User experience guidelines

Best practices for QlikView based on
human-computer interaction principles

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Introduction

Usability Design or User Experience Design involves very careful consideration of human psychological and behavioral aspects such as perception, cognition, and actions. Understanding these human behaviors can enable a designer to know exactly what will suit the user's intentional and unintentional behavior. This understanding enables them to design interfaces that are not only seamless but also guide the users in their tasks by minimizing or eliminating cognitive loads and hurdles.

Though QlikView is a unique application in itself, a lot of parallels can be drawn between designing for QlikView and designing for the web. When it comes to humans interacting with a piece of software or any form of computer program or device, the same principles of Human Computer Interaction Best Practices apply across the board.

This document discusses various topics of Human Computer Interaction (HCI) principles and illustrates how we can apply these principles to QlikView application design.

First, let us briefly look at the basic concept of how humans process information in order to act or react to something.

Human information processing

The first concept of Cognitive Psychology and Artificial Intelligence in the field of HCI was that people think like machines

Input $\longrightarrow$ Processor $\longrightarrow$ Output

This model was used to study the mechanics of complex human behavior such as vision and communication. Later, Claude Shannon from Bell Laboratories came up with the theory that translated the initial mechanical concept into a more human behavioral pattern.

Perception $\longrightarrow$ **Cognition** $\longrightarrow$ **Action**

Perception - How we perceive something and its psychological impact

Cognition - How we learn and understand something and keep it in our mind as accumulated knowledge

Action - How we act upon something we come across or react to something we experience

These three concepts are extremely important to understand the human mind and design interfaces that follow the pattern of the human mind. In this document, we will look at these three concepts of Perception, Cognition, and Action in terms of using these principles to analyze how and why certain norms can be applied to designing QlikView applications.

Perception

Perception is relative, meaning different people perceive the same thing differently.

To illustrate this point, the Nielsen Norman Group conducted a research study where some participants were shown the picture below and then asked to replicate the picture by drawing it without seeing it.

After the drawings were gathered, the conductors found that every drawing looked different even though it was supposed to be a replica of the same photo. Some people showed the head of the lamp post while others showed the entire view of the two flower baskets in spite of them being cut off in the original photo.

For designers, this means that the assumption that their design is perceived by all users in the same way that the designer intends to is incorrect.

So, when we design a QlikView application, it is always a good idea to get opinions from others and confirm whether or not a user perceives your design the way you intended.

Perception: emotions and design

Emotions within our minds are generated by what we see and feel about something. And what we see and feel about something is our perception about it. There are two ways in which people perceive things: Top Down processing and Bottom Up processing.

In Top Down processing a person's background knowledge about the things based on past experiences influences what is perceived. It is theory-driven, knowledge-driven, and context-driven.

Bottom up processing is pre-attentive processing which can take less than 250 milliseconds to register in our brains. Unique traits of the information perceived are visible instantly.

So, what do these concepts from cognitive psychology have to do with designing interfaces?

These concepts tell us how users will perceive information presented to them. The way a user perceives and interacts with information is highly influenced by his emotions. It is important for a designer to know which strings to pull in the design and which not to in order to influence emotions.

According to usability guru Don Norman, attractive things and products trigger positive emotions which make us more tolerant to minor difficulties, and thus makes problem solving easier. For example, Apple's products are so attractive in their designs that most of the users tend to forgive usability issues under the tremendous influence of its attractiveness.

Bottom up perception is the first impression of something. This is the first level of perception which has an immediate emotional impact. For example, when a user sees a great looking design, he assumes that it will have a great experience factor due to its appearance. For designers, this means that the appearance can in turn lower cognitive loads and frustration levels for the user.

The My Life in Data app on the Qlik demo site is a great example of an attractive design which sets a strong ground for a positive user experience.
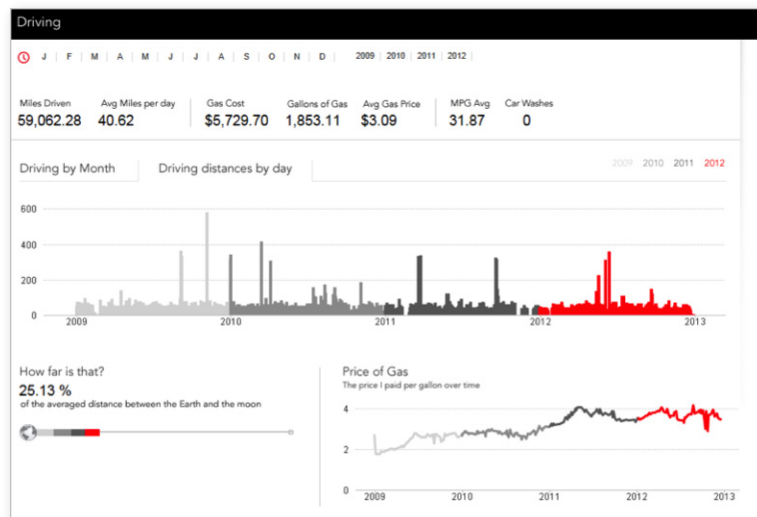
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Top down perception, on the other hand, is highly influenced by prior knowledge or a personal experience. It is the highest level of cognitive thought process and is capable of the highest level of feelings, emotions, and cognition. If people have prior knowledge of the information presented to them, they focus more on the details and notice things quicker than usual.

For example, when people see Apple launch a new version of the iPhone, they are compelled to compare it with the old one and the critiquing factor becomes extremely high, as people already have a prior knowledge of how the device should look and work. However, the first iPhone created a "wow" factor since it was a novelty at the time. People had no expectations nor prior knowledge which is bottom up processing.

The Pro Golf app is a good example of a top down level of perception since there is already an existing golf app that people have seen and liked on our website. Also golf is a popular sport that people relate to, therefore, they have preconceived notions and expectations of what the app should look like and what it should do.

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Everybody is not a trained designer, but some basic rules can be used by everyone to make a design look nice.

- Keep the layout clean and airy with lots of white space
- Group similar items together
- If you are unsure about using colors, it is a good practice to use soft colors

Processing information depends on the user, but creating emotions in the design depends on the designer. There are many obvious ways to create emotions using colors, pictures, and shapes. And, there are not-so-obvious elements like humor, recognition, dissonance, tone of voice, and engagement. Combining some of these factors to create the right emotion with respect to the audience is very important.

Perception: the "less is more" theory

We just saw how aesthetics play a significant role in stimulating perceptive senses in humans. The prettier the design, the more it triggers positive emotions in human beings. So, what about content density? Does that have an impact to how someone perceives something?

According to a study conducted by Nielsen Norman Group, users were given two versions of the same website to work with. One version had a lot of information displayed on a single page, while the other version had information broken down into several pages, with only a little bit of content on each page. The study found that the users preferred to work with the version that has a little bit of content on each page and found with this version, they remembered things quickly and easily.

What this means for us is that the more information on a page, the more time a user takes to decipher things. So, to elevate the aesthetic appeal and make the information consumption easier and faster, it is recommended to keep the designs light and simple. The content can be broken

down into sections on more than one when a lot of information needs to be presented. A content-heavy and dense design can slow down the information processing speed.

Below is an example of an introduction page to a QlikView application. We redesigned this page to be broken down into two pages which were lighter in design and quicker to understand.
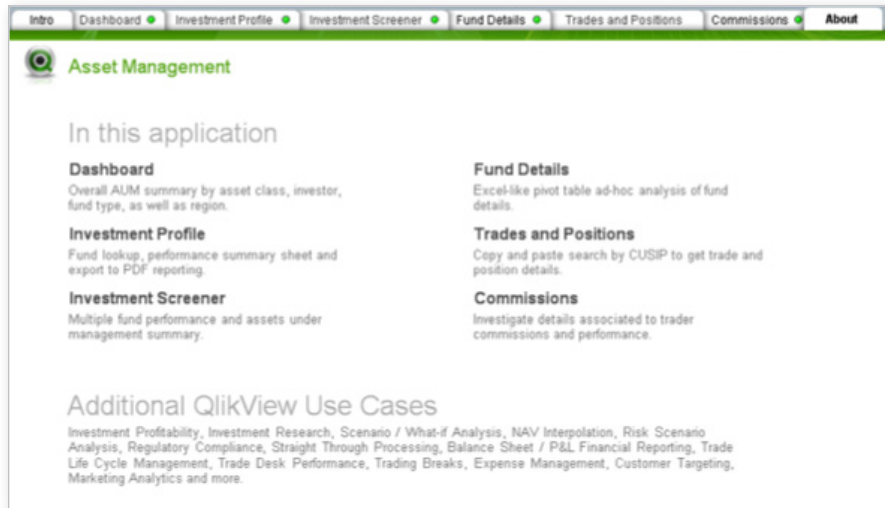
Original sheet
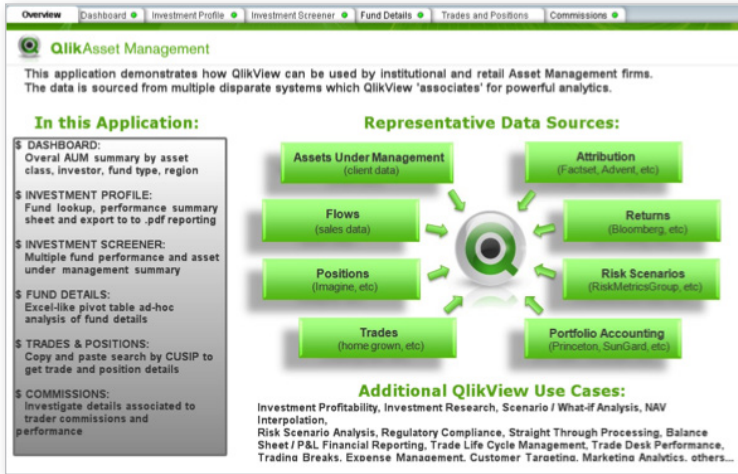
©2014 Qlik

Redesigned sheet

©2014 Qlik

Redesigned sheet

©2014 Qlik

Perception: reflective level of perception

Reflective level of perception is the feeling of "what does this product say about me?" This idea seems trivial, but it is very important from the point of a users' psychology and what shapes their perception about something.

QlikView application for US Department of Defense branded per their design style
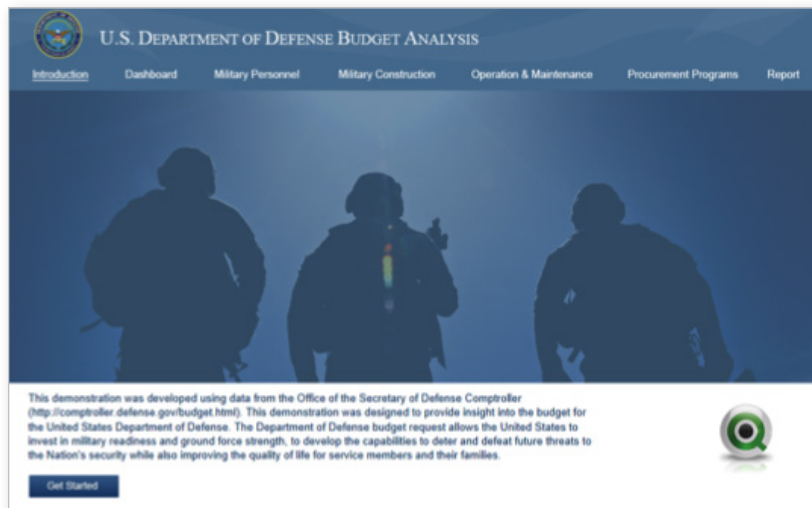
©2014 Qlik

When designing a QlikView application for a customer, it is extremely important to concentrate on showing data discovery. But in addition, showing a customer the application with their branding skin on top, will impact the customer on a reflective level, which can have a huge impact on the customer's perception about the application and the product.

## Perception: visual design best practices

When it comes to perception, the first thing people notice is how something looks. Visual design is what defines the look and feel of something. Below are some best practices to apply when designing that help to make the visual design effective and flawless.

Aiding to the color blind audience

About 4.5% of the world's population is color-blind, including about 8% men and 0.5% women. As color forms an important aspect of visual design, we must choose our colors wisely in order to serve all user types including the color-blind audience. There are three types of color-blindness, but the most common is the Red Green Color-blindness.

Red and green are two colors which appear as shades of yellow to color-blind people. When we create dashboard, red, green, and yellow are the most common indicators that we use to convey alert messages.

When using red and green together, choose a green which is closer to blue in hue, this way they can be differentiated easily by the color-blind users.
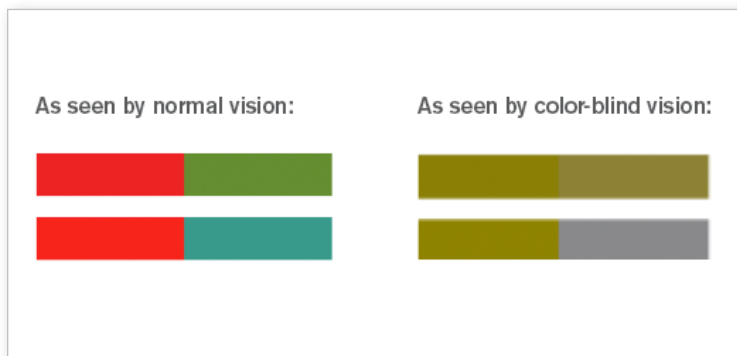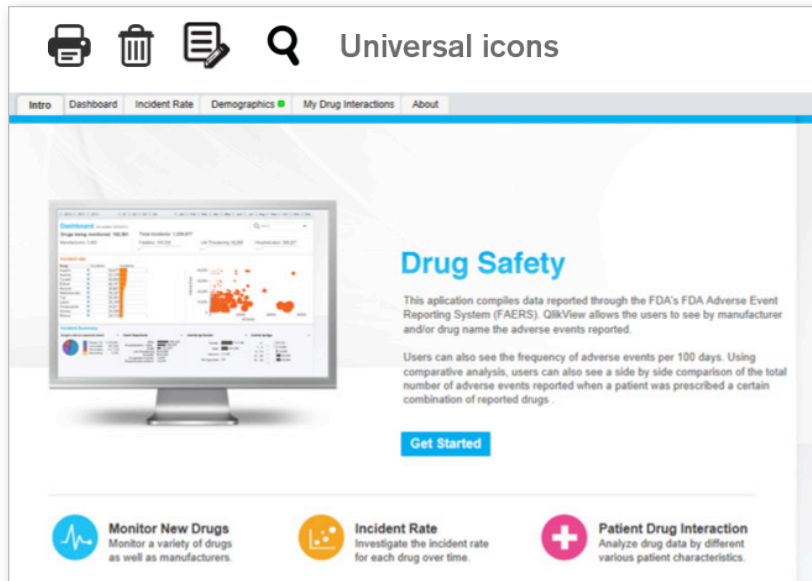

©2014 Qlik

Using icons

The use of icons needs careful consideration and understanding since it has the ability to solve or complicate a problem.
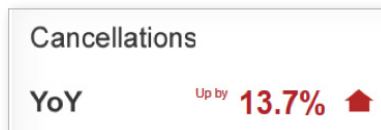
Icons that are universally known and accepted form a good visual cue for enhancing usability. However, using icons which are not commonly seen or used add ambiguity.

If the icons designed are not among those used universally, it is a good idea to add text along with the icon to explain the context as shown in the example on the left.

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Also, for the color-blind audience, icons are an important indicator because color is not always a reliable source of information. Icons can be used in conjunction with color to delineate information as shown below.
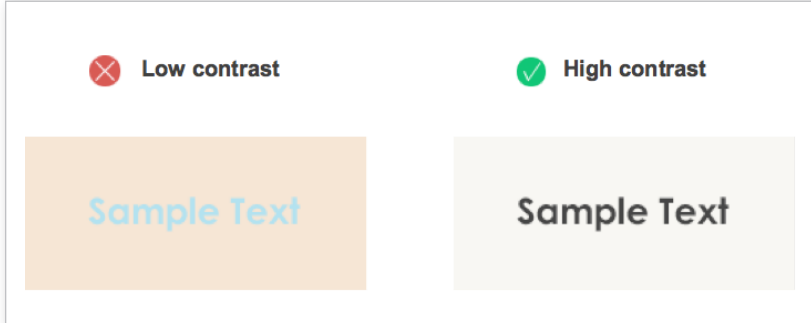

©2014 Qlik

There are a number of free resources for icons online:

- http://www.iconarchive.com/
- http://openiconlibrary.sourceforge.net/
- http://findicons.com/
- http://glyphicons.com/ Monochromatic

Text color

It is highly recommended to keep a high contrast between the text and the background. A low contrast between text and background can not only make the text non-legible, but can also cause discomfort to the eyes. Using black text on a white background is preferred.
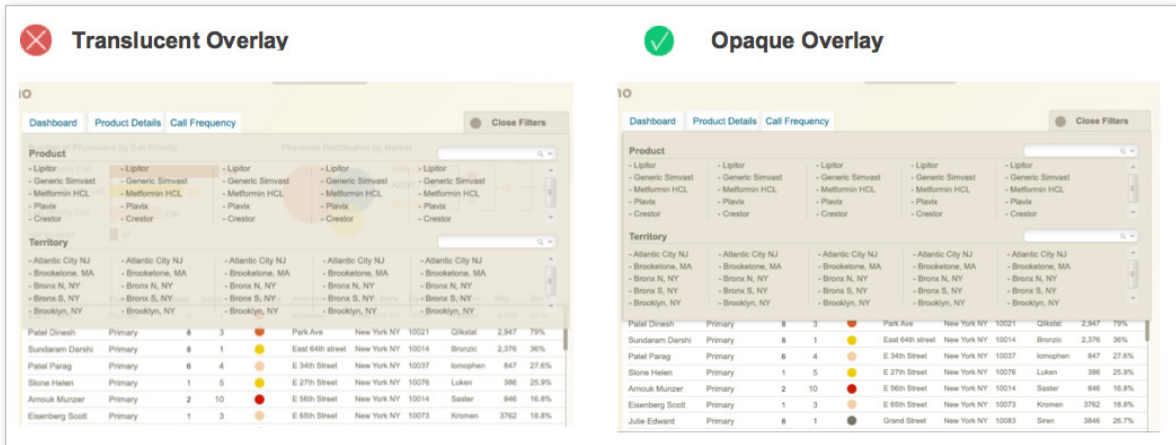

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Overlays

Translucent background overlays can make it highly difficult to read the text over it.

In the QlikView world, we use background overlays to show the additional filters option under the show/hide condition. Keeping background overlays opaque or with the least amount of transparency, only if required, will increase legibility to 100%.
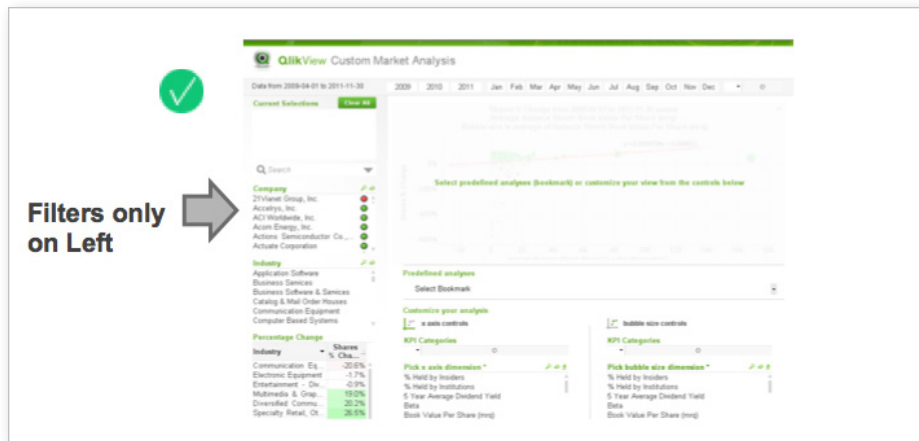

©2014 Qlik

Competing navigation

Placing a set of filters on the left and a set on the right is confusing to the user since the eyes tend to continue to dart from left to right to make sense of what is going on, causing stress and slowing down the information processing speed.
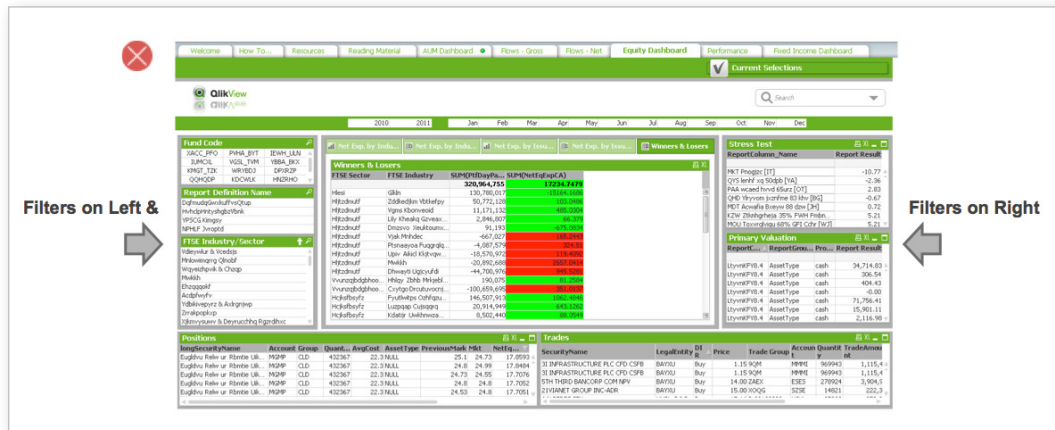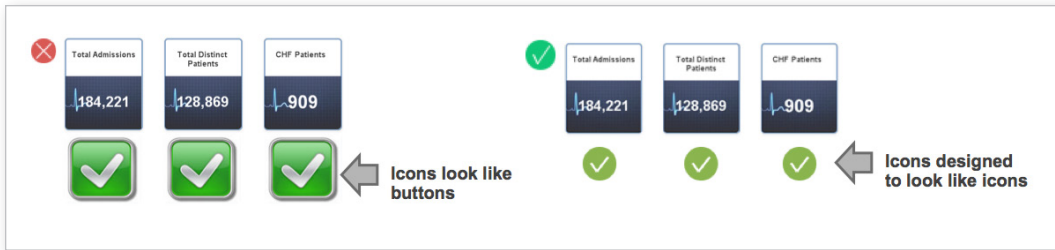

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Providing filters, navigation or controls only in one area of the page is recommended like shown in the example below.

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Differentiating between buttons and icons

Using icons that look like buttons, as shown below in the example on the left, can cause confusion and misguide the user. Bevels and shadows cause non-clickable UI elements to look like buttons because this is how we traditionally have been showing buttons. Using icons without bevels can help in defining them more clearly.
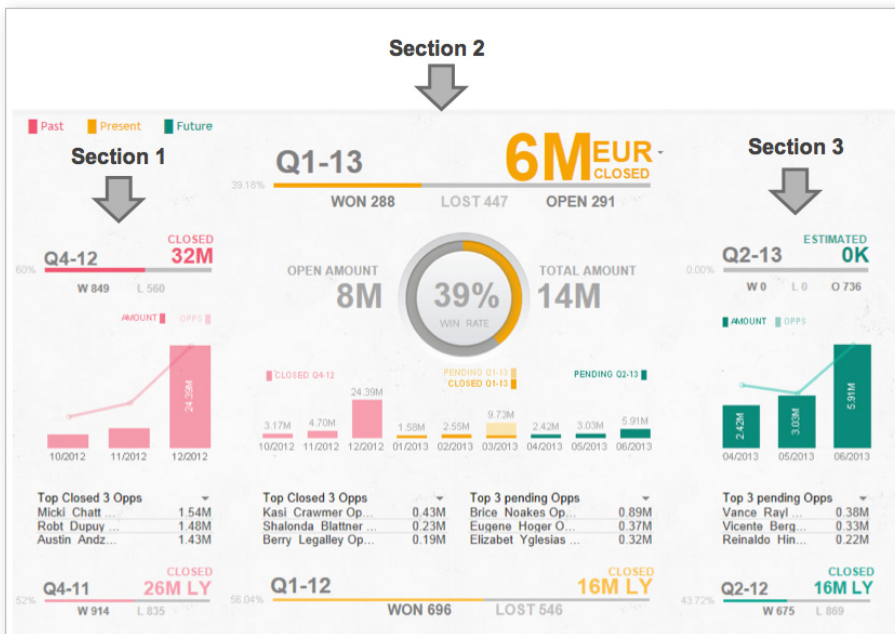
©2014 Qlik

Perception: visual tricks

There are some simple visual tricks that can be applied to make the design more visually appealing and to guide the flow of information in the design.

Closure

Arranging information so that it appears to be enclosed in a box is a way to create a sense of a closure and group similar information for the sake of visually guiding the user.

In the dashboard example below, the way the three sections of the dashboard are laid next to each other, they appear to be in context of each other. The user naturally tends to make a comparison between them, which is the intention of the design.

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Grouping and proximity

Grouping similar items together can make them look like they belong to the same section of a page. Playing around with the proximity can create this visual effect. In the dashboard example below, the top section of the page is grouped together to show high level KPI and low section is grouped to show more details about trends.
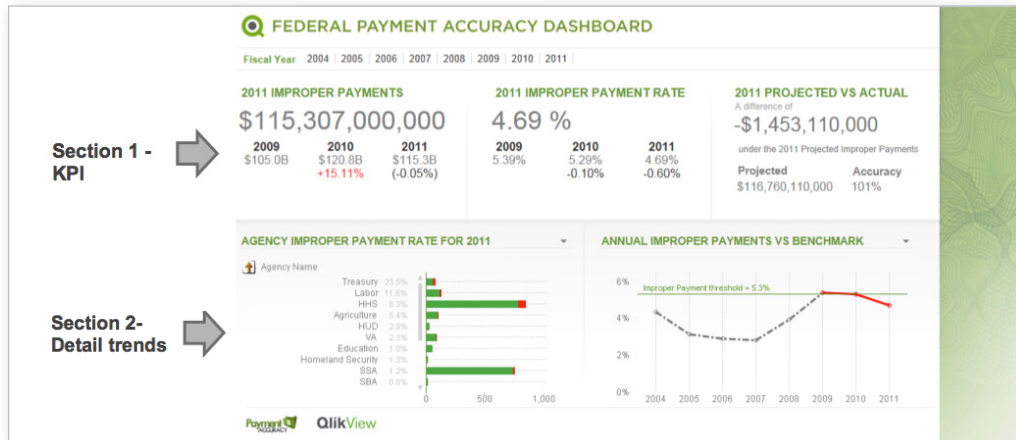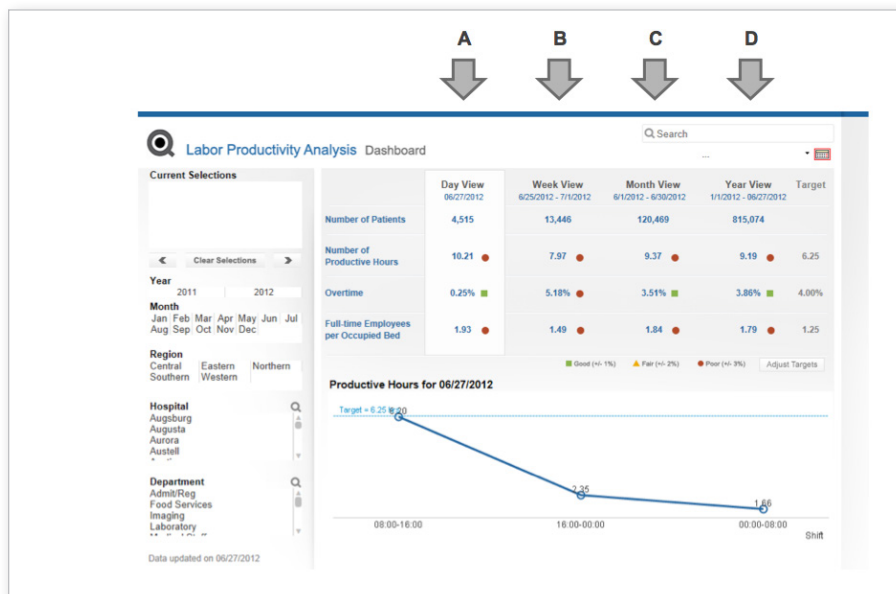

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Perception: content formats

When it comes to presenting a lot of information at once in the form of tables or paragraphs, it is very important to display the content in a format that can be easy to scan and read, and doesn't lose the user in a sea of information.

Structured and narrative formats of information display

When we design dashboards, we know the KPIs that we need to display on the dashboard. Many times, the format is obvious since KPIs need to be compared over time, but it is often difficult to think of the perfect layout to display the information in the most effective manner.

There are two kinds of layouts that can be implied: the structured format and the narrative format.

Structured format - A structured format is effective when there are many different dimensions to compare at the same time. In the next example of a dashboard, the same metrics have to be compared over a series of time, so a structured format is used.

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Narrative format - In a narrative format, the intent is often to take the user from one point to another in the form of a story. In the dashboard below, the highest level of information needs to be shown at the top and then the following information is shown according to the level of detail.
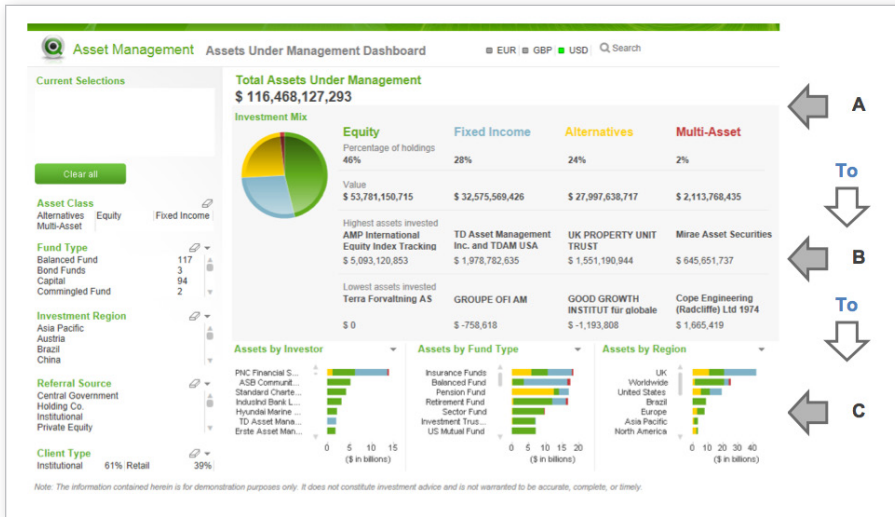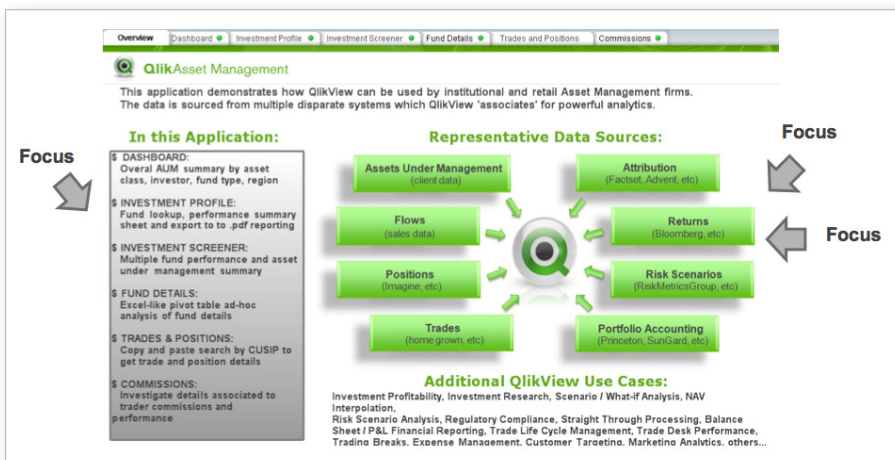

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Cognition

Cognition is a group of mental processes that includes attention, memory, and learning. Decreasing cognitive load increases positive user experience. Let us have a look at these three concepts and how they can affect the user's psychology.

Attention

Your audience has a short attention span. When information gets larger in quantity and in length, their attention span decreases. A content-heavy sheet forces the user to pay more attention to each piece of information resulting in a lowered attention span. On the other hand, a light, concise, and airy design can help the user understand how and what to pay attention to on the page.
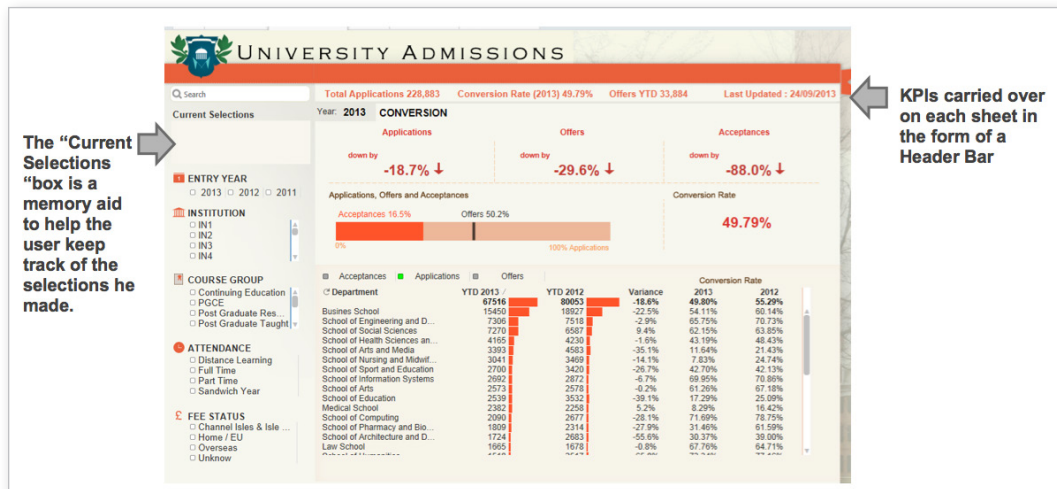

©2014 Qlik

Overly promoted entry points are always ignored. For instance, in the introduction sheet shown above, there are many images and visual distractions all over the page. This can divert attention of the user from focal point of the design, causing the user to ignore important action elements like the start button.

Memory

Memory is an important aspect of cognitive processing. In some cases, making the user remember certain items in a dashboard or the current state of the KPIs as they flip through other tabs is not efficient.

Recognition is easier than recall, so providing the users with little cues can ease the cognitive load.

For example, the application below is designed so that the KPIs are carried across all the sheets in the form of a header bar. In this scenario, it was necessary to have the KPIs as a baseline for comparison in the entire application. So, they were carried over across all sheets in the application instead of requiring the users to memorize them from the dashboard or flip back and forth between the sheets.

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Adding a "Current Selections" box in every application is a helpful feature in QlikView. It enables the user to have their exact drill down path in front of their eyes instead of forcing them to remember it. So, in order to decreasing the cognitive load, it is highly recommended to have the Current Selections box in all sheets in the QlikView application.

Learning

Constant learning of an interface causes frustration and tremendous cognitive load. It lays the groundwork for making a lot of mistakes and often results in a bad user experience.

Learning by doing is much more intuitive and immersive than learning by instruction. However, people are more receptive to instructions when you provide them at the very point of need as shown below.
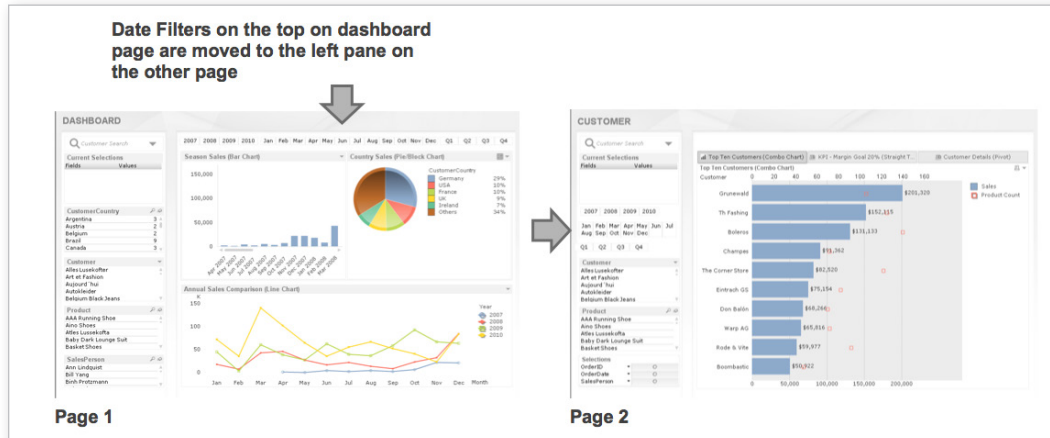

©2014 Qlik

Providing cues throughout the application can enhance learning. For example, providing text inside the search box to inform the user of what to expect the search engine to find for them is a good practice.
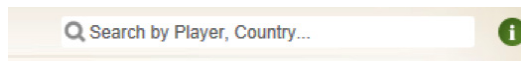
Cognition: consistency

Once a user understands the basic UI and style of an application, it is necessary to maintain consistency with the style, layout, position of navigation, and controls. Do not compromise on consistency while designing the UI of an application. Inconsistency in the design leads to a lot of guess work and a poor user experience. A layout that keeps changing within every page in an application forces the user to constantly relearn and adapt.
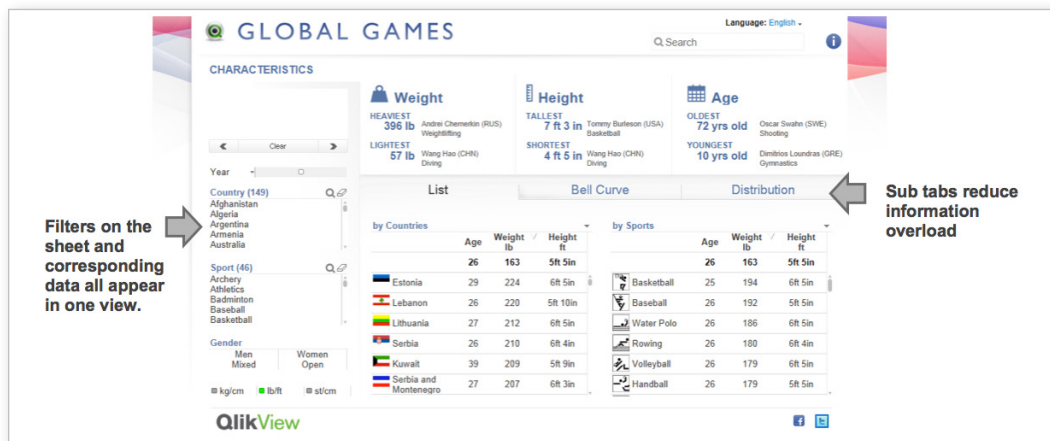

©2014 Qlik

Cognition: information organization

Many times, we need to present a lot of information in a single QlikView application which can result in the creation of a high number of document-level tabs. This means that in order to make sense of information, a user needs to go back and forth between document level tabs. This phenomenon is popularly known as "pogo sticking." Also, in a QlikView application, a user generally works a lot with filters and when the information changes on various tabs, it becomes hard to keep track of the changes.

One solution to this problem is to break down information and organize it into sub tabs within a sheet. This allows the changes in data and filter lists to appear in one view, even when the information is filtered.

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Cognition: mental models

A mental model is a person's thought process and their belief of how something should be based on their past experiences and knowledge. For example, for a Windows OS user, closing an application is always done from the top right corner of the application window. This is their mental model of closing an application.

Mental Model is a very important concept when it comes to designing user interfaces. Understanding a user's mental model can help tremendously with designing a UI that exactly suits the user's thinking.

When a user's mental model is broken, it takes a little while for them to refigure the correct procedure and move forward. For example, if the same Windows OS user is given a Mac OS to work with, they will look for the same interaction paradigm in a Mac but will not find it, so their mental model of closing an application will be disturbed.

Sometimes, there is a conflict between a designer's mental model and the user's mental model. When this occurs, there needs to be a smooth transition from the designer's mental model to the user's mental model. This can be done by providing subtle cues in the design to make the learning process easy. The other way to create a seamless interaction is to use the existing interaction paradigms that users are familiar with instead of creating new ones.

Though we design for an entirely different platform at Qlik, all of our users also use the internet and navigate through various websites. Taking advantage of their existing mental model of how websites works can help in designing QlikView applications by using the same tried and tested UI methodologies.

For example, it is a good idea to place the filters panel to the left side of the sheet in a QlikView application because the navigation in most websites is always on the left. This is a widely-known and accepted paradigm.
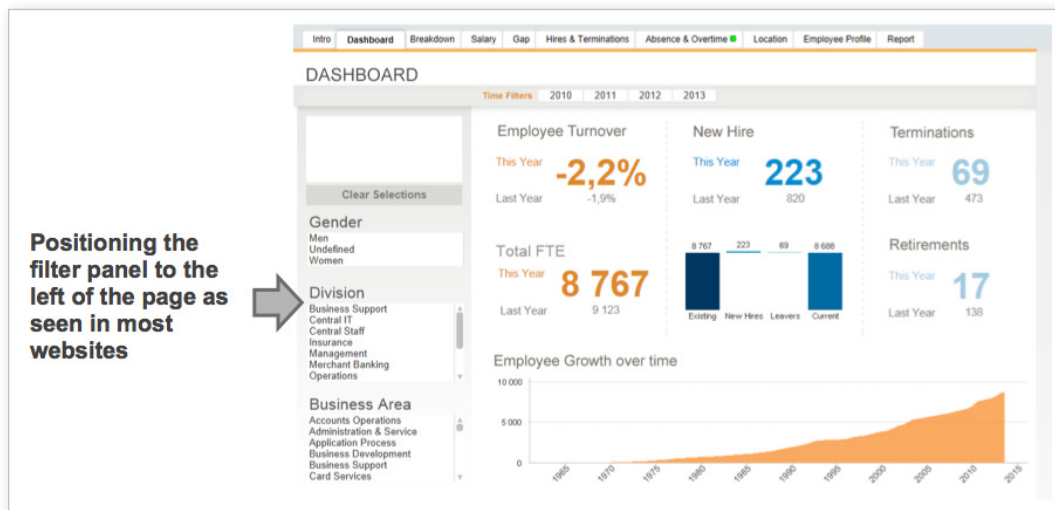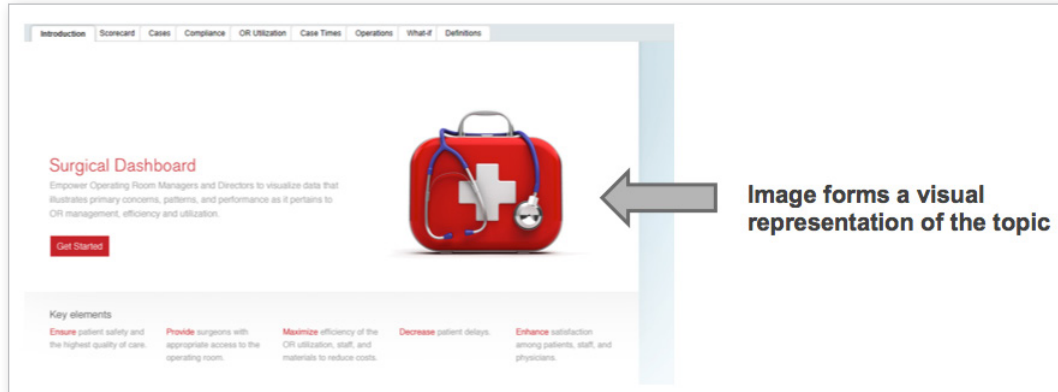

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Also, taking advantage of other UI paradigms such as using similar toggle buttons that people see on the internet can help people learn the usability of an application quickly on the basis of familiarity.

Cognition: contextual effects

When something is put into context, it becomes more meaningful and the cognition process becomes faster and more convincing.

Using images, titles, and descriptions which are suggestive of the content that you want to present and not ambiguous can set the groundwork for introducing the topic. This makes the learning process easier. Images that have vague or loose associations can confuse the audience.

In the context of QlikView, we tend to use images, titles, and descriptions in the Introduction sheets. Using the right images to introduce the topic is very important, as shown in the example below.
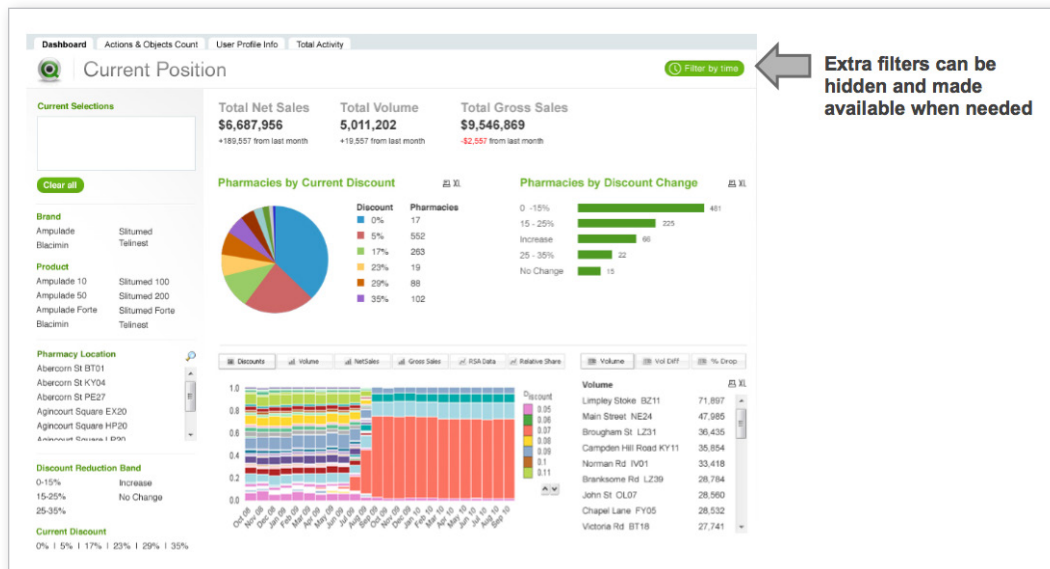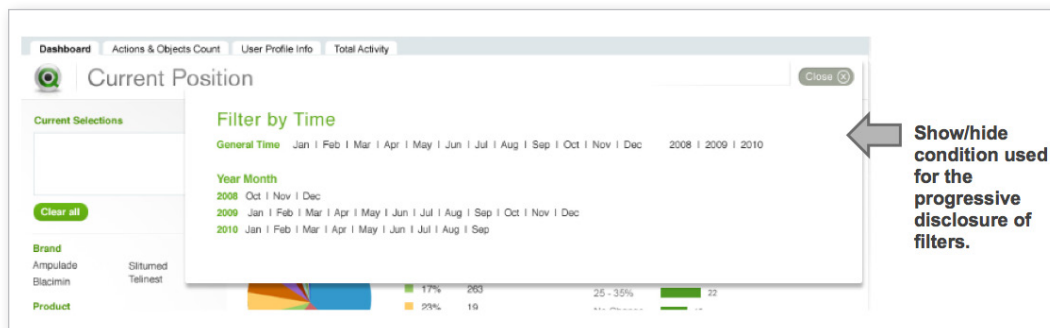

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Cognition: progressive disclosure

Showing supplemental information and options at the point of need is called progressive disclosure. The human brain can only process a certain amount of information at a given point in time so, as designers, we should consider this human limitation when designing interaction patterns for the user.

Showing information to the user progressively, at the point of need, can help simplify the cognition process and help speed up the consumption of information.

When developing a QlikView application, we often come across the need to have a lot of filters and list boxes. But many times it is not necessary to show all the filters at once. In this case, the list boxes can be prioritized such that only the most important list boxes are shown on the sheet, while others are hidden and accessed only at the point of need as shown below.

Extra filters can be hidden and made available when needed

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**Show/hide condition used for the progressive disclosure of filters.**

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Action

For a user to interact with a website or a QlikView application, there are actionable elements such as buttons, filters, etc. that are designed for the user to perform actions. Designing action items such that the user only does what they are supposed to do to complete the action seems like an easy task, but can create a complicated path for the user if it is not designed well.

Below are some recommendations with respect to button and controls.
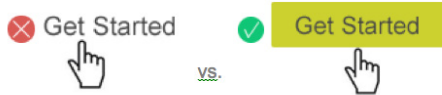
Text buttons, specifically those with text smaller than a 12 point font, is harder to target with a mouse cursor than a button with a solid background.

The solid background around the button gives the user more real estate to click. In contrast, with a text button, the user struggles to find the target area to click and sometimes has to make two to three attempts in order to complete the action.

A different way of optimizing the "text only" button is by expanding the target area around the button as shown below. This way, the user can click anywhere close to the text and still accomplish the desired action.
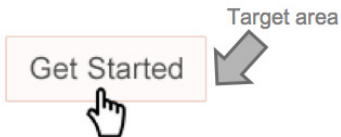
Alphabetically-sorted lists

Alphabetically-sorted lists are more user-friendly and make it easier to find information than categorically-sorted lists.

An alphabetically-sorted list works better in a vertical format, not in a horizontal format. In a QlikView app, sometimes the list boxes are broader and we tend to arrange the text in a horizontal alphabetical order which becomes difficult to scan.
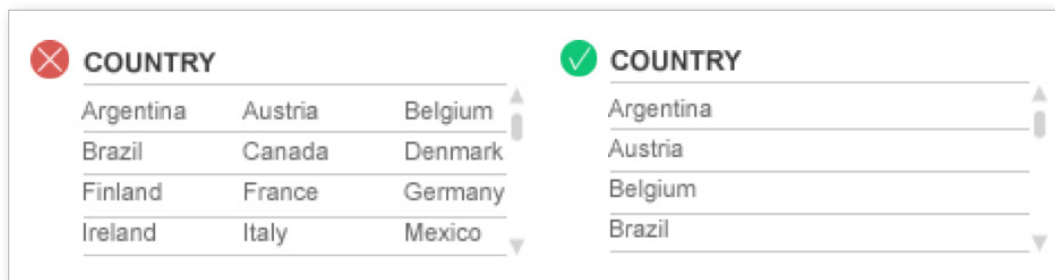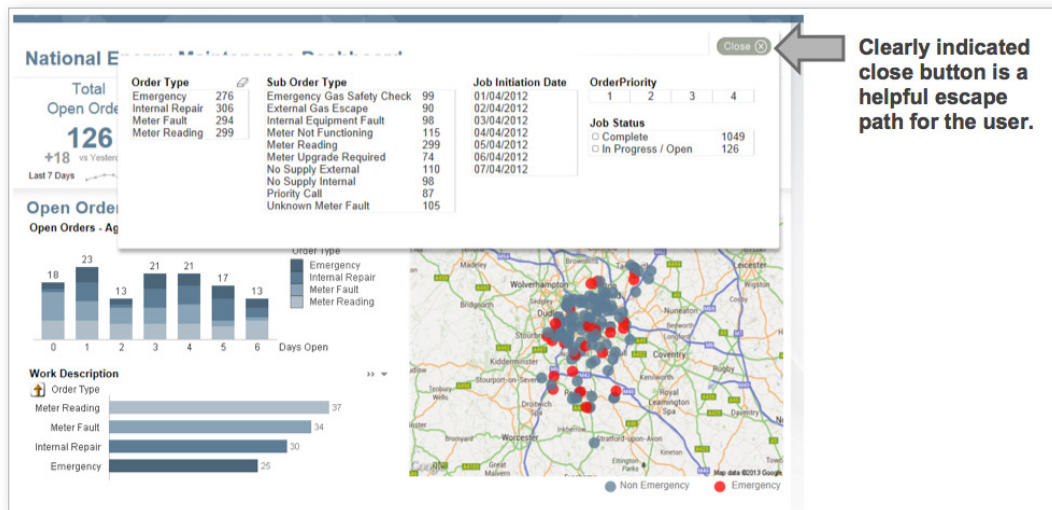

©2014 Qlik

However, a horizontal order works well for arranging time filters in a QlikView app like shown below.

| 2012 | 2013 | | Q1 | Q2 | Q3 | Q4 | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |

Escape paths

It is always a good idea to clearly provide an escape route to the users when it comes to model windows or overlays. For example, the obvious and legible close button that is provided on the "more filters" overlay panel shows users how to close the box.
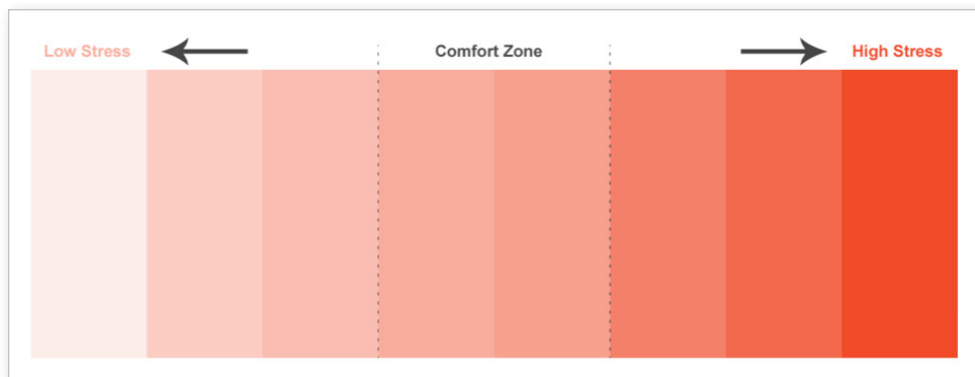

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Use of color for action items

Use of colors for action items or elements that need to alert the user is a very important and common concept when designing QlikView apps. We design dashboard to give an overview of the situation and the health of a particular business, and often use a lot of bright colors, especially red, to notify the user about something that needs their attention.

Below is a chart which shows how the varying difference in the saturation of a color affects the stress level in human beings.
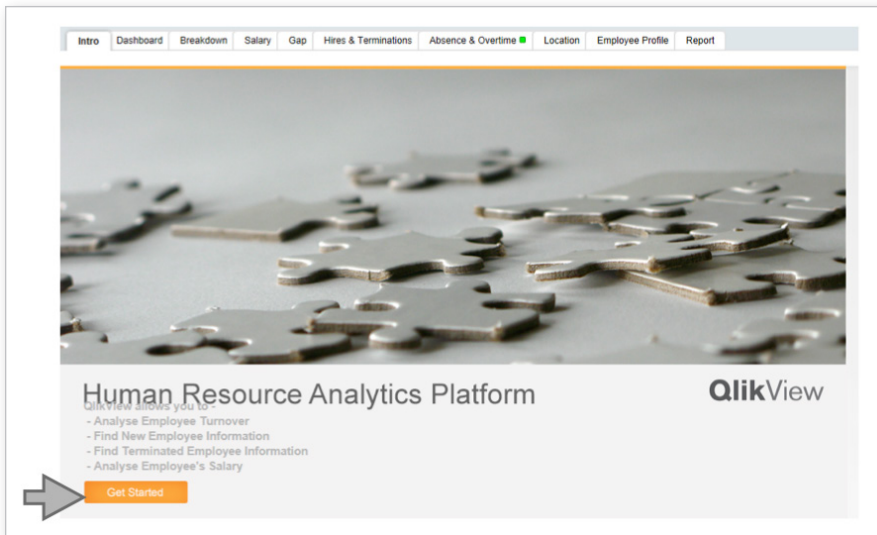

©2014 Qlik

According to the chart above, more saturated colors cause higher stress than less saturated colors. Using less saturated colors is recommended for elements like backgrounds and non-data elements. Using more saturated, strong, and bright colors for action items like buttons, icons, and KPIs can be a good indicator to highlight important information like shown in the dashboard below.
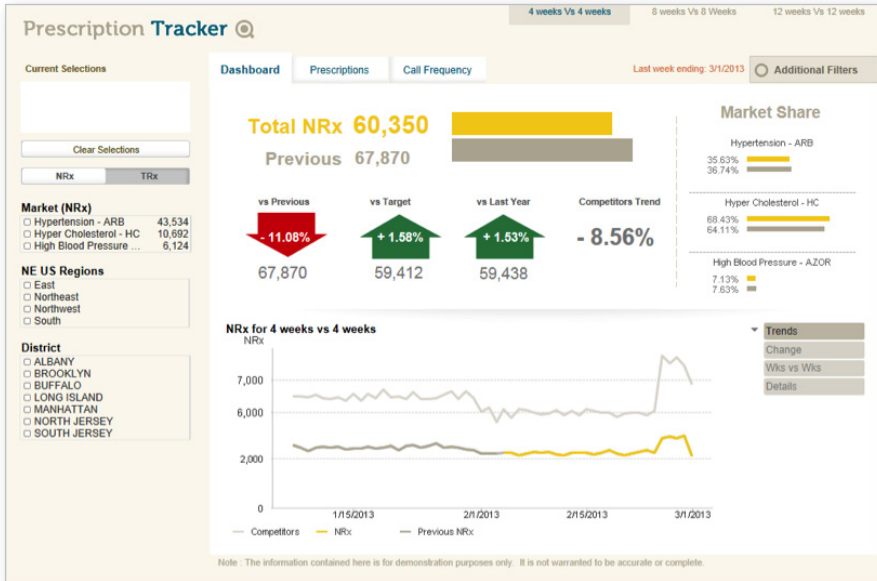
©2014 Qlik

In the example above, bright and saturated colors are used for data elements such as the bar chart, line chart, and icons, helping the user to quickly identify the important elements in the dashboard.

In the example below, a contrasting color is used for the "Get Started" button to emphasize the call to action which needs to catch the user's attention immediately.

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Universal design

Designing systems that can be used by anyone in any circumstance should be the final goal of any designer. When usability turns into accessibility, the design is said to be universal.
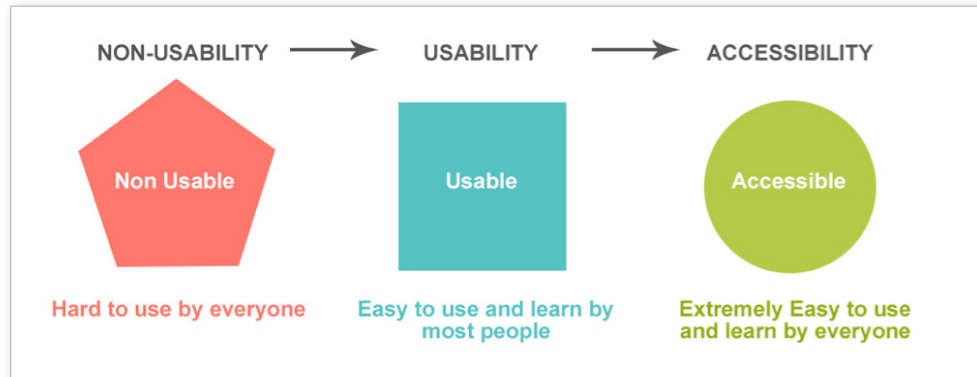
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Some people suffer from permanent physical or mental disabilities like color-blindness, while the rest of us often experience temporary disabilities from time to time such as finding it difficult to locate a fact in a complex data set while delivering a presentation.

It is important for every design to acknowledge all kinds of disabilities at all times. This is when any task becomes natural and seamless.

Below are few simple tips to consider while designing for all types of audience:

1. Always check that the colors used are color-blind safe - http://colororacle.org/ is a good tool for evaluation.
2. Do not use a font size that is less than 10 points.
3. Always use titles and sub-titles to break down information.
4. If the application is to be used in multiple languages, design the layout considering that some languages contain longer words.
5. Respect white space. This can help users to scan through information quickly and also contributes to a cleaner design.
6. Re-check the voice of your sentences, as writing in the second person can be confusing.
7. Provide alternating text for non-text elements such as icons.
8. Give hyperlinks unique, descriptive names.

Cultural considerations

Though we live in a global society and work with people from all parts of the world, we cannot deny the fact that there are wide cultural differences between us, especially between eastern and western societies. Cultural differences are also seen in design language, people's taste, and sense of design.

It is seen that the eastern societies have different design style than the western societies. For example, the eastern countries are used to busy, content-heavy, colorful designs. While in the western cultures, the design style is usually light and airy, using soft colors.

If you know your audience, designing according to their sense of taste is a good idea but if the audience is either not known or global, a right balance in the design style is the best option.

Cultures are not only based on countries and regions but are also associated to a corporate organization. When designing for a specific company, it is a good idea to have a look at their company website, corporate portal, and other material to get a sense of their design culture and deliver your design accordingly.

Below is an example of a dashboard designed for a specific company which incorporates their design language and branding style.
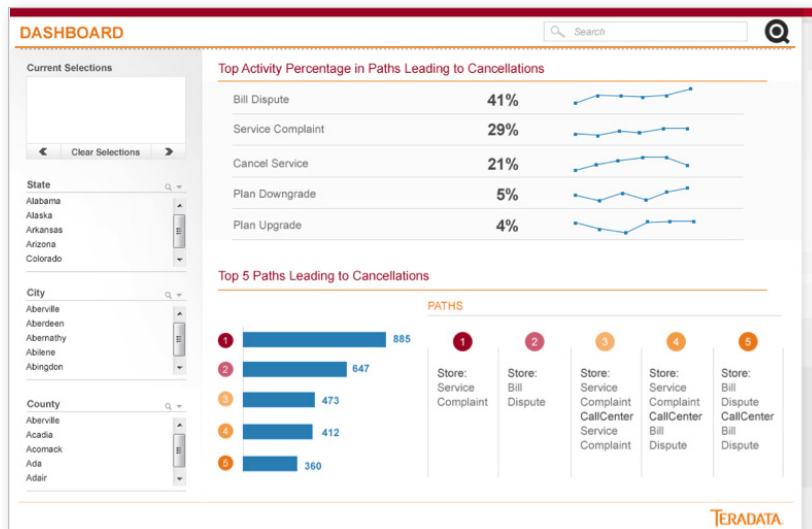
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Summary

There is always a lot to consider while designing any application, be it web or QlikView, but the usability guidelines remain the same even when audience and constraints differ. Even though all of us are not trained usability experts, it helps to think as if you were a user of your own creation. Always test out your design in a real environment, and then take an iterative approach towards your design process.

References

Nielsen Norman Usability training presentation on the topics of Human Computer Interaction and Human Mind and Usability which was held in Dallas, US in April, 2013.

Appendix

A brief history about the field of Human Computer Interaction

1946 – During the early days of invention, computers used to be the size of a whole room, and the only purpose was to achieve good computing power. Humans had to be trained to use complex interfaces and only expert users were able and expected to operate them.

Until the late 1970s, the only people who interacted with computers were technology professionals and hobbyists.

1973 – Xerox PARC's Alto was the first Mouse, graphical User Interface, Ethernet, email, and word processor prototype.

1980 – In late 1970s and early 1980s, the personal computers emerged and gave rise to novice and non-expert users using the computers. This highlighted the deficiencies in the interface of the early computers with respect to usability due to which scientists realized the need to take human limitations and capabilities into account when designing computer interfaces. So the computer interface needed to be changed to suit human needs instead of the other way around. This gave rise to the field of Human Computer Interaction which was a bifurcation from the field of computer science. This new field incorporated the study of cognitive psychology, artificial intelligence, linguistics, cognitive anthropology, sociology and the philosophies of the human mind.