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Article / Book Information

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種別(和文)	要約
Type(English)	Outline

THESIS OUTLINE

Title: FACILITATING ENHANCED CONCEPT GENERATION AT EARLY DESIGN PHASE THROUGH MIXED REALITY AND USER-CENTRIC APPROACH

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RESEARCH BACKGROUND

The concept generation process is essential for innovative product development that results in high user satisfaction, often validated through design prototypes, which are implemented at the end of the product design process. Changes at later stages require effort and may result in loss of high-potential design solutions due to the designer's trade-off among the generated ideas, to achieve the results. Hence, the early-design phase is important as the degree of freedom for design solutions is high even though the fidelity of ideas generated is low. The abstract nature of the early-design phase makes it difficult to introduce a supportive design tool which can provide higher fidelity design outcomes and is adaptable for different design problems. This thesis focusses on the early stage and addresses key aspects to enhance the outcomes at concept generation stage of the product design process (PDP). The research focus, here, is to enrich the experience of early-stage design for both designers and end-users and enable them to concentrate on the design part by minimising the existing technical and knowledge gaps among them. For this purpose, new design methods/tools need to be implemented to achieve effective concept generation and improve creativity at the early stage.

Research Question

The thesis addresses (se Figure 1) facilitating end-users, designers, and need definition to minimize existing technical/methodological barriers in the engineering design process. For this purpose, this research investigates the implementation and the impact of immersive mixed-media environment/methods with the user-centric approach on the early design stage. The originality of this work is in demonstrating a framework that of exploring along for generating design needs, which are explored by designers and end-users to generate design solutions through a proposed mixed reality-based design tool. The implemented design tool provides high

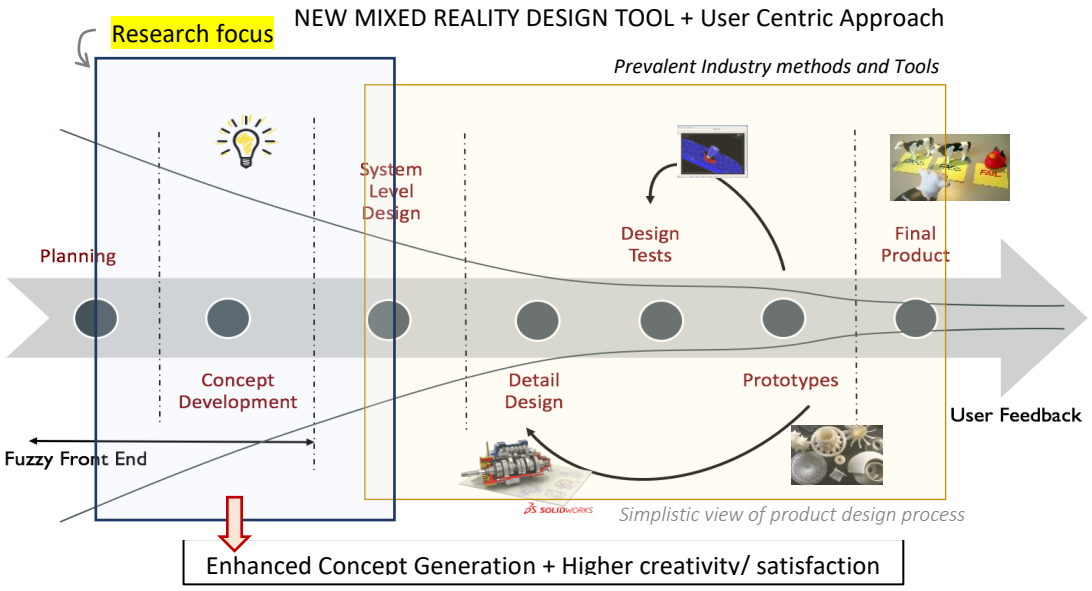

Figure 1 Research Focus

control for both end-users and designers along with high immersion, and it is adaptable to different design scenarios. The overall research question addressed in this thesis is:

> *How effective is the implementation of user-centric immersive media tools for generating concepts, and perform creative interaction in terms of user satisfaction, creativity and overall outcomes? And what metrics are required to implement it in a multi-parameter-based application field?*

Focus	**Activity**	**Hypotheses**
END USER[M]	*Early* Inclusion in design process	Active participation results in better experience and satisfaction
DESIGNER[M]	Reduce *Technical* Dependency on hardware prototyping	Reduced barriers and enabling experience-ability improves the outcomes and satisfaction/ creativity
Design NEED[Q]	Addressing *Intangible* problems along with people around the user	Behavioral and environmental patterns emerge once the basic need is achieved in terms of quality user experience

M: Mixed-Reality based Tool; Q: Exploratory Questionnaire tool

Thesis Structure

Chapter 1. A general introduction of the PDP is provided here, along with specifying a need for doing this research.

Chapter 2. This chapter discusses aspects to improve the early design process for better design experience and user satisfaction. The overall research question is presented. Here a study, an implementation of a complex project in an industrial environment, is presented and important aspects to inquire for improving the design process (user inclusion, experience of designing, address hidden aspects of designed experience)are established and discussed.

Chapter 3. This chapter addresses the intangible issues that are observed after the product is used by the end-users and the people around them. The study is based in the field of assistive technology, as an explorative study was implemented that focused on the experience of caregivers and wheelchair users, addressing the issue of difficulty in communication during the activity of assistance.

Chapter 4. This chapter focuses on enabling the end-user to let them be an active participant at the early stage of PDP, and the need and requirements to do so are discussed. The chapter is divided into two parts. Part I focuses on implementing a mixed reality (MR) based design tool for including the user in PDP, and tests its effectiveness for active end-user contribution through an empirical study based on an Interior design (virtual) usage scenario. Part II inspects the aspect of virtual interaction with the designed concept porotypes and collecting feedback from the end-user in order to simplify user participation. This implementation is tested through an empirical study on prototyping and interacting Intelligent Lamp in its physical and Virtual prototype forms.

Chapter 5. This chapter focusses on enabling the designers to let them create and experience their product behaviour concepts by making the prototyping phase straight-forward. It establishes the requirements to implement the design tool to enhance the experience of designing. A design method to create interactive product behaviours that can be experienced through the implemented mixed reality tool is implemented here. The protocol is designed to allow designers to create, experience and revise their ideas of Interactive Product designs. The evaluation of the impact of the implemented design method/tool on the generated solution is performed in terms of exploration of solution space, designer behaviours and the overall creativity of the processes.

Chapter 6. This chapter discusses the contributions from each Chapter (3-5) and how do they address the design questions raised in Chapter 2.

Chapter 7. This chapter summarises this thesis, concluding with how this work impacts the early design phase and how it can be used by others to continue research in this field.

Here Chapter 3-5, represent three sub-themes in the research and address an independent query about the design methodology and design tool implementation. The progress of research and structure of thesis is shown below (Figure 2).

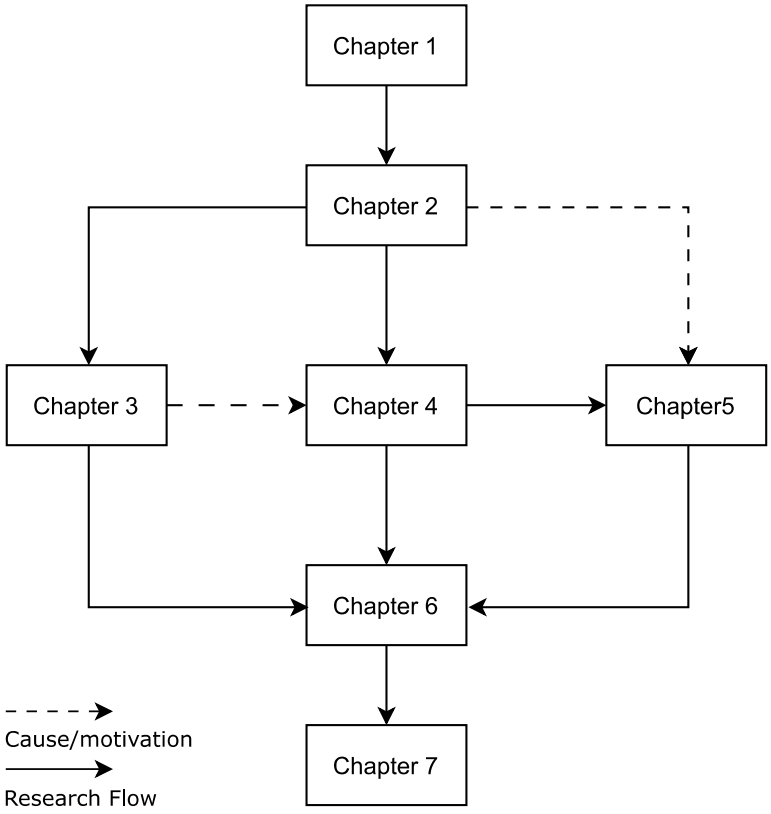

Figure 2 Progress of research and the structure of thesis chapters

Overall, this thesis assesses the impact of the implemented design methods on respective generated outcomes, giving insights on what metrics to consider while designing new tools/methods for the early-design phase targeting the needs, the designers and the end-users. It also highlights the limitations that can be addressed to improve the experience of early-stage designing.