Analysis of Previsualization Tasks for Animation, Film and Theater

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ABSTRACT

Previsualization (previs) is an essential phase in the visual design process of narrative media such as film, animation, and stage plays. In digital previs complex 3D tools are used that are not specifically designed for the previs process making it hard to use for creative persons without much technical knowledge. To enable building dedicated previs software, we analyze the tasks performed in digital previs based on interviews with domain experts. In order to support creative persons in their previs work we propose the use of natural user interfaces and discuss which are suited for the specific previs tasks.

KEYWORDS

previsualization; user requirements; natural user interface; animation; film; theater; interview; workshop

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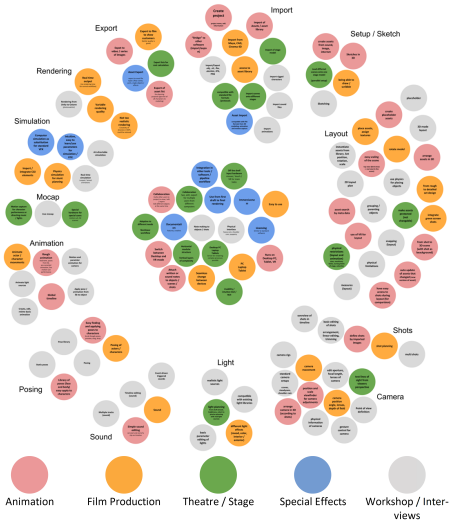

Figure 1: Circular arrangement of all requirements assigned to workflow steps. For details see supplementary files

[1]https://www.autodesk.com/products/maya

[2]https://www.autodesk.de/products/autocad

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INTRODUCTION

Narrative media disciplines such as film, animation, and theater use a profound planning phase for the visual outcome of a production to explore ideas, plan technical solutions, and communicate a shared vision. This planning phase is referred to as previsualization (previs) [6]. Previs gains increasing popularity through the steady advancement of technology and most of today's previs work is done digitally. Digital previs brings the advantage of precise planning, producing high-quality visual output and the ability to use the results of the previs phase in the production process later on.

Typically, complex 3D tools such as Maya[1], AutoCAD[2] are used for previs. However, the use of complex 3D tools requires skilled technical users excluding creative, non-technical users such as artists, designers, directors from the previs production process. Therefore, many iterations of designs and communication between creative personnel and technical staff is required [4]. The 3D tools used in the application domains are not designed for the previs process but rather are general 3D tools for high quality 3D modeling, design and animation. They offer a wide range of functionality and options, many of them focusing on very specific tasks which are not necessary in the previs production. Offering all these functions in a standard 2D interface makes the use in the previs context unnecessarily complex. In addition some of the functions required in previs are not supported by standard tools and workarounds have to be used resulting in complex workflows or the implementation of custom functionality.

In order to enable the development of previs software that is tailored to the previs process and offers the specific functions that are required, we investigate the specific tasks performed in digital previs. Furthermore, to enable creative persons without much technical knowledge to use digital previs software we discuss the use of natural user interfaces (NUI) for previs tasks. The interaction with NUIs is described as intuitive [5] and makes use of the humans inherent capabilities to express themselves by their body, gestures and speech [2, 3, 9]. Such interaction can be suited for the interface of previs software that speaks the language of artists instead of technicians.

In interviews with domain experts from the application domain of film, animation and theater we collect the tasks and workflows performed in digital previs. We aggregate and analyze these tasks to present a consistent set of previs tasks that should be supported by a dedicated previs software. We identified 20 core tasks presented in an overall workflow. We discuss possible natural user interfaces to support easy and intuitive interfaces for the presented tasks. We contribute a detailed analysis of

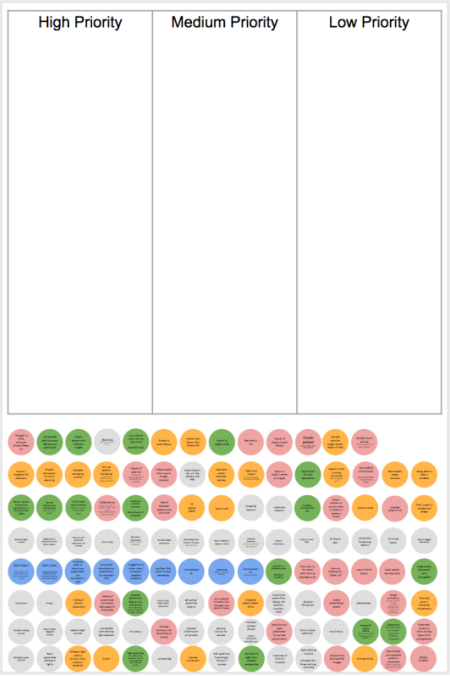

Figure 2: Prioritization template showing color-coded requirements at the bottom and three priority categories.

the digital previs process in three application domains and suggestions for supporting these tasks with NUIs.

IDENTIFICATION OF PREVIS TASKS

We aim to provide a set of core functionalities, that a previs software would have to offer in order to be sufficient and usable. We employed a structured methodology consisting of the following steps: 1. *Extraction of user requirements from interviews using personas, use cases and scenarios* - 2. *Workflow Generation* - 3. *Prioritization* - 4. *Categorization.*

Tasks in Animation

To get an insight in the daily routines and tasks that are typical for the professional animation domain, we conducted interviews with three different experts: an animation supervisor, a layout supervisor and an editing supervisor. One key requirement derived from the interviews was the capability of creating and working on projects containing information regarding scenes, shots, layout, animations, cameras and effects that can be shared with coworkers. Moreover, the experts identified the option to import different kinds of media such as texts, images, videos and 3D models as essential. Additionally, scenes and shots, the fundamental building blocks of any animation project, should be integrated into a timeline interface. For the purpose of communicating and sharing ideas with team members, it was required to attach annotations in the form of voice and text to objects in the scene. On top of that, the interviewees emphasized the need for exchange of content between the software and other standard industry applications. Final requirements expressed by the experts were export of asset lists, integration of motion capture technology and the use of VR for sketching and lay-outing.

Tasks in Film & Commercial Productions

For the application area of film and commercial productions, we conducted interviews with five domain experts including a professional producer, a set designer, a cinematographer and two directors. Sketching ideas was identified as one of the core tasks and starting point in previs for the film domain. Besides supporting the sketching process itself it was also required to allow users to import data sets from CAD software. To enrich the scene with objects and props, designers have to have access to a library of various assets. Another crucial task identified during the interviews was planning for character actions that would later be performed by real actors. To achieve this, animation experts have to able to select different character models and visualize their motions subsequently (e.g. by drawing a path for the characters to follow). In addition to that, it should be possible to design different light and camera setups with a variety of light colors, themes and lenses. Since modern film productions are concerned with the generation and integration of computer generated images (CGI), the incorporation of these elements was identified as another substantial requirement for the

Figure 3: Prioritization of requirements by the domain experts. For details see supplementary files

software. Further software requirements that were extracted from the interviews were exact physics simulation for stunt planning, high rendering quality for movie exports, hardware flexibility and clean UI design.

Tasks in Theater & Stage Productions

Eight domain experts were interviewed in the process of identifying tasks typical in theater previs. The main difference in theater productions compared to film is the fact that staff members are working on a single immobile asset - the stage. Naturally, import and export of accurate 3D models in industry standard formats is a crucial requirement for the software. Besides importing and working on a stage model, the technical and physical limitations of the stage should be represented as well. This way, set designers can guarantee visibility for the audience from all seats and make sure that it's impossible to peek behind the stage drawing the attention to set props. Generally, the interviews revealed that theater productions share many common tasks with the film domain. In both application areas, substantial requirements involve the light setup, integration of CGI, communication between coworkers and intuitive UI design.

Workflow Generation

Once the definition of user requirements based on expert interviews had been concluded, we organized a workshop including domain experts. For the purpose of obtaining functional requirements that could not be identified during the interviews, we made use of the MoSCoW Analysis [1], which provides a categorization into *must have*, *should have*, *could have* and *won't have*. Ultimately, we summarized a set consisting of requirements that originated from the interviews as well as the ones that were specified in the workshop. For reasons of organization and comprehensibility, we generated index cards and used color-coding as a means of indicating the origin of each requirement, see figure 1. With the help of a card sorting approach [8], the team assigned each card to a specific workflow step. This way, we compiled a circular workflow map including the steps: import, setup/sketch, layout, shots, camera, light, sound, posing, animation, motion capture, simulation, rendering, and export. Requirements that couldn't be associated with a single individual step were placed in the center, see figure 1.

Prioritization and Categorization of User Requirements

In total, we identified a collection of 118 different user requirements in the interview and workshop phase. Since the overall objective is to build a software based on these requirements, a thorough prioritization was obligatory. For the rating process, each domain expert received an empty template, containing all 118 requirements as well as three columns labeled *high priority*, *medium priority* and *low priority*, see figure 2. Ranking scores were assigned to each requirement: three points for high, two points for medium and one point for low priority. Upon completion, average scores for each requirement

Table 1: Definition of the core previs tasks

Project Structure: Organization of previs work in projects, including all resources like 3D models or textures, that comprise of scenes (scene graph) and shots (2D views on a scene).
Import/Export: For the integration of previs into production pipelines, different input and output options in the form of file format support are offered. For ex-ample, OBJ, FBX, or STL files are supported at both ends.
Shot Management: Creation and overview of shots on a 3D scene.
Sketching (Modelling): Creation and modelling of 2D and 3D objects for outlining and dressing scenes.
Assets and Layout: Creation of 3D scenes as virtual worlds, sets, or places using assets, models, animations, effects, etc. Import, selection, and interaction with pre-made 3D objects and animations from a database.
Camera Control: Adding and interaction with virtual cameras in a scene for shot creation with different camera parameters, lenses, and camera path animations.
Visual Effects (VFX): Create, edit, and arrange visual effects in a scene by selection from a database or by direct gesture control to the simulation.
Lighting: Adding and interaction with virtual light sources, creating different moods and scene styles.
Posing and Animation: Creation and application of animations onto characters and objects using pre-recorded animations, physics animation, and motion capture. Posing on rigged characters and pose selection from library.

were calculated and summarized in an overview table. To give an example, requirements that received the highest possible rating involved import/export, arrangement of 3D assets, compatibility with industry standard formats, project management (creation, information, editing) and an overall high usability.

The requirement acquisition process was carried out by each project member independently. As a result, various items were identified that were relevant in multiple application areas, overlapping entirely or at least in terms of content. To erase redundancies, some requirements had to be merged or reorganized. Ultimately, we accumulated lists of common, overlapping and application-specific requirements.

DERIVATION OF CRUCIAL PREVIS FUNCTIONALITIES

In accordance with the collection of requirements, we derived a set of 20 functionalities that previs software should provide to be a usable tool for domain experts. However, not all of the core functionalities can be directly translated into previs tasks. Some of them relate to general functions like multi-user capability or seamless changes between devices. Therefore, we reduced the set of 20 core functionalities to crucial previs tasks that apply to all application areas, resulting in a list of 9 core previs tasks: *Project Structure*, *Import/Export*, *Shot Management*, *Sketching (Modelling)*, *Assets and Layout*, *Camera Control*, *Visual Effects*, *Lighting* and *Posing and Animation*. See table 1 for definitions.

DISCUSSION

As previs is a creative process led by the vision of directors, artists or designers it is important to support the creative persons in using a previs software. A dedicated software which supports the exact tasks we identified will improve the accessibility for these people over standard software. However, these tasks still have to be controlled in an easy and intuitive fashion in order to be usable by creative people who often have not much technical knowledge. NUIs are described with these attributes [9]. Therefore, we discuss the use of different NUIs for the identified previs tasks.

The identified previs tasks show quite distinct features in the nature of their media types. Some of them are inherently one- or two-dimensional e.g., import/export, project structure, shot management, structuring some flat data content. Direct manipulation on touch devices offers a 2D interfaces that is intuitive, easy to learn and offer a high degree of precision and overview. Others previs tasks are by nature three-dimensional such as 3D scene modelling, layout, camera, or lighting. We argue that direct manipulation and gestures in 3D used in current VR systems offers the most intuitive and powerful type of interaction for these tasks. In previous research [4] we could show that VR is well suited for previs, especially for non-technical persons as they do not have to struggle with complex controls for navigation in 3D space but rather can look around naturally and build the space by using their hands. Interaction in VR utilizes the spacial nature of our interaction in the real world and therefore makes it

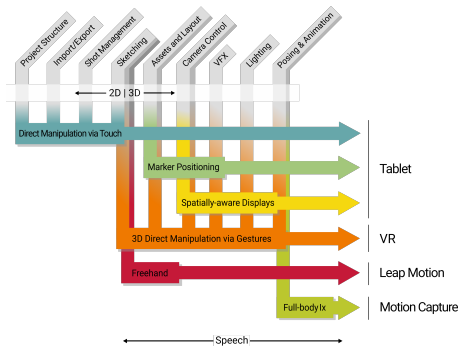

Figure 4: Mapping the core tasks in previs with natural forms of interaction and the related hardware.

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intuitive and easy to learn [9]. VR is mostly limited to one user at a time, making it not suited for every situation - previs is a collaborative process often including multiple persons. Tangible interaction can be used for a intuitive and collaborative interface that builds on the natural interaction with real world objects [7]. Spatially-aware displays and mobile augmented reality can provide the hand-held feeling of operating a camera while offering a view into the virtual world. This can resemble the natural way how creatives interact in their professional workflow. Motion-tracking solutions like motion-suits or camera-based tracking offer the capabilities of recording human motion. This technology can be used as full-body interaction and embodiment for intuitive and easy animation. This would offer creatives the possibility to perform the actions themselves instead of using abstract animation software. Finally, speech can provide an additional layer of interaction that could be combined with all other forms of interactions which were presented in order to give easy access to common actions, e.g. undo.

CONCLUSION

In this work we analyze the digital previs process and identify core functionalities for dedicated previs software. We aggregate the results form interviews with 16 domain experts. Further, we discuss the use of natural user interfaces for the specific previs tasks to support creative people in doing digital previs themselves. In future work we aim to evaluate natural user interfaces with domain experts for the previs tasks presented in this work.

REFERENCES

[1] Murali Chemuturi. 2012. *Requirements engineering and management for software development projects.* Springer Science & Business Media.

[2] Francisco J García-Peñalvo and Lourdes Moreno. 2017. Special issue on exploring new Natural User Experiences.

[3] Weiyuan Liu. 2010. Natural user interface-next mainstream product user interface. In *Computer-Aided Industrial Design & Conceptual Design (CAIDCD), 2010 IEEE 11th International Conference on*, Vol. 1. IEEE, 203–205.

[4] Thomas Muender, Thomas Fröhlich, and Rainer Malaka. 2018. Empowering Creative People: Virtual Reality for Previsualization. In *Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems (CHI EA '18)*. ACM, New York, NY, USA, Article LBW630, 6 pages. https://doi.org/10.1145/3170427.3188612

[5] Anja Naumann, Jörn Hurtienne, Johann Habakuk Israel, Carsten Mohs, Martin Christof Kindsmüller, Herbert A Meyer, and Steffi Hußlein. 2007. Intuitive use of user interfaces: defining a vague concept. In *International Conference on Engineering Psychology and Cognitive Ergonomics*. Springer, 128–136.

[6] Jeffrey A Okun and Susan Zwerman. 2010. *The VES handbook of visual effects: industry standard VFX practices and procedures.* Taylor & Francis.

[7] Orit Shaer and Eva Hornecker. 2010. Tangible user interfaces: past, present, and future directions. *Foundations and Trends® in Human–Computer Interaction* 3, 1–2 (2010), 4–137.

[8] Donna Spencer. 2009. *Card sorting: Designing usable categories.* Rosenfeld Media.

[9] Daniel Wigdor and Dennis Wixon. 2011. *Brave NUI world: designing natural user interfaces for touch and gesture.* Elsevier.