR and Conversion rate. It is also directly related to the Cost per Conversion. Optimizing by Conversion per Impression, allows you to promote the most well balanced advertisements. Even if you do not employ techniques as obvious as risque images, ads will still have different stack rankings based solely on CTR or Conversion Rate alone. For these reasons, I determine performance by Conversion per Impression and not CTR or Conversion Rate separately.

Feel free to use your own judgement when designing and implementing your own creative analysis tests. The examples below will use Conversion per Impression as their statistic but the tests are equally applicable to any test statistic chosen.

Closing

The tests discussed here are the most useful in optimizing your advertising process. If you still have worries about execution, the following section will iron out any remaining wrinkles via a step by step setup guide.

- Understand that performance can be tricky to define
- A supply curve test is not necessary but very helpful
- Bid optimization is easily accomplished via a waterfall process
- Univariate testing is easier to analyze than combinatorial

Footnotes

Day 6 - Valuation and Automation

Goal

So far we have reviewed and learned all the basics to Facebook® advertising: the necessary tests, analysis and bidding procedures. To create a complete system we need to learn audience valuation and testing automation.

After running advertisements for some time, you will have amassed a considerable amount of data regarding your patrons. This information is valuable! By analyzing purchasing patterns and various rates we can determine an ad-hoc LTV.

Finally, we must learn ways around manually changing bids. The finale of this section will be a discussion regarding the creation of a more automated system within Excel.

Valuing an Audience

All products have a natural customer base. It behooves any business to know the relative cost and expected profit from any customer based on various demographic targets. Figuring out acquisition cost is relatively straightforward. Take the total spent and divide by the total number of conversions for a specific time frame. This Cost per Conversion is typically what we are striving to lower through creative testing. On the other hand, estimating a customer's Life Time Value, LTV, can be a very difficult problem.

KISSmetrics produced a wonderfully laid out and informative guide

to this process. That infographic can be found in the following link[12]. More information about KISSmetrics can be found here[ˆfoo9].

Instead of purely rehashing KISSmetric's infographic, let's use pertinent information from our vitamin business, Vitamin Surplus.

Definitions

First let us define our variables. The following table gives the variables, symbol, definition and value for The Vitamin Surplus.

- Avg. Customer Lifespan or t
  - What is the average length of time for your audience to remain a customer. We will use **2 years**.
- Customer Retention Rate or r
  - The proportion of your audience that repurchases during a specified period when compared to an equal and previous period **85%**.
- Profit Margin per Customer or p
  - What is the average profit per order. We will use **20%**.
- Rate of Discount or i
  - In discounted cash flow analysis, the interest rate used to determine the present value of cash flows. Typically between 8% and 15%. We will use **10%**
- Avg. Gross Margin per Customer Lifespan or m
  - Take the profit margin and multiply by the average customer expenditure. In the example below, we arrive at **$331.14**. This is the product of $1,655.68 and **p**. $1,655 is the result of the product of Avg Customer Lifespan, Avg Customer expenditure and the number of weeks in a year.

[12]Yau, Nathan. "How to Read (and Use) a Box-and-Whisker Plot." Web log post. How to Read (and Use) a Box-and-Whisker Plot. Flowing Data, 15 Feb. 2008. Web. 09 May 2012. <http://flowingdata.com/2008/02/15/how-to-read-and-use-a-box-and-whisker-plot/>.

Averaging

Assuming a successful advertising campaign is underway for The Vitamin Surplus. We have proper customer tracking in place and have been able to do a cursory analysis of several remaining variables not previously defined: customer expenditures and number of visits per week.

Figuring out the average customer expenditure is a simple calculation. Take the gross sales for a given audience and divide by the number in the audience. Given sales of $6,379 for 100 customers we arrive at an average of $63.79.

For the number of visits per week, we will have to do a slight adjustment. Patrons of The Vitamin Surplus most likely purchase on a four week basis. Let's assume the average order total for a year is 13. Then the number of visits per week would be 0.25.

Given these two numbers we can figure out on an individual basis the average amount spent per customer per week. (It's simply the product of the two previous numbers on an individual basis.) You then average these numbers to arrive at an overall customer value per week average. For simplicity let's take the product of the two previous paragraphs to arrive at an average customer value per week of $15.94. (This number is close but not exactly what would be calculated from a table due to the nature of averages.)

Calculating

Using the above information we can now plug and chug. The columns in the table below shows three common LTV calculations. The rows of the table show the equation, numbers filled in and the final answer. For the equations below assume **a** is the Avg. Customer value per week, **c** is the averaged number of visits per week and **s** is the average customer expenditure.

As a side note, **m** is the product of the answer in column one with **p**, the profit margin we assumed in a previous section.

	Simple	Custom	Traditional
Equation	$52(a*t)$	$t*(52*s*c*p)$	$m*(\frac{r}{1+i-r})$
↓	↓	↓	↓
Filled	$52*(15.94*2)$	$2*(52*63.79*0.25*0.2)$	$(1,655.68*0.2)*(\frac{0.85}{1+0.1-0.85})$
↓	↓	↓	↓
Calculated	$\$1,655.68$	$\$331.71$	$\$1125.88$

Three ways to Calculate LTV

Each of these calculations have benefits unto themselves. I have used a modified version of the Traditional LTV calculation but the others argueably over and under estimate the true value of a customer. It is helpful to thus take an average of all three methods. In this example, our Customer LTV would be $1,037.76; however, this is not the LTV we use to find a proper bid.

How to Implement

We now have an LTV of **customers** within a user specified cohort. This is an extremely important distinction. What we need to use in bidding an advertisement is the LTV of **clickers** within a user specified cohort. What I mean by this is how many clicks produce conversions, then use this proportion to dampen the estimate.

To convert the LTV arrived at above, take the conversion rate of a cohort and the Customer based LTV of that same cohort.

$$\text{LTV of Customers} * \frac{\text{Number of Conversions}}{\text{Number of Clicks}}$$

LTV Conversion Equation

Let's assume the LTV calculated above, $1037.76, relates to US males between the ages of 25 and 40. We also know that for this cohort we received 32 orders out of 4946 clicks. This gives an LTV for clickers at $6.54.(32/4946 * 1037.76) Meaning, if we spend $6.54 on acquiring a new customer via FB advertising we will break even. If

we wanted a profit margin, simply multiply this number by (1- *the desired profit margin.*)I.e. for a desired 20% profit margin we arrive at a target of $6.54*(1-0.2)= $5.23.

Notes

These equations are not set in stone but rather a guide. Below are some suggestions that can be made to suit your specific needs.

*Data Acquisition Issues * In the example above you may have noticed that at the beginning of the example I mentioned we had 100 customers to arrive at an average purchase amount. Later, the clicker based LTV for 25 to 40 US males, I mentioned only 32 purchases. Saying that the remaining 68 came from another cohort. This was not a mistake. In a perfect world, inputs to calculating LTV would come solely for the cohort you are estimating. Typically, this is not possible and some data needs to be massaged. You'll have to make a decision of where data will be pure and where it will be mixed. In this example, I wanted to use the conversion rate for this cohort but used a mixed average purchase amount due to relative volumes. This implicitly assumes that average purchase volume is rather similar between genders but the conversion rates are rather different.

- Using Medians instead of Averages
  - The example above relies heavily on averaging. This is fine and usually the easiest way to analyze data but be wary. If your audience has outliers then medians may be more appropriate to use. Why? In technical terms medians are robust to outliers. This means, unlike averages, a small minority can not drastically sway the metric. E.g. If 2% of your buying population spends $1000 but the remaining 98% spends $10, then the average will be $11.80 for a population of 1000 people. For

the calculations using $10 would be more appropriate as it reflects the reality of your market.

- LTVs based on Demographics
  - One of the most important analytical tools you can wield is knowing the relative value of various demographics. Typically the most differentiation will occur between gender and age cohorts. After calculating the LTV for all patrons, see if you can figure out an LTV for various groups. You can thus see which groups contribute the most to your bottom line.

Bid Automation

Although we spoke about the bid optimization in the previous chapter, I would like to show you several steps regarding building your own system in Excel. Essentially, the goal of this system is to have ROI positive adjusted bids ready for any number of advertisements in minutes. Unless you have access to higher programming systems and Facebook API, this system requires the user to download advertising performance from Facebook and upload the new bids manually. These two steps are quick and easy.

Since this is a book, I can only speak about the general design of an Excel document that would accomplish the bid optimization. Please contact customerservice@BlackConeLLC.com for more information about licensing and distribution.

Overview of a Bid Optimizer

When creating a bid optimization document, the spreadsheet needs five tabs: Information, Reporting, Calculation, Valuation, and Output.

- Information

  - The simplest sheet to set up, this is where you place pulled reports for any advertisements you wish to bid adjust. Facebook has a standard data output regarding the columns used. The two necessary reports are Advertising Performance Report and the data export from the Power Editor. Feel free to use all the information provided but it is not necessary for our purposes. Any columns with pre calculated rates or information regarding social data are not needed for this bidding process.
- Reporting
  - This tab is the basic dashboard for tracking overall metrics during a campaign. This tab is optional as most of the data present here can be found within Facebook's reporting dashboards. I personally enjoy having one as I can add and tweak various graphs much more simply within Excel than in Facebook. Also, with Excel's pivot table capability, set up is a breeze as all that is needed is highlighting the information columns on the preceding tab and clicking where you wish to locate your pivot table on the Reporting tab.
- Calculation
  - This is the heart of this document. Without it you could not adjust bids. It will be described in greater detail in the following section. All advertisement's will have a baseline cohort specific bid based on conversion and LTV data. This tab modifies and updates a baseline when enough data is present.
- Valuation
  - There are many ways to organize this sheet but I find the most useful is to make a table of the cohorts you advertise to, their respective LTVs and historical conversion rates. Each row would correspond to a new cohort. An example of this can be found below:

Cohort	LTV	Historical Con. Rate
Male 20-40 US	6.54	0.65%
Male 41- 60 US	4.32	0.32%
etc.	etc.	etc.

- Output
  - This sheet is essentially the exact same as the Information tab with several key differences. Have the sheet be a replica of the Information sheet with three extra columns: one that performs a *VLOOKUP* regarding the advertisement's old bid, the next checks to see if the old bid is different from a new bid, and the final performs a *VLOOKUP* of the new bid. This sheet is then copied and pasted into a new excel document. This allows you to delete unecessary columns and rows with advertisements which have no bid adjustment. Save this sheet as a Unicode Txt and upload it via Facebook's Bulk Import tool in the Power Editor.

Calculation sheet

This sheet can be difficult to code but is essential. This is where the waterfall process, discussed in the previous chapter, takes place. The goal of this is to set up a system that has the advertisement name in the same row as a newly calculated bid. This is done via multiple *VLOOKUPS* and concatenations. I will describe the broad strokes of this sheet and leave the coding to the reader.

The first aspect of this sheet is a table specifying threshold values and ROI goals. By threshold values, I mean how many X need to happen before switching from a segment data to weekly summarized data or yesterday's data. I.e. if an advertisement has 540 clicks yesterday, you should not be bid adjusting it based on its cohort's conversion data. Instead, it should be adjusted on yesterday's data

as it is most recent. These threshold values are then used as inputs to the numerous cascading functions present in remaining sheet.

I would advise using several pivot tables based on the Information tab with date as a filter to accomplish this task. The first pivot table lists an advertisement's name, various demographic information and is filtered for the past 14 business days. This is your **Benchmark Data**. Next to this pivot table, set up a column which *VLOOKUP* the cohort's historical conversion rate if an advertisement did not reach the necessary threshold value. The next pivot table is exactly the same as Benchmark Data table but has a date filter only for the last business day. In a column next to this pivot table a *VLOOKUP* is made comparing yesterday's conversion rate with the 14 day conversion rate. If the advertisement had enough clicks yesterday to use it's data then it updates the column with yesterday's conversion data. If not then the column is updated with the value from the other pivot table.

Finally a new bid is calculated based via a *VLOOKUP* of the advertisement's cohort LTV from the Valuation sheet and the finalized conversion data. The following process is shown in pseudocode below.

```
IF Yesterday Clicks is greater than Click Threshold THEN
    Conversion Rate * Demographic LTV * Margin Goal
ELSE
    IF Benchmark Clicks is greater than Click Threshold  THEN
        Benchmark Conversion Rate * Demographic LTV * Margin Goal
    ELSE
        Segment Conversion Rate * Segment LTV * Margin Goal
    ENDIF
ENDIF
```

Pseudo Code Formulation of the Bid Optimization Algorithm

As a side note, it may be helpful for you to add CTR to this table as well and compare 14 day with yesterday data. It is optional, as it is not part of the bid formula but can be helpful to have in the same place.

Creative testing

The example in the previous section did not go over an important extension of creative testing, horse racing. This is a term I derived from another riddle typically given during an interview process. There are 25 horses in a stable and you can race five horses at a time. How many races do you have to conduct to figure out the top three horses? The answer is seven.

Here's why. The first step is to race all the horses individually in heats of 5. This creates five groups of horses with an internal ranking. It is still not known though how to rank these groups. To rank the groups simply race the first placed finishing horses from each group. We now have each group stacked ranked as well. Now, we know some extra information at this point. We know the top horse already, being the fastest horse from the fastest group. What we do not know are the second and third fastest horses overall. Yet we do know that they can not come from the fourth and fifth placed groups. As the groups which finished second and third are faster than these two groups. Similarly, horses which finished 4th and 5th in their respective groups can't be the second or third place overall fastest horses. This leaves us with eight horses. By similar moves of reasoning, we do not need to race the second and third place horses in group three and the third place horse from group 2. This leaves us with five horses to race in our seventh and final race. The matrix below is a representation of this answer.

Heat				
A	B	C	~~D~~	~~E~~
1st	1st	1st	~~4th~~	~~4th~~
2nd	2nd	~~2nd~~	~~2nd~~	~~2nd~~
3rd	~~3rd~~	~~3rd~~	~~3rd~~	~~3rd~~
~~4th~~	~~4th~~	~~4th~~	~~4th~~	~~4th~~
~~5th~~	~~5th~~	~~5th~~	~~5th~~	~~5th~~

Horse Race Riddle Matrix

Assume in the matrix above that we conducted the first five races in heats A through E. We then raced the first place finishers in heats A through E and were then able to order them alphabetically. By the reasoning above, you do not need to race the horses which are crossed out and already know the first place finisher in group A is the overall fastest horse. This leaves the five highlighted cells to race to determine the second and third fastest overall horse. (The final, seventh, race would be between A.2 vs A.3 vs B.1 vs B.2 vs C.3)

With creative testing we undergo an extremely analogous process. Each test we are typically changing one aspect of an advertisement to test. Say we conduct three separate tests regarding image color, avatar use and text within the picture. We should run each of these tests separately as each category most likely has many variants. After running a creative test within each category, we can then test the overall winners from each category. This allows us to stack rank the effectiveness of the categories and the various images within one.

You may wonder why if we know the conversion rate of each ad variant we must test the category's top place finishers against each other. This is due to test conditions. Unless all three tests were uploaded at the same moment, with the same targeting options and bids it is worthwhile to run another test comparing the top place finishers. It is hard to make a data driven comparison if each test was run under different circumstances. I.e. another test makes the

comparison cleaner.

As a side note, any system you use with these statistical tests should aim to suss out the best and the worst advertisements. This means that there will be many advertisements which are middle of the road in terms of the creative used. Don't fret. With proper bid management, they should not overspend your ROI. This is true of really bad creative as well. The reason you want to delete or pause these in your account after discovering the culprits is that it can bring your Facebook account or campaign score down. Which means less seed impressions and exposure given by Facebook.

Before any Test

It is helpful to document all your creative tests. This allows you to see if any general trends are emerging and not repeat any one test unnecessarily. Before any test is executed I like to answer the following questions and upload the results to a shared document. (Google Docs® is great for this!)

- What is this test specifically comparing?
  - This could be a title, image, body, etc. It is helpful for record keeping to list copy or image names with this question.
- What is my prediction? why?
  - This helps you track your predictive capabilities when it comes to Facebook advertising. This is a helpful skill to improve and a simple one to track.
- What is the time frame, budget and demographics of the test?
  - Extremely helpful when looking back at past tests to understand the given results in context.
- What were the winners and losers?
  - To be answered after the test is run, obviously.

Closing

This section goes over a lot of information. The most important is valuation of an audience. I hope the discussion of the bid sheet is helpful in creating your own. The limitations of the ebook platform make it difficult to show it in a cogent manner.

- There are three main ways to calculate LTV
- LTV based on customers is very different from the LTV used in bid adjustment
- Creating a bid adjustment document in Excel is a non-necessary but extremely helpful exercise
- Document and record your findings with the following questions
  - What is this test specifically comparing?
  - What is my prediction and why?
  - What is the time frame, budget and demographics of the test?
  - What were the winners and losers?

Footnotes

Epilogue

Hopefully, the information in this book will help you reach your Facebook advertising goals. As you have most likely seen, the math involved in advertising is rather simple, but the process contains many nuances. I would also recommend reviewing Facebook's wonderful FAQ sections in addendum to this book.

As promised, below you can find all of the bulleted lists in one place separated by chapter heading. A short guide to graphical analysis and a glossary follows this section.

Day 1 - The Building Blocks

- Brand advertisers want influence, direct advertisers want interaction
- CPM is paying for impressions, CPC is paying for Clicks
- Facebook™ measures ads based on their RPM, Revenue per Impression
- CTR, Conversion Rate and Conversion per Impressions are key to measuring an adâ€™s success
- A User Funnel is a helpful way to explain and remember the important rates to optimize.

Day 2 - Understanding Facebook™

- A Facebook™ advertisement is made up of a three components: title, body and Image.
- Facebook offers many targeting options based on location, demographic and keyword variables.
- As a small advertiser, begin by acquiring quality customers rather than quantity
- Facebook's suggested bid is typically inflated, adjust properly

Day 3 - Ideation

- A Facebook™ advertisement is made up of a three components: title, body and Image.
- Continually test and update copy
- Copy should be both honest and direct
- Passion, not logic, sells product.
- Copy Style Guide
  - Vary sentence structure
  - Use simple language
  - Emotive language that fits the brand
  - Brevity counts
  - Don't use puns
  - Questions can be helpful
  - Vary punctuation
- Image Style Guide
  - Color scheme
  - Image direction
  - Avatars
  - Text and buttons
- Look elsewhere for inspiration

Day 4 - Statistics Review

- For a more thorough statistical discussion, please refer to the books provided
  - *A Drunkard's Walk* by Leanord Mlodinov
  - *Stat Labs: Mathematical Statistics through Applications* by Debrah Nolan
  - *Mathematical Statistics and Data Analysis* by John Rice
- Examining a normal coin toss can be helpful understanding the basic statistics
- More data means more confidence in test statistics but will cost more money

- The A/B test is the most common advertising testing procedure
- Univariate tests are easier to analyze than multivariate
- The Pooled Two - Proportion Z test can be used for any measurement with a bound of 0 to 1.

Day 5 - Setup and Execution

- Understand that performance can be tricky to define
- A supply curve test is not necessary but very helpful
- Bid optimization is easily accomplished via a waterfall process
- Univariate testing is easier to analyze than combinatorial

Day 6 - Valuation and Automation

- There are three main ways to calculate LTV
- LTV based on customers is very different from the LTV used in bid adjustment
- Creating a bid adjustment document in Excel is a non-necessary but extremely helpful exercise
- Document and record your findings with the following questions:
  - What is this test specifically comparing?
  - What is my prediction and why?
  - What is the time frame, budget and demographics of the test?
  - What were the winners and losers?

Quiz Number Two

Goal

This quiz will cover days four through six not all questions will have correct answers, as they will depend on your business. As this is a book, you can take the quiz mentally but it will be more helpful to pull out a pen and paper and write your answers down.

Questions

1. What is a Null Hypothesis?
2. What is an Alternative Hypothesis?
3. At what level is significance typically defined at? Highly significant?
4. Describe a supply curve test.
5. Describe the waterfall process implicit to bid optimization
6. What test statistic is used in creative testing?
7. How many ads should a campaign have if we use 2 targeting options, 4 titles, 2 images and 3 bodies?
8. Why can performance be a tricky word? What metric is the most helpful in determining an advertisement's success?
9. What is an ad hoc way to calculate an error bound on a sample size?
10. Two ads have the following metrics. Calculate a two-proportion Z test statistic for them.

Advertisement	Impressions	Conversions
A	3,415,267	343
B	8,520,193	783

A Quick Glance of Graphical Analysis

Goal

The goal of this section is to acquaint you with several basic graphing tools. This will allow you to perform most of the important tracking and analysis related to your advertisements' performance.

This section only focuses on the graphical side of data analysis. Please refer to the books in *Section 4 - Statistics Review* for a more thorough review.

Why have this Section?

By this point in the book you should feel comfortable with the Facebook® advertising platform. You have learned several advanced tests, how to create game-changing advertisements and other applicable knowledge. I will be forthcoming by saying that this section is optional. You don't have to learn it to advertise successfully, as Facebook offers a wonderful graphical UI.

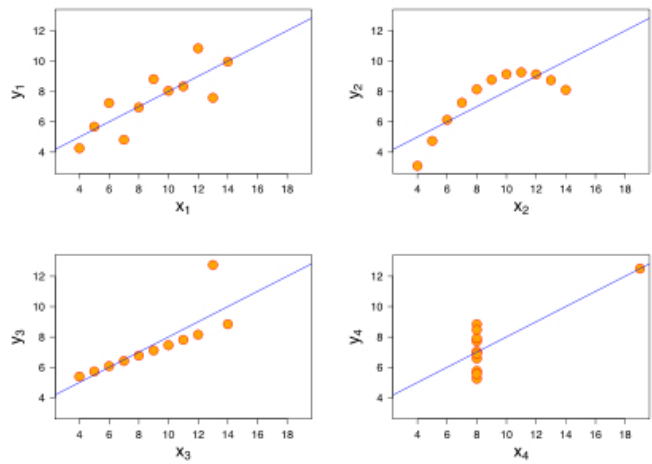
This knowledge is useful because having the power to ask and answer your own questions will dramatically help your bottom line. Learning how and when to apply the smorgasbord of statistical tests can be daunting. Graphical analysis does not necessarily lend itself to a definitive answer like these rigorous statistical tests but it does offer a glimpse. Typically, a glimpse is more than sufficient in the business world.

To motivate you even more, there is a famous set of data which shows the necessity of graphical analysis: Anscombe's Quartet.[^foo1]

The data set is composed of four groups of (x,y) coordinates. Each group of data has the following properties

- Mean of x in each group is 9
- Variance of x in each group is 11
- Mean of y in each group is 7.50
- Variance of y in each group is either 4.122 or 4.127
- Correlation between x and y in each group is 0.816
- Linear Regression line in each group is $y= 3.00 + 0.500x$

Despite having identical summary statistics, the figure below shows the disparity in the data sets.



Graph of Anscombe's Quartet

Group 1 shows a typical scatter plot. Group 2 tells of the story of a non-linear relationship between x and y. While groups 3 and 4 show the impact of outliers within a data set.

It is my opinion that graphical analysis is an important tool to acquire. Like the rest of the book, I will attempt to boil down this

fascinating discipline down to the core essentials which apply to your advertising needs.

A Quick Note

The graphs below have been produced via R or OpenOffice. Both of these programs are open-source products, a huge plus! This means that all the examples included in this book can be replicated for free on your home computer. Producing the graphs via these open-source tools allows all audience members to practice and recreate the following examples for free.

If you are not a fan of open-source software, that is perfectly fine as well. To my knowledge, all of these graphs can be reproduced in more popular, commercial programs of SAS, Excel, Numbers, STATA, etc. For more difficult graphing procedures, I will include the code used to produce the graphs in R. Along with the open source software, the data sets used are free to access and are included in the default R install.

For more information on installing R, visit the following link: http://www.r-project.org. OpenOffice can be acquired at the following link: http://www.openoffice.org.

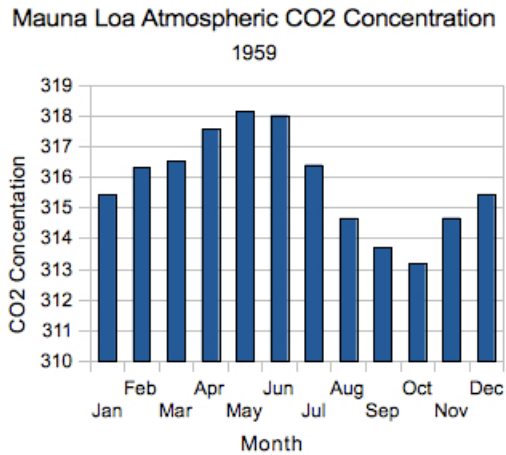
Basic Reporting

This section will focus on several common graphing techniques: bar graphs, line charts and pie charts. These three graph forms are used extensively, and for good reason. They are easy to produce and intuitively easy to understand. Although, I'll try to point out some common pitfalls along the way.

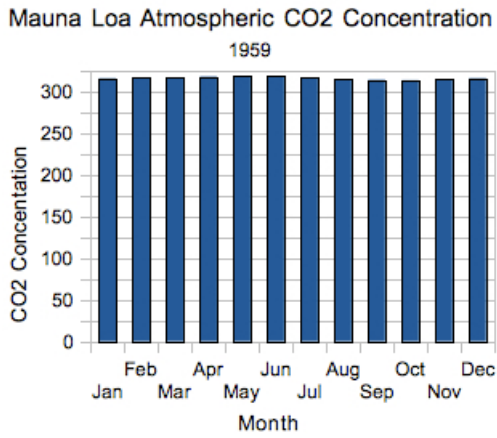
Bar Graphs

These types of graphs are extremely useful in distilling so much data down to a simple to understand picture. Each bar represents a factor or variable . The height of the bar is proportional to their value. They can be graphed vertically or horizontally and can be used to see trends over time or simply compare categorical data.

I have produced two graphs referencing CO2 concentrations from the Mauna Loa Observatory to illustrate a point. (This data set is accessible via the command *co2* in R and can be found online.)[ˆfoo2] When producing bar graphs be wary of the scale implemented on the y axis. Small fluctuations in data can be made to look very important when an improper scale is used.



Shortened Y Axis



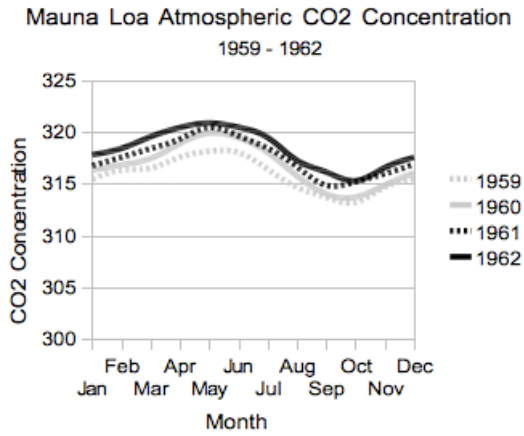
Elongated Y Axis

These two graphs can be used to tell two very different stories based purely on the scale of the y axis. Simply rarifying or contracting the y axis can easily exaggerate gains and minimize losses respectively in a business presentation. When performing your own data analysis it is important to look at your numbers with an honest eye to avoid making decisions off unrealistic assumptions.

In the advertising world, I use bar graphs extensively to compare various cohort's CTR, CPC, Conversion Rate, and other standard advertising metrics. This will be discussed in more detail in the *Pie Chart* section, but bar graphs are typically a better alternative to pie charts as well.

Line Charts

Unlike bar graphs, line charts are most appropriate when you wish to show continuity between the x and y axis. Longitudinal data is usually most appropriate for line charts. This means the data set above would be a perfect candidate for these types of charts. Especially if we wanted to compare the fluctuations of multiple years overlapping each other.

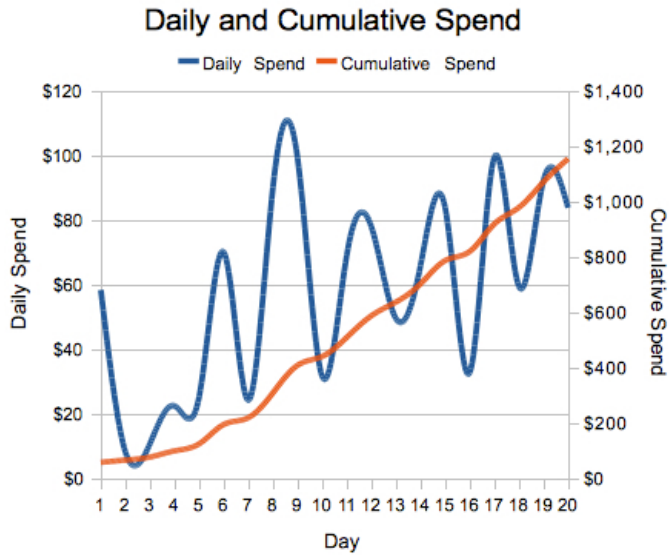


Line Chart Comparing Years

As you can see from this analysis, each year in this small data set shows an extremely similar trend of peaking in May and dipping in October. Yet, every year is incrementally higher than the year before.

In the advertising world, these charts can be very useful after acquiring a lot of data for multiple cohorts. I usually like to track CPC values by cohort and some determined time interval. E.g. You create a data set that has averaged the CPC in three day increments for each of your cohorts.

An even simpler graph is merely tracking daily spend. It is helpful in a graph such as that to have two lines, one tracking the daily spend amount and another tracking cumulative spend. This also means you will have to create a double axis graph as seen below. It is always nice to easily know at a quick glance how much money has been spent and if any day of week effects are present. (Data was randomly created in OpenOffice via *=rand()*100*)

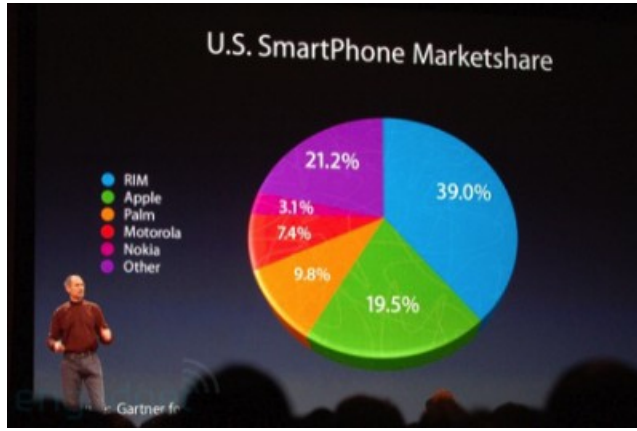


Double Y Axis Graph

Pie Charts

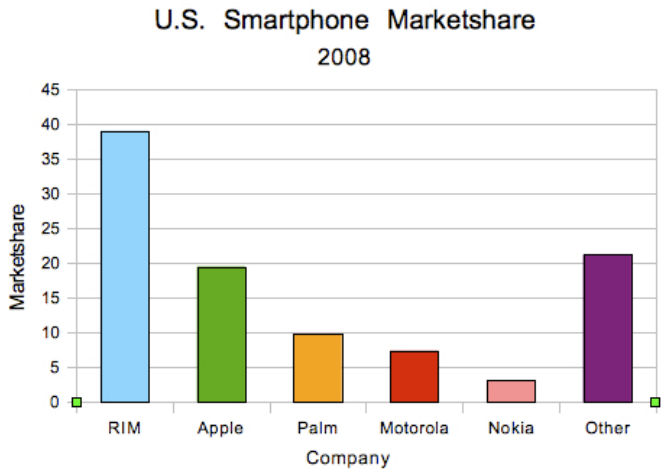
For graphing enthusiasts, pie charts are a choice of last resort. This is due to several reasons: a large amount of pixel space needed to convey relatively little data, it is difficult to distinguish which slice is largest, scaling does not improve clarity, and they can be manipulated to skew the viewers perceptions. All of these points are solved by bar graphs. (For more discussion on the subject I recommend any of Edward Tufte's numerous books.)

A subtle example of manipulation happened in Steve Jobs 2008 keynote. Touting the success of the then recent Apple iPhone, he shows a pie chart expressing the percent of US SmartPhone Marketshare by company. This chart caused quite a storm because the angled 3D effect makes Apple's share look almost as big as RIM's.[ˆfoo4] Even with a very slight tilt it is rather hard to see the difference in marketshare between 19.5% and 39%.



2008 US Smartphone Marketshare

compared with



Bar Graph of 2008 US Smartphone Marketshare

Of course, you will run into pie charts over and over again because people are stuck in their ways. Be careful when employing them to compare spend or marketshare as you may inadvertently not notice important differences in size.

Basic Data Analysis

The previous section covered the three basic graph types. These are used all the time in all sorts of applications and the examples given above are a mere snippet of their extensive use. Hopefully, it spurs your imagination on how to conform them to your own uses.

The following sections will cover three more specialized graphing techniques: box, scatter and interaction plots. All of which are commonly used to illustrate advanced statistical theory on variance, regression, and ANOVA respectively. I will not discuss these extremely important topics in much rigor but the graphs should clear up any confusion on what these words mean.

Unless otherwise noted, the data for the following sections can be found within the standard R install, accessible via the command *mtcars*.[ˆfoo5] "The data was extracted from the 1974 *Motor Trend* US magazine, and comprises fuel consumption and 10 aspects of automobile design and performance for 32 automobiles (1973â€"74 models)."

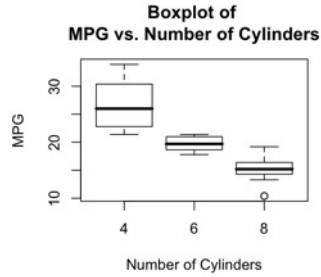
Box Plot

It is the author's opinion that a box plot is the most informative type of graph. At a quick glance, you can see the general trends present in a data set and the variance of that data's measurements. It should be obvious why being able to view trends is important but a quick view of variance might not be clear at the moment.

Being able to view the variance of a measurement quickly allows you to understand the volatility present within a factor. If you believe your sample size was sufficient, a large amount of variance may point to either the data being naturally volatile or a low amount of relationship based upon your grouping.

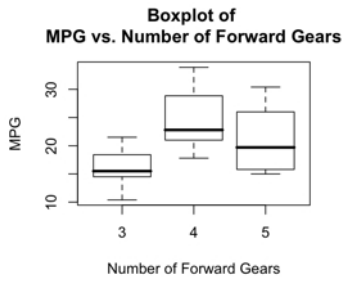
Using the data from the 1974 *Motor Trend* US magazine, let us compare the relationship between miles per gallon, MPG, and number

of cylinders vs. MPG and number of forward gears. After showing you these examples, we will discuss how to read them.[ˆfoo6][13]



MPG to Number of Cylinders

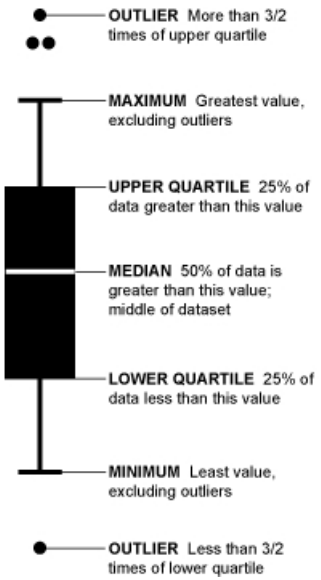
compared with



MPG to Number of Forward Gears

Before delving into why one shows a better relation than the other let us learn how to read these box plots. You may have never seen a graph such as this but reading one is extremely simple. The following image points out the box's important features.[ˆfoo6]

[13]R code for the graph: *boxplot(mtcars[,1]∼mtcars[,10], xlab="Number of Forward Gears", ylab="MPG", main="Boxplot of MPG vs. Number of Forward Gears")*



How to read a box plot

As you can see, the median is the dark line bisecting the box. The box limits refer to the lower and upper quartile of the the data and the whiskers extend out to the minimum and maximum. (The width of the box quickly shows the viewer the variance of the measurement.) Any dots present outside of the whiskers are referred to outliers. It is an easy switch to bisect the box at the mean but medians are robust to outliers.

Presented with the graphs above, which factor would you say is more associated with MPG, number of forward gears or cylinders? Hopefully you chose cylinders. Despite having the outlier present, there is a clear trend present among the medians of the data of decreasing MPG with increasing cylinders. Also, the variance (width of each box) is generally smaller among cylinders than gears. The next two graphing techniques will further confirm this.

In the advertising world, I use box plots often. For example, say you have a month of CPC data associated with advertising cohorts and

images used in an advertisement. With CPC as the Y axis value, you could quickly make box plots with cohorts or image as your x value. These graphs could possibly answer a few questions:

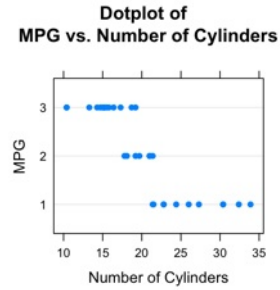
- Does CPC increase by age group? Is a trend present?
- Which has a greater effect on median CPC, image or cohort?
- Can the images be grouped further to show more of an effect?

The next section is about scatter plots, where one can make a less descriptive boxplot. We will also see how a regression line can be easily applied to view the correlation between two data vectors. Scatter plots are hugely useful to see the relation between numerical data while box plots are more useful to see the relation between a factor or variable, such as number and cylinders, and numerical data.

Scatter Plots

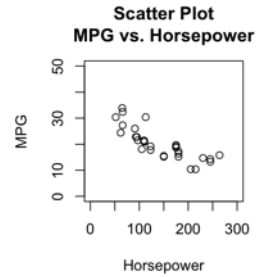
Scatter plots cover an extremely broad array of graphs. Whenever you wish to measure the relationship between two or more variables, a scatter plot can be used. These are also the foundational graphs for trend lines.

First off, I mentioned in the previous section that you can also use scatter plots to create a less descriptive box plot, commonly called a dot plot. Below is an example of such a graph relating MPG to the number of cylinders. The benefit to a dot plot is its ability to quickly show the relative number of data points present in each factor. The downside is of course the lack of visual summary statistics.



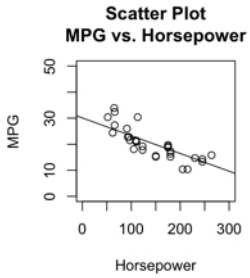
A dot plot of MPG vs. Number of Cylinders

A scatter plot looks similar to a dot plot yet the x or y axis has more discrete values. Let us take the example comparing MPG to a car's horsepower.[ˆfoo9]



A Scatter plot of MPG to Horsepower

We can see from the graph above that a relationship does exist between MPG and horsepower. To graphically see this we can take the graph above and add a trend line.[ˆfoo10]



A Scatter Plot of MPG to Horsepower with a Trend Line included

If you are familiar with Excel, you may know about the option to add an r^2 value to a graph. This value is the square of the correlation coefficient, *r*, between the two data sets and refers to how much of of the variance can be explained. The sign preceding *r* dictates the slope of the line.

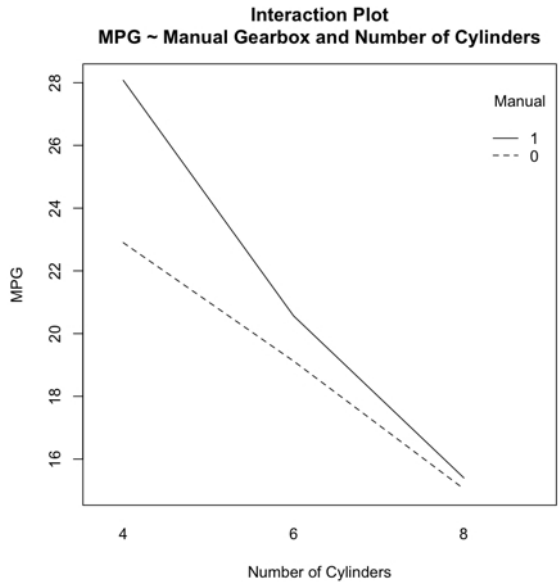
In the data set above, MPG and horsepower have a correlation coefficient of -0.78 and an *r^2* value of 0.61. Typically a correlation coefficient above 0.7 or less that -0.7 is said to be strongly correlated. Although, be wary as there are many examples in statistics where **correlation does not equal causation**. This bears repeating, **correlation does not equal causation**. It can help make a case for it but by no means should this be your only test to see if one variable influences the other.

In the advertising world, scatter plots can be used in numerous examples. As you can see from the prior discussion, they are helpful in visualizing the correlation between two variables. In an earlier section, I discuss how CTR will typically increase when the maximum bid of an advertisement is increased. Graphing these two variables via a scatter plot can be helpful is visualizing their relationship. Most likely, it is not a linear one and with enough data you might be able to see a non-linear, i.e. curved, relationship.

Interaction Plots

For a back of the envelope analysis of how two variables interact, you can not do better than an interaction plot. These graphs are strongly associated with a statistical procedure called ANOVA or Analysis of Variance. ANOVA, and the closely associated F test, helps rigorously determine which dependent variable contributes the most to a independent variable.

The math behind the test exceeds the scope of this book but interaction plots are easy enough to produce and use. Let us examine the relationship between MPG, number of cylinders and whether or not the car is automatic.[^foo11]



Interaction Plot

Before we discuss what this graph means let us first dissect what is going on. The Y axis of the graph is the response variable, or MPG. The two lines graphed relate to the trace factor of the graph, in this

case the presence of a manual gearbox. (1 denotes manual, 0 denotes automatic.) Finally, the x axis of the graph shows the final variable, number of cylinders. Interaction plots are powerful because with a quick glance you can see if the two variables have an effect on the response variable.

With our graph we can see, as discussed earlier, that an increase in cylinders is strongly associated with a drop in MPG. The lines are not parallel between the jump in 4 to 6 cylinders but are nearly parallel between the jump in 6 to 8 cylinders. What this suggests is that number of cylinders and whether or not a car is manual has a stronger interaction on higher MPG at lower cylinder counts. I.e. Having four cylinders and a manual gear box offers an added boost in MPG that would not be predicted from a comparison of cars with six or eight cylinders.

In the advertising world, interaction plots can be implemented in many of the places that have been discussed above. For example, a similar analysis of the example in this section could be conducted with CTR as the response variable, the trace variable as an age bucket and the x variable as image. This could help you, the advertiser, discern which of these two factors has the largest impact on CTR performance.

Closing

A whole book could easily be written on the topic of graphical data analysis. This section serves as a quick glance at the numerous techniques and tricks available within this field. Hopefully, this guide to graphical analysis helped spur on your imagination about questions to ask regarding your advertising and given you some tools to answer them.

Footnotes

Answers to the Quizzes

The questions to each quiz are replicated for ease of use.

Quiz 1

Questions

1. Define the following
    a. CTR
    b. Conversion Rate
    c. CPC
    d. CPM
2. How does a brand advertiser differ from a direct marketer?
3. How does Facebook® decide to serve an advertisement?
4. Organize the following Diffusion of Innovation categories and give a rough estimate of the proportion of the population in each.
    a. Late Majority; Laggards; Innovators; Early Adopters; Early Majority
5. Name at least three targeting options.
6. For your business, write five iterations of copy. This means 5 separate titles and 5 bodies. Be wary that titles can not exceed 25 characters and bodies can not exceed 135 characters.
7. You are advertising for an upcoming off broadway show in New York City. Describe three ways to target a potential audience.
8. Why can artificially boosting your CTR hurt your bottom line?

9. For your own business, write two pitches. The first pitch go from What to How to Why. For the second pitch, go from Why to How to What. Do not worry about length.
10. Now worry about length. Take your second pitch and attempt to whittle it down by half.

Answers

1. a. Defined as clicks/impressions. This metric is typically shown as a percentage. For a range of typical values by industry, see here[14]
   b. Defined as conversions/clicks. A typical conversion rate metric would by IPC, installs/clicks. Although this metric will differ depending on what the advertiser determines is a conversion.
   c. Defined as Total Cost/ Total Clicks. In a CPC model, the advertiser determines the max amount she wants to spend per click. By bidding this way you are valuing clicks over exposure.
   d. Defined as Total Cost/Total Impressions. In a CPM model, the advertiser determines the amount he wishes to spend for each thousand impressions. Bidding this way indicates that exposure is more valued than maximizing clicks.
2. A direct marketer advertises to an active audience. Typically, direct marketers will price their advertisements via a CPC rather than a CPM model. Repetition of an advertisement can hurt a direct marketer's bottom line.
3. Facebook decides to serve an advertisement based on the RPM, revenue per impression, of an advertisement. This selection process is done via a second price auction.

[14] http://www.businessinsider.com/chart-of-the-day-facebook-ctr-cpc-per-sector-2011-1

4. Innovators to Early Adopters to Early Majority to Late Majority to Laggards. The following series of numbers corresponds with the previously ordered list (2.5% ; 13.5% ; 34% ; 34% ; 16%)
5. The full list of targeting options: Location, Age, Gender, Precise or Broad Interests, Sexual Preference, Relationship Status, Language, Education, Workplace, Connections
6. Answers will vary
7. Answers will vary but the following are three possibilities
    a. Target Age >35 , Broad interest in travel, and gender female
        i. This is an extremely large bucket of people. But with a large enough bucket and if the broadway play was park of a travel package this could work. This targeting line also assumes women prefer off broadway plays more then men.
    b. Target the following states: New York, New Jersey, Pennsylvania and Conneticut , gender male and female, and Age >35
        i. This reduces your advertising bucket by a decent factor from option *a*. The addition of state targets allow a finer targeting feature with the ability to vary copy to local factors.
    c. Target Education College or greater, Age > 35, gender male and female, and City target only New York City and a 25 mile radius.
        i. This is the finest of the three targeting options. The bucket size here will be much smaller than the previous two. The addition of the education target means we are assuming college educated people enjoy off-broadway plays more than others.
8. Artificially boosting CTR, say with a picture of a buxom lady, can drastically lower your CPC but will also cause your Conversion Rate to drop precipitously. It is usually the case that the boost is not proportional to the drop in Conversion Rate which means it will hurt your bottom line.

9. Answers will vary.
10. Answers will vary.

Quiz 2

Questions

1. What is a Null Hypothesis?
2. What is an Alternative Hypothesis?
3. At what level is significance typically defined as? Highly significant?
4. Describe a supply curve test.
5. Describe the waterfall process implicit to bid optimization
6. What test statistic is used in creative testing?
7. How many ads should a campaign have if we use 2 targeting options, 4 titles, 2 images and 3 bodies?
8. Why can performance be a tricky word? What metric is the most helpful in determining an advertisement's success?
9. What is an ad hoc way to calculate an error bound on a sample size?
10. Calculate the test statistic from question 6 for the following A/B test.

Advertisement	Impressions	Conversions
A	3,415,267	343
B	8,520,193	783

Answers

1. A Null Hypothesis is what you are attempting to reject in the standard model of hypothesis testing. It is typically written

at *H0* and means the neutral position implicit to a test if no effect was present. E.g. if we were to conduct a fertilizer test, the null hypothesis would be that the fertilizer would have no effect on the rate of growth compared to not using it. For our purposes, the null hypothesis is that any two ads in an A/B test have no difference in performance.

2. The Alternative Hypothesis relates to the hypothesis our test may accept. This opposes the Null Hypothesis as it relates to an observable effect. Taking the example above, the alternative hypothesis would be that our advertiser would cause the grass to grow as a faster rate. For our purposes, the alternative hypothesis is that any two ads did not perform equally in a given A/B test.
3. In statistics, if an effect is only observable less than 5% of the time we say it is a significant event. Less than 1% relates to a highly significant event.
4. A supply curve test allows you to measure the marginal return in advertising performance based on an advertisement's bid. Please refer to *Day 5 - Setup and Execution - Creating a Supply Curve* for more information.
5. The following image describes the waterfall process. Please re-read *Day 5 - Setup and Execution - The Waterfall Process* for more information.

```
IF Yesterday Clicks is greater than Click Threshold THEN
    Conversion Rate * Demographic LTV * Margin Goal
ELSE
    IF Benchmark Clicks is greater than Click Threshold  THEN
        Benchmark Conversion Rate * Demographic LTV * Margin Goal
    ELSE
        Segment Conversion Rate * Segment LTV * Margin Goal
    ENDIF
ENDIF
```

Pseudo Code Formulation of the Bid Optimization Algorithm

1. We use a pooled two-proportion Z test

2. 48 ads = 2 targeting options **x** 4 titles **x** 2 images **x** 3 bodies
3. Performance can be a tricky word in advertising because CTR and Conversion Rate don't always match up when stack ranking an advertisement. In some applications, they can be inversely correlate and in other they can be correlated rather well. This is why it is advisable to analyze ad performance on Conversion per Impression as it is the product of CTR and Conversion Rate.
4. Take the square root of the number of trials and divide by the number of trials. 1000 trials yields an error bound of 3%. (31.3/1000)
5. Plugging in the numbers below to a pooled two-proprotion Z test we acquire a test statistic of either -1.37 or 1.37 depending on how you performed the subtraction in the numerator. Either way the difference is not large enough to reject the Null Hypothesis. Which means we suspect any difference in conversion to be based on chance.

Advertisement	Impressions	Conversions	Conversion Rate
A	3,415,267	343	0.010%
B	8,520,193	783	0.009%

Glossary

Advertising is a profession laced with acronyms and jargon. This is by no means an exhaustive list; however, it should help as a quick reference. For more Facebook® specific information, please visit the Facebook Glossary[15]. For more generalized definitions, visit the Ad Glossary[16] The glossary is separated into four sections: General, Reporting, Social and Targeting.

General

- Account
  - An account is a grouping of campaigns. Facebook sets a limit of 250 campaigns per account.
- Ad Auction
  - Every impression on an advertising platform is determined via an auction. Facebook optimizes it's auction based on performance and bid. (I.e. the ad with the best expected value is shown, P(payment)*(Ad's Bid.)
- Advertisement
  - An ad features title and body copy and an image. The title can be no longer than 25 characters long and the body no more than 135. The image has a size restriction of 110x80 pixels. It's important to review creative guidelines of any advertising platform to know what will be allowed and what is not.
- Campaign
  - A campaign is a grouping of advertisements. All advertisements within the same campaign will share a daily

[15] https://www.facebook.com/help/?page=173642556024605

[16] http://www.adglossary.com./

or lifetime budget; however, individual ads may have differing bids. Campaign structure is very important to make sure test results are accurate.

- Clicks
  - A Click is counted when an advertisement is clicked and brings the user to a landing page. For fan pages or events, clicks are counted differently.
  - "[Facebook has] a variety of measures in place to ensure that [Facebook will] only report and charge advertisers for legitimate clicks, and not clicks that come from automated programs, or clicks that may be repetitive, abusive, or otherwise inauthentic" - *Facebook Help Center: Glossary of Ad Terms*
- Click Through Rate or CTR
  - Defined as clicks/impressions. This metric is typically shown as a percentage. For a range of typical values by industry, see here[17]
- Copy
  - The text surrounding an advertisement. For Facebook, the copy includes both the title and body.
- Conversion
  - A conversion is determined by the advertiser. A typical conversion could be a like, install, signup, or some other action one wishes the user to take.
- Conversion per Impression
  - Defined as Conversions/Impressions. Mathematically this is similar to CTR x Conversion Rate (Clicks/Impressions x Conversions/Clicks). This metric can be helpful in measuring performance of an ad due to it containing all information in the user funnel.
  - E.g. An ad has a CTR of 0.05% and an IPC of 45%. (Here installs are set as a conversion.) The Conversion per Impression would be 0.0225%.

[17] http://www.businessinsider.com/chart-of-the-day-facebook-ctr-cpc-per-sector-2011-1

- Conversion Rate
  - Defined as conversions/clicks. A typical conversion rate metric would by IPC, installs/clicks. Although this metric will differ depending on what the advertiser determines is a conversion.
- Cost Per Action or CPA
  - Defined as Total Cost/Total Actions. An action here is typically synonymous with a conversion. Facebook does not offer this type of advertising. CPA advertising can be very beneficial as controlling cost and budgeting properly is very easy to accomplish. A type of CPA would be CPI, or Cost Per Install.
- Cost per Click or CPC
  - Defined as Total Cost/ Total Clicks. In a CPC model, the advertiser determines the max amount she wants to spend per click. By bidding this way you are valuing clicks over exposure.
- Cost per Thousand Impressions or CPM
  - Defined as Total Cost/Total Impressions. In a CPM model, the advertiser determines the amount he wishes to spend for each thousand impressions. Bidding this way indicates that exposure is more valued than maximizing clicks.
- Daily Active User or DAU
  - The number of unique visitors to a product or service each day
- Daily Budget
  - The amount you are willing to spend per day on a campaign. Please note that this resets at 12:00 am and not 24 hours after launch.
- Daily Spend Limit
  - An account level setting. This is the maximum amount the advertiser wishes to spend per day. Please note this is different from your daily budget.

  - E.g. A daily budget of $200 for 10 different campaigns could result in $2,000 of spend as each campaign could spend $200 each.
- Diffusion of Innovation
  - A product's adoption cycle. Five categories of people can be defined based on their behavior around the product: Innovator, Early Adopter, Early Majority, Late Marority, Laggards.
- Frequency
  - The average number of views an advertisement had per person in an advertiser's target audience.
- Impression or Imp
  - Every time an ad is shown to a user.
- Max Bid
  - Each advertisement has a bid associated with it. A typical range is from $0.65 to $2.00 but can vary depending on product, targets and current market conditions. The advertisement will never cost more than this value.
- Metric Degradation
  - The natural process of a metric declining in performance mainly due to exposure and staleness.
- Monthly Active User or MAU
  - The number of unique visitors to a product or service each month
- Reach
  - Is the number of people who saw an advertisement during an allotted period of time. Reach is similar to impressions; however, impressions count multiple views by the same individual.
- Reporting
  - Facebook offers three types of reports to users: Advertising Performance, Responder Demographics, Conversions by Impression Time
- Revenue per Impression or RPM

  - Facebook serves advertisements based on maximizing this metric. This can be viewed as the expected value of an advertisement's impression or the product of CTR and its CPC price. Most likely Facebook includes many more factors into this equation.
- Second Price Auction
  - The winning bid pays the second bidders price. This means I will never pay more per click than my max bid but will pay the market clearing price.
- Splash Page
  - After clicking on the advertisement. The first page the user encounters.
- Spent
  - The total cost from running the advertisement
- Status
  - An advertisement can be active, paused, completed, deleted or disapproved. Only active ads will receive impressions.
- Suggested Bid Price
  - Facebook will suggest a bid range for any ad in your account. It will use historical information regarding account, campaign, and ad performance. Please see page N for a discussion on how and when to use this.
- Target
  - Target means to only show advertisements to users who fit a specific definition. The Facebook platform offers many categories to target on: Country, Age, Gender, Relationship status, Likes and Interests, education, etc. Targets are inclusive, i.e. if defined they are only shown to that audience.
- User Funnel
  - The process the user has to undergo to enjoy the product. A typical user funnel is impression, click, install/sign up, retain, pay. Each step of the user funnel will

have some drop off rate which the advertiser/business owner would like to minimize.

Reporting

The definitions below can be found in the Facebook Ad Manager.[^foo4]

- Advertising Performance

  This report includes statistics like impressions, clicks, click through rate (CTR), and spend. Although this information is available in your Ads Manager, you may find this a useful way to export and manage your Facebook performance.

- Conversions by Impression Time

  This report shows the number of conversions organized by the impression time of the Facebook Ad a conversion is attributed to, categorized by the length of time between a user's view or click on the ad and the conversion (i.e., 0-24 hours, 1-7 days, 8-28 days).

- Responder Demographics

  This report provides valuable demographic information about users who are seeing and clicking on your ads - key for optimizing your targeting filters.

Social

Facebook, due to the nature of its product, also offers *Social* versions of several metrics above. The below definitions are taken from the Facebook Glossary[^foo3]

- Social Clicks

  The number of times your ad was clicked with social context (i.e. with information about a viewer's friend(s) who connected with your Page, Place Event, or App).

- Social Impressions

  The number of times your ad was shown with social context (i.e. with information about a viewer's friend(s) who connected with your Page, Place, Event, or App).

- Social Click Rate
  - Social Clicks divided by Social Impressions.
- Social %

  The percent of impressions where the ad was shown with social context (i.e. with information about a viewer's friend(s) who connected with your Page, Place, Event, or App).

- Social Reach - > People who saw your Sponsored Story or ad with the names of their friends who liked your Page, RSVPed to your event, or used your app. If you're not using Sponsored Stories or advertising a Page, event, or app, you won't have social reach.

Targeting

- Age Targeting
  - An Advertiser can define an age range to advertise to. The age range starts at 13 and goes to 64, with 65+ being determined as one age. Please note that the advertiser has a choice of making the boundaries of the range relaxed. It is the opinion of the author that one should always make age targets inclusive.
  - E.g. If an advertiser defined an age range target as 25 to 35 and make the boundaries relaxed, the ads would be shown to users slightly younger that 25 and slightly older than 35.
- Connection Targeting
  - If the advertiser has admin rights to an application, event or page they can either target users who are already associated with the product or exclude them from their advertisements. Please see page 26 for a discussion on how and when to use this. (At 19% completion for Kindle® readers.)
- Estimated Reach
  - Facebook offers an estimation based on targeting features. This number varies and should not be taken as exact but it does serve as a helpful guide.
- Likes and Interest Targeting
  - Outside the Facebook platform, this would be corollary to keyword advertising. Facebook offers two versions of this type of targeting: Broad and Precise. Precise targeting allows the advertiser to use specific likes and interests. Broad targeting allows the advertiser to target users by a general category.
  - E.g. An advertiser can only target people who have liked the San Francisco Giants (TM) or could advertise broadly to the Baseball category, which includes the

San Francisco Giants and any other Baseball related likes and interests.

- Location Targeting
  - Facebook offers the advertiser the ability to geo-target users. Users can be advertised to based on Country, State/Province, City and Zip Code. City targeting also features the ability to hit users within a 10, 25, or 50 mile radius of a given city.

Bibliography

"Anscombe's Quartet." Wikipedia. Wikimedia Foundation, 05 June 2012. Web. 09 May 2012. <http://en.wikipedia.org/ wiki/Anscombe %27s_quartet>.

All equations were produced via CodeCogs Online LaTeX Equation Editor: CodeCogs. Online LaTeX Equation Editor - Create, Integrate and Download. Computer software. Online LaTeX Equation Editor - Create, Integrate and Download. Vers. 3.05. CodeCogs, 2011. Web. 08 May 2012. <http://www.codecogs.com/latex/eqneditor.php>.

Kaushik, Avinash. "How To Calculate Lifetime Value - The Infographic." Web log post. How To Calculate Lifetime Value. Ed. KISSmetrics. KISSmetrics, 2011. Web. 08 May 2012. <http://blog.kissmetrics.com/how-to-calculate-lifetime-value/?wide=1>.

Keeling, C. D. and Whorf, T. P., Scripps Institution of Oceanography (SIO), University of California, La Jolla, California USA 92093-0220.

Mlodinow, Leonard. The Drunkard's Walk: How Randomness Rules Our Lives. New York: Pantheon, 2009. Print.

Nolan, Deborah Ann., and T. P. Speed. Stat Labs: Mathematical Statistics through Applications. New York: Springer, 2000. Print.

Rice, John A. Mathematical Statistics and Data Analysis. Belmont, CA: Thomson Brooks/Cole, 2007. Print.

Rogers, Everett M. Diffusion of Innovations. New York: Free, 2003. Print.

Schofield, Jack. "Lies, Damn Lies, and Steve Jobs Keynotes." The Guardian. Guardian News and Media, 30 June 0021. Web. 09 May 2012. <http://www.guardian.co.uk/technology/ blog/2008/jan/21 lies-damnliesandstevejobs>.

Sinek, Simon. "Start with Why: How Great Leaders Inspire Action." Speech. Ted X Pugent Sound. Puget Sound, Washington. 8 May 2012. Ted.com. Ted, 4 May 2010. Web. 8 May 2012. <http://blog.ted.com/2010/05/04/ho great_leade/>.

Standard Deviation Diagram.svg. Digital image. Wikipedia. Wikimedia Foundation. Web. 14 May 2012. <http:// en.wikipedia.org/wiki/ File:Standard_deviation_diagram.svg>.

Stanicek, Petr. "Color Scheme Designer 3." Color Scheme Designer 3. Petr Stanicek & ColorSchemeDesigner.com., 8 June 2011. Web. 08 May 2012. <http://colorschemedesigner.com/>.

Webtrends. "Facebook Advertising and Performance Benchmarks & Inisghts." Editorial. Webtrends Whitepaper 31 Jan. 2011: 1-7. Web. 7 May 2012. <http://www.brandchannel.com/ images/papers/ 522_-2011-01_webtrends_facebook-ads.pdf>.

Yau, Nathan. "How to Read (and Use) a Box-and-Whisker Plot." Web log post. How to Read (and Use) a Box-and-Whisker Plot. Flowing Data, 15 Feb. 2008. Web. 09 May 2012. <http://flowingdata.com/2008/02/15/h to-read-and-use-a-box-and-whisker-plot/>.

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