SUPPLEMENTARY MATERIAL

Formative Study – Select Examples from Different Categories

While we provide the collection of all graphics used in our formative study as a list of links in a csv file (saved as a .txt file) along with this document, we show some examples from the collection in this document. We selected some interesting examples that allow us to explain the properties of a graphic and our reasoning process for assigning it to the categories described in the paper. The examples are as follows:
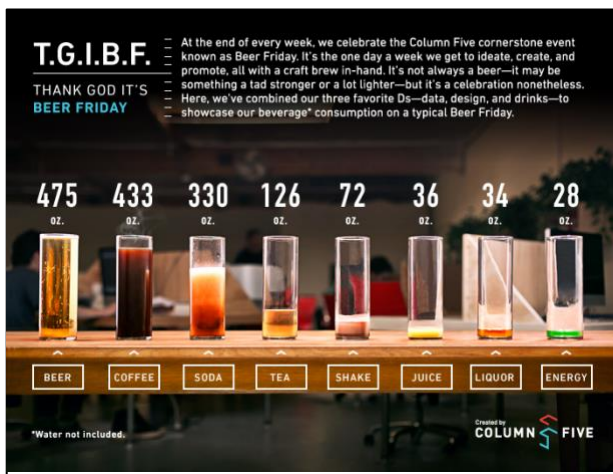

Chart Type: Bar
Embedding Method: Fill
Thematic Imagery: Yes
Reasoning: This graphic makes use of multiple measuring glasses to represent bars of a bar chart. The glasses are filled with drinks to different levels to communicate different data values. The data being presented here is the volume of different drinks consumed during social events thus we believe the choice of imagery is thematic.

Chart Type: Bar
Embedding Method: Fill
Thematic Imagery: No
Reasoning: This graphic makes use of multiple stripes in a crosswalk to represent bars of a bar chart. The stripes are filled with a texture to different levels to communicate different data values. The data being presented here is the number of information and consultation meetings, thus we believe the choice of imagery is not thematic.
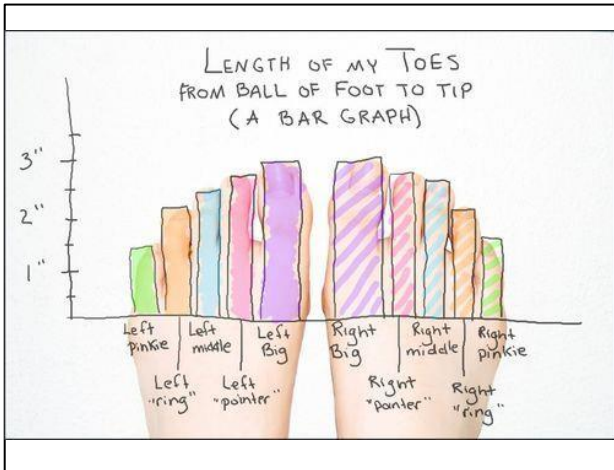
Chart Type: Bar
Embedding Method: Overlay
Thematic Imagery: Yes
Reasoning: This graphic makes use of a bar chart overlaid on an image of a person's feet such that the trend of the bars match the trend formed by the tips of the toes. The data being presented here reports the length of a person's toes thus we believe the choice of imagery is thematic.

Chart Type: Bar
Embedding Method: Overlay
Thematic Imagery: No
Reasoning: Here a designer has physically overlaid a bar chart along some stairs such that each bar falls within a stair. The data being presented here reports number of people in different age ranges from the Panama staff thus we do not believe the choice of imagery is thematic.

Chart Type: Bar
Embedding Method: Replicate and Transform
Thematic Imagery: Yes
Reasoning: This graphic makes use of a glass of beer to represent bars. Here the same glass has been replicated, arranged in a row and resized to represent different data values. The data being presented here reports the amount of Guinness beer consumed by counrty thus we believe the choice of imagery is thematic.

Chart Type: Bar
Embedding Method: Replicate and Transform
Thematic Imagery: No
Reasoning: This graphic makes use of multiple toothbrushes to represent bars. Here the toothbrushes have been arranged and repositioned to represent different data values. The data being presented here reports the amount of low income voters for government parties thus we believe the choice of imagery is not thematic
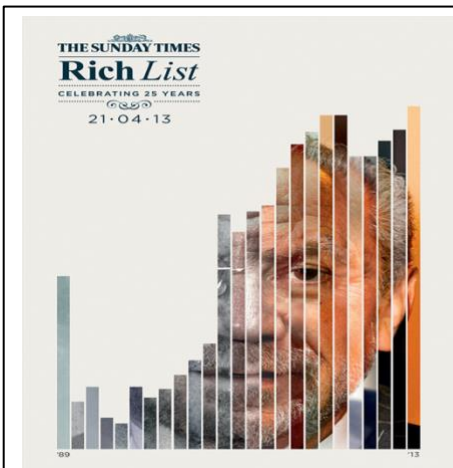

Chart Type: Bar
Embedding Method: Cutout
Thematic Imagery: Yes
Reasoning: This graphic makes use of an image that has been cropped or cut out that only parts of it fill in bars of a bar chart. The data being presented here shows a person's wealth over a few years and the image employed is a portrait of that person thus we believe the choice of imagery is thematic.

Chart Type: Line
Embedding Method: Overlay
Thematic Imagery: No
Reasoning: This graphic makes use of a bent straw to represent a line. Here the line is overlaid on a slice of bread such that it somewhat matches the shape of the top of the slice. The data being presented here shows the popularity of two political parties over the years thus we believe the choice of imagery is not thematic.

Chart Type: Pie
Embedding Method: Fill
Thematic Imagery: Yes
Reasoning: This graphic makes use of multiple slices of pie to represent a pie chart. Since there are no gaps between slices and the edge of the pie seems continuous, we feel that portions of the pie have been textured. The data being presented here shows proportion of different types of pies consumed on Thanksgiving thus we believe the choice of imagery is thematic.

Chart Type: Pie
Embedding Method: Replicate and Transform
Thematic Imagery: Yes
Reasoning: This graphic makes use of multiple slices of cheese to represent a pie chart. Since the slices are not aligned well and have different radii, we feel that slices were cut, replicated and rotated to create the chart. The data being presented here compares the fat content of Cheddar cheese to other cheeses thus we believe the choice of imagery is thematic.
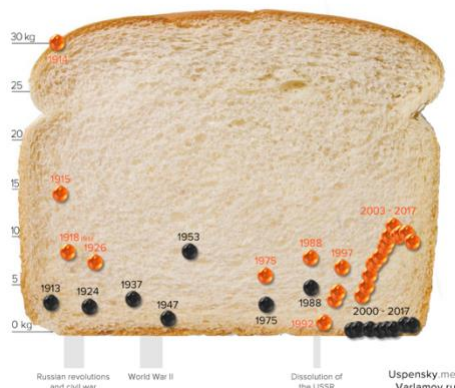

Chart Type: Scatterplot
Embedding Method: Replicate and Transform / Overlay
Thematic Imagery: Yes
Reasoning: This graphic makes use of multiple images of caviar to represent points on a scatterplot. These caviar points are then overlaid on a piece of bread whose edges serve as the axes. The data being presented here shows a cost of caviar in Russia thus we believe the choice of imagery is thematic.

Chart Type: Single divided object
Embedding Method: Fill
Thematic Imagery: No
Reasoning: This graphic makes use of a shirt divided vertically into regions by using different materials or textures to represent data. The data being presented here shows the percentage of people that have different occupations a thus we believe the choice of imagery is not thematic.

Chart Type: Single divided object
Embedding Method: Replicate and Transform
Thematic Imagery: No
Reasoning: This graphic makes use of a coffee cup that has been "exploded" with pieces of the cup representing data values. Here we consider the explosion to be a transform. The data being presented here show the amount of people performing different activities during meetings thus we believe the choice of imagery is not thematic.

Chart Type: Multiple resized objects
Embedding Method: Replicate and Transform
Thematic Imagery: Yes
Reasoning: This graphic makes use of multiple objects whose sizes communicate data. Here we consider the technique used by the designer to be replicate and transform. Here the objects were replicated and resized. The data being presented here shows the cost of different foods thus we believe the choice of imagery is not thematic.

Formative Study – List of Designers

In addition to collecting the graphics used in our formative study we also used google images to reverse lookup the graphics to find their creators. Below is a list of the designers and links to their webpages or online profiles:

Peter Ørntoft - http://www.peterorntoft.com/

Oliver Uberti - http://www.oliveruberti.com/

Mona Chalabi - https://monachalabi.com/

Soon… - https://www.coming-soon.be/en/ & https://www.behance.net/coming-soon

Column Five - https://www.columnfivemedia.com/

Shy Inbar - https://shyinbar.com/ & https://www.behance.net/shyinbar

Anna Lena Schiller - https://www.annalenaschiller.com/

Lisa Rienermann - https://lisarienermann.com/

Marion Luttenberge - http://marion-luttenberger.squarespace.com/

Andrew Charles Bly - https://www.andrewcbly.com/

Sarah Illenberger - https://sarahillenberger.com/

Christina Winkless - https://visual.ly/users/christinawinkless/portfolio

Anton Egorov - https://dribbble.com/egorov

Gemma Warriner - http://gemmawarriner.com/

Gareth Holt - http://www.garethholt.com/ (Link dead. See https://flowingdata.com/2010/12/09/picturing-social-order/)

Smäll - https://www.smallbcn.com/

Jose Duarte - https://www.flickr.com/people/joseduarteq/

Aligning Trends with the Ant Colony Optimization

We experimented with a number of methods to automatically find objects in an image that match the trend displayed in a data chart such a line chart or bar chart. Our best attempt at a fully automatic approach involved the use of an edge map that is analyzed with the ant-colony optimization technique. In this method, we first compute an edge map of the background image. We then employ the ant-colony optimization method to search an edge or combination of edges that match the trend of the data. The algorithm uses "coding-ants" to traverse edges in the edge map with ants "jumping" to different edges in the edge map. After an ant jumps to a different edge and traverses it, the algorithm tests if this traversal matches a segment of the data trend. If it does not the ant goes back and "jumps" to a different edge and the process is repeated until an optimum path is found. The algorithm succeeds when an edge or multiple small edges combined match the data trend closely. An example is shown in figure 1. However, in the case of multiple small edges the algorithm may place the chart in a location where a trend may exist in the edge map but is not visible to the human eye in the natural image. In some cases where areas of the image contain multiple densely packed small edges, the algorithm gets stuck in local minima or maxima with ants jumping to small edges in the same area. In our tests, this approach often failed as it either got stuck in a maxima/minimum or it found edges in the image that were not visible to the naked eye.

Ant colony optimization reference: *M. Dorigo and G. Di Caro, "Ant colony optimization: a new metaheuristic," in Proceedings of the 1999 Congress on Evolutionary Computation-CEC99 (Cat. No. 99TH8406), vol. 2, July 1999, pp. 1470–1477 Vol. 2.*
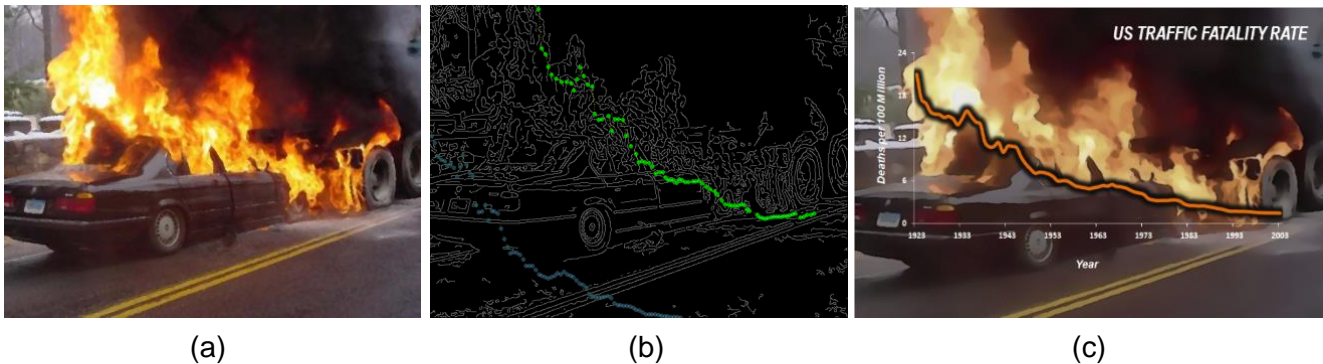

(a)   (b)   (c)

Figure 1 The ant colony applied to an image shown in (b) to align a line chart over it and produce the infomage shown in (c). Here, we see that the algorithm finds two paths (green and red) shown in (b). The path with the green points is selected as it is a better match for the line chart.

Preliminary User Study: How much distortion is acceptable

To evaluate if a certain amount of distortion is acceptable, a viewer must not be able to tell the difference between a graphic showing a distorted representation of the data and a chart showing the actual values (non-distorted chart). Ideally, to determine such an acceptable level of distortion one would first have to select a representation (fill or overlay) and create multiple versions representation which vary minutely by the amount of distortion. Then one would test these versions of the representation against the ground truth (non-distorted chart). The amount at distortion at which users begin to tell the difference would be the limit for the acceptable amount of distortion. This is because below this level of distortion picking the correct match would be akin to tossing coin, the viewer would have a 50-50 chance of picking the correct answer. Beyond this amount the distortion would be detectable and the viewer will identify the distortion with a higher confidence and therefore the level of distortion is unacceptable.

For such a study to be robust, one would have to test this for multiple variations of the same chart. For example, if we were testing the fill technique for pie charts, we would have to generate multiple shapes that are representative of all the possible shapes that can occur. Then we would need to fill these shapes with different amounts of rotations, different amounts of segments, as well as different types of data distributions. Conducting such a study is extremely difficult and prohibitively expensive. Thus, we conduct a preliminary study that approximates the acceptable level of distortion

Procedure:
In our study each participant was presented with either an infomage or a regular chart showing the real data values. He/she was then asked to select a matching option from two regular charts which had their labels removed. One option was the regular chart showing the real data and the other was a regular chart showing a noisy (or distorted) version of the data. We postulate that if a viewer can pick the correct chart then the distortion is detectable.

To determine the amount of noise to add to the charts we first conducted a pilot study among four of our own lab members. We presented them with two charts, a chart showing the real data and a noisy chart. We started at 5% noise kept increasing the noise in the second chart by an increment of 2% until they could tell the difference. We found that at minimum amount of noise that was not detectable across all chart types (line, bar and pie) was 7%. And for pie and line charts once we reached a 20% level of noise users could always tell the difference. For bar charts this value was 15%. Thus, in our preliminary study we chose noise levels of 10% and 20% for the line and pie charts and noise levels of 10% and 15% for bar charts.

For the preliminary study, we recruited 12 participants from various departments on our university campus. Participants were graduate students who were asked to volunteer in the study. There were 8 male participants and 4 female participants all within the age range 18-36. All participants reported that they could read basic data charts such as bar charts, line charts, pie charts and scatterplots. The study consisted of 14 trials per participant, 8 for infomages and 6 for regular charts. The infomages contained vastly different backgrounds and those that were filled also differed in the shapes that were filled. Each participant received two pie, and bar fill-style infomages and two line, and bar overlay-style infomages

resulting in a total of 8 infomages. Similarly, they received two standard pie, line, and bar charts resulting in a total of 6 regulars. While one of the answer options was the standard chart showing the actual values, the other option was selected randomly from the regular charts with 10% or 20% (15% in case of bar charts) noise. The options were selected such that every user got 2 questions with the same chart-type and embedding type but with the two noise levels. For each question we recorded the participant's response. The order of the trials and the two answer options were presented in random order. We chose to perform this study on-site since we provided each participant with the same 30-inch screen which was able to display the infomage or regular chart along with the options at their full resolution without requiring any scrolling.

Results:
The results of the study are shown in table 1. We observe that in case of regular charts viewers could always detect a 20% distortion. In the case of line and bar charts with 10% error, the participants never mismatched more than 5% of the charts. This indicates that at least 95% of the time a viewer can identify a 10% error or distortion when comparing regular line and bar charts. In the case of pie charts with 10% error this number was even higher at under 9.6%. This indicates that it is difficult for viewers to detect a 10% error in regular pie charts.

Detecting distortion in infomages was more difficult for viewers. In case of fill style pie charts, at least 25% of the time viewers were confused and mismatched the charts for both the 10% and 20% error versions. For fill style bar charts the users mismatched the 10% error charts 25% of the time and the 15% error charts 8.4% of the time. We expect that it would drop further when there is 20% error.

In the case of overlay-style charts the performance is better. In both line and bar charts, users mismatch the 20% error charts less than 5% of the time. While they perform worse for the 10% error charts with viewers picking the wrong line chart 37.6% of the time and the wrong bar chart 12.6% of the time. This reason the line charts for performing so badly is complex background images possible obscure the subtleties in the line chart.

Conclusion:
Since users still made mistakes when matching some types of charts with those that have 20% distortion, we pick this level as the acceptable level beyond which a chart is considered too distorted to be used. In the future we plan to conduct a more robust study that tests a finer grain of difference in error values and a wider variety of shapes.

Table 1. Results of our distortion study. The table shows the number of times (as a percentage) that a viewer picked a distorted version of the chart. The higher the value, the more difficult it is for viewers to distinguish between the distorted and original versions of a chart.

Answer Type (Data Noise Level)	Chart Type						
	Regular Pie	*Infomage Fill Pie*	*Regular Line*	*Infomage Overlay Line*	*Regular Bar*	*Infomage Overlay Bar*	*Infomage Fill Bar*
10%	9.6%	29.2%	4.8%	37.6%	4.2%	12.6%	25%
20% (15% for bar)	0%	25%	0%	4.2%	0%	0%	8.4%

Preliminary User Study: Venue for Infomages

Infographics which include infomages are not always suitable for data visualization in all types of scenarios or venues. We tested the user preference with respect to four publication venues - official reports (or scientific publications), newspapers, blog posts and social media. We chose these four venues based on the classification performed by Borkin et. al. (*What makes a visualization memorable?, IEEE Trans. on Visualization and Computer Graphics 19, 12 (2013), 2306–15. 1, 2, 3, 12*) which distinguishes among visualizations for infographics, scientific publications, news media and government reports. On closer inspection of their dataset we see that the scientific publication visualizations only contain illustrations or human recognizable objects when the object itself is the data but the other visualization are similar to those of government reports i.e. regular unembellished charts. However, in the case of infographics and news media the visualizations use human recognizable objects to refer to the subject of the data much like infomages. Thus, for our study we group scientific publication and government reports into a single publication venue. Additionally, we split the news media category into two categories - newspapers and blogs. Our reasoning behind this is that newspapers tend to be more objective while blogs tend to emphasize the user's point of view and at times tend to be more casual. Finally, we added social media as a fourth category since it is nowadays the primary venue in which people share their personal visualizations. The study procedure and results are discussed as follows.

Procedure:

For this study we recruited 27 participants from various departments on our university campus. Participants were graduate students who were asked to volunteer in the study. There were 19 male participants and 8 female participants all within the age range 18-34. Their education levels included high school (2 participants), bachelor's degree (9 participants), master's degree (13 participants), and doctoral degree (3 participants). Finally, 8 participants reported that they were analytical, 14 were neutral while 5 reported being creative. Just as in the distortion study the participants were provided with an explanation of each chart type and infomage. They also received two practice questions. For each question a participant was presented with a regular chart and its corresponding infomage in random order. The question contained the text "Which of the following charts would you prefer if you were reading [publication venue]?" where publication was selected randomly from our four publication venues. The subjects were asked 16 questions, four for each publication venue consisting of two fill style infomages (pie and bar) and two overlay style infomages (line and bar). The regular chart and the corresponding infomage were displayed on the participant's screen at maximum height of 300 pixels thus making difficult for the user to read data values. We chose this size so that the participant would not focus on reading the data values, but instead would focus on the overall chart design.

Results:

To analyze the preference data, we used a binomial test with a 95% confidence interval. The outcome is given in table 2. We observe that when reading an official report, infomages are only preferred 20.83% of the time. However, when reading a newspaper or blog post infomages are selected 68.75% and 70.83% of the time, respectively. Finally. for social media a huge majority, 83.33%, prefers infomages.
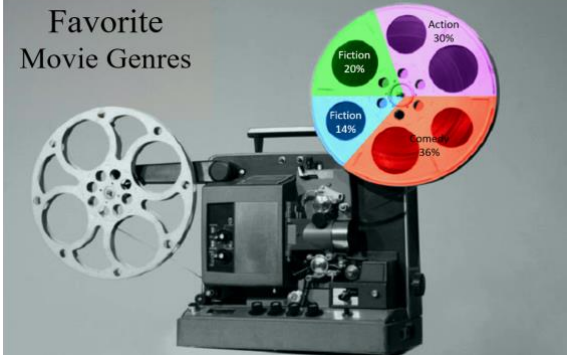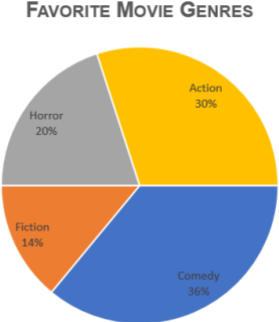
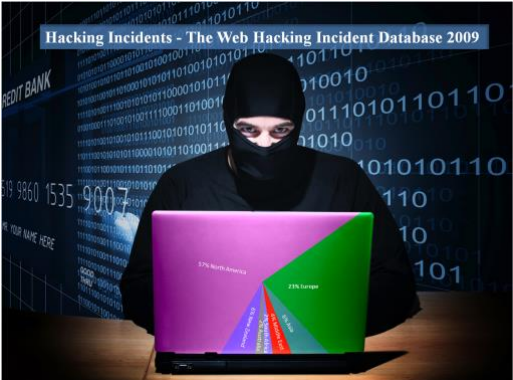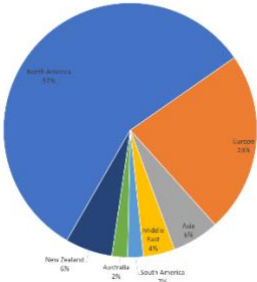**Table 2.** Percent favorability of infomages within a 95%

Measure	Publication Venue			
	Official Report	*Newspaper*	*Blog Post*	*Social Media*
% Choices for infomages	20.83	68.75	70.83	83.33
CI Low	17.06	63.94	66.09	79.26
CI High	25.19	73.19	75.16	86.74

Infomages Created with Our Design Tool

Here we provide some examples of infomages. These infomages were created by novice users with our design tool. We also provide their regular chart versions plotted with the same data. Below each image we report the distortion metrics computed by our tool which are also reflected in the interface.
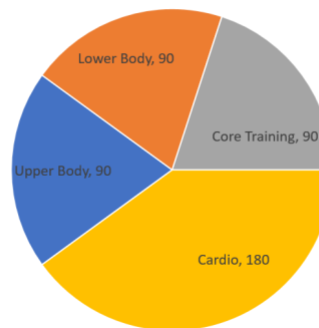
Fill Style Charts:

Avg. Distortion Error: **0.01**
Angle Distortion Error: **0**
Area Distortion Error: **0.02**
Arc Length Distortion Error: **0.01**

Note: In this example the error is minimal as the area filled is almost a perfect circle. Small irregularities in the boundary and the slightly elliptical shape of the area contribute to the error.
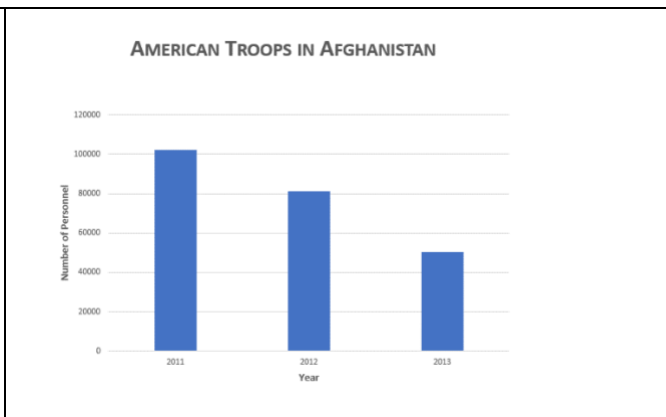

Avg. Distortion Error: **0.22**
Angle Distortion Error: **0**
Area Distortion Error: **0.45**
Arc Length Distortion Error: **0.21**

Note: In this case the area filled is mostly rectangular. This shape is expected to cause large area-based and arc length-based distortions. When compared to a circular pie, the rectangular shape causes the larger segments to have disproportionately larger areas and arc lengths.

POPULAR LIPSTICK BRANDS
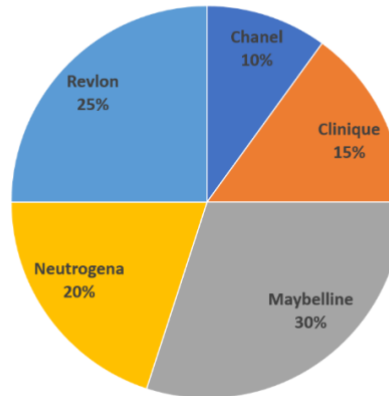
Avg. Distortion Error: **0.098**
Angle Distortion Error: **0.2**
Area Distortion Error: **0**
Arc Length Distortion Error: **0.09**

Note: In this example the area that is filled is very irregular, however, during the fill process the algorithm was set to optimize for area. Thus, there is 0 error based on area but due to the irregular shape the angles and arc length are erroneous.
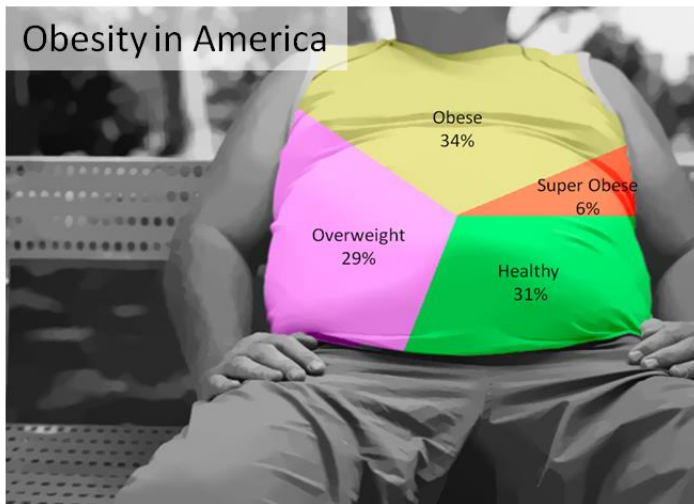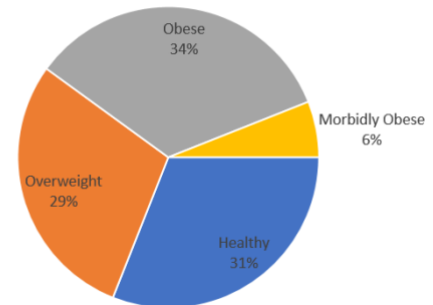
Avg. Distortion Error: **0.03**
Angle Distortion Error: **0.05**
Area Distortion Error: **0.04**
Arc Length Distortion Error: **0**

Note: Here the shape being filled is irregular but has a resemblance to a trapezoid with uneven edges. In this case the fill algorithm was set to optimize for arc length thus there is 0 error in the arc lengths but due to the non-circular shape of the area there are errors in the area and angles.

Web Search Market Share (August '07)

20% Yahoo
9% MSN LIVE
4% Other
67% Google

Web Search Market Share (August `07)

Yahoo 20%
MSN Live 9%
Other 4%
Google 67%
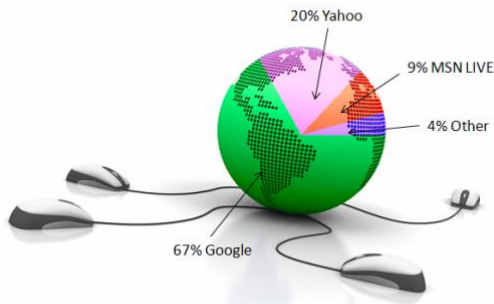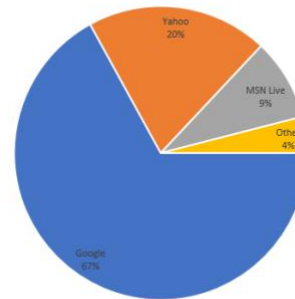
Avg. Distortion Error: **0.153**
Angle Distortion Error: **0**
Area Distortion Error: **0.03**
Arc Length Distortion Error: **0.43**

Note: In this example the filled area appears to be a perfect circle but it actually is elliptical and has a few large irregularities on its boundary that cause the fairly large arc length distortion.

MY WEEKLY WORKOUT ROUTINE

Upper Body 90 Min
Core Training 90 Min
Lower Body 90 Min
Cardio 180 Min

MY WEEKLY WORKOUT ROUTINE

Lower Body, 90
Core Training, 90
Upper Body, 90
Cardio, 180
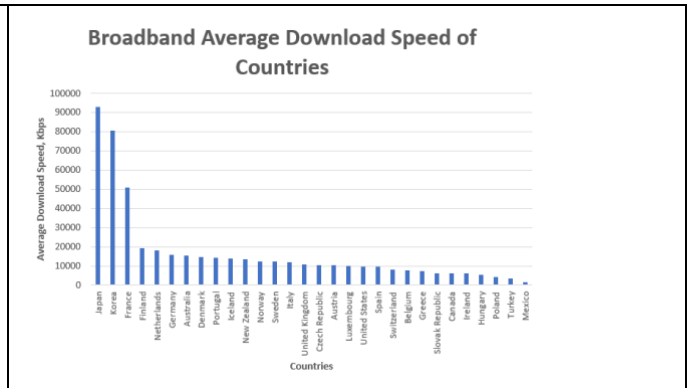
Avg. Distortion Error: **0.029**
Angle Distortion Error: **0**
Area Distortion Error: **0.06**
Arc Length Distortion Error: **0.03**

Note: In this case the area filled is mostly circular except for the portion near the feet. The irregularity of this portion contributes to the area and arc length distortions.

**AMERICAN TROOPS IN AFGHANISTAN**

2011: 102100   2012: 81100   2013: 50500

Avg. Distortion Error: **0.08**
Height Distortion Error: **0.01**
Area Distortion Error: **0.15**

**Note:** In this example the bars are represented by 3 image areas that are silhouettes of soldiers and filled based on height rather than area. As each silhouette differs in size and shape there is an error in the area. Additionally, the silhouettes are not vertically aligned perfectly thus there is a small amount of error in the height.

AVERAGE PRICE OF BEER AT OKTOBERFEST

2006: €7.8   2007: €8.2   2008: €8.5   2009: €8.7   2010: €8.7

Avg. Distortion Error: **0.195**
Height Distortion Error: **0.01**
Area Distortion Error: **0.38**

Note: Here the bars are represented by five beer bottles in an image and filled based on height rather than area. Each bottle has minor differences in size and the narrowing shape to the top causes area errors. Additionally, there is a small amount of error in the height as bottle 3 had a few pixels at the bottom excluded from the segmentation.
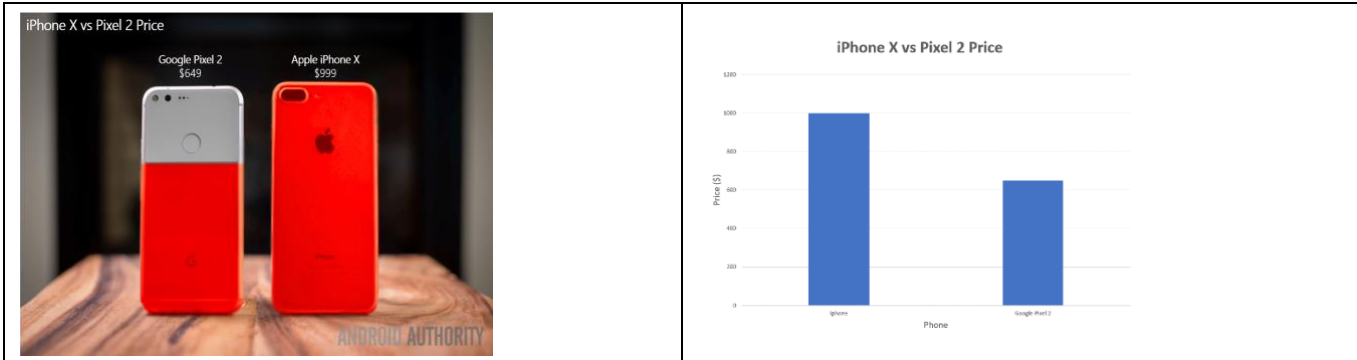
Avg. Distortion Error: **0.01**
Height Distortion Error: **0.01**
Area Distortion Error: **0.01**

Note: Here the bars are represented by two cellphones in the image. The widths of the two phones are very similar and the vertical misalignment is minor thus the resulting area-based and height-based errors are small.
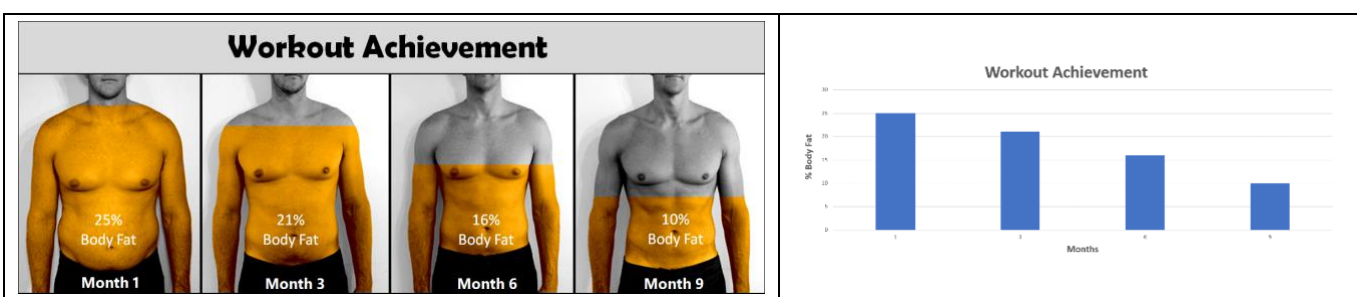
Avg. Distortion Error: **0.05**
Height Distortion Error: **0**
Area Distortion Error: **0.1**

Note: In this example, a person's upper body photographed over a period of time is used as bars for a bar chart representing body fat over that time period. The bars are filled based on height rather than area. Since there is no misalignment or excluded pixels the height error is zero. However, due to the different sizes and shapes of the body there is an error in the area.

Overlay Style Charts:

Note: In all of the overlaid bar charts below there is no height or area-based distortion error as none of them have truncated axes. However, each of the examples has some orientation-based error. This error is the difference of the average angle of the lines that join the tops of two adjacent bars and a 45-degree (positive or negative whichever is smaller) line.
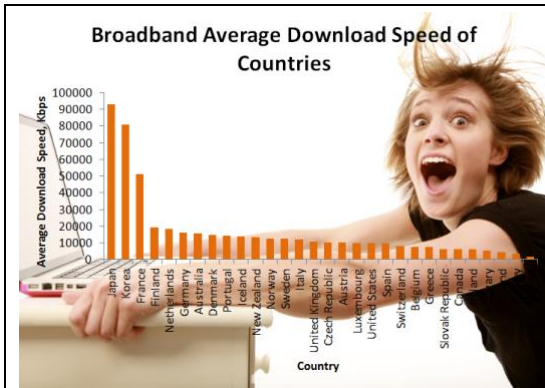
Avg. Orientation Error: **38.3°**
Height Distortion Error: **0**
Area Distortion Error: **0**
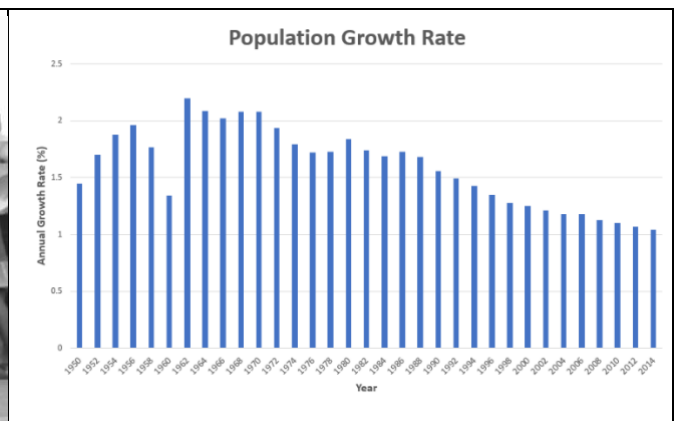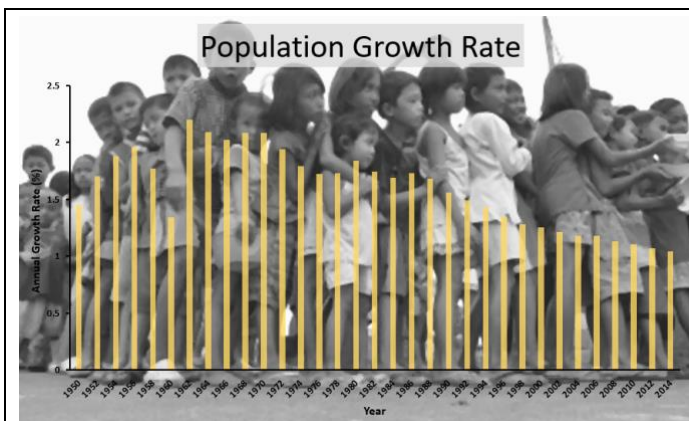
Avg. Orientation Error: **8°**
Height Distortion Error: **0**
Area Distortion Error: **0**

Titanic Survivors in Each Class
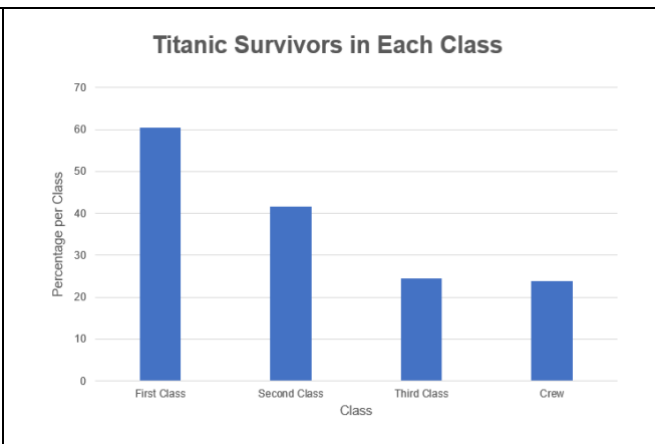
Avg. Orientation Error: **34.3°**
Height Distortion Error: **0**
Area Distortion Error: **0**

Favorite Movie Genres
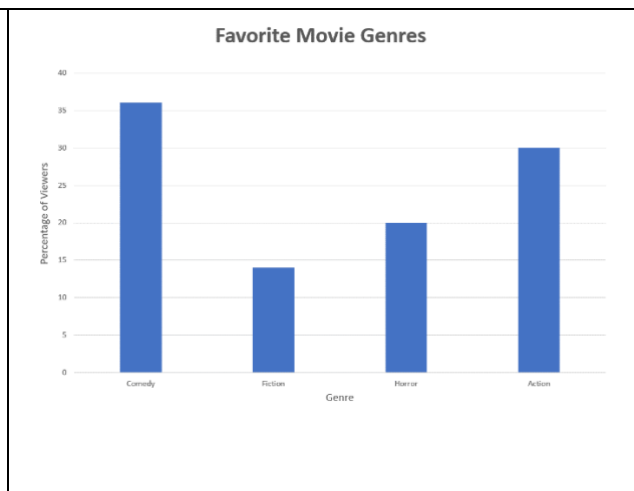
Avg. Orientation Error: **32.8°**
Height Distortion Error: **0**
Area Distortion Error: **0**

Note: In the overlaid line charts below, some of these have a non-zero height distortion error as they have truncated axes. Each of them also has some orientation-based error. This error is the difference of the average angle of the lines that join the data points and a 45-degree line.
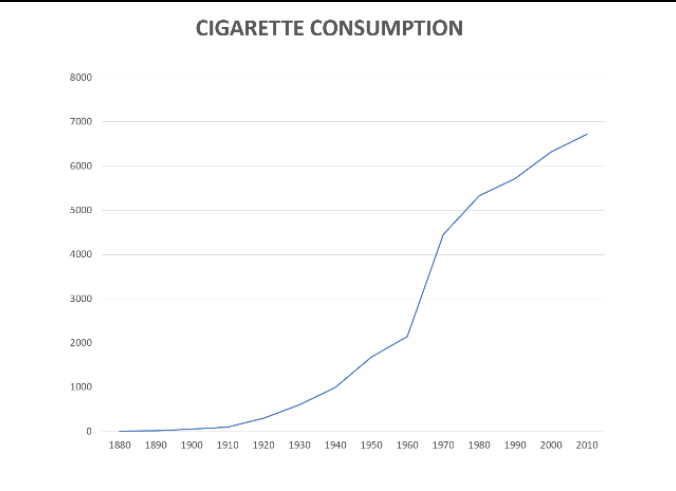
Avg. Orientation Error: **24.65°**
Height Distortion Error: **0**
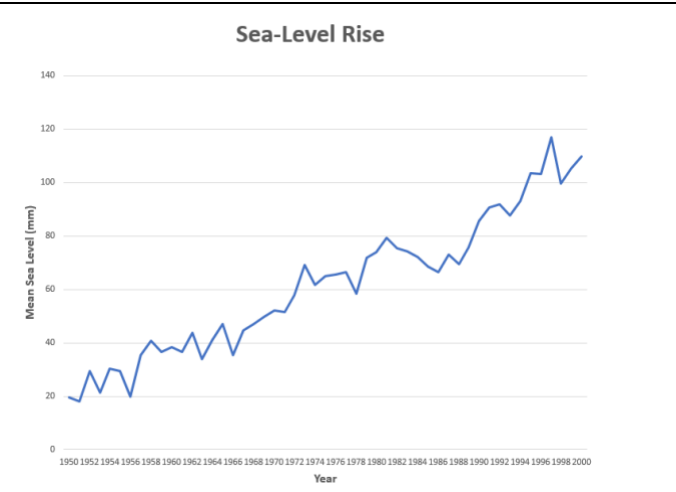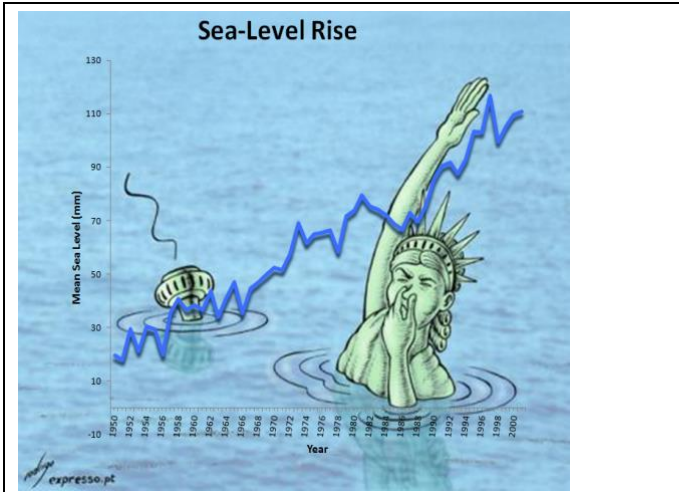
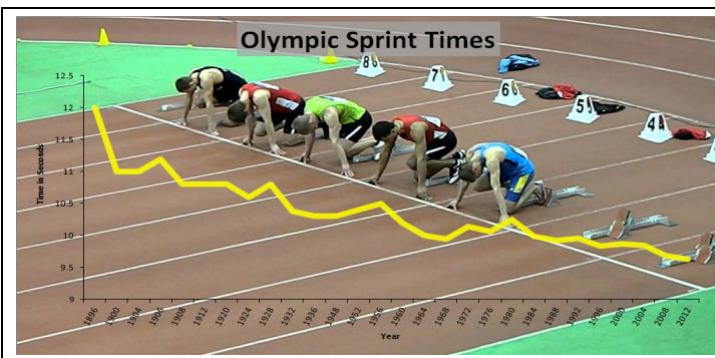Avg. Orientation Error: **1.88°**
Height Distortion Error: **0**
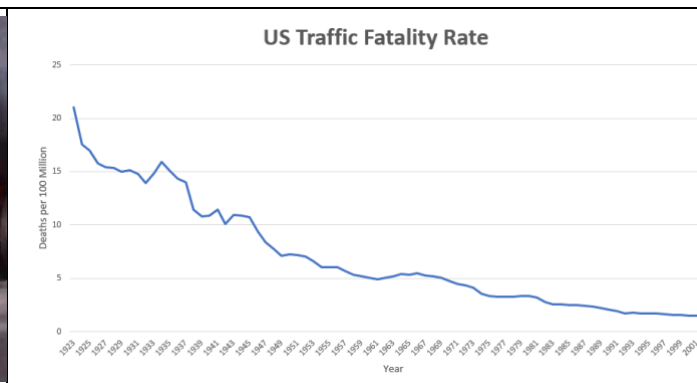
Avg. Orientation Error: **26.83°**
Height Distortion Error: **0**
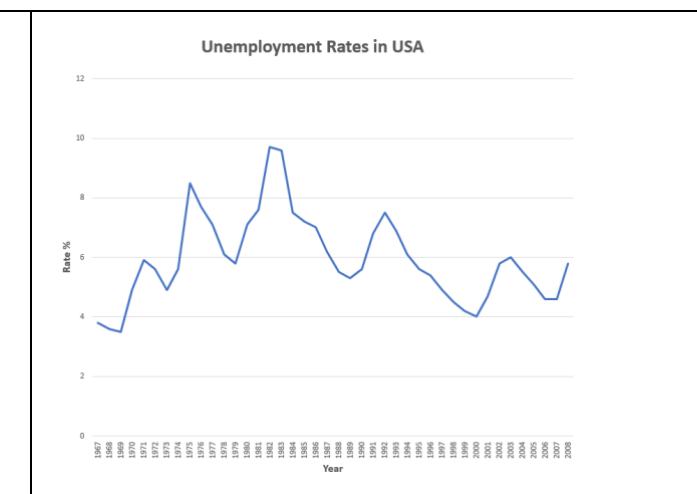
Avg. Orientation Error: **9.82°**
Height Distortion Error: **0.769**

Here the height distortion is caused due to the Y-Axis starting from the value 3% instead of 0%. This could give the viewer the impression that the unemployment rate was close to zero at the start of the line
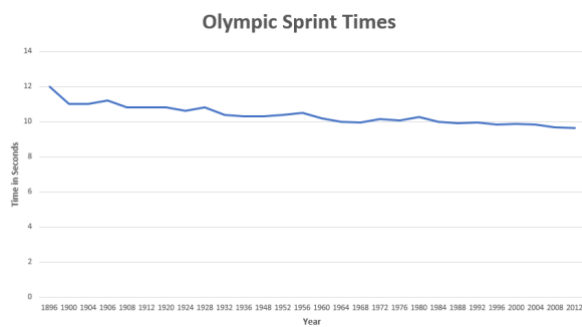
Avg. Orientation Error: **34.68°**
Height Distortion Error: **1.39**

Here the height distortion is caused due to the Y-Axis starting from the value 9 instead of 10. This could give the viewer the impression that the sprint times have drastically reduced over the years. While this may be considered a distortion, in the context of Olympic sprinting the small differences can drastically affect the result of a race.

Distortion Optimization – Simulated Annealing

Algorithm:
Here we present the general pseudocode for the simulated annealing algorithm used to optimize the distortion error in our fill style charts. The algorithm is as follows:

values: initial scaled data values e.g. for pie charts these are the computed angles.
neighbor(*values*): adds random amount of noise to the values
distortionError(*values*): computes the distortion error for a particular chart based on the *values*
random(): generates a random value between 0 and 1
abs(value): computes the absolute value
acceptance_probability(*old_cost, new_cost, T*): this function returns 1 if *new_cost* $<$ *old_cost* otherwise it returns a value of $e^{-(new\_cost-old\_cost)/T}$

old_cost = **distortionError**(*values*)
T = 1.0
T_min = 0.00001
alpha = 0.9
Avg_cost_diff = 1
Cost_diff = 0
Iter_count = 0
while *T* $>$ *T_min* & *Avg_cost_diff* $>$ 0.001:
    i = 1
    while *i* $<=$ 100:
        new_values = **neighbor**(*values*)
        new_cost = **distortionError** (*new_values*)
        ap = **acceptance_probability**(*old_cost, new_cost, T*)
        if ap $>=$ **random**():
            values = *new_values*
            old_cost = *new_cost*
            Cost_diff = *Cost_diff* + **abs**(*old_cost* – *new_cost*)
            Iter_count = *Iter_count* + 1
            Avg_cost_diff = *Cost_diff* / *Iter_count*
        i += 1
   T = T∗alpha
return *values*

Fill Optimization Example:

Here we show a fill-based example, we chose the radial division as it has the greatest number of measures upon which the chart can be optimized. Focus on the three largest segments (Maybelline, Neutrogena and Revlon) to see the difference.
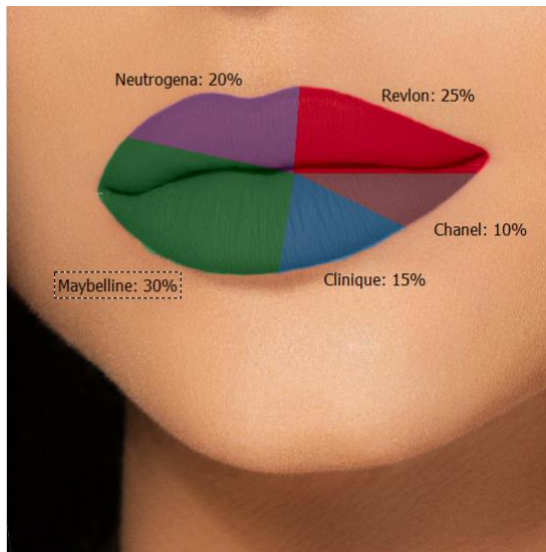
a) Here the lips have been filled and the chart optimized based on angle i.e. the ratio of angles of segments is identical to the ratio of the data values. Avg Err: 0.14
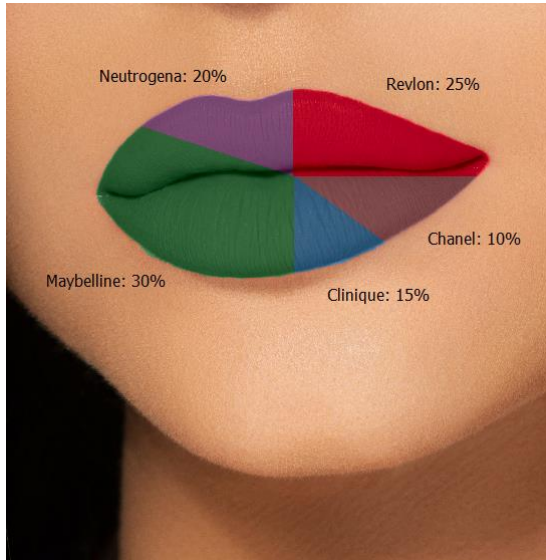

b) Here the lips have been filled and the chart optimized based on area i.e. the ratio of area of segments is identical to the ratio of the data values. Avg Err: 0.13
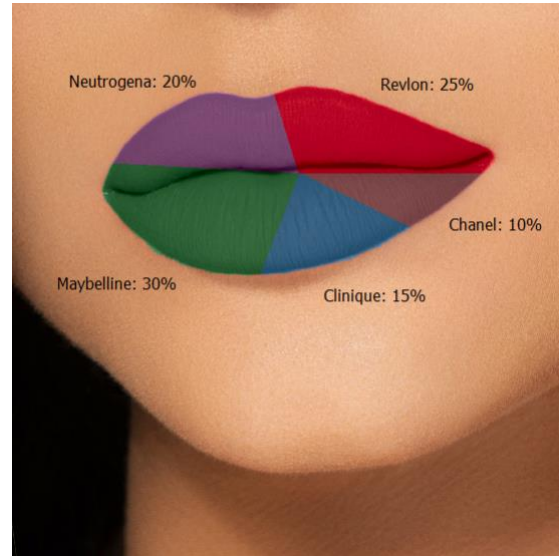
c) Here the lips have been filled and the chart optimized based on arc length i.e. the ratio of outer perimeter segments is identical to the ratio of the data values. Avg Err: 0.13

d) Here the lips have been filled and the error of all 3 measures (angle, area, and arc length) minimized. Avg Err: 0.11
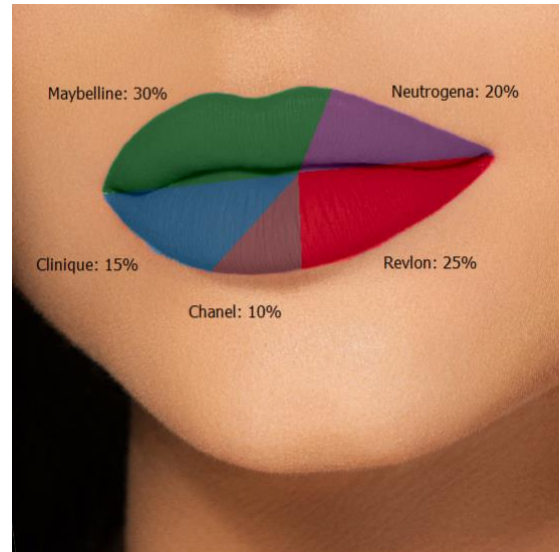
# Distortion Optimization – 45-degree banking

Method:

Here we present the formula used to compute the optimal aspect ratio based on the 45-degree banking rule:
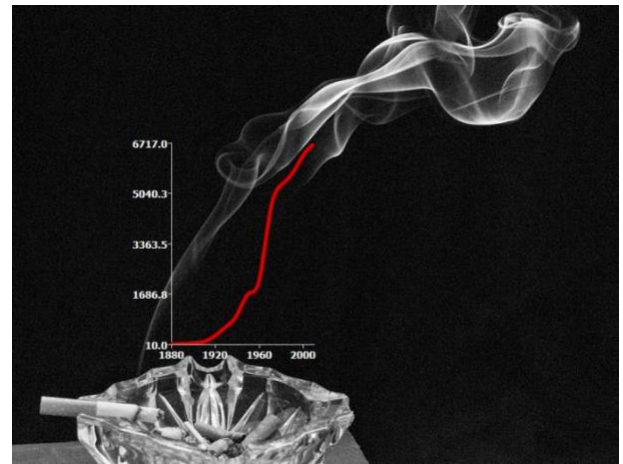
$$\alpha = \frac{M.\,R_x}{R_y}$$

where α is the aspect ratio, M is the mean absolute slope of all line segments in the chart, and R_x and R_y are the range of x and y values respectively.

Trend Optimization Example:

Here we show a line chart example where we have applied the 45-degree banking to optimize it.
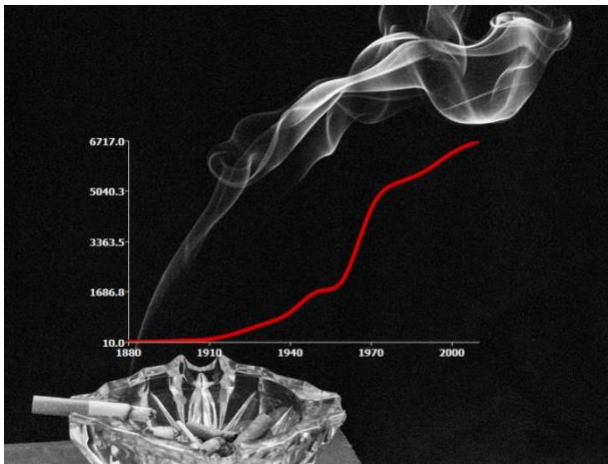
a) Before 45-degre banking.

b) After 45-degre banking

Background Styling

Here we show two examples of the styling the background to emphasize the data.

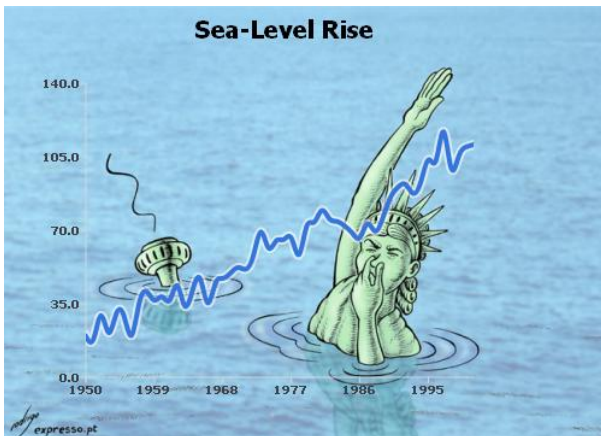**Grayscaling the background while leaving the data in color:**

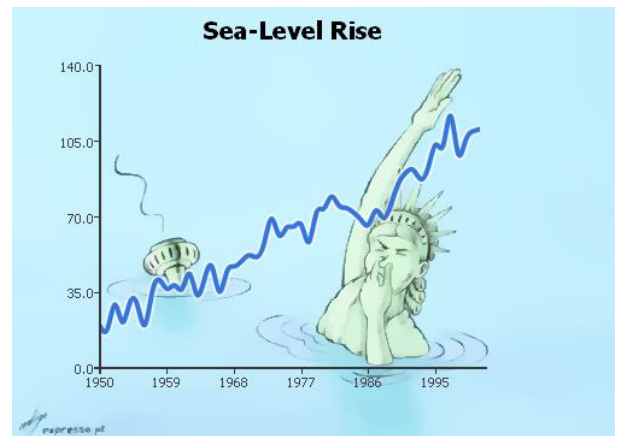a) Raw background image.

b) Grayscaled background image.

De-emphasizing the background details:

a) Raw background image.

b) De-emphasized background image details. Here we smooth the background.