

Pre-visualization as a Tool for Visualization: A Thematic Analysis of Experts' Perspectives

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ABSTRACT

This paper presents the findings of a thematic analysis of various facts, opinions and conclusions from experts, regarding the application of visualization and pre-visualization in design process. The objective of this paper is to analyse pre-visualization as a tool for visualization as well as to understand the significance of the practice of pre-visualization in the context of visualization. A qualitative research was done which involved examining the diverse views of a range of experts. The research attempted to analyse pre-visualization as an emerging field of study and its application from several distinct perspectives. The analysis was initiated based on the codes and themes emerged and the inferences were drawn. This study analysed the views of experts, about the effectiveness and significance of pre-visualization as an extension for visualization that is already in practice. It was observed that pre-visualization is a dynamic tool, with similar traits like any visualization tool and it supports creativity, helps in communication and collaboration of ideas.

Keywords: Design process, Pre-visualization, 3D Animation, Visual communication, Visualization

I. INTRODUCTION

The stage of visualization is important in any design process. "Visualization offers a method of seeing the unseen" (McCormick. 1987). Designing is considered as a creative process and visual reasoning is the fundamental aspect of design process. It is an iterative process which consists of seeing, imagining, and creating visual form such as drawing; it is a process of understanding, analysing and synthesizing in mind. The drawing represents the synthesis results, and the seeing process to analyze the drawings. (Oxman 1997)

Problem solving is the key outcome of any design process. Since the design process is creative, it can be considered as a creative problem solving, which consists of initiating concepts, developing it and reaching a meaningful solution through synthesis.

Visualization is the process of interpreting mental images into visible form ("Dictionary And Thesaurus | Merriam-Webster"). Visualization plays a key role in the concept development. Designers use sketches and drawings in order to create visualizations. Sketches can be either simple or detailed. Visual representations help us to make sense of data and therefore produce better information (Mazza, 2009) (Wilson, Stephen 2002).

Design practice requires dynamic skills. Creativity is most desired skill among designers and it is vital in the success of a designer. The depth of core competency and interdisciplinary nature of current designers' portfolio are important and they have to also deal with the fundamentals of designing such as power of storytelling and prototyping. "Fail early to succeed sooner" underlines the importance of this segment of the design process (Brown, 2009). The mental images, thought and content representations are the integral part of design

process (Pylyshyn,2003). The different types of visualization tools are available which helps in converting data into more meaningful information (Steele and Iliinsky, 2010)

Pre-visualization uses 3D software to create visuals and represent virtual environment. The complex mental images can be translated into less complex scenes, so that the understanding will be easier hence cognitive load is less (Lemon 2011), (Steele and Iliinsky, 2010). It helps the designer in his idea development and further improvement of the design. This study attempts to find an opportunity for a visual designer and techniques like pre-visualization to mediate in the design process. The effectiveness of Previs under discussion, the researcher is investigating the importance and effectiveness of this tool, and trying to expand its application to new areas.

1.1 Pre-visualization

The pre-visualization is defined as how something will look when created or finished using computer graphics (The Oxford Dictionary). In the field of movie making, this is known as Previs/Previz. It is a collaborative process that generates preliminary versions of shots and sequences using 3D animation tools. It is a graphical representation of a design element or a process before the final production (Previsociety.com). Previs reduces the ambiguity of the design elements, by creating rough version of the design and animation using 3D animation tools. Previs can ease the workflow and reduce the workload and thus, saves time and cost. Previs allows filmmakers to create quick, detailed, computer-animated versions of scenes; before time and resources are committed to the actual filming (Lemon 2011).

II. CONTEXT AND SCOPE

The study is broadly related to visualization, in the context of designing and exploring pre-visualization and its attributes as a tool for visualization and the significance of pre-visualization in the context of visualization and design process. The present work is fundamentally based on a possible association and the position of pre-visualization in the larger framework of visualization

Much work has been done on visualization and visualization techniques based on traditional visual representations like drawing. The current research is to enhance the power of the designer with relatively new visualization tools.

Visualization helps the designer in his idea development and further improvement of the design. It also enhances the communication among the team or group. Previs is an effective tool in film making. The technicians from Hollywood discuss the role of Previs in current film making and are appreciating its significance in the production (Smpte.org.) Different variations of Previs is existing now, to help the visualization process in order to make the process of design much easier and accurate (Previsociety.com).

III. ROLE OF VISUALIZATION RESEARCHERS IN DESIGN PROCESS

According to Goel (as cited in Seitamaa-Hakkarainen and Hakkarainen, 2000), “Using several visual representations (i.e., thinking sketches, prescriptive and final sketches), a designer generates alternative solutions and tests them before bringing the designed product to production” (Seitamaa-Hakkarainen and

Hakkarainen,2000). Goel (1995) suggests that ambiguity is one of the key factors because it allows the seeing of new possibilities in the representations, in other words, re-interpretations.

The importance of visualization in a design process was underlined by Goldschmidt. One of the most influential views is that sketching is a dialogue between the designer and what the drawings suggest (Goldschmidt, 1991). Use of digital drawing tools and design software for visualization is common practice now, but in the earlier times because of the rigidity of initial digital design tools, designers used to stick to freehand sketches for pure concept development. The argument is supported by Lawson (1997). There was resistance in the beginning, to use computer graphics as visualization tool; may be because software capabilities were not robust enough during that time.

Design process can be enhanced with the use of digital technologies and tools which greatly influence the outcome (Mitchell, 1997). In the mean time, computer technology continued to impact the traditional design process in many ways (Lee, 2004). Most important is the possibility of using computer aided design (CAD) to develop ideas in early design stage. In this context this paper attempts to find out the significance of pre-visualization in the context of visualization.

IV. METHODS

The inquiry was based on qualitative approach. Strategy of inquiry was Hermeneutic i.e, it is the search for unifying ideas through an exploration of opinions of experts which involved relevant investigation methods. The data collection methods and sampling strategies are used to identify the relevance of data and the thematic analysis was used for drawing inferences and to arrive at the final conclusion.

The opinions of the experts in the field of visualization and design is used for thematic analysis. In order to supplement data, additional excerpts from websites and books are also used. Thematic analysis is widely used in qualitative research. It is a method for identifying, analyzing and reporting patterns within data (Braun and Clarke 2006). The sample is purposive rather than exhaustive because the purpose is interpretive explanation.

The study starts with gathering of right data, it is most crucial to get the data right and appropriate. The researcher then makes sense of it and familiarize through careful reading and analysis. The initial codes can be generated from the data extracts derived from the data items. The search for themes will be conducted and refined ones will be reported. The themes that are emerged will go through a review process and a careful analysis and the final step is to generate a comprehensive report.

The data collection was started with gathering information related to the visualization and pre-visualization such as journal papers, books and web content. This information will act as data corpus, which refers to all the data collected for this study. The content is carefully selected for data corpus in order to maintain the focus to a particular domain such as visualization. The papers and materials of data corpus is again filtered and identified to fulfil a particular criteria, that is considered as a Data set. In this case, all selected papers and materials are considered as data set. A data set consists of many data item. A specific article can be considered as a data item. After a thorough examination of each data item, the conclusion or an opinion can be extracted that is used for further analysis such as thematic analysis. The following pyramid shows the steps involved in the extraction of data (Fig. 1).

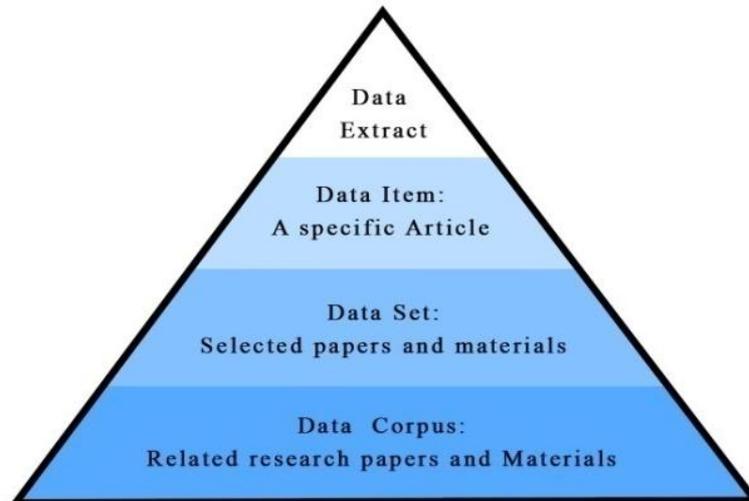


Fig. 1: Pyramid illustrating data extraction

V. ANALYSIS

Thematic analysis is an analysis based on identifying codes and pinpoint themes within that coded data through a thorough examination. The thematic analysis can be used in any context since it is not attached to any particular theoretical framework.

The process includes examining the data which is in the form of transcripts and ascertaining the relevance of the content for acquiring data for the data corpus. The extracted data is then organized according to the relevance, and documented in a tabular form to analyse it. It then involves exploring the coded information for probable patterns and determine the themes associated with it. The data collection during the primary stage of the work itself is considered as a part of the analysis due to the connection or the relevance of the material which will decide the outcome of the study. The researcher uses his prior subject knowledge, understanding, reasoning and observations to validate the material, subsequently the codes and themes emerge from it.

The data extracts were organized in a tabular format as in Table 1 for the careful analysis and finding patterns within the data. The code related to visualization and pre-visualization primarily showed a connection to the communication aspect of human beings. The thinking, and cognition aspects are also discussed by various visualization researchers. The diverse opinions from the researchers converge in the aspect of communication, which is the primary requirement of any visualization and pre-visualization. As expressed by Tim brown and Barry Katz, visualization enhances creativity. Similar views are found in various observations. Since it is deals with non-visual data, it relies on the connection with visual arts, aspect of iterative process, application of colour theory, different presentation styles, application of new technology which are apparent in the evolution of visualization and pre-visualization. Also digital technology such as computer graphics, 3D animation, digital display, static and dynamic visualization are also evident in the development of visualization and pre-visualization. The primary goal of drawing as a visualization tool was to represent the data and information but it was also used for enhancing creativity, communication and for better collaboration among design teams. The collaboration part of communication is utilised in the application of story boarding and later in animatics - the animated form of storyboarding. In this study, a large number of opinions from experts who were associated

with visualization and certain views about pre-visualization were analysed. Sample data for thematic analysis is depicted in Table 1 which illustrates the codes and refined themes that is generated from the data.

Table 1: Sample data for thematic analysis

Expert Perspective (Data Item)	Refined themes from codes (Creativity, Communication & Collaboration)		
	Creativity	Communication	Collaboration
Characteristics and different kinds of visualization (Kosara et al., 2008)	Based non-visual data.	Produces Output image, Recognisable output	Tools for collaboration
Visual data stories, and complex data (Kosara and Mackinlay, 2013)	Visual data Stories	Preserving information, Passing knowledge	Data collaborating Processes
Previs and filmmaking (Lemon 2011).	Computer-animated versions of scenes	Use to improve communication among crew	Helps in Planning and shooting
Visualizations, computer graphics and iterations (Kim Hyun-jung and Lee, Hyun - Ju , 2011)	Use of computer graphics to refine visualizations	Computer in communicating ideas	
Modern visualization theory and associated theories (Ziemkiewicz, C, et al. 2010)	Creativity and visual theories	Common visual theories and communication	Theories as collaboration tools
Categorization of 3D visualizations (Kjellin et al., 2010)	Static & dynamic visualizations	Effective in visualizing qualitative information	Communicating qualitative information
Increased use of 3D representations (Forsell, C. 2007)	Use of 3D computer graphics	Use of computer graphics for communication	Computer graphics for collaboration of ideas
3D computer modelling and students' learning experience (TAKAYAMA, 2004)	Enhanced the problem solving strategy	3-D computer modelling in teaching,	Communicating to a larger group
Graphical representations and grasping data and information (Norman 1993)	Graphical representation as external aid	Helps in communicating abstract data	Convey abstract data
Types of visualization and definition (Renata Lis 2014)	Mental process & iconic representation	Presentation of information (both Static and Dynamic)	Architectural and 3D visualization
New design technologies for creative expression. (Walters and Thirkell 2007)	New design technologies & creative expression	Creative expression & communication	Creative expression & collaboration of ideas
Definition of visualisation Hoffler (2010)	Non-verbal illustrations and animations for symbolic ideas	Visuals for applied learning	Illustrations and animation for collaboration
Advantages of computer based visualization tools (2D&3D) (Hegarty, Kriz & Cate 2003).	Design process is complex and iterative	Visualizations support more interactions	Reach to more audience
Animated in contrast to static pictures .(DianK.Putri 2011).	Enhancing cognitive process	More engagement from learners	Communicates to more people
Application of animations and static drawings as representaions Höffler and Leutner (2007)	Animations as better representations	Animation can communicate Motion and time	
Well-designed animated display (Bétrancourt & Tversky (2000))	Facilitate to draw inferences	Facilitate to draw inferences	
Depth processing and comprehension (DianK.Putri	Representing depth	3D visualization helps in the communication of	

2011)		depth	
Definition of Visualization ("Dictionary And Thesaurus Merriam-Webster")	Interpreting Mental images	Communicating through Visible forms	Convey information to an audience
Pre-Visualization - Definition ("The Oxford Dictionary").	Iteration of idea through imagery	Enhancing communication	Share information to an audience
3D graphics visualizations for clients (Jie Yan 2014)	Extended possibilities of visualization	3D visuals for better communication	Helps clients to comprehend for the clients
To increase the validity of visualization results. He, Yang, Shifley, and Thompson (2011)	Detailing in representation reduces the ambiguity		
Previs in planning , digital special effects and practical effects (Price 2015)	Effective in planning special effects	Previs communicate better than story boards	Technicians' tool for collaboration
Movement, a powerful means for highlighting (Ware 2004).	Stimulus and visual sense	Movement is a powerful mean for highlighting	
The visual representation and plausible solutions (Seitamaa-Hakkarainen, 2000)	Visual representations & creativity	Designers tools for achieving solutions	
3D modelling helps in more accurate planning (Russ 2017)	Helps in visualizing and creative expression	Representation of Camera movements	Helps in more accurate planning
Previs definition ("The ASC -- American Cinematographer: Assessing Previs:")	It enables filmmakers to visually explore creative ideas	Use preliminary versions of shots to improve planning	Helps in communication among team
Previs- definition ("PREVIS SOCIETY ASIA")	3D graphics based on concepts	Helps in Storytelling,	Collaboration tool like storyboard

VI. CONCLUSION

The experts' views are based on visualization and pre-visualization and some views are the larger context of visualization and shows some prominent codes related to visualization. A close examination of codes revealed different themes. The prominent themes listed here are creativity, communication and collaboration.

Various codes such as non visual data, mental images, drawing, computer graphics that emerged from the different expert perspectives clearly showcase the significant aspects of visualization that assists and enhances creativity. Visualization helps in seeing the unseen, creating iterations and analysing it before arriving to the final concept of design (Oxman 1997).

The communication aspect of visualization is clearly evident through the codes such as drawing, use of computer graphics, visual theories, representation of qualitative information, communication of abstract data, visual aids and storytelling etc.

Collaboration is another theme emerged from the analysis from the codes such as planning, illustrations, 3D animation, architectural animation, communication with clients and team. Visualization can be used to convey, organise and to collaborate different ideas. The communication of ideas to a client, to a team or to a larger audience for the purpose of better understanding or planning especially when communicating abstract and qualitative information and sharing of information, visualization can be used as a better tool for comprehension.

The findings from the study advocates that, pre-visualization assists creativity, communication and collaboration. In fact these attributes makes visualization an important phase in a design process. The study confirms the role of these attributes. The visualization researchers firmly declare that the visualization is an integral part of any design process. Earlier studies proved the significance of drawing as a visualization tool. The evolution of visualization tools occurred in the form of innovative methods such as storyboard, animatics and later Pre-visualization (Previs/Previz) which is a graphical representation of a design element or a process before the final production using a 3D animation software, in the form of a movie. It is a systematic expansion, evolution and development in the paradigm of visualization.

This study analyzed the significance of pre-visualization and observed its significant effect on human cognition like other visual representations. Application of pre-visualization in the movie industry is one of the direct evidence for its significance, so it can be considered as an extension of visualization. Even though Previs is effective and significant in a design process, it has to be utilized properly to solve the problem in hand, similar to right-tool right-time concept (Do, 2005).

The advent of technology creates new areas of opportunity and easy availability of 3D software tools which is almost free to use and some of them being open source. These software can be used to create pre-visualization and can be utilized effectively in new areas. Pre-visualization based on 3D animation can be seen in different situations with minor variation and form i.e, to visualize the end product for clients, to present most accurate view for architectural representations, to represent a movement and to enhance the perception of three-dimensional shape and structure.

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