



Using Web Animation to Enhance Usability

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ABSTRACT

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The purpose of this thesis is to find out how to use web animation to improve web usability. The research is tailored for the case company, Verto Analytics. For the theoretical background, usability and relevant terminologies are first clarified. Secondly, the principles of web usability and usability tests as a way of measuring are studied. The theory of web animation starts from understanding the traditional animation and its principles. The definition and role of web animation are discussed before going through the example of animation description in brand guidelines.

After the theoretical section, the study discusses a usability test which was conducted in the case company Verto Analytics to understand current usability issues of the product called Monitor. The issues which could be potentially improved by web animation were selected with the production team. Animation proposals for the implementation were then suggested.

The study results suggest that animation can improve the usability significantly in several situations. When there is a complicated feature in the application, using animation helps to demonstrate the feature to the user. Animation draws users' attention to the feature, and, therefore it's useful to implement animation when communicating "hidden" messages to the user. Web animation can also improve the usability by bettering the loading messages. On the other hand, web animation should be considered when the interaction and visual elements are designed. Overusing of animation can slow down the performance of the application and cause visual chaos.

Key words: web animation, web usability, user experience, interaction design

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ABBREVIATIONS AND TERMS

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IxD: Iterative Design

UI: User Interface

UX: User Experience

HCD: Human Centred Design

1 INTRODUCTION

The research question of the thesis is ‘how to use web animation to improve the web usability’ and it’s tailored for a case company, Verto Analytics. The reason for choosing the topic in the field of web animation is because of my personal passion in the topics of motion graphics, user experience, and usability. This brought a great curiosity to me to explore how to use web-based animations in practice. Usability is an essential part of a user experience of web applications and yet it is not as broad as user experience. Therefore, I want to find out how could web animation enhance the usability of web applications.

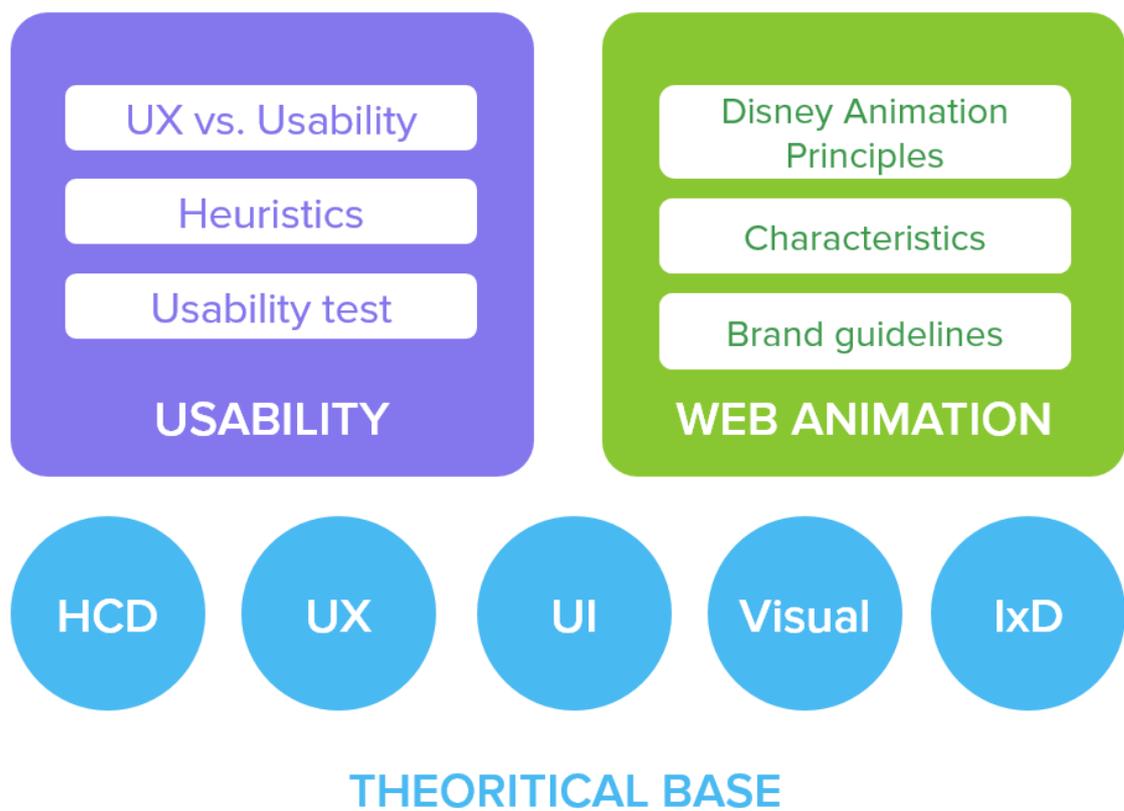
My thesis study includes theoretical and practical parts. Web animation and usability are the focus in theoretical part. I first plant a theoretical basis for web animation and usability. The theoretical basis including Human Centric Design (HCD), User Experience (UX), User Interface (UI) design and summarize the roles and principles of Interactive Design (IxD) and Visual Design. Then I dive deep in the direction of web usability: definition, principles and usability measurement. The detailed implementation guide of the usability test is also included. Web animation comes in when all necessary terms and theories related to usability are explained. I define the meaning of web animation by comparing and summarizing the different articles and theories. Then study the traditional Disney animation theories to investigate which rules are still suited for web animation. Furthermore, I describe the popular Animation brand guidelines, to get a deeper understanding of the animation usages in the web environment, such as Google Materials design, Apple and salesforce.

The case study company, Verto Analytics, is a big data measurement company. Verto Monitor is a business intelligence data reporting tool which provides a set of features and a vast amount of data to its users. The current UI of Verto Monitor is static without any animations or transitions. Verto has also received feedback from users that Monitor is not easy to use. Therefore, I first need to conduct a usability test for the Verto Monitor to find out its usability issues. From these issues, ones that potentially can be improved by web animation will be selected for further prototypes.

In the conclusion, I summarize the findings from the study along with the limitations of the study.

2 Understanding definition of HCD, UX, UI and IxD

To find out and build an argument of enhancing usability by web animation, the first step is to understand the concepts and use-cases of web animation and usability, and then clarify the relationship between web animation and usability. Usability has close relationship with human centered design and user experience design. Web animation is applied on top of user interface and tightly connected with interaction design. Therefore, my research starts from a brief overview of definitions and character of human centered design, user experience, user interface design, visual design and interaction design.



Picture 1: Theoretical frame of the study (Liu, 2016)

2.1 Human Centered Design (HCD)

The term of 'human centered design' (HCD) is first mentioned in Donald Norman's research laboratory at the University of California San Diego in the 1980s. Norman builds further on the HCD concept in his famous book 'The Psychology of Everyday Things'. In the book, he recognizes the needs and interests of the user and focused on the usability of the design. He gives four suggestions which place the user at center of the design:

- 'Make it easy to determine what actions are possible at any moment.'

- ‘Make things visible, including the conceptual model of the system, the alternative actions, and the results of actions.’
- ‘Make it easy to evaluate the current state of the system.’
- ‘Follow natural mappings between intentions and the required actions; between actions and the resulting effect; and between the information that is visible and the interpretation of the system state.’ (Norman, 1988)

The role of the designer in HCD is to facilitate the task for the users and to make sure that the users can make use of the product as intended and with a minimum effort to learn how to use it. Norman points out that a heavy written manual is not designed in user-centered approach. He suggests that the products should be accompanied by a small booklet that can be read quickly and easy for the users to understand. He also realizes that design principles are needed to guide the design instead of only telling designers that products should be intuitive. (Norman, 1988)

The ISO 9241-210 defines HCD: ‘an approach to systems design and development that aims to make interactive systems more usable by focusing on the use of the system and applying human factors/ergonomics and usability knowledge and techniques’.

HCD is based on the physical and psychological needs of the user, enabling the user to function at the highest level possible. Instead of demanding adaptation from the user, product development process should aim to meet the needs of the user. HCD is not a design style, but a process for designing and developing buildings, products, and communities that is grounded in information about the people who will be using them. (Winograd & Woods, 1997)

HCD builds a sustainable relation between the product and user. There is a set of questions for helping designers align their design with human centered approach. These questions include the following:

- Who is the consumer? Does the design reflect the user characteristics?
- What are the consumer’s goals of using the product?
- What is the consumer experience about the product?
- What are the goals of using this specific product or service?
- When and how does the consumer interact with the product design?

- How do the consumers think about the product or the design?
- Why does the consumer use this product or design?

Besides checking through above mentioned questions at the beginning of the design process, designers also create the personas, scenario and use cases to result the design with human centered approach.

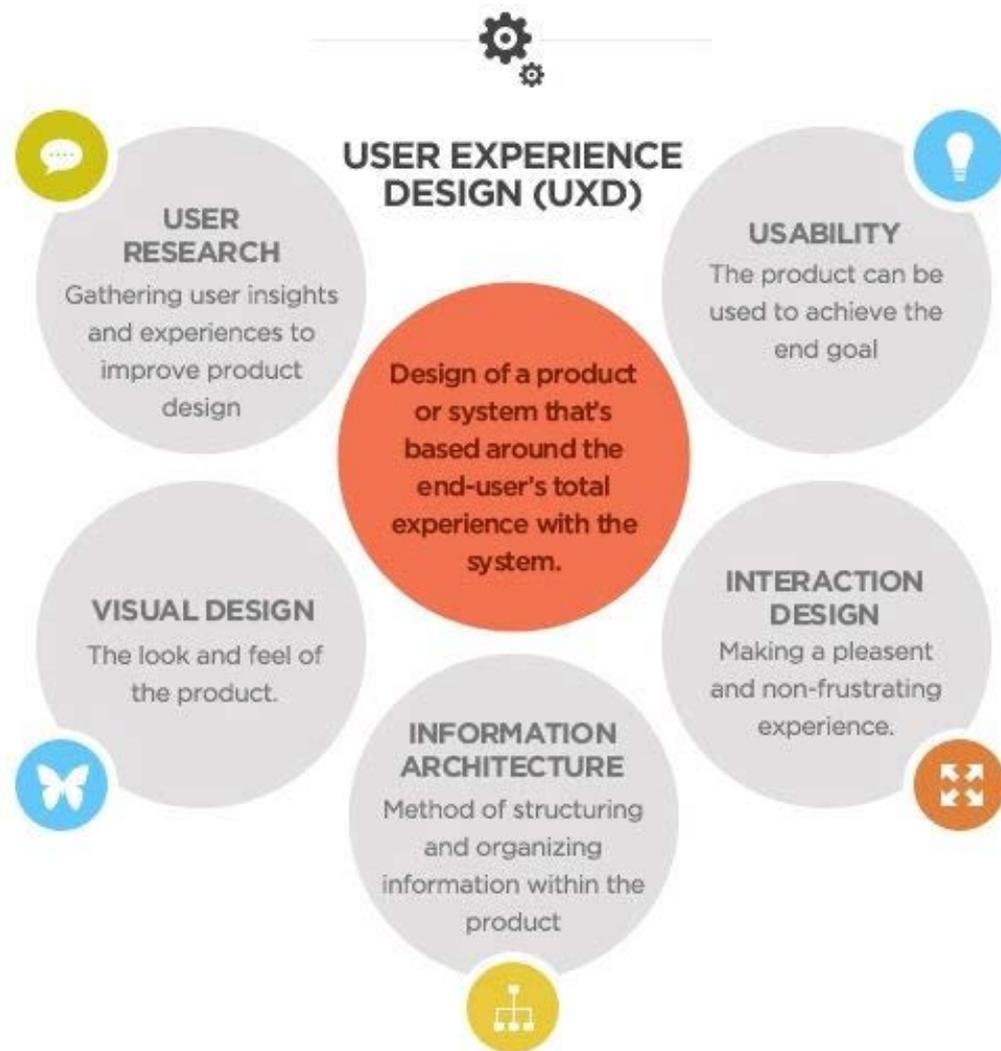
- **Persona** is to create fictional character that has all the characteristics of the user, such as user's demographic information and behaviors.
- **Scenario** is to build a fictional story about the usage of the product or service based on a specific event. Scenario is how a typical user interact with the service or product. This fictional scenario helps the stakeholders to understand the different scenarios, even to determine the “best-case scenario” and “worst-case scenario”.
- Unlike the scenario, **use cases** are the actual events in the real world. These use cases are simple actions in a short period recording how the user will interact with the product. (Elamnsy, 2015)

2.2 User Experience (UX) design

User Experience (UX) is how users feel when using a system. The system can be a website, an application or desktop software. In the digital environment, UX is generally denoted by some form of human-computer interaction (HCI). (Gube, 2010) According to the study of “Oxford Journal Interacting with Computers”, UX design is the process of designing functional products that are easy to use and delightful to interact with. It's about enhancing the experience that people have while interacting with the product. (Kujala, 2011)

Designing a great user experience is not an easy task to achieve, but there are commonly practiced principles around user experience design that can work wonders. (Bhusari, 2013) Below picture explains the key elements of UX: usability, user research, visual design, interaction design and information architecture.

THE ELEMENTS OF UXD



Picture 2: Five vital elements of a good User Experience Design (Bhusari. 2013)

As shown from the picture above, Bhusari summarizes that UX focuses on the total experience of the end-users. UX is not an isolated concept. It includes user research, visual design, information architecture, interaction design, and usability are the aspects influencing the whole experience.

2.3 User Interface (UI) design

User Interface (UI) is an informative and systematic graphic design for machine or software which allows users to use the site smoothly. Interaction design (IxD), visual design and information architecture come together to create the UI Design. (Livingston, 2014) IxD focuses on creating engaging interfaces with well thought-out behaviours. Visual design focuses on the aesthetics of a site by strategically apply the colours, fonts,

images and other media elements. Information architecture emphasizes on organizing, structuring, and labelling contents of an effective and sustainable way. (Usability.gov)

A good user interface design lets the users interact with the product in a simple and efficient way. A well-designed UI shouldn't take a long time to load or respond. It shouldn't make the users think. As highlighted by Usability.gov, 'UI design focuses on anticipating what users might need to do and ensuring that the interface is easy to access and understand' (Usability.gov)

During the years of web development, users become familiar with how certain behaviours are communicated in the UI. They are called UI element, such as checkboxes, radio buttons, dropdown lists, list boxes, buttons, breadcrumb, slider, tooltips, progress bar, notifications, message boxes, etc. These UI elements are still developing constantly. With the heavy usages of mobile devices, mobile friendly UI elements are also getting familiar to the users, such as hamburger menu. It's important to use familiar UI elements while designing an application. (Garrett, 2011)

2.3.1 Principles for web UI design

Bill S & Theresa N (2009) summarize the six design patterns for web UI design. These patterns are the core solutions for solving the issues that often occur while designing and implementing the web UI.

1. **Principle one: make it direct.** Alan states 'when there is output, let there be an input'. Make it direct is to let users do a direct manipulation of the content in the site. (Cooper, 1999)
 - In page editing: rather than leaving the page, users can direct edit contents within the page.
 - Drag and drop: it is a feature brought to the world by Macintosh in 1984. Users can directly place objects where they want by using drag and drop. Drag and drop can be useful when users rearranging modules on a page, rearranging the items in a list, changing relationship between objects, invoking actions on a dropped object.
 - Direct selection: Users can select object directly and apply actions to them. The common ways of direct selection are toggle selection (checkbox or control-based

selection), collected selection (selection that spans multiple pages), object selection (direct object selection), hybrid selection (combination of toggle selection and object Selection)

2. **Principle two: keep it lightweight.** Ericson D. uses the phrase “light footprint” to describe the need to reduce the required efforts to interact with the site. A primary way to create a light footprint is using contextual tools. Contextual tools are the web version of desktop’s right click menus.

3. **Principle three: stay on the page.** The page refresh is disruptive to the users’ mental flow. Instead of refreshing a page for every action, we can decide intelligently when to keep the user on the page. Overlay is a lightweight comparing with browser pop up. Dialog overlay informs the users a new stage by adding a dialog pop up. Detail Overlay allows an overlay to present additional information when the users click or hover over a link or a section of contents. Inlays is to inlay the information directly within the page. Inlay is good to apply when you want to display information without cover up the information already in the page. Virtual page is to add additional real estate which can be called on as needed to extend the interface. A common way to achieve the virtual page is virtual scrolling, inline paging, scrolled paging, panning and zoomable user interface.

4. **Principle fours: provide an invitation.** Discoverability is one of the most important aspects for rich interactions on the web. A feature is useless if users can’t discover it. A key way to improve discoverability is to provide invitations. Giving visual clue leads users through the interactions and make the site easier to use. Static invitations provide cues directly on the page. Dynamic invitation engages user at the point of the interaction and guide them through the next step of interaction, such as mouse hover invitation.

5. **Principle five: use transitions.** There is a second region that deals with attention capture, besides the normal visual-processing region of the brain. Therefore, human is naturally draw attention by moving objects which are the transitions in the web environment. Transitions provide visual feedback during an interaction. There are transition patterns are commonly used in website, such as **Bright and Dim, Expand and Collapse, Self-healing Fade, animation and Spotlight.** we can use these

effects to explain happenings, show relationships, focus attention, improve performance, and create the illusion of virtual space.

6. **Principle six: react Immediately.** A feedback occurs immediately after each interaction with the system. Newton's 3rd law of motion states: 'For every action, there is an equal and opposite reaction.' Immediate reactions are an expected part of intelligence, which is a well-designed interface system must have. Bruce Tognazzini, who is founder of the Human Interface Group at Apple, emphasizes on the importance of latency reduction. The emphasis is on communication, feedback, and engagement. Providing 'auto complete', 'live suggest', 'live search', 'refining search', 'live previews', 'progressive disclosure', 'progress indicators', and 'periodic refresh' form the tools for creating a lively, reactive interface. (Bill S. & Theresa N., 2009)

2.3.2 Visual design

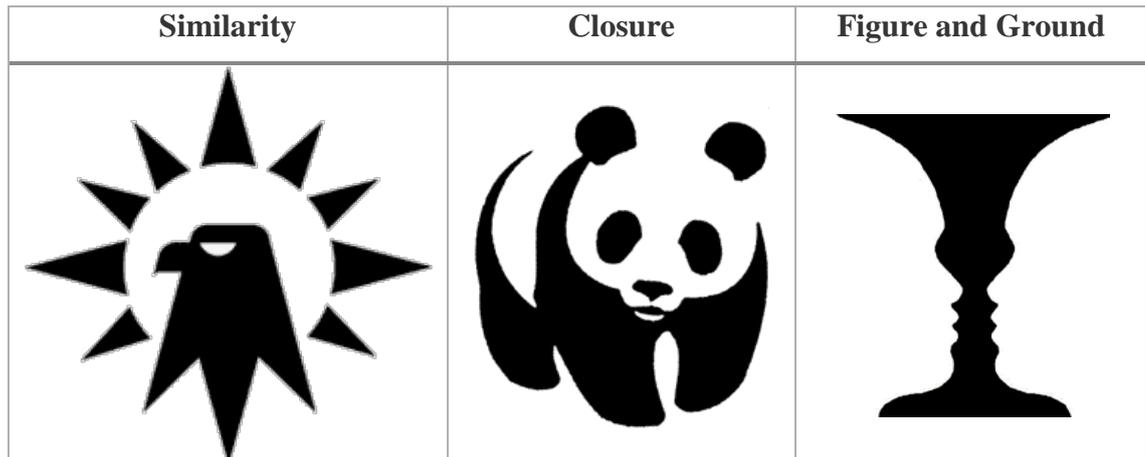
Visual design focuses on the aesthetics aspects of a site. A good visual design enhances the function and information of the site by engaging the users and helping the brand to build trust and interest in the brand. Elements of visual design are colour, typeface, line and shape, texture and form. (Usability.gov)

Practical application of Gestalt web UI design

'Gestalt' is originally from German language, meaning 'shape or form'. Gestalt is also recognized in academic world as a psychological study of sight initiated in 1910 by Max Wertheimer and continue developed by his colleagues during the following decades. It means 'unified whole' and refers to the theories of visual perception. It describes how human eyes tend to organize visual elements into groups when certain principles are applied. These principles include:

- **Similarity:** When the objects look similar, human eyes see them as a group or pattern. Anomaly is when similarity occurs, an object which differs from other can easily noticed by human eyes.
- **Continuation:** Human eyes are compelled to move through one object and continue to another object.
- **Closure:** If enough of the shapes are indicated, even the whole picture is incomplete, the human eyes can still fill in the missing information.

- **Enclosure:** ‘Things that appear to have a boundary around them are perceived to be grouped, and therefore related’.
- **Proximity:** When shapes or objects placed close together, human eyes tend to perceive it as a group.
- **Figure and ground:** human eyes differentiate an object from its surrounding area. ‘A form, silhouette, or shape is naturally perceived as a figure/object, while the surrounding area is perceived as ground/background’. (Cao, 2015)

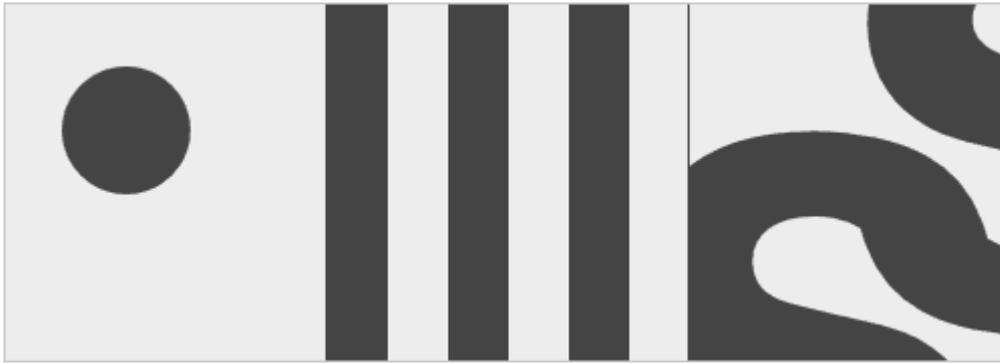


Picture 3: Samples of Gestalt principle (Cao, 2015)

The Gestalt principles describe the way that our minds interpret with visual elements. These classic Gestalt principles are continuously empowering the web UI design.

- **Similarity:** Users predict objects that ‘looks similar are having the similar uses’. This principle is applied massive in UI design. By using similar icons, buttons or interactions, users understand easier how to use the applications or website. (Bonner, 2014)
- **Grouping:** Enclosure and proximity are two ways could channel the information grouping. Enclosure is to add boarder-lines or shades to indicate the elements group. For example, Facebook post has used background and outlines to group a post information together. Proximity is grouping elements together when they’re close to each other. For example, in Tweeter, icons under each tweet has no clear outline to group them, but icons indicate to user clearly that they’re a group as they appearing in a similar style. (Cao, 2015)
- **Continuation:** Human eyes form a movement as it moves from object to object, and lines increase this effect. (Cao, 2015)

The figure-ground relationship:



Picture 4: Stable, reversible and ambiguous figure-ground relationships (Cao, 2015)

Steven Bradley describes three relationships:

Stable: (left) It's clear that the circle is the foreground, while the grey area is the background. **Reversible:** (center) The grey column or black column are equally as figure and ground, as they share the same amount of space. **Ambiguous:** (right) It is similar to the 'reversible' relationship, but with the added element of ambiguity. Different users will interpret which is which, sometimes even at different times. (Bradley, 2014)

2.3.3 Interaction design (IxD)

Everything from a button to a link is part of interaction design. 'In the same way that industry designers have shaped our everyday life through objects they design for our offices and for our homes, interaction design is shaping our life with interactive technologies – computers, telecommunications, mobile phones, and so on.' (Smith, 2008) UX booth states the difference between UX design and IxD: UX design accounts for all user-facing aspects of a system. In comparison, IxD focuses on the specific interactions between the users and screens. (UX booth, 2015)

Ben Gremillion summarizes that UI is what the users can actually see, IxD is concerned with how the users engage with the UI, and how that UI will respond so the users know how to accomplish their goals. Robert Fabricant from Frog Design also addresses 'feedback' to IxD – 'without feedback to us, how would we know if an interaction has accomplished the goal that we wanted'. (Gremillion & Cao, 2015)

Jerry Cao analogies that interaction is the conversation between application and user. If the conversation is boring, users just leave. Then he further defines IxD - 'IxD is taking

into account the human elements of the users, and in creating that human connection built from human-to-computer interaction (HCI).’ (Cao & Kamil , 2015)

Cognitive Psychology

Cognitive psychology is the study of how the mind works. According to American Psychological Association, these processes of the mind work include attention, language use, memory, perception, problem-solving, creativity, and thinking. Don Norman applies many of the psychology elements into IxD in his book - The Design of Everyday Things.

1. **Mental models** are the images in users’ minds that inform their expectations of a certain interaction or system. By learning the users’ mental models, interaction designers can create systems that feel intuitive.
2. **Interface metaphors** make use of known actions to lead the users to new actions. For example, the trash icon on most computers resembles a physical trash can, which alert users to the expected actions.
3. **Affordances** are not only designed to do something, but that are designed to look like they are designed to do something. A button that looks like a physical object you can push, for example, is an affordance designed so that someone unfamiliar with the button will still understand how to interact with it. (Norman, 2013)

The five Dimensions of IxD

The concept of ‘four dimensions’ was introduced by an IxD professor, Gillian Crampton Smith. The original four dimensions are **words, visual representations, physical objects or space, and time**. In 2007, senior interaction designer at IDEO Laboratories, Kevin Silver added ‘**behaviour**’ as the fifth dimension. (Moggridge & Silver, 2007)

1. **Word:** Words should be easy to understand, and written in a way that communicate information easily to the users.
2. **Visual representation:** All the graphics and imagery contents should be used in moderation, not overwhelm the users.
3. **Physical objects or space:** Refer to the mouse, screen, keyboard or any product that interface installed in.
4. **Time:** It is how long time do users spend to apply above three dimensions.
5. **Behaviour:** It focuses on the emotions and reactions that the users have when interacting with the system.

Using these five dimensions, an interaction designer can pay attention to the experience that users have when connecting with a system.

Principle of IxD

- **Goal-driven design:** Alan defines goal-driven design holds ‘problem solving’ as the highest priority. Instead of focusing on the technology capacity as tradition design method, goal-driven design focuses on personas, user stories and experience maps so that every interaction leads the users getting closer to the goal. (Cooper, 1999)

According to Alan, there are five tenets required in goal-driven design process:

1. Consider how the users interact rather than beginning with technical considerations.
2. Separate responsibility for design from responsibility for programming.
3. The interaction designer has a responsibility to the person who will use the product, not the ones who make decisions.
4. Develop a user persona and keep following questions in mind during the design phase: where will this person use this? who is he or she? what does he or she want to accomplish?
5. Interaction designers should always work with other team members in order to make the design practical.

- **Usability:** Function must be intuitive and reliable before it can be fun for the users. The features in the product should be carefully picked depending on users’ needs. (Cao & Kamil, 2014) There are also many usability principles which will be studied in the chapter of usability.

- **Affordances & Signifiers:** Affordance means that feature should speak to themselves and suggest its own use. Signifiers are what hit at the affordance, such as blue underline for link texts. Without signifiers, users won’t perceive the affordance.

- **Learnability:** In practice, users will not remember every feature that they used in the application. To let users learn the application easily, UI should be designed in a consistent and predictable fashion, for example using UI patterns is a common way to improve users’ learnability.

- **Feedback & response time:** Feedback is the heart of IxD. Proper use of animation, micro-interactions or a simple beep give the users satisfaction of knowing their task was accomplished or not. The key feature of feedback is responding time, which should be as immediate as possible. This is also addressed by Bill and Theresa in their 'principle for UI design'. (Scott & Neil 2009)

Anand sums up that interaction design defines the structure and behaviour of interactive systems. Interaction design is focused on users' mind and behaviour - how they think and how they expect the UI to work. (Bhusari. 2013)

3 Web usability

Jakob Nielsen defines usability is a ‘quality attribute that assesses how easy user interfaces are to use’. During the design process, ‘usability’ refers to the methods that improves ‘ease-of-use’ for the users. For example: if the product can hypothetically do what you want, but you not able to use it because the user interface is too difficult. The other quality attribute that define how easy to use the site is utility, which is designing the features that user needs. Usability and utility are equally important when defining the usefulness of the product. Utility defines weather the product provides the feature users need while usability is to show how easy and pleasant these features are to be used. (Nielsen, 2012)

Usability does not exist in any absolute sense; it can only be defined regarding the contexts. Jakob Nielsen emphasizes on using usability test while iteratively designing the UI - redesigning user interface on the basis of the usability testing can continuously improve the usability. (Nielsen, 1993)

Usability can also be described as achieving the user’s goals, rather than the organization’s goals. Usability is just one of the many layers that influence the overall user experience. A typical user like you and me uses a product or website to satisfy some needs. You need to accomplish a task or to find some information. User may enjoy flashy images and sounds briefly, but not when these contents get in the way of getting your job done. A good behavioral design should be human-centered, focusing upon understanding and satisfying the needs of the people who use the product. The best way to discover these needs is through observations, when the product is being used naturally, but not in response to some arbitrary request to ‘show us how you would do x.’ (Norman, 2004)

3.1 UX vs. usability

As mentioned in the early chapter, UX is a consequence of brand image, presentation, functionality, system performance, interactive behavior and assistive capabilities of the interactive system. The user's internal and physical state resulting from prior experiences, attitudes, skills and personalities, and the contexts of use. (IOS 9241-210, 2010)

Hassenzahl and Tractinsky argue that the concept of UX attempts to go beyond the task-oriented approach of traditional HCD by bringing out the aspects, such as beauty, fun, pleasure, and personal growth that satisfy general human needs but have little instrumental value. Therefore, comparing to usability, joy-ability makes major differences between usability and UX. (Hassenzahl, 2001).

3.2 Usability heuristics

There are many theories in the books and published papers to conclude usability principles. It's not hard to understand that a good web usability comes from well thought UI design including the clear visual design and IxD. Heuristic evaluation is the process by which an expert examines the UI against a set of accepted usability standards. The most used and accepted principles for heuristic evaluation is that of Jakob Nielsen's. (usabilitybok.org, 2012)

Ten usability heuristics for user interface design:

The 10 Usability Heuristics for user interface design has been developed by Jakob Nielsen in 1995.

1. **'Visibility of system status'**: users should be aware what's going on when using the interface, and feedback from the system should present in a reasonable time.
2. **'Similarity between system and the real world'**: the system should follow the real word conventions and deliver the information in a way that users can easily understand.
3. **'User control and freedom'**: Users feel comfortable when they know that they have the option of controlling their actions in a system. When users make a mistake, the system should clearly mark how to 'go back'. Avoid letting users go through extended steps.
4. **'Consistency and standards'**: Interface should remain the consistency through the entire product in order to let users using the product without wondering the meaning of the indication. Words or call-to-action buttons must have similar use all across the interface. Users should not be confused by different layouts in different page.
5. **'Error prevention'**: A carefully designed interface prevents user making mistake at the first place, which is even better than shows an error message. Users must

be asked for confirmation messages while carrying out important actions so that they are aware of what will result from it.

6. **‘Recognition rather than recall’**: Users should not have to memorised the information from one place to another. The interface should present the actions, objects, and options frankly visible to the users. User menu or instruction also should be visible and easily retrievable whenever the users need it.
7. **‘Flexibility and efficiency of use’**: Make the use of the system flexible so that it is usable for both novice and expert level users.
8. **‘Aesthetic and minimalist design’**: Users should receive information which is relevant and needed for using the product.
9. **‘Help users recognize, diagnose, and recover from errors’**: the error messages should be expressed in plain language and clearly indicate the problem and suggest a solution.
10. **‘Help and documentation’**: even it’s better that the product can be sued intuitively that does not need an extend instruction. Though, if there is documentation needed, users should be able to find information easily and clearly. (Nielsen, 1995)

Jakob’s five quality usability components:

1. **Learnability**: How easy is it for the users to accomplish basic tasks the first time they encounter the design?
2. **Efficiency**: Once users have learned the design, how quickly can they perform tasks?
3. **Memorability**: When users return to the design after a period of not using it, how easily can they reestablish proficiency?
4. **Errors**: How many errors do users make, how severe are these errors, and how easily can they recover from the errors?
5. **Satisfaction**: How pleasant is it to use the design?

It is not hard to see from above usability principles that usability ties closely with the UI design, visual design, and IxD.

3.3 Measuring usability via usability test

A usability study is a process of testing your application's design by observing users, measuring their performance, and documenting their comments. (Lowdermilk, 2013) Usability tests help development team understand the users' expectations and validate assumptions. Usability tests should run both before and during the design process. (Cao & Kamil, 2015)

The most basic and common method of studying usability is user testing. The essential element for the user testing is observing a group of representative users while they performing representative tasks. This way, the production team can find out where the users succeed, and the users have difficulties to use the product. The test should be performed individually without interruption. The significant usability issues can be shown by conducting five to eight tests. Run many small tests and revise the design between each one is better than run a big and expensive study. (Nodder, 2015)

Jakob Nielsen states that iterative design is the best way to increase the quality of user experience. The more UI ideas that you test with the users, the better usability you will get. Though, it's important to keep in mind that conducting user tests is not the same as interviewing with the 'focus group'. Interviewing the focus group is a qualitative research by listening to what people say in order to determine the usability issues. Focus group interviews focus on discovering what user want from the system. (Nielsen, 1997 & 2012)

Usability tests can be performed in each stage of the design process. Testing the old design before starting the new design clarifies the good parts you should keep, and the bad parts which give users conjunctions. Test competitor's design to get a cheap data on alternative UI that has similar feature as your site. It is enough to test the design ideas even if it's just paper prototypes. Refining the design that could take multiple iterations and polish the design idea from prototype to high-fidelity representations that implemented to the website or software. When the design is completed, you should inspect the design relative to the usability guidelines. (Nielsen, 2012)

The basic elements of usability testing are listed by Jeff R. and Dana C. (Rubin & Chisnell, 2008)

- Development of research questions or test objectives.

- Use of a representative sample of end users which may or may not be randomly chosen.
- Representation of the actual work environment.
- Observation of end users who either use or review a representation of the product.
- Controlled and sometimes extensive interviewing and probing of the participants by the test moderator.
- Collection of quantitative and qualitative performance and preference measures.
- Recommendation of improvements to the design of the product.

These elements are implanted in the entire usability test, from planning, conducting until the concluding phase. (Rubin & Chisnell, 2008)

3.3.1 Benefits and limitation of usability test

While benefits of the usability are mentioned by UX professionals and development teams, usability test also has its clear limitations. Having a clear understanding of its benefits and limitations ensure to apply the usability in the best-suited situation. (Dumas & Redish, 1993)

Benefits of usability test

Usability testing focuses on users' needs, using empirical measurement and iterative design. Usability test involves watching representative users working with the product so that you can make improvements based on what you see.

Dumas & Redish summarized five goals of the usability tests:

- improving the product's usability
- involving the real users in the testing
- giving the users real tasks to accomplish
- enabling testers to observe and record the actions of the participants
- enabling testers analyze the data obtained and make changes accordingly

Usability test gives feedback about how the users behave with your product. Rather than guessing what users might like, you can see their reactions and get the first handed information of it. Moreover, you can learn the issues early in the process which saves development time and money.

There's nothing quite like real users' feedback to help determine the best way forward. The main difference between usability testing and many other methods is that with usability testing, you're seeing the real behaviors-what people do rather than just asking what people think. Often watching people do something is the only way to understand where the issues lie and how to fix them. (Nielsen, 1994).

A big benefit of usability studies is percentages, proportions, and other hard numbers, these studies also provide lots of qualitative data, such as participant's words, actions, and attitudes. Although qualitative data can sometimes be harder to analyze, the real advantage of it is that it lets you find out about issues you didn't know you had. (Nodder, 2015)

Limitation of usability test

The basic methodology for conducting a usability test has its origin in the classical approach for conducting a controlled experiment. Thus, it's important to be aware the shortage of the usability test when deciding to host one.

- Test is done in a planned/artificial situation.
- Test results do not prove that a product works, they only show the probabilities.
- Participants are only picked to represent the personas in your understanding, therefore they are rarely fully representative of the target population.
- Test is not always the best technique to use, sometimes it's more efficient to conduct an expert or heuristic evaluation of the product.

However, usability test as part of an overall user-centered design approach, is an almost infallible indicator of potential problems. (Rubin & Chisnell, 2008)

3.3.2 Planning the test

Test plan is the foundation for the entire test. It addresses the how, when, where, who, why, and what of the test. (Bank & Cao, 2016)

While planning the usability test, you need to consider below listed elements:

- Purpose, goals, and objectives of the test
- Research questions

- Participant characteristics
- Method (test design)
- Task list
- Test environment, equipment, and logistics
- Test moderator role
- Data to be collected and evaluation measures
- Report contents and presentation

Define the goal of usability test

Jeff and Dana explain the goal of the usability test is to inform the design by collecting data to identify usability deficiencies in the products. Usability tests also aim to eliminate design problems and usability frustrations between the product and users. Doing usability tests to also minimize the costs of customer service and support calls, meanwhile increasing sales and the probabilities of repeat sales.

Recruit Participants

Number of the participants: The great thing about usability testing is that after running sessions with **five** participants you'll have seen about **80% of the issues** that exist in your product. (Nodder, 2015)

First to agree the user profiles with the team, then you can determine who among those profiles should be included as participants in the usability test. To be prepared that the content of the information you get may not make an obvious user profile. You may have to apply some analysis and critical thinking to establish those characteristics that make up realistic human traits and behavior. If you can, interview these sources yourself rather than through a third party. If they do not have the information you require, you may be forced to acquire that information directly from the end users via surveys and phone calls. (Rubin & Chisnell, 2008)

For every usability test, you'll have to ask who is your participants. Personas are fake people who have all the important attributes that the team cares about. If you have personas, you can use them as the basis of your recruiting process. Just work out which personas would be performing the tasks that you care about, and then, recruit people who share your personas' primary characteristics. Some examples of attributes you'd care about might be their age range, gender, experience levels and habits, and whether they're

existing users or not. Make sure that each attribute you list is measurable. (Rubin & Chisnell, 2008)

Regardless of who your users are, one thing is certain: in most cases, you should consider both novices and experts. Novice users should be enabled to learn as fast as possible, while expert users should be enabled to perform their tasks extremely efficiently. (Nodder, 2015)

Scheduling the test

Unless you're running remote usability studies, the participant will need to be in the same city as you are, so they can easily show up for the study. They also need to be available at the times you're running your study. It's good to check if people have any accessibility requirements, like using a wheelchair or not being able to climb stairs, so that you can accommodate them. If the person does qualify, you'll also need to make sure that you have a phone number and email address, so that you can send study details out, and so that you can contact the person if there are any changes to your schedule. Before you start calling people to recruit for your study you need to know what times you want them to show up. Instead of arranging all the sessions into one day split them over two or several days. If the participants agree with the time, remember to remind the participant before the test starts. (Nodder, 2015)

You'll also need to schedule time for the team to get together and discuss what they saw and what they plan to do about it. This debriefs time should be as close as possible to the sessions because otherwise people will forget what they saw and they may be tempted to go off and make changes without discussing them first. Make sure you give yourself sufficient time to recover from each one. (Nodder, 2015)

Designing the tasks

Once you understand what questions to ask, you need to turn those into tasks that participants can perform for us. These tasks are the way of getting people to show how they behave in certain circumstances.

People are normally okay at answering behavior question, such as things relate to they've done in the past or tasks they perform regularly. On the other hand, people are not very good at answering questions that are forward-looking and speculative like: 'do you think

you'd use this product?' When participant performing the tasks with the product, test team can capture three distinct types of metrics which moderator can ask after the test.

- Efficiency: how long it took them to do the task?
- Effectiveness: how many errors they made?

Satisfaction: how they felt about the task, frustrated or happy with the outcome? (Rubin & Chisnell, 2008)

There several types of tasks could consider when designing the task list:

- Exploratory task: participants can choose their own method to get to the end results without feeling being guided through.
- Direct task: rather than giving broad end goals, we indicate where we want someone to start and what we want them to achieve.
- First impression task: we use the first impression task when people first see the interface they'll be working with. This type of question is a way of seeing what parts of the interface jump out, and what they think they can do with the product.

Test normally starts with impressions task, then move on to exploratory tasks, and before finishing with some directed tasks if needed to. Exploratory tasks often take some time to complete. However, they are good at giving people an overview of the product they're working with. The directed tasks are normally better to given after the participants have familiarized themselves with the whole product. (Chris Nodder, 2015)

Test materials

One of the important and resource consuming actions in planning phase is preparing all the materials. These materials will help the tester communicate with participants, collect data and clarify the legal issues. Test materials include orientation scripts, nondisclosure agreement, a template for the test team to collect data, background questions, task list, and post-test questionnaire. (Rubin & Chisnell, 2008)

Pilot test:

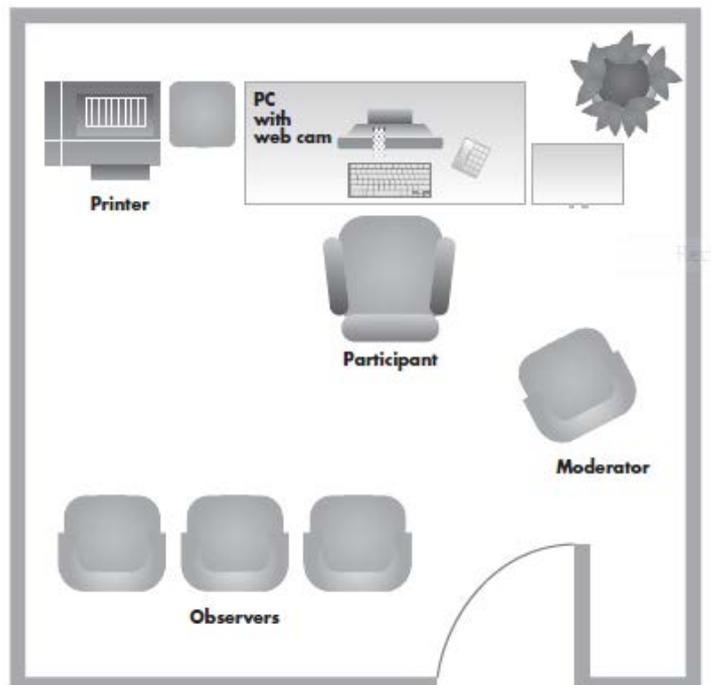
Dumas and Redish call the pilot test as a “dress rehearsal for the usability test to follow.” The pilot should be conducted in the same way you would do for a real test, but the difference is that you don't analyse or include the data. (Dumas & Redish, 1993)

3.3.3 Conducting the test

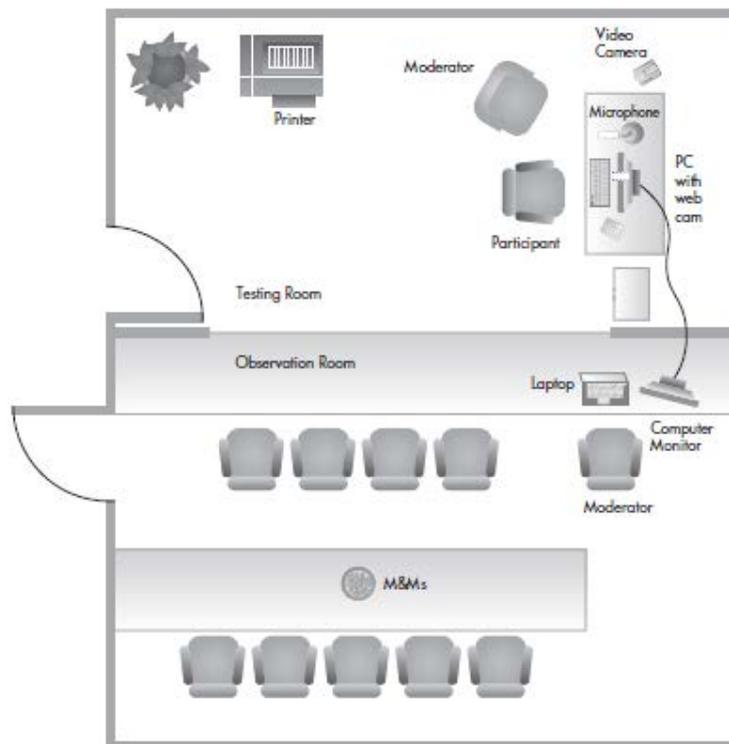
After having a study plan in place, it's time to conduct the study. It's recommend to print out the tasks which will be used during the test. In addition, moderator should have the script prepared ready. Script should also include description of **think aloud method**, which should communicate to the participant before the test starts. (Lowdermilk, 2013)

Testing environment

You can design a simulated environment for the test, for example to simulate a sales office for product that the agency uses. Test can also be conducted in a lab or at the participants' site. The decision is made depending on weather you need to site next to the participants and type of the task participants will receive in the test. Usability tests can be also conducted across the different locations: as much as 80% of usability problems may be the same across locations, but the other 20% may be location or context specific. (Rubin & Chisnell, 2008)



Picture 6: Simple single-room setup (Rubin & Chisnell, 2008)



Picture 7: Classic testing laboratory setup (Rubin & Chisnell, 2008)

If you are hosting a test which participants will come to your office, picture above shows an example of how to set up your meeting room for the test. This way that the test moderator has an excellent sense of what is going on with the participant. Though moderator can also affect the behaviours of the participants. If the participants have struggle with the materials, you can encourage and overcome the participant's self-consciousness. Moreover, observers may be invited by the test moderator to ask to follow up questions or to write their questions down and pass them to the moderator for later asking. Sometimes, if there is more room available, observers can also observe the test from other room to eliminate the potential effects to participant's behaviours when everyone sits in one room. (Rubin & Chisnell, 2008)

The classic test lab setup includes one testing room and an observation and control room. The only individual inside the testing room is the participant. All other test personnel, including the test moderator, observers, camera operator, and so forth are stationed inside the control room viewing the proceedings through a one-way mirror. You can rent well equipped testing lab although it's normally rather costly. (Rubin & Chisnell, 2008)

Employ video cameras or audio-recording equipment to capture all Participants' comments and behaviour. On the other hand, these equipment-sets can distract the participants and may affect the performance during the test. In fact, most of the participants dislike the idea of being on camera, and no matter how much you reassure them to the contrary, participants will feel like they are being tested. Having a camera pointed at their face doesn't help reduce the anxiety. (Lowdermilk, 2013)

“Think-Aloud” method

The ‘‘thinking aloud’’ method is a technique intended to capture what the participants are thinking while working. Think-Aloud method requires the participants explain the ideas or thoughts come across their minds during the test. Advantages of the ‘thinking aloud’ methods are summarised by Jeff and Dana:

- Testers can capture preference and performance information simultaneously.
- It helps some participants to focus and concentrate
- Test team receive early clues about misconceptions or confusion before they manifest as incorrect behaviours.

There are also disadvantages of using think-aloud method in the test. Some participants find that this method is unnatural and distracting. While this isn't always what they would do in real-life, their doing so will give tester ideas about how to remedy design problems. Moreover, think-aloud can slow down the performance significantly. (Rubin & Chisnell, 2008)

When you decided to use ‘think-aloud’ method, keep in mind of these guidance which will enhance the technique.

- Avoid using it for very short or pointed tests where the unusual aspect of the technique does not have time to wear off.
- Demonstrate the technique first, so that participants feel less self-conscious. You can also do a practice with the participants before the official test starts.
- Do not force the technique if you encounter strong resistance.
- Pay attention to where participants become quiet. When user become quiet, it can indicate that they are concentrating on solving some problems.
- Acknowledge that you are listening to your participant's comments by periodically repeating comments back and following up.

- In some situations, it's better for moderator to observe a behaviour or ask a question and then wait. (Lowdermilk, 2013)

Guideline for observer: No matter the observers will be in the same room with participant or not, it's important to inform observers the test rules and direction beforehand.

Running a successful usability test requires observers to adhere to strict guidelines so that participants feel comfortable and willing to share the information. To make sure your presence as an observer does not cause discomfort to participants or otherwise affect the quality of the data we collect, please observe the following rules:

- Arrive before the session is scheduled to start. It is important for you to be present when the participants arrive so you can choose your seat and get settled and ready to begin taking notes. Participants may interpret your lateness as disregard for what they should say, and a stranger entering the room is distracting and disruptive.
- You must stay for the duration. We would like participants to forget that anyone else is in the room. Having people constantly coming in and going out is very distracting. Therefore, once we start the session, it is imperative that you stay until the session is complete. If you cannot stay for the duration of the session, please do not come at all.
- Turn off your cell phone or leave it at your desk. If you bring your computer, turn off the email and instant messaging. It's a short session. Please be fully present and ready to pay attention to the moderator and the participant.
- No laughing, grunting or distracting body language. Participants may think you are laughing at them. Please do your best to keep as quiet as possible. It is important that observers do not make facial expressions or utter comments during the session. Space has been inserted into the script for you to take notes. Please turn the pages of the script quietly.
- Ask open-ended questions about what happened in the session when invited by the moderator to do so. Don't offer design or feature alternatives. Avoid asking about preferences or opinions.

Keep the participant's identity confidential. We have promised the participants that their identity will be kept confidential. Please help us maintain this confidentiality. (Rubin & Chisnell, 2008)

Guidelines for moderator: An experienced test conductor shows minimal interaction with the participants. The main task for moderator is to guide participant through the whole test, and present the test in the same manner with all the participants. Below are few rules moderator should be aware through the tests:

- No matter how is the participant's performance in the test, moderator should not Don't show surprise.
- Focus on what the participants expected to happen.
- Act as a mirror to reflect what the participants are saying and help them to express their thoughts in a useful way.
- Do not always ask direct questions. Instead, ask questions which are in neutral tones, such as 'you seemed surprised/puzzled/frustrated, what happened?' or 'How close was that to what you expected?'
- During the session, limit your interruptions to short discussions.
- The probe in response to both verbal and nonverbal cues from the participants.
- Look for opportunities to understand the rationale for a behaviour or preference.
- Handle one issue at a time.
- Do not use the testing time to fix problems that are discovered.
- Don't "Rescue" Participants When They Struggle (Jeff R. & Dana C., 2008)

3.3.4 Analyse data and observations

After the test, an immediate meeting can be held with the development and test team for a debriefing and informal report, and then follow up with a formal report later. The informal report will only include obvious items that do not require further analyses, and if possible. (Nodder, 2015)

Jeff and Dana recommend three steps to analysing the test data and propose the improvements:

- Compile and summarize data: collect all the test data into on file let you see the pattern of the data. You can collect all the data after each testing day to see if the tests are reflecting the research issues. Notes from observers should be kept in digital format which allows you to re-sort the notes and easy to organize, for example, spreadsheet is a simple and straightforward way to collect the data and notes from all the observers for the tests. Transfer data collected sheets into

summary sheets after all the tests have been conducted. These summaries indicate if there were differences in performance of different groups.

- Analyse data: remember to stay task-orientated while transferring the data into a more useful summary. The test team identifies the tasks are not performed well by the participant and rate them based on time spend, participant attributes, and test notes.
- Develop recommendations: by the time, test team should be clear what are the pain-point of the testing product. Expand the discussion of each of the pain-points with narrative, notes, and illustrations (such as screen captures). Then mapping out all the pain-points to see correlations between each pain-points in order to sort and group them in some way that makes sense to propose solutions.

While analysing and concluding the finding, it's important to remember that always reflect the research questions to ensure the test's goal is clear. All the analysis and findings should be concluded from the data collected during the test. In the end, a final report of the usability test should be delivered by the test team. (Nodder, 2015)

4 Web animation

When it comes to interaction design, one of the most popular concepts is animation. In order to know how could web animation improve the usability, I will first study what is web animation, the connection between traditional animation and web animation.

4.1 Definition of web animation

Web animations and transitions have become increasingly common for modern web design due to the development of HTML 5, CSS3 and JavaScript. Rachel states that web animation is ‘an umbrella term for web-first technology like CSS, JavaScript, HTML, Canvas and SVG that don’t require plugins’. Web animation includes anything from a cool hover state effect to a full-screen cartoon that plays in the background. Animation can also provide context for the design by helping users know how to interact with it. (Nabors & Cao, 2015)

From the user experience point of view, web animation brings the interactivities to the UI elements. Purpose of the animation is to attract users’ attention for a notification, call an immediate action from the user, indicate a relationship between elements that user is aware of in the interface, and to show the continuity in a transition between UI states. (Bedford, 2014)

Jakob explains the effects of animation in a deeper perspective. He describes that ‘movement in a person’s peripheral vision triggers a stimulus-driven shift in visual attention.’ This is opposite as ‘goal-directed shift’ as users voluntarily adjust attentions based on their interests. The instinctual attention switch to the motion is in human genes to quickly react to potential danger in the surrounding. How quick to switch the attention depends on the perceived animacy of the object. Movement acceleration, the magnitude of the position, and self-propelled motion are the main influencers on the perceptions of animacy. In the implementation phase, it means that display a shift in position. For example, a ‘shift in’ effect can draw the attention more efficiently than ‘fade in’. ‘Fade in’ could be used in the situation that shows the contextual features without interrupting users from the main task. Things that moves in peripheral vision dominates users’ awareness, therefore IxD should avoid a permanent animation on a web page. (Nielsen, 1995)

4.2 Disney animation principles apply to web animation

Animation is the illustration of motions. There are traditional cartoon animation and web animation. The traditional animation is a familiar form for most of us who have seen cartoon in TV when we were kids. The twelve principles are the concentration of Disney's deep understanding of how things move and behave in real-life. These principles also serve the cartoonists to engage with the audience in emotional levels. (Thomas & Johnston, 1981)

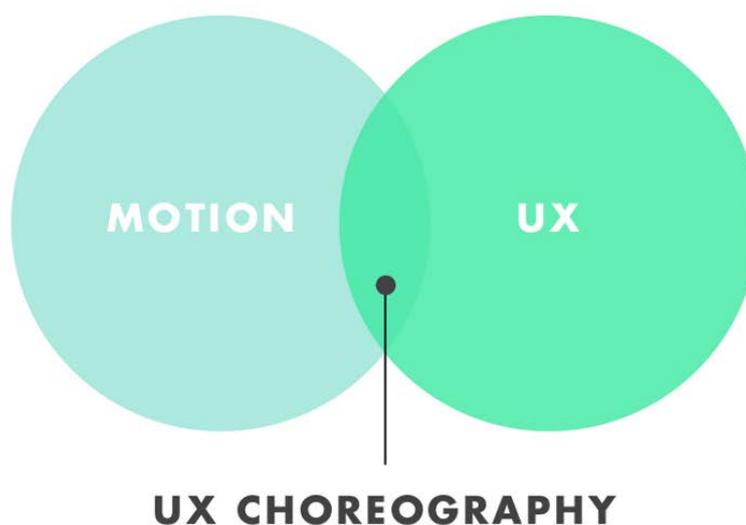
4.2.1 Traditional animation theory: Twelve Principles by Disney

1. **Squash and stretch:** define the rigidity and mass of an object by distorting its shape during an action. It used in form of motion blur, dramatic squashing, and stretching.
2. **Timing** defines the weight, size and personality of objects by adjusting the spacing of actions.
3. **Anticipation** indicates that the character prepares an action to indicate the audience what's happening next.
4. **Staging** presents the idea so that it is unmistakably clear and attract views' attention in the scene. It includes timing, acting, camera position, and lights setting.
5. **Straight ahead & pose to pose** illustrate the actions. Straight ahead is to animate each frame while the action is happening. It used to object that has unpredictable movement, such as fire, water particles, explosions etc. On the other hand, pose to pose is to first define start and end of an action, then animate out the movement in between. It indicates clearly what's to animation in between the frames.
6. **Follow through & overlapping action** terminate an action and indicate the relationship to the next action, such as inertia in actions. This is opposite to anticipation as it reminds the audience previous actions.
7. **Slow in and slow out** adjust the speed and spacing of the frames to emphasizes the action. This makes the action more realistic to show how the speed changing during an action.
8. **Arcs** show the movement path realistic as the most of the moving objects have a circular path, such as when throwing a ball.
9. **Exaggeration:** exaggerate the character's expression, action or pose to increase the amount of impact on the audience.

10. **Solid drawing** takes volume, weight and balance in consideration to achieve effects that characters are in three-dimensional space.
11. **Secondary action**: it used to make the main action more believable; it shows the action of an object resulting from another action.
12. **Appeal**: the character should have some charismatic aspect to like about them and it applies to every character not only the main roles. ‘Appeal is a mysterious thing because you know when you’ve got it and you know it when you don’t have it but you have no idea how to get it.’ (Thomas 6 Jonston, 1981)

4.2.2 How to use the Disney principles in web animation

The twelve principles not only applicable when creating animated characters, but also teach us how to control the movements and expression via any type of animations. The vocabulary terms used in animation principles can be used in web animation as well. Applying easing on a button can influence what it’s like to interact with it. An easing action can be influenced by principles of timing, spacing, follow-through, anticipation, and exaggeration. But it’s also worth to mark that Disney principles were not developed for web animation. Among the twelve principles, a fully understanding of timing, follow-through, appeal, anticipation and squash and stretch is useful for web animation. (Valhead, 2014)



Picture 8: UX choreography (Ussai, 2015)

The principle of UX choreography has been introduced by Rebecca and Glen. UX choreography is a combination of ‘the how’ with ‘the when and why’ to apply animation in web environment. Rebecca concludes five principles of applying motion to improve

the UX. The principles meant to solve the gaps between extreme states and create an overall more polished experience.

- **Feedback** indicates the results from users' interaction. Feedback not only communicates users' behaviour in the product, it also builds up the trusts with the users. Feedback should be designed obvious for the users to see, and 'it's more effective when multiple layers of elements are working together to react to what users do'. Disney uses 'exaggeration' to indicate changes, especially in emotional changes, which normally will not be noticed in real-life. Exaggerating the emotion changes during the web experience, users will notice the changes clearly without adding extra taglines. An example of feedback is that iOS password shakes when you miss-type it: a simple head shake of the dots, directly give feedback to users that the password is incorrect.
- **Feedforward** gives hint to the users and prepares the users to what possible would happen next in the interface. Feedforward leads users through the interface with correct sequence of actions to accomplish the goals. Feedforwards are very 'subtle details', that users may not notice they're happening or recognize the cues helped them. Anticipation in Disney has similar goal as feedforward which is to prepare audiences for what's about to happen.
- **Spatial Awareness** helps users understand the UI environment and the relationship between the UI elements. 'Every experience you make has a unique lay of the land', it's essential to communicate the logic of the elements relationship to the users, such as where things come from, where they go next, and where they can find them again. 'You really have to ease people through these transitions so they understand how they got from point A to point B so that it doesn't feel like a stark, sudden change'. Disney's principle of staging teaches us a lot about this.
- **User-focus** draws users' attention and notify the changes. 'Controlling the transitions of hierarchy at each moment in time' is essential for this principle. Users feel that they are in control and concentrated for the next step. This serves the same purpose as Disney's principles that never leave audience behind.
- **Brand Tone of Voice** can be interpreted as movement style of the brand. Is it subtle added details that help users recognize which application is it. Website or application which are having the same features, the one having an appealing brand tone of voice is naturally more attractive to the users. They have emotional appeal

to the users. Appeal in Disney principles is the last principle and the most magical, but ‘admittedly can be difficult to design for’. (Keane & Ussai, 2015)

Rebecca delivers a great talk on how to apply the twelve Disney animation principles as five laws of UI animation. Kit later re-orders and re-groups the principles as he recognizes the material principles should be applied before the functional principles.

- **Solid drawing** is to apply three-dimensional space to the objects. Solid drawing requires animators to understand the basics of three-dimensional shapes: anatomy, weight, balance, light, and shadow. Disney animators use solid drawing to make cartoons look real. ‘What they used to call solid drawing, today, we’ve started calling material design.’
- Dynamic **Straight ahead** and linear **Pose-to-Pose** are the two ways to draw motions. In web animation, it is how to implement animation by coding.
- **Squash and stretch** describe the mass and rigidity of the object and define the materials of the object. In UI animation, it means to define the objects as solid planes, rigid surfaces, sharp, and exact movements.
- **Arcs** defines the curve of the motion. It can be defined for the UI object after squash and stretch is clarified.
- **Staging** is to define the emphasises of the UI elements, which can direct users’ eyes to exact where needs interaction or attention. It helps user to pay attention to what is important.
- **Timing** as the most important part of the animation, it effects on users’ perceptions and comprehensions. ‘Composing animation—just like movie editing—requires finesse and practice. The key of truly mastering timing is cubic bezier (or the velocity curve).’
- **The follow-through and overlapping.** Follow-through indicates the hierarchy between UI elements and overlapping let the motion sequence seamless and within the measure.
- **The secondary action** is similar to ‘follow-through and overlapping’. It helps to clarify which UI elements should be brought in front of the users and which ones should be hidden. Note that secondary motion should never detract the users from the primary motion.
- **Ease in/out** helps the users follow the animation story while correctly using timing and overlapping together. Ease conveys the law of inertia in material perspective, and it allows the law of physics to be presented in the digital world.

From the functional perspective, human eyes tend to attract by things are slowing down than the things are accelerating.

- **Anticipation** provides a clue to the users about what will happen at beginning and ending of the animation. ‘Slowing down the beginning of the important animations calls users’ attention. A second way to use Anticipation (or feedforward, as redefined Rebecca and Glen) is to provide visual affordance for suggested interactions or gestures at the end of the transitions’
- **Exaggeration** means that the UI elements (such as buttons, knobs, and panels) should respond to users’ interaction in a noticeable way.
- **Appeal** means that you could surprise or delight users by things were not expected, which gives an emotional appeal when used correctly. (Oliynuk, 2015)

Rebecca and Kit state strongly on how the Disney principles could apply to modern web animation, though not everyone agrees with them. Sophie in her article points out that many of the ‘Disney fiction of UI motion out in the wild that exhibit garish motion’. She argues that using animation is ‘almost like we’ve abandoned visual skeuomorphism and replaced it with behavioural skeuomorphism in which our digital objects act as though they are made from jelly, or dangling from invisible rubber bands.’ (Paxton, 2015)

4.3 Role of animation in web design

“It looks pretty” doesn’t qualify a good web animation. The use of motion enhances the UX of the application because it helps draw the users’ attention to an important notice. Linear animation easing should also be avoided. It makes motion uninteresting and mechanical. Most of the animations should apply a simple easing as “ease-in” or “ease-out”. Usage of more dramatic animations (such as spring, bounce) is quite seldom. (Paxton, 2015)

Jakob summarizes the advantages of employing animations on the web page. Animation is ‘showing continuity in transition’, which means that animation helps users to understand the relation between different stages of an UI element without spending extra efforts to detect the changes. Animation also visualize 3-dimensional structures. (Nielson, 1995)

Val Head points out that good UI animations have the purpose, personality, and alignment with your message. As all animation is a representation of the change in time and the time is represented by pace, responsiveness, and context. Generally, trigger duration of the animation should be within 0,1 seconds from the moment of users' action to make the interface feel responsive. (Head, 2014 & Nielsen, 2010)

Jerry Cao describes the role of the animation in web design:

- **Communicating function:** animation shows users how to navigate around in the web application.
- **Revealing the information:** animation is great way to reveal the secondary information, such as revealing upon hover or revealing upon clicking. A side note is that hover doesn't work with the mobile site, click to reveal is more common in the mobile site.
- **Distraction:** animation works well to distract users' attention when your site is loading.
- Many websites are using **automatically loaded animation** to loop through a simple story. This is a fun way to engage with the users and keep them stay longer and provides a more lasting impression of the experience. (Cao, 2015)

Animation can help to achieve UX goals and make UI feels more consistent and real. (Oliynuk, 2015) When applying animations to the UI elements which users can easily spot, it can enhance the usability by indicating functionality of the UI through animated way. Web animation can also introduce a process of an action to the users. For example, when the user makes a selection in step one, it leads to other dependent fields appearing under the selection.

Aurora emphasizes on the timing and frequency of the web animation. Animation must begin within 0.1 seconds of the initial user's action, which is the time that user maintains the feeling of direct manipulation and react to a new element entrance. Another aspect to be considered when applying animation is the frequency. Users do not want to wait for or interrupted when performing a task, thus a long animation repetitively appears when use using the website is not recommended. (Bedford, 2014)

Using the suitable mechanics of the animation to the context should also be taken into the considerations. A slower transition has the character of causing less distraction which is suitable for animations indirectly triggered by the user, such as the elements appear with

little or no change in position to minimize distraction. In contrast, the fast animation is used for attracting users' attention and it is suitable to apply on the UI elements that are calls users' attention or an action. Playing the animation right after the interaction is appreciated by the users as it saves time, however the animated context should have no text or less texts to avoid user spend more time to read them. (Bedford, 2014) Jakob argue that the users are not able to respond accordingly when the animation is too fast, and even when they do notice, changeable UI is harder to understand in the limited timeframe. (Nielsen,2013)

Applying animations on the website could catch user's attention and explain the changes on the site. Such as showing or hiding of content, changes in the state of a UI. Web animation also kept its character from tradition animation as fun and delighting for example it is commonly used in kid website. Adding animation or transition presents your website as a modern and up to date with the new technology. (Bedford, 2014)

4.3.1 Usage of Web Animation

After observing and following the web animation showcases for more than seven years, Kit classifies the web animation into functional, material and delightful animation.

Functional animation enhances the usability and makes the application more comprehensive. It also drives users' attention, provides visual feedbacks and prepares the users for the next step. It helps users to orient themselves within the interface, find their ways and establish the visual relationships. (Oliynuk, 2015)

Amit further explains that it's worth to highlight that web animation should bring the **functional first** rather than the excitements to the users. Amit defines functional animation as 'subtle animation that we embed in a user interface design as part of process'. Functional animation can be distinguished from Disney animation or gaming animations. Having a clear logical purpose to improve the usability is the core value of the functional animations. To exam whether an animation is functional one or not, Amit presents nigh rules. (Daliot, 2015)

Below is a summary of Amit's logical purpose of functional animation rules:

Description	Logical purpose
-------------	-----------------

Orientation	Orient the users
Same location, new Action	Emphasize a functional change in an action button
Zoom in	Associate a thumbnail with its detailed view
Visual hint	Give hint to exhibit unconventional functionality or a hidden action
Highlight	Catch users' attention and rise above the noisy layout
Logical purpose	Simulate the topics that are otherwise hard to convey
Visual Feedback	Acknowledge the users' action
System status	Impact a sense of control in a linear process
Marketing tool	Support a brand's values or highlight product strengths.

Table 1: Logical purpose of functional animation rules (Daliot, 2015)

Below is detailed description for each logical purpose:

- **Orientation:** animation that gives users a sense of orientation and help users understand the UI changes.
- **Same location, new Action:** animation helps to explain the relationship between the UI elements.
- **Zoom in:** users can select the contents to view the detailed view, such as image gallery. It's important that users feel like they're still in control of the situation.
- **Visual hint:** animated hints help users to understand better how to interact within the interface. It's common seen as one-time animation which demonstrates how certain functionalities work in the interface.
- **Highlight:** motion has the highest level of prominence in a UI.
- **Simulation:** in some case, users need customized functional animations to simulate the experience.
- **Visual feedback:** a responsively designed subtle animation is needed after users interact with a button to indicate that the website/software is responding to the interaction.
- **System status:** a group of animations show feedback of starting a process, ongoing progress and completing the process. A very common example in this group is loading animations.

- **Marketing tool:** the animation can be fun when it serving for marketing purpose. (Daliot, 2015)

The material animation is wildly misunderstood as it's Google guidelines. In fact, material design is making UI spatially logical and then animating them according to the laws of physics. Some people also call it as 'skeuomorphism design'. **Animations which follow the rules of gravity, inertia, velocity, rigidity have an authentic appeal to the users.** It tells users that an object is light, heavy, flexible, big or small, which would help users to remember the UI and UX pattern and make it easily to access and predict. Kit also brings up that human aesthetic taste is based on the world around us, thus animations with good mechanics, dynamics, and optics will be easier accepted by users. (Daliot & Oliynuk, 2015)

In the real-life, we are used to things move in and out to our view, appears gradually from small into large. It explains that users feel confused when web page or application change the state in a sudden or unnatural way. The design mentality should apply to full page refreshes and other UI elements, such as hover states, pop-up windows, tooltip hints, loading icons, progress bars and so on. **Anything that changes on the page which can be seen by the users should have movements and transitions, and it's important to make that movements look real and natural.** (Thomas, 2014)

One of the core values of traditional animation is fun which is also fits to web animation. Adding some entertainment helps the product to stand out from the crowd. Kit explains it as 'human beings we're not only rational, we're emotional. We want to have fun. We want to love our apps and websites and relate to them, and animation can make your users experience truly delightful and memorable.' **Connecting with users emotionally enhances the entire UX, and users would also have longer attention-stay in the application or website.** Kit also recommends that material principle should be applied first before the functional principles. The reason for that is 'material principles need to deal with the information architecture and material model of the UI'. (Oliynuk, 2015)

Some people argue with the total load time of the UI vs. actual perceived time by the users. Rachel Nabors gives a good example: the shaking animation of incorrect password entry seems take more time for users to recognize than instantly displaying a small error message. In fact, users might spend a couple seconds trying to locate error message to

find out what went wrong, instead of noticing the animation and instantly understanding the action. (Nabors, 2015)

Val Head as one of most active interface animation consultants in the field, points out the most commonly suited situation to apply animation on the interface:

- Animation can help the eyes see where a new object comes from or where a hidden object goes.
- animation is particularly helpful to establishing connections and content relationships in both functional and stylish way.
- When adding, moving, or reordering content is required, animation is a good way to offer useful visual cues.

Val Head explains that well-placed animation can win over the users, making interactions as fun to use as they are to design. These little additions may seemingly lack real utility, but they speak volumes about the brand and the story.

Although the UI animation works well in explaining the content changes, it's import to use them selectively. Remember to implement the animation for the most important moments of the interaction—the ones most critical to the main message, or the ones that most need that extra bit of attention from users. Over usage of animation can get on the way of whole usability. (Head, 2014)

4.3.2 Implementation of web animation

In 2009, Bill and Theresa propose the six principles of web UI design, and the fifth is to use web transition to engage with users. They describe how to use transitions in the web from the perspective of transitional patterns and how to implement these patterns in the practices. Term of 'transitions' describes special effects that happened over a specified period of time, which plays the same role as animation in this thesis context. The most commonly used web transitions are 'brighter and dim, expand or collapse, self-healing fade, animation, and spotlight'. (Scott & Neil 2009)

- **Brighten and Dim:** colour changing does not calls the same level of the attention as a movement. Changing speed of the colour or contrast between the states effects on the attention engagement, such as using dim to reduce attentions to an area.

Dim and brighten can also communicate the emphasis of the UI elements, as well as indicate whether an interface is active.

- **Expand or collapse:** showing a hidden information when user need it, an animated transition of expanding or collapsing the panel helps connect with the users. Expand or collapse can also appear as overlay on the page, such as a dropdown menu.
- **Self-healing fade:** ‘animating the remove of the item and the closing of the hole reinforces where the deleted item was removed.’ Self-healing transition can be used to remove an object, convey the stage of the removal and indicate the completion of a remove.
- **Animation:** provide clear feedbacks of user’ interactions by using animation to show the orientation of the object. Bill and Theresa also emphasize to downplay the effects in web animation. ‘To avoid over-emphasizing a luminance effect or timing transition just cut the effect’s values in half. It is too easy to get focused solely on the effect and forget the overall interaction story you are trying to create.’
- **Spotlight:** Sport light is good at temporarily calling user’s attention to a change in the interface. It is often used by first highlighting the background of an object, then fading out the highlight.

The main goal of web transitions is to provide an engaging interface and enhance communication. In most of the websites, communication is the most important purpose of the transitions. The story is the key, and transitions are only making the story more compelling. Transitions maintain context while changing views, explain what just happened, show relationship between objects, focus attention, improve perceived performance and create an illusion of the virtual space. (Scott & Neil 2009)

Bill and Theresa list the best practice of implementing transitions:

- The more rapid the change, the more important the event.
- A rapid movement is seen as more important than rapid colour change.
- A movement toward the users is seen as more important than a movement away from the users.
- A very slow change can be processed without disrupting the users’ attention.
- By seeing the object moving from one place to another, users understand where it went and therefore will be able to locate the object in the future.

- If an object moves and collapse to a new spot, users should be able to open and see the object which opens with the reverse transition.
- If users delete an object and it fades, then if they create an object it should fade into place. This illustrates the concept of symmetry of interaction.
- The misuse of effects by advertisements should teach us to be cautious about overusing transitions.
- Try not to rely solely on transitions for communicating the changes in the interface.
- Keep the transitions near the users' area of the focus. This will make the transitions more discoverable.
- Flashy effects annoy and distract the users rather than communicate.

Transitions in UI elements are a powerful way to communicate and engage the users. Using them correctly will benefit the product. (Scott & Neil 2009)

Val Head describes the secret weapon of doing UI animation prototyping and implementation iterations. To make sure the animation suits to the context, the best way is to test it out - 'The faster the prototype method, the better'. Produce a quick prototype using any application that you're most comfortable with, such as CSS, After Effects, Edge Animate, or any other tools. It is not important to produce ready code, or even do any coding at all in the prototyping phase. Instead, ask yourself a below questions as if you were the user:

- **Does the animation provide any useful information about the interaction?**
- **Does it feel like it's responding to you as the user?**
- **What sort of emotional response does it trigger for you?**

When you decide which animation to apply, it is worth to remember that some users may not have the browser to support the animation displaying. Here is a link of the article describes the browser performance in supporting different UI animations:

<http://www.html5rocks.com/en/tutorials/speed/high-performance-animations/#toc-imperative-declarative>.

False Usage of Web animation

Animated UI is a tempting and powerful tool, yet they can be distracting and waste users' time when over using it on the website. To assure the animations add meaning to the interaction, designer should think first whether the animation will cause an attention shift or reinforce relationship between UI elements or would the users trigger it directly. (Bedford, 2014)

Blinking images and video advertisements are the most obvious examples of utilizing peripheral animation for flashy advertisements. Even well-meaning animations can prove to be distracting and annoying. Notifications appearing near the edges of the screen and promoting related content, the capability of live chat are the examples of peripheral animation which intend to inform the user, but in practice it can be as interrupting and unwanted as a pop-up window. (Neilson. 2013)

4.4 Animation Guidelines

Heuristic evaluation is the process of examining applications against a set of rules or guidelines. Pioneered by Jakob Nielsen, heuristic evaluations can occur with or without the users present. It's almost like the process of editing a written work, but instead of evaluating grammar and spelling guidelines, you're evaluating your application's effectiveness based on industry standards or principles. (Lowdermilk, 2013)

There are many animation guidelines available to follow. These animation guidelines are given as part of the brand guidelines, such as Microsoft, Google, Apple, IBM, Salesforce etc. These guidelines can help designers or developers understand what the application should and should not do. The animation guidelines are specifically designed to give you guidance on the position of user interface (UI) elements, use of animations, loading times, terminology, etc. For example, if the users aware that the 'share' button in iOS applications is for sharing content via email, social networks, and other services, it would be unwise to create your own sharing mechanism that users would have to learn. In some other cases, companies will reject the submission of your application if these guidelines aren't followed. (Lowdermilk, 2013)

Companies enforce these standards because they want to ensure their users have a consistent experience among the applications. Therefore, it can be costly to ignore the

guidelines of the development platform you are using. The more familiar you become with the rules of the framework's design, the easier it will be for you to spot inconsistencies. (Lowdermilk, 2013)

4.4.1 Meaningful animation in Google material design

Google announced that motion design is a huge and required component for creating a great software for mobile, desktop and wearable devices. (Stamatiou, 2014)

When users give an input no matter from touch, voice, mouse or keyboard, UI elements and motion cues should instantly react in a way that 'look and feel like direct manipulation'. Google summarizes animation principles in four segments – Authentic motion, responsive interaction, meaningful transition and delightful details.

Authentic motion suggests animation design needs to consider the mass and weight as if the animated objects are affected by the law of physics. Force triggers the movement in the physical world, and it defines the strength and duration of an accelerating, decelerating, turning or pausing movement. The movement in acceleration and deceleration should be asymmetric rather than linear. Changing speed draws users' attention, such as giving a pause after an object enters or before the object exits. 'It describes spatial relationship. Functionally and intention with beauty and fluidity.' Terms of 'easing' differs when indicating in traditional animation and UX animation. Term of easing means leading motion into and out of a key-frame in traditional animation while it means motion entering or leaving the transition.

Responsive interaction in Google material design suggests that animation should be applied with **time, logic and delightful screen reaction**. The interaction is 'thoughtful, perhaps whimsical, but never distracting.' Using responsive interaction up-grades the application from an information-delivery service to an experience. Surface reaction triggers immediately when a user interacts with the screen, and the reaction is channelled through visual elements and animations. When a user interacts with the device, interface transition should have material response, which means that transition should start from the point that user touches or clicks. The point of origin and life on touch are the rules clarified in material design animation. When user has an on-screen action, the input event should react radially. 'A touch ripple indicates where and when a touch occurs and

acknowledges that the touch input was received.’ The visuals which present the transactions or reactions should indicate the input event.

Motion design has a strong effect on guiding users’ attention. It helps the users navigate between contexts and reinforce the hierarchy of the UI elements. A clear, smooth and effortless transition indicates to the users to where should they pay attention. Material design categorizes the transitions into three types: **incoming elements, outgoing elements and share elements**. When designing a meaningful transition, should always consider ‘direct users’ attention’, ‘connect transition visually’ and ‘use movement with precision’. During a transition, giving hierarchies to the moving objects can create a path for eye to follow. The transitions applied should have a consistency in choreography, such as all the entrance transitions in an application should behave in the same manner.

The delightful details can give an appealing experience to the user when apply it beyond the obvious. ‘It imbues the application with a moment of wonder and a sense of superb craftsmanship’.

Using a sequence of small, delayed transitions as an affordance to express the transfer of energy from the user to the system. You can improve the users’ understanding of the relationship between spaces by connecting users’ actions to the resulting changes (Google motion design guidelines)

4.4.2 Apple

Apples states in its animation guideline ‘beautiful, subtle animation throughout iOS builds a visual sense of connection between people and content onscreen.’ Animation can convey status, provide feedback, enhance the sense of direct manipulation, and help users visualize the results of their actions.

Animation should be applied carefully, and excessive animation can be disturbing to the users. Animation should be used purposely and restrained when applying on motion effects, and the results should be tested.

No matter it’s a custom animation or a build-in animation, it should be subtle and consistent through the application. Users prefer the smooth transition between the views

and the physics-based scrolling as an expected part of iOS experience. Avoid immersive animation unless it's a gaming application.

When making a custom animation, people tend to accept artistic license in appearance, but they can feel disoriented when they experience movement that doesn't make sense or appears to defy physical laws. (iOS Human Interface Guidelines)

4.4.3 Salesforce's Lightning design system.

Salesforce in 2015 published new brand guideline which includes a downloadable framework for adding animation to your projects. It has some interesting concepts, such as elevation settings to handle positioning on the z-axis.

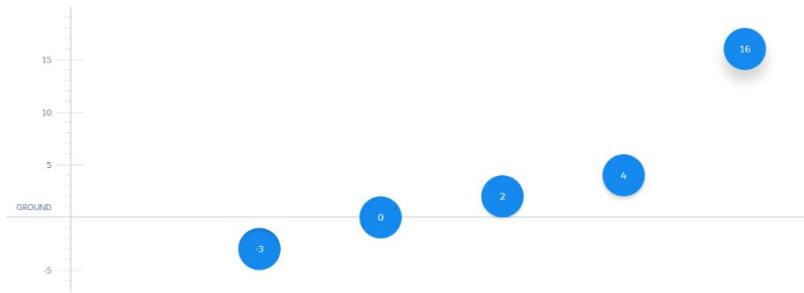
Salesforce points out the key principles in animation/motion are timing, elevation and effects:

- Timing: a “grid of time” creates consistent rhythm. Animation is defined as multiples of a base grid.
- Elevation: utilizing the Z-axis to support spatial organization aids in creating a visual hierarchy we refer to as “atmosphere”.
- Effects: attributes are animated over time to create a vocabulary of effects.

Salesforce also summarized web animation into four types:

- Enter & exit: the appearance or disappearance of an object on the screen.
- Emphasis: drawing attention to an object that is already on the screen.
- Transitional: informing the user that a context change is taking place.
- Personality & Branding: characteristics or sequences of engaging animation that create surprise and delight.

Physical Mass is also an aspect need to be considered while applying animations, such as motion should be subtle, short timing makes UI brisk, flashing and large motion should be avoided.



Picture 9: Correlation between elevation and physics (Salesforce design system)

Salesforce also has a set of animation vocabulary to present different animations, such as fade out and fade in; colour; grow; shrink; fall, rise etc. These vocabularies smoothen up the communication between designers and frontend developers.

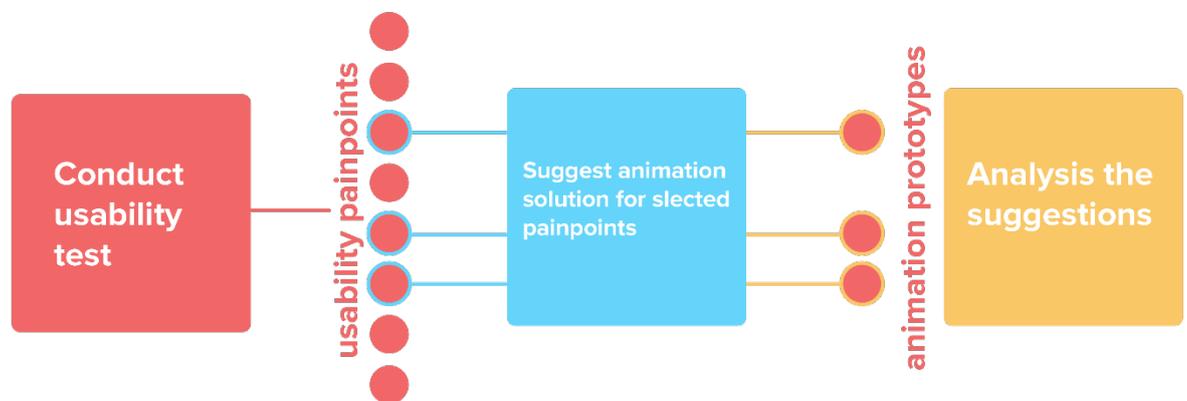
Motion can and should go beyond a single-phase as polish or delight. It is another path for adding personality, educating your users about how to interact with the particular elements and for creating a story for the users. (Salesforce design system)

5 Case study

The case study company, Verto Analytics, is a data measurement company located in Espoo, Finland. Verto Monitor is a business intelligence (BI) data reporting tool which provides a set of features and vast amount of data to its users. The current UI of Verto Monitor is static without any animations or transitions. We have received feedback that users have difficulties to understand all the features in the Monitor and it is challenging to navigate around the Monitor.

The case study plan is to first conduct usability tests for the Verto Monitor to find out a list of usability issues in current UI design. Web-development team, product manager and I will together select the usability issues which could be potentially solved by applying web animations on the UI elements. Then I produce a set of animation prototypes and transition descriptions. In the end, the animation suggestions will be reviewed by product manager, UX expert and frontend consultant.

Findings from the study along with a list of limitations of this study is concluded in the summary part.



Picture 10: Logic frame of the case study (Liu,2016)

5.1 Conduct usability test

To find out the usability issues, we plan to conduct a usability tests for Verto Monitor. This test should be held for the users who has no pre-impression to the Verto Monitor. A list of the usability issues will be generated from the test, and these issues are called as usability pain-points. These usability issues can be individual or they could be correlated with each other. Therefore, a thoughtful analysis within the product team will be conduct

in order to pick out the pain-points which have the potential to be solved by implementing web animation. As shown in below picture, I first defines the research question and objectives with the case company. Once the research goal is approved, I plan the test from three parts: **recruiting test participants, develop test contexts, and forming a test team.**



Picture 11: Preparing a usability test (Liu, 2016)

As mentioned by Jeff and Dana in the theoretical studies, the first step of conducting a usability test is to develop the research questions. The research question is: **In Verto Monitor, what aspects need to be improved in current UI in order to easily navigate around and create wanted report?**

The research question can be further anatomized into a list of small questions according to the features and user flow in the Verto Monitor:

- What is the first impression of Verto Monitor as data reporting tool?
- How do users start exploring the Monitor?
- How do users interact with the menu bar?
- How do users read or interact with the reports from the dashboards?
- How do users create a new report by using report configuration menu?
- How do users edit a report?
- Are the users able to compare two reports in the Monitor?
- How do users treat the data after reports are generated – do they export the report or pin the report?

These questions are the skeleton of the tasks list which will be performed during the test by each participant.

5.1.1 Planning the test

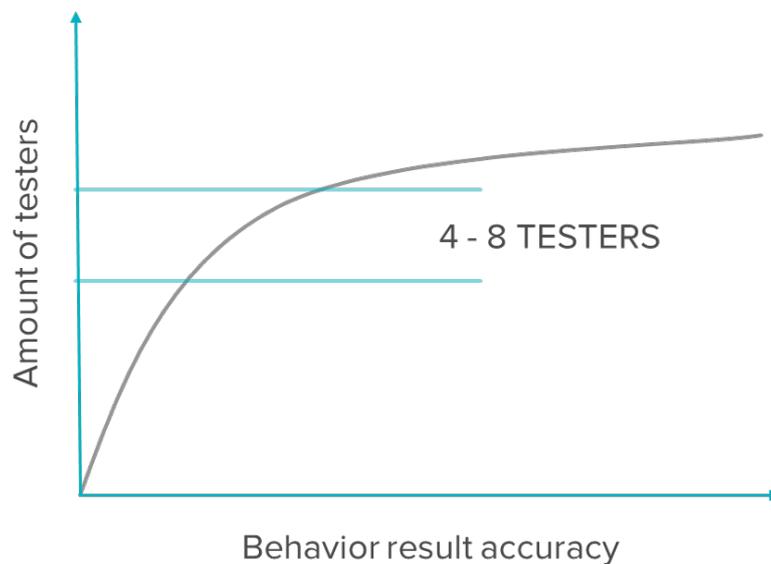
After few iterations, the research question and objectives is approved by the case company. I start planning phase as shown in picture 11, and follow the theoretical studies in the chapter of ‘measuring usability via usability test’.

Recruiting the participants

In the step of **recruiting participants**, I study the person and users’ attributes to form a recruitment plan. Recruitment survey is drafted from the chosen attributes for the usability tests, then we send out the survey and invite the most suited test participants join the tests. Below is the detailed description of each planning actions:

In order to know who should be invited to the test, we need to first find out who are the typical users of the Verto Monitor. We spend two weeks to filter out an attributes list from the information of Verto Monitor’s users.

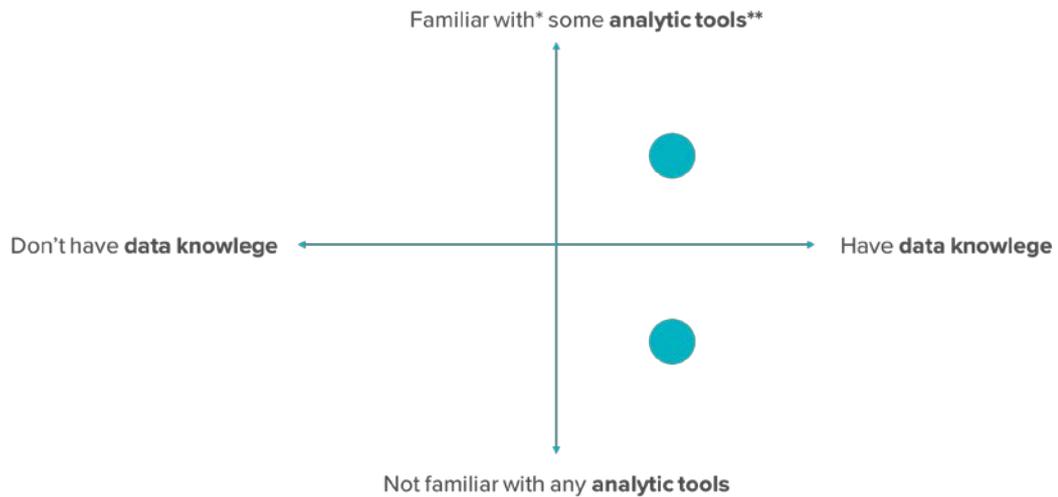
1. **Attributes of the participants:** we summarise above one hundred user accounts information and list below attributes for the target users:
 - Familiar with web environment or use web applications frequently
 - Education level is at least college degree graduates
 - at least have basic knowledge of statistics
 - Titles of the user can be journalist, editor, tech-writer, data analytics, researcher, data scientist, marketing strategist, marketing manager, chief marketing officer, business intelligent, consultant or investors.
2. **Number of the participants:** according to Jakob Nielsen, the ideal amount participants of the usability test is between four to eight. The accuracy of the behaviour results will not increase linearly with amount of test participants.



Picture 12: Number of participants vs. behaviour result accuracy (Liu, 2016)

We set two basic attributes for targeted participants: level of familiarity with the analytic tools and level of data knowledge.

- **Level of familiarity** presents how familiar the users are with the analytical tools – use analytical tool frequently, seldom or never. The experience level in reading and producing report in similar BI report tools is one of the most important elements considered while recruiting the test participants. Participants who have rich experience of using BI tools would have pre-formed behaviour patterns and expectations for the Verto Monitor. In the other hand, participants with zero experience in BI analytical tools will give an organic feedback to the self-explanatory level of the UI design in current Verto Monitor.
- **The level of data knowledge** presents users' goal – are the user using the Monitor as an analyst or as a media planner or decision maker. According to the user study, we know that the test participants should have some level of the data knowledge. If the participant is analyst, he or she would prefer to automating the data report or direct export the data from Verto Monitor for the further analysis. If the participant fits into the category of median planner or decision maker, he or she would prefer an interface which is easy to use when creating report and reading the data within the Monitor.

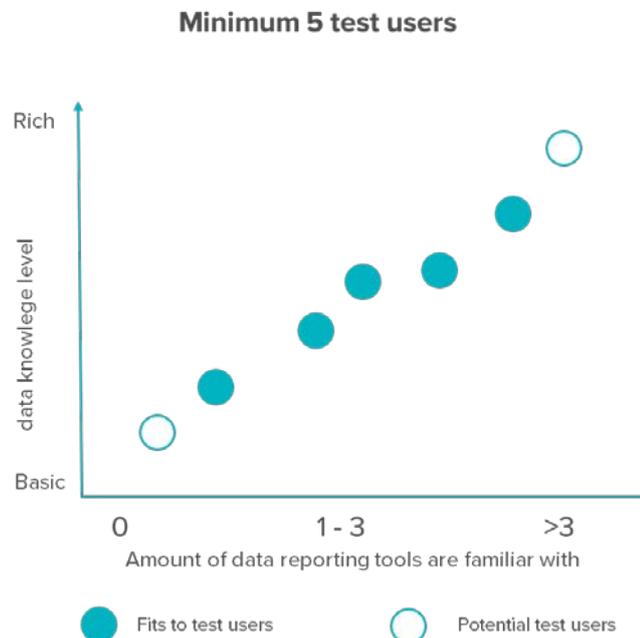


*familiar with: user creates and exports reports individually and frequently.

**Analytic tools are the ones similar to Verto Monitor

Picture 13: participants two curial attributes (Liu,2016)

- We plan to have at least five participants for the tests. In the group, there are at least two participants which have rich experiences of using BI data reporting tools, and at least three participants have little experiences of using analytic tools.

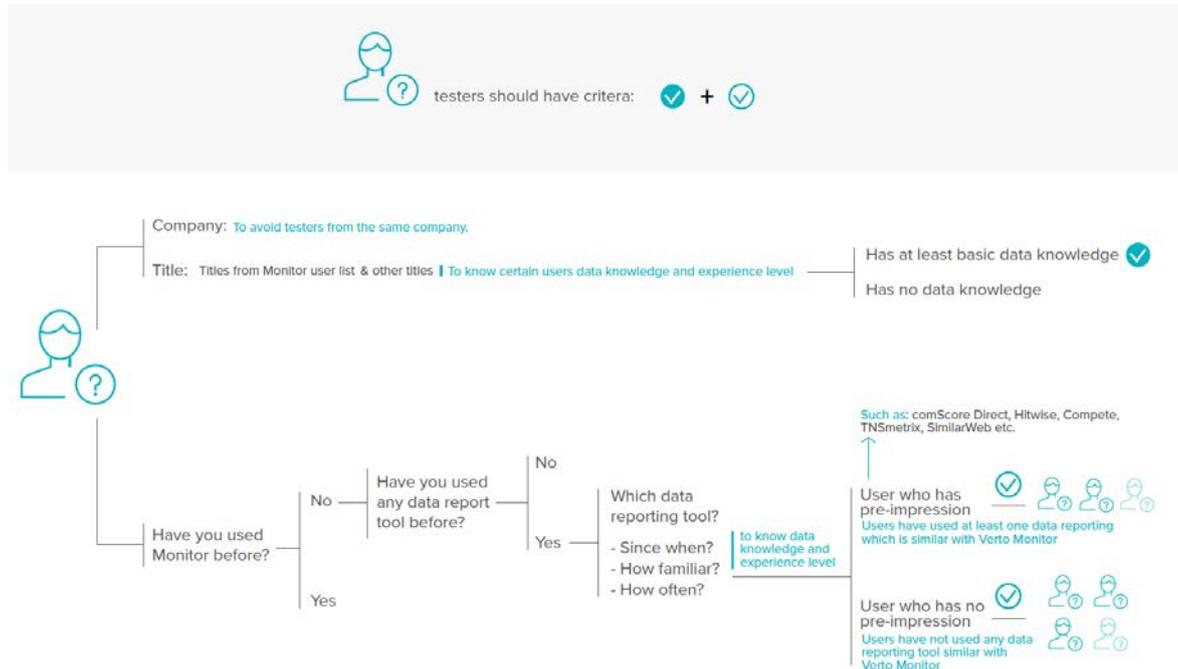


Picture 14: Allocation of participant group (Liu, 2016)

Although many of the Monitor Users locate in United Sates, none of the user attributes associated with geographic location. Verto Monitor also aim to be used by the international users locate in different countries. Therefore, we decide to recruit most of

participants from Finland and contact usability tests in Helsinki. But we do not eliminate the possibilities of remote test when there is a suited test participant not locate in Helsinki.

- A **recruitment survey** is sent through online survey platform - SurveyGizmo. The survey questionnaire is drafted with the test team, and the aim of the survey is to select the most suited participants for the test. The image below shows the logic flow of selecting a suited candidate:



Picture 15: Logic flow for recruiting survey (Liu, 2016)

During two weeks of time, we collect twenty-four potential participants from the survey results. After studied and analysed the result with the team, we picked seven most suitable participants for the usability test. All the participant has never used Verto Monitor before. Six out of seven suitable participants will be conducted in Helsinki office, and one remote test will be performed.

Seven participants are invited to the test two weeks before the test with informed of test schedule and context. At the two days before the tests, participants will receive a reminder of the test and to confirm the attendance.

Developing the tasks

While recruiting the participant to the test, we also work on developing a task for the participants to perform in the test. We will discover the usability issues of Verto Monitor

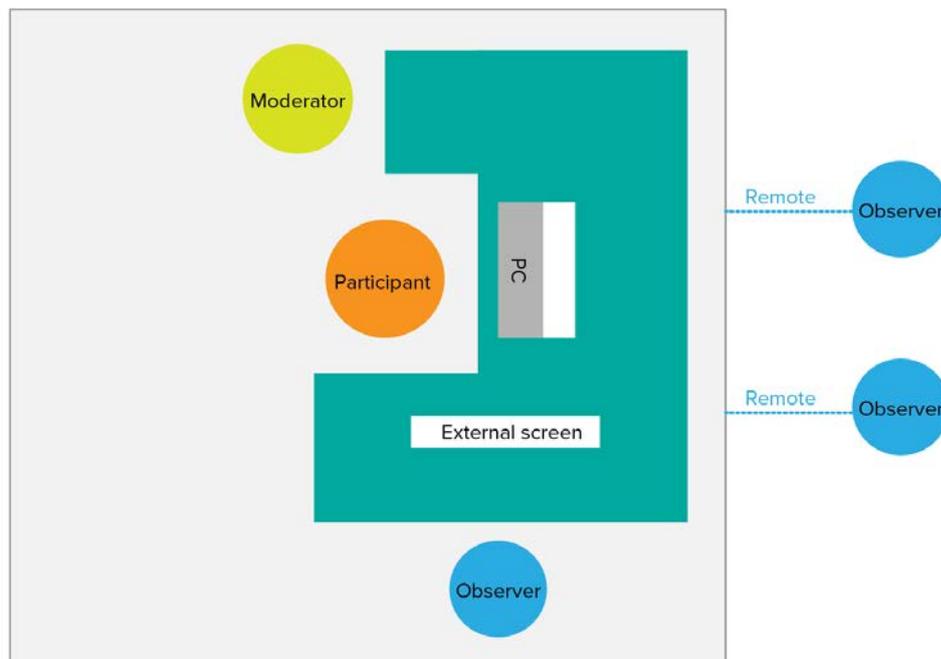
by observing how the participants perform the given tasks. Developing tasks involves the actions of develop a task list, set the test method, and set the room and test equipment.

There are three types of tasks are developed from the research questions:

- **Impressions task:** test starts with three general questions. The questions are designed to make user feel comfortable meanwhile let the team confirm the background of participants.
- **Exploratory tasks:** we prepared three scenarios which cover the basic features of the Verto Monitor. The exploratory tasks are several questions, participants need to read through the question and find the answer via operating the Monitor.
- **Post-session questions:** after each test finished, we can ask questions for the participants. These questions are related to the actions that the participant has done, and the questions can be asked from both moderator and observers.

Setting up the test room

We set one of our meeting rooms as the test room. The layout setting is shown in below picture.



Picture 16: Test room layout (Liu, 2016)

As state in the test plan, there are at least two observers in each test. One of the observers is in the same room with the moderator and the participant, other observers are watching the test via GotoMeeting. The observer who sits in the room can observe the behaviour

and expressions of the participant. Remote observers can hear and see the screens of the participant. Reason for setting observers locate both in the same room and a separate room with the participant is to ensure we observe the emotion/expression of the participant without disturbing the participant's performance during the test. The participant uses a prepared PC to do the test while moderator sits slightly behind him/her to give guidance when needed. All the screen behaviours are recorded by GotoMeeting as a video material for reviewing when needed.

Test team and roles

The test team is formed by product manager, backend coder, frontend developer, software tester and me as UI designer. the roles we perform in the test are as observers and moderator. I am the test moderator while the others take role as observers. We agreed that there are at least two observers in each test. Observers can observe the test via internet or be in the same room with the participant and moderator. GoToMeeting is the vide call software we choose to use for recording and observing the test.

Before conducting the test, a list of rules for the observers is produced according to Jeff and Dana's rules for observers. Test team study the rules for the observer together before conducting the test.

Rules for observer in Verto Monitor usability test:

1. Arrive before the session starts. It is important for you to be present when the participants arrive so you get settled and ready to begin taking notes
2. You must stay for the Duration. Once we start the session, it is imperative that you stay until the session is complete. If you cannot stay for the duration of the session, please do not come at all.
3. Mute your microphone and turn off your phone, email and instant messaging. It's a short session. Please be fully present and ready to pay attention to the moderator and the participant.
4. Usability testing is about the user's real actions – focusing on what they do. During the test, don't think about solutions for the problem you see.
5. Listen to the participants 'thinking aloud'. Note down any relevant thoughts, particularly the words said by the participant.
6. Take notes. Please make notes about anything interesting you notice, particularly points where the participant is confused or couldn't get the tasks done. We'll be comparing notes during the debriefing session after each test.

7. All your notes should be recorded in shared Google sheet. Please also spend some time to organize your notes, clean up the typos for reviewing and concluding the test results.
8. If you think of a question you'd like to ask the participant, write it down in the 'Question Tab'. Near the end of each session, we'll check to see if you have any questions.
9. Ask open-ended questions about what happened in the session when invited by the moderator to do so. Don't offer design or feature alternatives. Avoid asking about preferences or opinions.
10. Don't reveal how many tasks we have. We may well run out of time before the participant finish all the tasks. If the participant get stuck on a task, that means that there is a wealth of information we should be taking notes on. It is often more useful to explore an area of difficulty in detail rather than try to 'get through' all the tasks. The facilitator will keep an eye on the clock so that we can cover as many of the important areas as possible.
11. Keep the participant's identity confidential. We have promised the participants that their identities will be kept confidential.

These rules are inserted in the Google sheet which also includes the information of the test participants, tasks, and template for note-taking. To ensure we always deliver the standard information for each participant, we also draft a script for the Moderator to read out before starting a test.

Scripts of moderator:

Thank you for agreeing to take part in our research study. During the rest of the session, I'll be working from a script to ensure that my instructions to everyone who participates in the study are the same.

I'm here to learn about how people create report in Verto Monitor for the first time. In this session, we'll have you do typical tasks, to learn how Verto Monitor work for people like you. Please keep in mind that we're not testing you—it's you who are helping us evaluate the software. As you explore the Verto Monitor, please try to do whatever you would normally do.

We will use ‘think-loud’ method during the test. Just tell me whatever is going through your mind. Describe what do you see, what do you want to do and why do you do so. Please know that there is no such thing as a wrong answer. You’re doing this to help us understand what works or doesn’t work about the Verto Monitor. Also, please don’t worry that you’re going to hurt our feelings. We’re doing this to improve the site for all of our users, so we need to hear your honest reactions.

If you have any questions as we go along, just ask them. I may not be able to answer them right away, since we’re interested in how people do when they don’t have someone sitting next to them to help. But if you still have questions when we’re done, I’ll try to answer them then.

With your permission, we’re going to record what happens on the screen and our conversation. The recording will only be used to help us figure out how to improve the site, and it won’t be seen by anyone except the people working on this project. Also, there are a 3 of my colleagues observing this session in another room.

The whole session will take about one hour. Do you have any questions before we begin?

Then I demonstrate the technique of the ‘think loud’ to the participant by explaining how to login to the Verto Monitor, so that participants feel less self-conscious.

Besides clarifying the rules for observer and moderator, we also prepare the tasks list which is printed and handed out to the participant at the beginning of the test. The detail information of the task list can be viewed in Appendix 2. With completed tasks list, ready equipment for the test and prepared test team, we conduct a pilot test to ensure a smooth process.

Pilot test

We conduct a pilot test to practice the roles of observers and moderator, meanwhile to test out the task list. The pilot test is run with our newly joined college who has not been using Verto Monitor before, and her portfolio fits into the test participant requirements. Pilot test is very useful for the team to self-examine the test plan and test materials. After the test, we have debrief session and adjust the test tasks which apparently is too difficult for the first-time user. We try to use both Skype and GotoMeeting to let observers see both participant’s facial expression and screen. Unfortunately, Skype is less stable than

GotoMeeting. Skype keep dropping during the pilot test and it clearly make the distraction to the participant. We also improv the Google sheet for observers' note-taking template according to the feedbacks from the pilot test.

5.1.2 Conducting the test

After all the adjustments done, it is time for the test. We plan to conduct seven tests, in which six tests in the office meeting room and one test is conducted remotely. Depending on the available schedule of the participants, we decide to book one test per day which is easy to handle comparing with multiple tests in one day.

Running the test

Each test has a standard procedure: moderator welcomes participant, asks participant to explain their background and reason to attend the test. The moderator reads the introduction of the test and ask participant to sign an NDA. This is a warming up session before the official test starts. The duration of the test is one hour. Before starting the test, moderator will also demonstrate the method of 'think loud'.

After the participant logs in to the Verto Monitor, moderator first asks the impression questions:

Impression questions: (Preparing test participant to get familiar with the Verto Monitor)

1. What do you see at first when you log in? (To understand what information user observes when logged in to the Monitor for the first time. Is the information clear or helpful for the users to continue exploring the Verto Monitor?)
2. Can you briefly browse through the menu, and explain what kind of contents are displayed in each page? (By asking user to browse through each page, it would let us understand how user reads the default dashboards, and how does user understands the relationship between each dashboard page.)
3. While browsing through each page in the Verto Monitor, participant uses 'think-loud' method to describe what is he/she viewing, what is he/she thinking about or why some actions were taken. All the observers can hear and see how the participant browsing through the Verto Monitor. If there

is action-delay or uncertainty from the participant, observers can add description to their note. Furthermore, we have prepared a shared google excel sheet which includes all the participants' information that observers should be aware and a common layout to insert their notes easily.

After the Impression questions are answered, the participant continues the test with a list of given tasks. We provide one scenario and asked three questions: QA, QB, QC. The participant is expected to produce one type of report for each question.

Task list:

You are a business strategy consultant for a company in the gaming industry. The company has the resources to develop a game which is targeted for female users in the U.S. market. You need to analyze the gaming market by using the Verto Monitor. You can now start using the Verto Monitor.

A. You want to have a general understanding of the big players in the gaming industry. Using the Verto Monitor, find the top 100 games with the most players in the U.S in December 2015.

- Q A1: Which game had the most players in December 2015?
- Q A2: Now narrow down the top list to consist only of iOS games. Which one had the most iOS users in December 2015?

B. 'Candy Crush Soda Saga' is a popular game among females. You want to see the how the popularity of that app evolved during November and December 2015.

- Q B1: During the two months, on which day did Candy Crush Soda Saga have the highest reach?
- Q B2: What was the split of the reach among male and female players?

C. You want to know which of the following games has the most female players aged 20-39 during December 2015: 'Cookie Jam', 'Panda Pop' and 'Clash of clans'.

Please save the report C, which you will show to the client later.

Observers are taking notes while participant performs the tasks. Moderator is also observing the test, and I was giving necessary guidance if participant has a clear emotional impact when he or she stuck to the task.

A question session is held after participant finishes the task list or when time is up. Moderator can ask the questions to the participant. Observers can write their question to the participants in the Google sheet notes template, so the moderator can see the question instantly and ask the participant. We ask open-end questions or the questions related to what participants have performed during the test. After no more questions from the observers, moderator also ask a general feedback from the participant for test and walk the participant out the test room.

Debrief

We have a quick debrief session after each test. We comment on the top three pain-points observed during the test. After all the tests are conducted, we have an overall debrief workshop to go through each observer's notes collected from all seven tests.

5.1.3 Finding the usability pain-points

After all the tests notes are organised, a workshop is held between the product development team, including backend software engineer, frontend software developer, product manager, usability test consultant, software tester and UI designer. They are the observers and moderator in the test as well. Procedure of the workshop is to raise the pain-points and categorized them, then open the discussion for possible solutions in two groups. Pain-points are the usability obstacles that are shown during the test. We use paper notes method that each observer prints out the pain-points and stick them under the different topics on the walls of the workshop room. After all the pain-points are listed, we can see a clear pattern from the wall which pain-points are significant and which are less outstanding. Then we linked pain-points which are related and re-sort them based on the features.

Dashboard:

- Each dashboard has very similar look, participants has difficulties to distinguish them. There isn't any type of explanation about the content in the dashboard. Participants tries to distinguish the dashboard contents by going through each report, but it doesn't help much.
- The layout of dashboard is hard to read.

- Each report in the dashboard is lacking of highlighting. Title and description of the report is not obvious to users.

Instructions:

- Tutorials and tooltips are not useful. Pictures in tutorial are too small to see. Some participants just clicked away the tutorials and some participants can't remember what they have viewed earlier in the tutorials or tooltips.
- Participants have difficulties to go back to the report after checked 'Glossary' in pdf format. Participant would like to have a 'table of content' in the user guide in order to directly read the wanted content.

Report type/ New report:

- It's challenging to understand the different report type. Names and descriptions of report types did not communicate what they are. Not all the participants were able to switch between report types.
- It's hard to notice which report type that participant is currently in.
- Not all the participants were able to create a report via 'new report'. Some of the participants click on 'my report' to start a new report. Some participants try to create report by modifying dashboard report, but with the wrong report type.

My report:

- Participants tried to click on the icons which look like a button in order to create a new report.
- Participants expect created reports are automatically saved in 'my report'.

Subject selection:

- Not all the participants are able to discover the configure menu which is on the left side of the screen.
- Search feature is difficult to find which hidden in configuration menu.
- Feature of 'select all' is not discovered. But in most of the cases, participants still get the result that they're looking for by direct clicking table after report has rendered.
- In configuration menu, when participants select the upper level of the options, the lower level of the options are automatically disabled. This misleads the participants that they cannot select the option.
- It is difficult to understand what are the selected item.

- Unable to find subject category from configuration menu.

Filter:

- The active button should be removed away in order to let user directly apply filter.
- Participants are not fully aware the functionality of the filter in current UI.

Breakdown:

- Most of the participants are in the wrong report, thus they did not even see the option of report 'Breakdown'.

Target group:

- It is difficult to go back to the report view from target group page
- It is difficult for participants to notice that they can't save the target group without giving a name of the target group.

Ranking report:

- meaning of columns is not clear

When all the pain-points have been concluded, we also rate the priority level individually within the product development team, then get a final list of pain-points with an average rate from test team. We also summarize the action points for each pain-point in short term perspective and possible solutions in long term perspective.

Below is the priority level of the pain-points list:

4.8	Active button should be removed away to let user use the filter
4.4	Navigating back from target group to reports is difficult
4.2	Not all the users are able to create a report via 'new report'
4	It's challenging to understand the difference report type
4	Difficulty to understand what has been selected
3.8	It is hard to understand the report data
3.8	No easy way to start creating a new report from the page
3.8	If users select upper level of the options, the lower level of the options are automatically disabled
3.8	It is difficult for user to notice that they can't save the target group because they did not enter the name of the target group.

3.4	Each Dashboard has very similar looks, users have difficulties to distinguish them from both visual and content
3.4	Users are not fully aware the functionality of the filter by current UI
3.2	It's hard to notice which report type that user is currently in
3.2	Search is difficult to find, hidden in selection tree-menu
3	Layout of dashboard is hard to read and understand
3	User cannot go back to the previous menu
2.8	"Select all" was not discovered
2.8	Unable to find a specific subject category
2.6	Tutorials and tooltips are not useful.
2.6	Expect the report is automatically saved in 'my report'
2.4	User did not see the configure menu on the left-hand side
1.2	User had difficulty to go back to the report after checked Glossary pdf.

Table 2: Usability pain-point priority list (Liu,2016)

5.2 Using animation solve the usability issues

From above pain-point list, we have summarise below usability issues which could be potentially improved by web animation.

1. **Give an interactive tutorial** which users can choose to turn off or turn on freely.

From the test, we can clearly see that Verto Monitor requires a long learning curve from the users to be familiar with the UI. In practice, the users aim to see the data from the Monitor as fast as possible without spending extra time to exploring around. Below usability issues for the Monitor first time users should benefit from the interactive tutorial:

- Not all the users are able to create a report via 'new report'
- It's challenging to understand the difference between report types
- Each Dashboard has similar looks. Users have difficulties to distinguish them.
- Layout of dashboard is hard to read and understand
- Tutorials and tooltips are not useful.

As the first-time users have no clue of how the product works, they need some guidance to get familiar with the Verto Monitor. By adding an interactive tutorial to explain the

major features can give a quick view to the users in order to partially solve above mentioned usability pain-points.

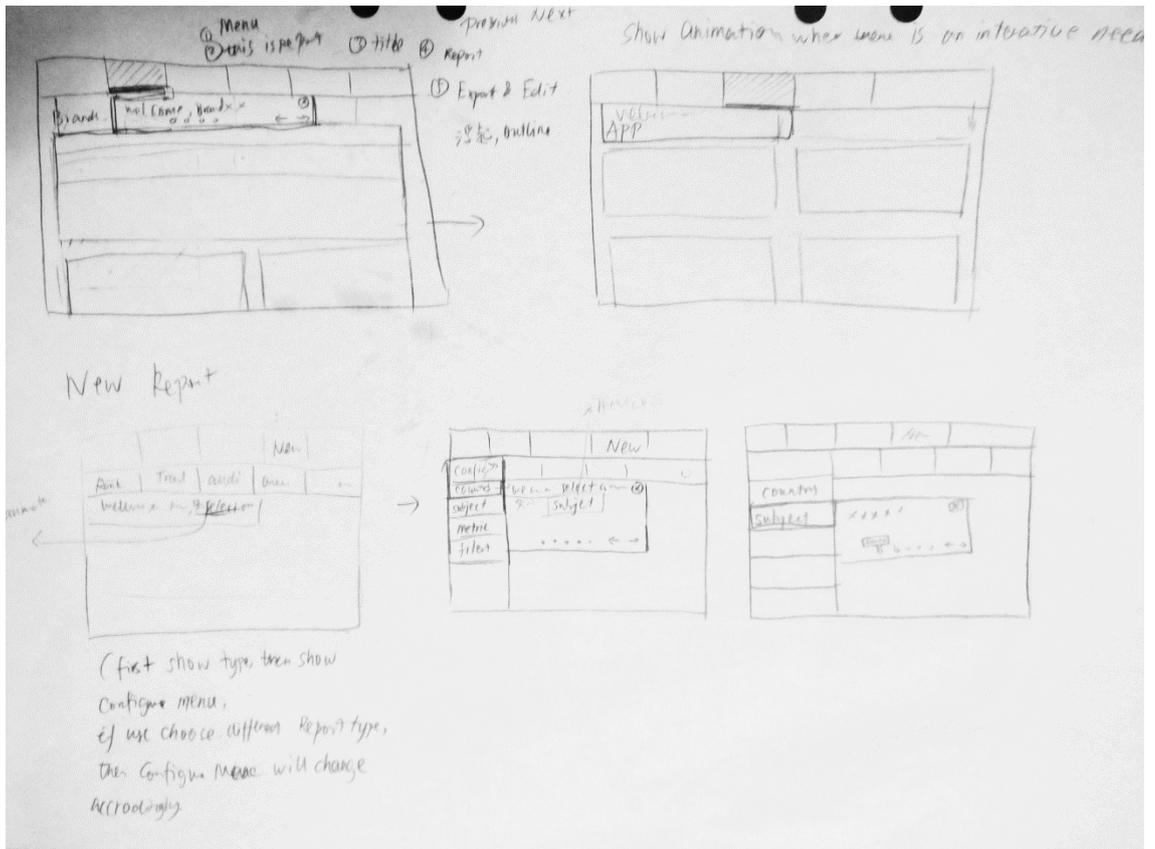
2. **Loading:** In current Monitor, when user do modification to the report, the entire report interface replaced by a loading icon. The entire report appears suddenly to the screen when the new report is generated. The loading UI interrupts the user flow and make user feel frustrated for waiting. I would like to suggest a loading animation to improve user's impression for the loading time.
3. **New report icon in My report should be clickable.**
4. **Adding transition for report title** in order indicate selected criteria and possible action. The current title is static, as shown in the test, participants found the clickable feature is hidden in the title.

Give an interactive tutorial

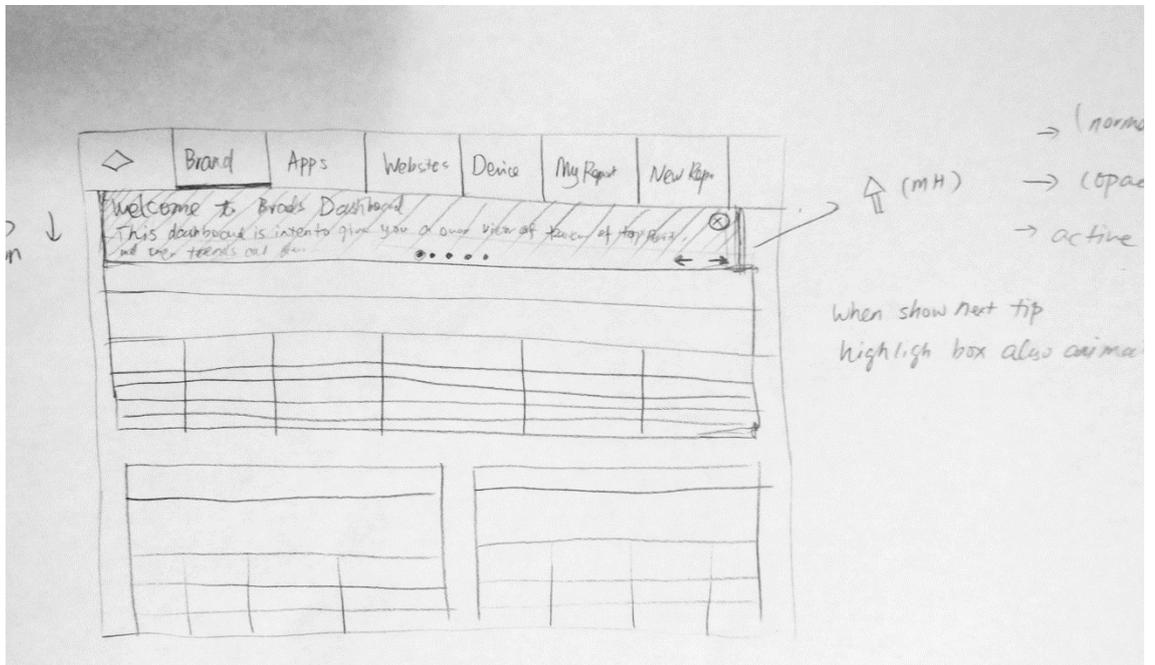
Providing a suggestion for interactive tutorial is not simply applying web animation to any UI elements, it also needs considerations from interactive and visual design. I want to ensure that users feel that they're in the loop or in control during the tutorial demo. The tutorial should easily to be turned on or off by user whenever they need a guide.

This design is meant to highlight the features in the dashboard that would help user who is not familiar with the dashboard to understand structure and actionable places in default reports dashboards. In current design, each subject type has a default dashboard, and each dashboard includes a set of reports. Take default app dashboard as an example, there are four ranking reports indicate the rank of the apps, two trend reports indicate changes of the top apps, and a sets of audience reports show the users in different demographic breakdowns. User can edit or export each report from the dashboard.

To find out how to solve the confusion while operating through the dashboards, I start drawing out the logic flow of the tutoiral, determine which features should be highlighted in the interface according to the results from usability test. After set the hierarchy of the UI elements, I sketch out a quick prototype by pen and paper. Sketching out the ideas also help me to future determine which parts of the information in the tutorial should be triggered by users and which parts should be played automatically.



Picture 17: sketch prototypes for interactive tutorial in creating new report. (Liu,2016)



Picture 18: Sketch prototypes for interactive tutorial in the dashboard. (Liu,2016)

Below is the screen short of UI suggestion:

Titles of the report describes the content of the data, such as Subject, Metric, Time, etc.

Ranking Report

In USA , Top 50 Brands (by Parent) (all) ranked by Users (#) , with Reach (%) and Devices (#)
Data for Last month (July 2016)

Rank	Subject	Users (#)	Reach (%)	Devices (#)
1.	Google, Inc.	217,231,840	88	992,406,793
2.	Microsoft Corporation	195,707,974	79	268,711,212
3.	Facebook, Inc.	143,721,110	58	177,934,843
4.	Apple Inc.	99,526,530	40	149,752,289
5.	Amazon.com, Inc.	93,112,329	40	117,937,709

Show 45 more rows

Ranking Report

In USA , Top 50 Brands (by Parent) (all) ranked by Users (#) , with Reach (%) and Devices (#)
Data for Last month (July 2016) on/via/using Smartphones or Tablets

Rank	Subject	Users (#)	Reach (%)	Devices (#)
1.	Google, Inc.	155,188,939	63	211,512,612
2.	Facebook, Inc.	143,721,400	58	177,583,958
3.	Amazon.com, Inc.	94,354,889	38	111,396,437
4.	Apple Inc.	92,630,687	37	131,408,564

Ranking Report

In USA , Top 50 Brands (by Parent) (all) ranked by Users (#) , with Reach (%) and Devices (#)
Data for Last month (July 2016) on/via/using PCs

Rank	Subject	Users (#)	Reach (%)	Devices (#)
1.	Microsoft Corporation	180,310,737	73	215,352,164
2.	Google, Inc.	154,114,019	62	179,894,906
3.	Adobe Systems, Inc.	86,433,989	35	91,875,741
4.	Mozilla Foundation	67,183,591	27	76,184,072

Picture 19: UI suggestions for dashboard tutorial – report title (Liu, 2016)

As shown in above UI suggestion, tutorial will be shown in the grey tab. The tab automatically slides up when the users login to the Monitor for the first three times. Users can trigger the tutorial by clicking on the button ‘show tips’ on the top right if the interface. This will ensure user can turn on the tutorial whenever and wherever they’re in the application. Highlighting frame is in yellow colour which frames out the feature that is in the tutorial tab. The colour of warm yellow is a contrast colour of the Monitor Turquoise which should be more appealing visually than only using one accent colour. Highlighting frame switches the position depending on which feature is demonstrated in the tutorial tab.

Below UI prototype shows the feature of ‘show all ranking’ is in demo:

Besides the top 5 ranking, you can see **more ranking** in the list by click open the tap.

Ranking Report In USA , Top 50 Brands (By Parent) (all) ranked by Users (#) , with Reach (%) and Devices (#)
Data for Last month (July 2016)

Rank	Subject	Users (#)	Reach (%)	Devices (#)
1.	Google, Inc.	217,231,640	88	992,406,793
2.	Microsoft Corporation	195,707,974	79	268,711,212
3.	Facebook, Inc.	143,721,110	58	177,934,843
4.	Apple Inc.	99,526,530	40	149,752,289
5.	Amazon.com, Inc.	99,112,529	40	117,937,008

Show 45 more rows

Ranking Report In USA , Top 50 Brands (By Parent) (all) ranked by Users (#) , with Reach (%) and Devices (#)
Data for Last month (July 2016) on/via/using Smartphones or Tablets

Rank	Subject	Users (#)	Reach (%)	Devices (#)
1.	Google, Inc.	155,188,939	63	211,512,612
2.	Facebook, Inc.	143,721,400	58	177,583,958
3.	Amazon.com, Inc.	94,954,689	38	111,396,437
4.	Apple Inc.	92,630,687	37	131,408,564

Ranking Report In USA , Top 50 Brands (By Parent) (all) ranked by Users (#) , with Reach (%) and Devices (#)
Data for Last month (July 2016) on/via/using PCs

Rank	Subject	Users (#)	Reach (%)	Devices (#)
1.	Microsoft Corporation	180,310,737	73	215,352,164
2.	Google, Inc.	154,114,019	62	179,894,906
3.	Adobe Systems, Inc.	86,433,989	35	91,875,741
4.	Mozilla Foundation	67,183,591	27	76,184,072

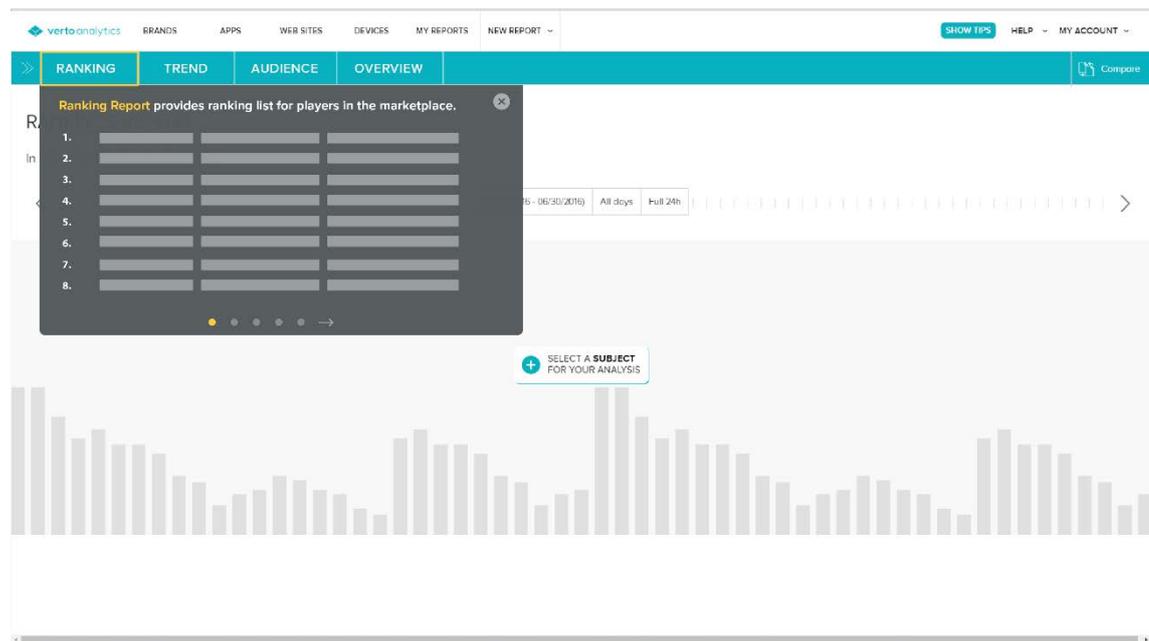
Picture 20: UI suggestions for dashboard tutorial – see more ranking (Liu,2016)

Once the UI elements and interaction flow set, animation is considered for the information that are hard to understand for the novice users. Transitions have been also take in to consideration to ensure the smooth switch of the UI elements. When a user clicks through the arrow on the button of tutorial tab, information in the tutorial tab and highlighting frame will be animated to fits the context. Tutorial tab slides in with a subtel pop-up transition and exits in a reverse way. Switching movement of the highlighting frame is designed as well. The animation prototype is produced in Adobe After Effects, click following link to see the animation demo: https://youtu.be/P9UQ3HWZ_JU

The same UI style of the tutorial is also applied in new report page. In the new report section, current UI only allows the users to create a new report after the report type is selected. Users will see different configuration menu options for different reports. As resulted in the usability tests, the limitation of this user flow and UI design is that user may start with a wrong report, and they are not able to create expected report due to the differences in the configuration menu for different reports. In many occasions, participants have a clear idea of what to select as subject and metrics but they are able to decide which report type they should select first. Therefore, once users chose a wrong report type, they will have hard time to see what they want to reporting in the Monitor.

To solve these usability pain-points, I provided a design proposal to change the user flow and UI in order to reduce the hierarchy between report type and report configuration menu. I suggest to place report type and configuration menu in the same hierarchy of the user flow. Meanwhile, users can see an interactive tutorial when they landed to the new report page or click on a button of 'show tips'. The tutorial aims to demonstrate the differences between the report types by showing short text explanations and animated visual indications.

Below is a UI prototype:



Picture 21: prototype for the tutorial of new report UI suggestion – ranking report (Liu, 2016)

The tutorial behaves in the same fashion as in the dashboard tutorial. Once the tutorial has been triggered, explanations of report type in both text and illustrative way are displayed. As in the dashboard tutorial, animations which are applied on the UI elements are meant to illustrate report type and to indicate the changes of the highlighting area. Report type animations clearly demonstrate the meaning of rank, trend, audience and overview reports. Transitions of the tutorial tabs and switching between report types are shown whenever an iteration occurred from the user. Click here to see the full animation of the report type tutorial: <https://youtu.be/dJ35sQ5Qf-Y>

Loading

In the web animation theory part, I have studied importance and usage of the loading animations. Amite summarizes that one of the functionalities of web animation is to inform

the users their current contact in the system at any given time. Animation should show a clear feedback to indicate that the process has initiated, present on going feedback while the process is in the progress, estimate the completion of the process and show clear feedback that the process has terminated. Jerry Cao also describes that animation serves well to distract user's attention when your site is loading.

In Verto Monitor, loading interface is a completely isolated UI. There is no visual transition before and after the loading. Once the loading is completed, the new report just suddenly appears to user. Loading occurs by any modification that the user does for the report. No matter applying a new selection or just sorting out a data table, the entire report screen replaces by the loading interface until the changes have been applied. For example, when user click to sort the ranking tables, the entire table disappeared, so user will not see any data during the report loading time. Furthermore, there is no indications of the loading time or progress besides a static loading interface. Thus, it saturates the feeling of the slow speed.

Monitor is a BI tool that capable of producing and generating big amount of data in order to show holistic reports to the users. Depending on the contents of the report which the user wants to generate, loading time of creating the report can be as short as a second, or as long as ten minutes. Therefore, a thoughtful design of communicating loading time to user is one of the important aspects of Monitor usability. I propose two types of animations for the loading interface: applying a loading bar when the loading time is short, and an animated loading icon when the loading takes long time.

In current Verto Monitor, there is a loading bar appears when user lands to a new page. The loading bar shows in the same way as in Youtube and Chrome browser. Thus, I add a loading bar on top of report section as shown in below prototype. The loading should progress according to the loading time, meanwhile report UI (data table or graph) stays the same until the render of the new report is completed. The reality is we do not know how it might take for the loading time, therefore the visual indication for the progress is passive – the loading bar will load fast at the beginning, and slowdown in the middle of the progress to earn buffer for the loading. Once the loading complete, progress bar continuously reaching to the end and fading away at the same time. Click on the link to see the animation prototype for the loading phase:

<https://www.youtube.com/watch?v=NtRZcMqAyIM>

In USA , Top 50 Brands (by Parent) → Facebook, Inc. (all) × ranked by Users (#) × , with Reach (%) × . Data for June 2016 on/via/using Smartphones

< (06/01/2016 - 06/30/2016) All days Full 24h >

Rank	Subject	Users (#) ▼	Reach (%)
1.	Facebook	149,613,303	60
2.	Facebook - External Traffic	107,533,628	43
3.	Instagram	74,869,440	30
4.	WhatsApp	15,702,366	6
5.	Instagram - External Traffic	3,452,235	1

Picture 22: UI prototype for report loading bar (Liu, 2016)

As mentioned earlier, sometimes loading time in Monitor can take rather long time if the user is creating a heavy data report. In that case, we would like to inform the user that loading will takes long time, user could go do something else before the report is ready. In current monitor UI, there are static texts shows the report tile and a sentence of ‘go grab a cup of coffee’. To deliver the loading message clearly, I take away the report title in loading UI as the title is already showing on top of the report section. To convey the message of long loading time, an icon of coffee cup is displayed. Animated steams on top of the coffee cup shows together with the message of ‘it takes forever, how about grab a cup of coffee’. Using Animation here is meant to attract attention from the users, so that they can see the message and be prepared for long loading time.

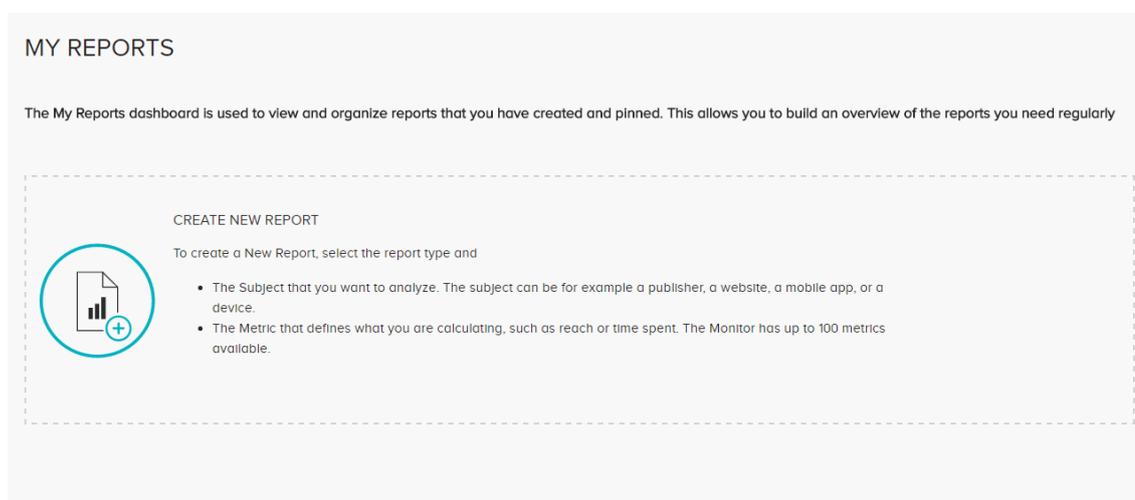
Rank	Subject	Users (#) ▼	Reach (%)	Devices (#)	Installations (#)	Update Installations (#)	Uninstallations (#)	Sessions (#)

Picture 23: long loading time. (Liu, 2016)

Click the link to see the loading animation prototypes: <https://youtu.be/5fe1Tcn86no>

New report icon

As shown in the test, it is a significant usability issue in my report page that the ‘new report’ icon seems intractable but is not clickable. Majority of the participants try to click on the ‘new report’ icon to create a report.



Picture 24: Screenshot of the my report page (Liu,2016)

As shown in the screenshot above, the icon has a stronger indication than texts on the right-hand side to the users. The design of the icon is also similar to the call to action button which users could interactive with in the target group page. Thus, we decide to enable the icon as a clickable button which can trigger the new report page and allow user start to create report. Once the button is clicked, the blue underline on the menu bar transits from ‘my report’ page to ‘new report’ page. This way, users are informed changes. Click to see the prototype animation. <https://youtu.be/WbSTtb499U0>

Adding transition for report title

In the Monitor, each report has a report title to describe the subject, metric and other criteria of the report. There are many ‘hidden’ features applied to the report title.

- Selected subject (s) and metric (s) are shown in turquoise texts, user can click the ‘X’ behind each selection to remove it from the report. Though other selectable elements from the configuration menu are not clickable, such as breakdown, filter, etc.
- Moreover, when a user clicks on the subject, he or she will land to an overview report of the subject, though this change done without any feedback to the user before or after the action.
- Tooltips of the metrics pop up inexpertly when user mouse-hover the metric selections in the title.

The intention of having a report title is to show report in a more understandable way and help the users to manipulate the report easier than in configuration menu, but the clickable

keywords, unified visual styles and hidden links led user to confusion. As seen in the usability test, it's challenging for users to acknowledge content of the title and its features.

Below is a screen short of current UI of report title:

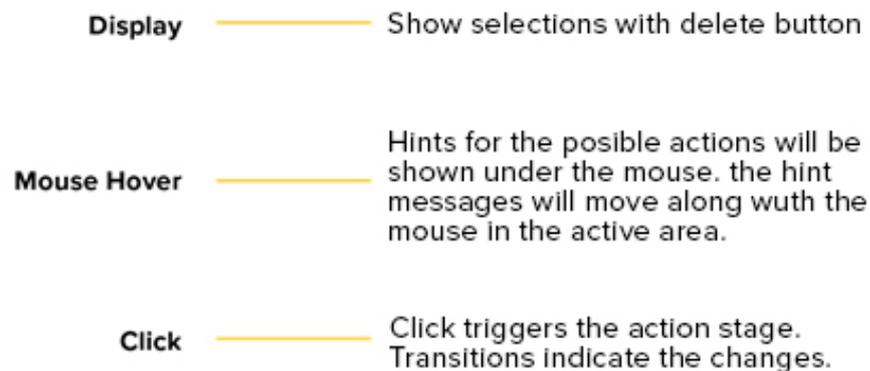
RANKINGS REPORT

In USA , Top 50 [Apps \(by category\)](#) → [PRODUCTIVITY \(all\)](#) × , ranked by [Users \(#\)](#) × , with [Reach \(%\)](#) × . Data for May 2016 on/via/using Android

Picture 25: Screen short of report title in current Monitor (Liu,2016)

It's clear that by only adding animation or transitions cannot solve this usability issue. Instead, using animation is part of the solution. I start design the solution by re-organizing the logic flow of the interactions and unify the UI elements in the title.

There are three stages considered in title: display, mouse-hover and click as shown below:



Picture 26: logic flow for Report title three stages. (Liu, 2016)

In display stage, UI should be self-explanatory and consistent, meaning that all report selections behave in the same fashion, not just subject and metric selections. Selection frame out as tab to indicate the user can delete the selection as wish. See below prototype of title in display stage:

RANKINGS REPORT

In USA , Top 50 [Productivity apps \(category\)](#) × , ranked by [Users \(#\)](#) × , with [Reach \(%\)](#) × . Data for May 2016 [using Android](#) ×

Picture 27: new UI suggestion for report title. (Liu, 2016)

In mouse hover stage, tooltip will show the feature that will be trigger by clicking. Meaning of the metric should not show in tooltips of the title. The tooltip should show when the mouse is in the clickable area. This way, users are well informed before click on any selections. See UI prototype in below:

RANKINGS REPORT

In USA , Top 50 **Facebook Messenger (App)** × , ranked by **Users (#)** × , with **Reach (%)** × . Data for May 2016 **using Android** ×
Open its overview report

Picture 28: new UI suggestion for report title – mouse hover subject. (Liu, 2016)

RANKINGS REPORT

In USA , Top 50 **Facebook Messenger (App)** × , ranked by **Users (#)** × , with **Reach (%)** × . Data for May 2016 **using Android** ×
add more metrics

Picture 29: new UI suggestion for report title – mouse hover metric. (Liu, 2016)

RANKINGS REPORT

In USA , Top 50 **Productivity apps (category)** × , ranked by **Users (#)** × , with **Reach (%)** × . Data for May 2016 **using Android** ×
Delete

Picture 30: new UI suggestion for report title – mouse hover delete. (Liu, 2016)

Animation is applied for smooth transitions when user triggers an UI changes by clicking. In the click stage, when a user clicks on metric selections in the title, the metric selection in the configuration menu slides open. When the user clicks on subject, an overview report of the subject renders for the subject. When the user clicks on the ‘X’ behind selections, the selection is deleted. If deleted selection is one of the compulsory selections, then the configuration menu slides open to inform the user to make a selection. The transitions for the report title can be implemented together with frontend developer without a video prototype needed.

5.3 Summary of the case study

The case study is a big scope project - I organize and conduct the usability test with the case company, summarize the usability pain-points, produce UI, interaction and animation suggestions to solve the selected usability issues. During the case study, I found few important things need to be take in consideration when implementing the web animations:

When it comes to explaining complicated features, or showing hidden features which cannot be indicated clearly by static visual elements, using animation is a better solution than using long text-heavy user manual or any still image tutorials. Some transitions must be considered, such as subtle transitions and loading animations. The subtle transitions play an important role of keeping user in the flow by providing immediate and consistent feedback to user interactions. Loading animation is not just to indicate the change of the content, it also informs user the loading process and time in order to let user feel that they're in control of the system.

There are many **UI animation prototyping tools** available in the market, such as Adobe Edge Animate, Adobe After Effects, Framer, Pixate Prototype, Justinmind Prototype, etc. For this study, I have used both Adobe Edge Animate and After Effects. Adobe Edge Animate were mainly used for producing UI transition prototypes. Unfortunately, Adobe stopped supporting Edge Animate in early 2016. In practice, I found Edge Animate is a good tool for simple transition prototypes, but not the best option for complex animation prototyping. Framer, Pixate and Justinmind are all designed for prototyping in mobile environment, so they were not viable tools that I could use.

For more complicated UI animations, After Effects is the tool I used to create quick prototypes. It is sufficient to demonstrate the design ideas to the production team. I produce a prototype as quickly as possible, then show it to the team for further iterations. Team then could review the design and determine the different possibilities of the implementation before writing any actual code.

If you work with an application and a team to maintain it, I would suggest having a set of standard **transition descriptions** for the ones that occur regularly in the interface, such as ease in, ease out, fade in, fade out, slide open, slide up, etc. Animation description documents the particular transition both in visual and programming way. It sets the standard for timing, speed and frames of the transition. Once the description has set, each description can be seen as an element of building up a more complicated animation. Applying consistent transitions throughout the application, it brings coherent experience to the user. Moreover, having the common terms which describe the certain transitions with defined time and speed helps the communication between design and frontend development.

Animation implementation is result of team work. To apply an animation, the designer and the frontend developer need to work closely and prepare for multiple iterations. Animation is a delicate result of applying time, speed and frames. Therefore, working closely between designer and developer helps produce most suited animation for both perspectives from frontend development and UI/ UX design. I have been sitting together with frontend developer and communicating while polishing the animations.

Test and test again. Testing is the best way to measure how well the new feature works. Test can be done via quantitative or qualitative method with users who fit into the product personas. Usability tests can be conducted with a small group of user in a cost-efficient way. It's beneficial to test out before the final design is completed. Test results directly show what could be improved further and what is clearly not working.

When there are multiple options for production team to choose from, AB test is a good way to help make the decision. Either in the design process or after the design has been launched, testing is an essential part of the product development circle.

6 Conclusion

The thesis study has lasted for ten months, including the theoretical research and practical studies. The initial study is to find out how could animation improve usability in web context. I studied usability from perspective of UX, UI, IxD and visual design and usability test as measurement. I then studied animation from tradition and web animation. During the practical study, I realized that animation should be used for improving usability issue only when static UI can't achieve the same result. Applying animation from design to implementation demands close team work. Thus, I conclude following points which should be taken in consideration when using web animation to enhance the usability.

When visual elements in the UI and interactions are carefully designed, animation can improve usability significantly in below situations:

- Enhance the visibility of the system status: Animation can help user be aware of what is happening in the system. Subtle motions during users' interaction indicate the immediate response from the system to users. Such as using animation indicate the loading progress of the system.
- Similarity between system and real world: Animation can let the users receive their interaction between mouse and screen as in the real physical world, thus enhance the usability of the system. Carefully designed speed, space and timing for the transitions are the essentials to reach that effects.
- Recognition rather than recall: Comparing with static interface, animation can help the users understand progress of a process or a complicated feature in a more explanatory way. Thus, having animated indication, users more likely to can carry out tasks from memory.
- Aesthetic and minimalist: One of the nature of animation is to explain complicated information without using heavy text. Therefore, using animation replacing a text content can provide a neat visual layout in the system.
- Help users to recognize, diagnose and recover from issues: as animation is good at drawing attention, using animation to provide a noticeable error message is very effect way to help user recognize the issues. A very common practice is animations that play when you typed in a wrong password to unlock the phone-screen.

- **Help and Documentation:** Although systems should be easy to use, it is often helpful if a ‘user menu’ is available to the user. Comparing a user menu with long texts which user may need to download, using an on-screen interactive tutorial to guide the users find their way in the system gives effective help to users.

As Jakob Nielsen says: usability does not exist in any absolute sense; it can only be defined with reference to particular contexts. Animation should be applied on top of thought through and self-explanatory UI elements. If the UI design is poor, animation should not be used as a patch to fix the UI design. Therefore, before deciding to implement any animations, the UI designer should first ensure that the visual elements and the interactions were well defined for the usage.

Limitation of the study:

As I put passion and spent long time to study the relation between web animation and usability, I also acknowledge the limitations of this study:

- The study is tailor made for a desktop browser tool which brings the limitation that I only focus on using web animation improving usability of desktop browser without considerations of usability in mobile browser.
- The original plan was to have two usability tests. Due to the change of company’s goal, the Monitor has been de-prioritised. Therefore, only one usability test was held. Thus, I could not exam the animation solutions through a quantitative way.
- Web-animation is an umbrella term for web-first technologies like CSS, JavaScript, HTML, Canvas and SVG that don’t require plugins. As an UI designer, I studied web-animation and usability purely from UI and UX perspectives without any further investigation in implementing the code. Therefore, this study doesn’t have much insights of how to implement web-animation.

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APPENDICES

Appendix 1. Survey for recruiting usability test participants



USER TEST SURVEY

[Verto monitor is a data reporting tool for media measurements. This survey is conducted to find suitable candidates who are willing to help Verto improve our product usability.]

Name:

Title:

Company:

Have you used any data reporting tools before?
Such as Google Analytics, comScore Direct, App Annie

Yes

No

Have you used Verto Monitor before?

Yes

No

Which data analytic tools are you familiar with?

(such as Google Analytics, comScore Direct, App Annie, Hitwise, compete, TNSmetrix, SimilarWeb etc.)

Name of the tool:

When did you start using it: [year]

How familiar you are with above mentioned tool?

- I know the basic features.
- I know some of the features well.
- I know most of the features well.

How often do you use it?

- I use it on a daily basis.
- I use it on a weekly basis.
- I use it on a monthly basis.
- I use it several times a year.

Is there other analytic tools that you are familiar with?

Name of the tool:

When did you start using it: [year]

How familiar you are with above mentioned tool?

- I know the basic features.
- I know some of the features well.
- I know most of the features well.

How often do you use it?

- I use it on a daily basis.
- I use it on a weekly basis.
- I use it on a monthly basis.
- I use it several times a year.



USER TEST SURVEY

[Verto monitor is a data reporting tool for media measurments. This survey is conducted to find suitable candidates who are willing to help Verto improve our product usability.]

Have you used more analytic tools?

(such as Google Analytics, comScore Direct, App Annie, Hitwise, compete, TNSmetrix, SimilarWeb etc.)

Name of the tool:

When did you start using it: [year]

How familiar you are with above mentioned tool?

- I know the basic features.
- I know some of the features well.
- I know most of the features well.

How often do you use it?

- I use it on a daily basis.
- I use it on a weekly basis.
- I use it on a monthly basis.
- I use it several times a year.

If you have experience with any other data reporting tools, please tell us the name of the tools:

Would you be interested to help us improve Verto Monitor's usability?

- Yes
- No

Please leave your contact information:

Mobile:

email:

Appendix 2. Task list

Impression questions:

1. What do you see at first when you log in?
2. Then please briefly browse through the menu and explain what kind of contents are displayed on each page.

Scenario:

You are a business strategy consultant for a company in the gaming industry. The company has the resources to develop a game which is targeted for female users in the U.S. market. You need to analyze the gaming market by using the Verto Monitor. You can now start using the Verto Monitor.

A. You want to have a general understanding of the big players in the gaming industry. Using the Verto Monitor, find the top 100 games with the most players in the U.S in December 2015.

Q A1: Which game had the most players in December 2015?

Q A2: Now narrow down the top list to consist only of iOS games. Which one had the most iOS users in December 2015?

B. 'Candy Crush Soda Saga' is a popular game among females. You want to see the how the popularity of that app evolved during November and December 2015.

Q B1: During the two months, on which day did Candy Crush Soda Saga have the highest reach?

Q B2: What was the split of the reach among male and female players?

C. You want to know which of the following games has the most female players aged 20-39 during December 2015: 'Cookie Jam', 'Panda Pop' and 'Clash of clans'.

Please save the report C, which you will show to the client later.

Appendix 3. Moderator scripts

Thank you for agreeing to take part in our research study. My name is Caroline and this is Antti. During the rest of the session, I'll be working from a script to ensure that my instructions to everyone who participates in the study are the same.

I'm here to learn about how people create report in Verto Monitor for the first time. In this session, we'll have you do typical tasks, to learn how Verto Monitor work for people like you. Please keep in mind that we're not testing you—it's you who are helping us evaluate the software. As you explore the Verto Monitor, please try to do whatever you would normally do.

We will use 'think-loud' method during the test. Just tell me whatever is going through your mind. Describe what do you see, what do you want to do and why do you do so. Please know that there is no such thing as a wrong answer. You're doing this helps us understand what works or doesn't work about the Verto Monitor. Also, please don't worry that you're going to hurt our feelings. We're doing this to improve the site for all of our users, so we need to hear your honest reactions.

If you have any questions as we go along, just ask them. I may not be able to answer them right away, since we're interested in how people do when they don't have someone sitting next to them to help. But if you still have questions when we're done, I'll try to answer them then.

With your permission, we're going to record what happens on the screen and our conversation. The recording will only be used to help us figure out how to improve the site, and it won't be seen by anyone except the people working on this project. Also, there are a 3 of my colleagues observing this session in another room.

The whole session will take about one hour. Do you have any questions before we begin?

Demonstrate the technique first, so that participants feel less self-conscious.

Question template:

- What are you thinking right now?
- You seemed surprised/puzzled/frustrated, what happened?
- Exactly how did that differ from what you expected to happen?
- Would you expect that information to be provided?
- How close was that to what you expected?
- Could you please describe what are you thinking now?

- is there alternative way to...?
- When you are lost in Monitor, how could help yourself to get around?
- Did you find anywhere that could help you?