3. Design Thinking Methodology

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Innovation is recognized as one of the principal driving forces behind growth. Countries that embrace innovation usually fare much better than ones which do not (Grossman & Helpman, 1991). Museums are looking at innovation as the key to help them adapting to major changes affecting the cultural heritage sector. The three main forms of innovation happening in museums are: 1. Technological innovation in museum-visitor experiences; 2. Museum management, and 3. Organizational innovation (Vicente, Camare-ro, Garrido, 2012). Innovation is fueled by the insights gained through the understanding achieved from observation of what visitors want and need.
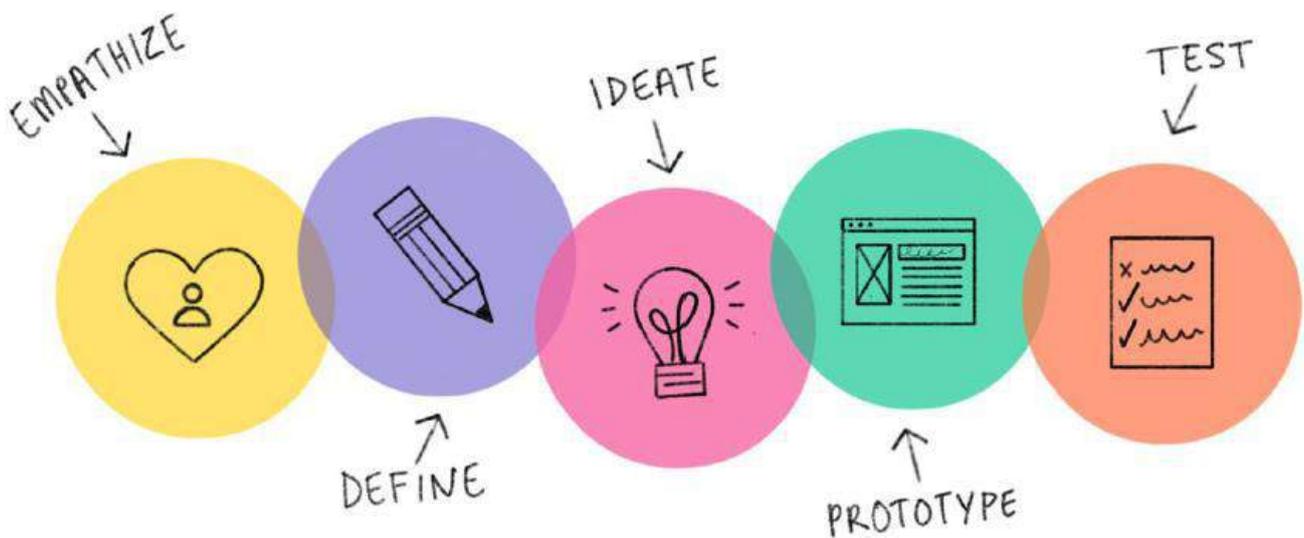
Design Thinking, described as a methodology, a culture and even a philosophy is a system that insures all forms of innovation activities are inspired by a human-centered focus (Brown, 2008). It is an approach that uses creative problem-solving as a driving force for human-centered innovation (Kelley & Kelley, 2013). John E. Arnold was one of the first authors to write about "Design Thinking". In his "Creative Engineering" seminars at Standford University, he identifies four particular outcomes of design thinking. These include: Novel functionality" relating to innovative solutions for old problems or solutions for new needs, improved solution performance levels, reduced production costs and improved profitability (Clancey, 2016).

The earliest education teaching research institutes about Design Thinking was introduced in 2005 at Stanford University, the Hasso Plattner Institute of Design, which is commonly known as the d.school. In "Theoretical Foundations of Design Thinking" (von Thienen, Clancey, Corazza, & Meinel, 2018) one finds an overview of the historical development of Stanford University's design thinking programs starting from the first innovation curricula of creative thinking, visual thinking and ambidextrous thinking that shaped today's Design Thinking methodology.

Design thinking is spreading world wide in many different sectors that require innovation. More educational institutions, appreciating the positive benefits of this methodology, are implementing it in their curricula with their own design thinking schools, following the University of Stanford and Potsdam's d.schools. Design Thinking revolutionizes the way people, companies and organizations look at innovation. The process of innovation becomes truly dynamic, continual, reflective, detectable and most importantly human centered. Those organizations that adopt design thinking as fundamen-

tal catalyst of their innovation process will be able to sustainably and continuously design completely new processes, services and products (Plattner, Meinel, & Leifer, 2012) .

Design Thinking for Museums

In the last decade, museums have also started using design thinking to help them innovate the way they manage themselves and communicate their collections to visitors. In fact the process of design thinking can literally be applied to any settling, challenge or problem within the museum. Design thinking helps museum to see issues as challenges that can be tackled and solved rather than just problems. There are five main steps in the Design Thinking model proposed by d.school of the Hasso-Plattner Institute of Design at Stanford University. These are Empathize, Define, Ideate, Prototype and Test.

Phase 1: Empathize

The design think process starts with gaining an empathic understanding or the issue or problem that needs solving. In a human-centered design approach such as that being proposed by Design Thinking, empathy takes a central and very important role. Empathy allows designers to set aside their personal assumptions and understand or feel what the other person is going through. Empathy is crucial in obtaining a valuable insight into the museum visitors' profile, needs and underlying problems that need to be addressed.

Phase 2: Define

Identifying the challenge is often one of the most important steps in the whole process. During this stage, all the information and insight collected in the first stage (Empathy) is analyzed and synthesized to be able to define the core problem that needs to be addressed. The problem needs to be clearly defined from a human-centered point of view rather than simply from the museum's point of view. This stage will help designers to collect idea on how to create features and functions that will allow them to target and solve the problem.

Phase 3: Ideate

By this stage the designer has understood the users and their needs in the Empathize stage, analyzed these observations in the Define stage and based on this information ready to start coming up with ideas to solves the issues in question. There are many approaches and techniques to deal with the ideation stage. The ideation phase will allow the designer to shift through all the identified ideas to find the ones which best solve the problem at hand.

Phase 4: Prototype

Prototyping involves the creation of an early sample which is inexpensive simplified versions of the service or product to be able to test the concept or identified solution. This prototype would allow users both from within the museum but also from outside to test and evaluate the proposed solution. This stage will help the designers to have a clearer view of how users would react to the solution being proposed. Prototyping offers many disvantages to designers hese include the possibility to make practically same time changes and test new iterations which takes us to the next stage.

Post 5: Test

Prototyping will allow Designers to meticulously test the final solution based on the solutions identified in the prototyping phase. Although this is considered as the final stage one would also see a loop between the last stage and previous stages until the testing is successfully completed. This is because results from the testing phase are then used to fine-tune the proposed solution and prototype in phase 4. Prototyping and testing re very powerful tools for museum and used well will save the museum from very expensive mistakes and encourage innovation.

The Design Thinking Process is not a linear one and the five different stages are not always sequential, the different stages may sometimes occur in parallel or be repeated iteratively. Rather then sequential steps each phase must be understood as a component or node that contribute to a successful development process of innovative problem solving design. Each museum design project will be different but the Design Thinking process identifies the 5 different stages of development that need to be carried out.

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