

Week 13 Summary and learning

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Video 1: Mystery of Picasso

The 1956 documentary *The Mystery of Picasso*, directed by Henri-Georges Clouzot, is a captivating exploration of Pablo Picasso's creative process. In this unique film, Clouzot uses innovative filming techniques to capture Picasso as he produces 20 original works, from early sketches in black ink to full-color compositions. Filming with a specialized transparent screen, the documentary allows viewers to watch each brushstroke and see paintings develop in real-time.

This technique provides an intimate, almost meditative look at Picasso's artistic methods, showing how he builds up compositions, adds colors, and modifies elements, revealing the fluid, evolving nature of his work.

The documentary offers insight into themes central to Picasso's art, such as the human form, Mediterranean scenes, bullfighting, and abstract expressions of women. It also gives viewers a rare look at Picasso's improvisational style, which often involves reworking and transforming his pieces mid-creation, highlighting his flexible approach to art. The documentary has been celebrated for its portrayal of the "metaphysical" aspects of Picasso's creativity, showcasing not just the creation of art but the artist's internal dialogue with his work as it takes shape on canvas.

The documentary provides several valuable takeaways:

1. Art as an Evolving Process:

- Picasso's approach underscores that creativity is often non-linear. He frequently reworks pieces, adding layers or altering compositions, showing that art evolves organically and that the final work might look entirely different from the initial concept. This reinforces that creative processes are fluid and benefit from adaptation and flexibility.

2. Embracing Imperfection and Transformation:

- Throughout the film, Picasso's willingness to transform or even completely alter his paintings highlights an openness to imperfection and change. This is a powerful reminder that creative endeavors don't need to strive for a perfect outcome but instead value experimentation and evolution as part of the process.

3. Innovation in Technique:

- Picasso's use of black ink and gradually adding color demonstrates a thoughtful approach to composition and layering. By watching Picasso develop each piece, one learns the value of building ideas progressively, allowing for foundational aspects of an idea or project to be solidified before adding complexity.

4. Transparency and Vulnerability in the Creative Process:

- The film's transparent screen approach allows viewers to witness Picasso's work in real-time, creating a sense of vulnerability in exposing each brushstroke and decision. This is a reminder of the value of transparency in creative work, and the courage it takes to share one's process with an audience.

5. The Role of Passion and Intuition:

- Picasso's dynamic and passionate engagement with each piece reflects the importance of intuition in creative work. Rather than adhering strictly to a pre-planned design, he allows his instincts to guide him

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illustrating how intuition can be a driving force in artistic expression.

Video 2: Saving Lives for 20 Cents Manu Prakash 2017 TEDxStanford

In his TEDxStanford talk, Manu Prakash, a bioengineer at Stanford University, introduces the "Paperfuge," an innovative, ultra-low-cost centrifuge that costs only 20 cents to produce. This device has the potential to revolutionize medical diagnostics, particularly in low-resource settings around the world where access to traditional lab equipment is limited.

Summary of Key Points:

- 1. Inspiration and Problem Identification:** Prakash highlights the challenge in many parts of the world where electricity and advanced lab equipment, like centrifuges, are unavailable. Centrifuges are essential for diagnostics, as they separate blood components and allow for disease identification, such as malaria and HIV.
- 2. Development of the Paperfuge:** Inspired by traditional toys like the whirlygig, which operates by spinning in opposite directions, Prakash and his team sought to replicate the centrifuge's functionality using simple materials. After experimenting with multiple designs, they developed the Paperfuge, capable of reaching high speeds up to 125,000 rpm, which is sufficient for diagnostic needs, even without power or expensive materials. This invention works by pulling on two loops of string attached to a paper disc, generating centrifugal force similar to that of electric centrifuges.
- 3. Cost and Accessibility:** The Paperfuge is made of durable synthetic paper, string, and plastic, making it affordable and easily transportable. Prakash emphasizes that, due to its simplicity and cost-effectiveness, it can be distributed widely in underserved areas, potentially saving lives by enabling early, accurate diagnoses where none were previously possible.

Outcomes and Learnings:

- **Innovation through Constraint:** Prakash's work is a prime example of "frugal science," where technological advances come not from expensive materials but from reimagining existing principles (in this case, a toy mechanism) for practical applications.
- **Global Health Impact:** The Paperfuge addresses health inequities by making life-saving diagnostic tools accessible to people in remote or impoverished regions. Its widespread use could reduce the burden of diseases like malaria, anemia, and tuberculosis by facilitating early and accurate diagnosis.
- **Inspirational Approach to Problem-Solving:** Prakash's approach encourages other innovators to think outside conventional boundaries, particularly in scientific and medical communities, showing that transformative solutions can emerge from low-cost, simple designs.

The Paperfuge embodies a significant step toward equitable healthcare, empowering communities with the tools needed to manage and diagnose diseases autonomously and affordably.

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Video 3: TED talk on Frugal science - paper centrifuge by Manu Prakash 2017U

In his TED Talk, bioengineer Manu Prakash introduces the concept of "frugal science," a philosophy of designing scientific tools that are not only functional but also affordable, accessible, and scalable for use in low-resource settings. Prakash begins by highlighting the disparity in access to medical and scientific tools across the world, especially in remote or economically disadvantaged regions. Many essential diagnostic tools, he notes, are prohibitively expensive and often unavailable in these areas, leaving millions of people without the basic healthcare services they need.

To address this issue, Prakash and his team at Stanford University have pioneered an approach to scientific tool development that leverages local resources, cultural practices, and innovative thinking to create effective, low-cost alternatives. The flagship example of Prakash's frugal science approach is the Paperfuge, a paper-based centrifuge that costs only a few cents to produce but can achieve the high speeds required to separate blood components — a critical step in diagnosing diseases like malaria, tuberculosis, and HIV.

The Paperfuge: A Breakthrough in Accessibility and Simplicity The Paperfuge, as Prakash explains, is inspired by the mechanics of a traditional spinning toy. It consists of a simple disc of paper, string, and plastic, yet it can achieve up to 125,000 revolutions per minute (RPM) when operated manually. This is a significant achievement, as conventional centrifuges require electricity and complex machinery to reach similar speeds, often costing thousands of dollars. By simply pulling the strings, healthcare workers in remote areas can spin blood samples to separate plasma from red blood cells, enabling critical diagnostic tests to be conducted in settings without electricity or specialized equipment.

This device represents more than just an innovative tool; it reflects a paradigm shift in how we think about healthcare accessibility. Prakash's approach embodies the idea that scientific innovation doesn't always require high-tech solutions; instead, it can be achieved by understanding local needs, thinking creatively, and designing tools that make the most of available resources.

Broader Implications of Frugal Science Prakash's concept of frugal science extends beyond the Paperfuge. He argues that scientific innovation must be reoriented toward creating tools that are affordable and accessible on a global scale. Frugal science, in this sense, has the potential to democratize healthcare by providing tools that can be used by anyone, anywhere, regardless of their socio-economic status or geographical location.

He also points out that innovation in frugal science relies on interdisciplinary thinking. By drawing inspiration from fields such as engineering, biology, and even traditional crafts, scientists can develop versatile, low-cost solutions that serve real-world needs. The Paperfuge, for instance, was inspired by an ancient toy called a "whirligig," demonstrating how even centuries-old toys can spark ideas for modern medical tools.

Another essential component of frugal science is its scalability. Since frugal science solutions are inexpensive and easy to produce, they can be quickly scaled and distributed across communities with high demand and limited resources. Prakash envisions a world where local production of such tools could lead to a more decentralized approach to healthcare, enabling communities to produce the medical devices they need rather than relying on imports.

Learning Outcomes and Key Takeaways

Prakash's TED Talk teaches several powerful lessons about innovation, accessibility, and the power of simplicity:

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Innovation Doesn't Have to Be Expensive: Prakash's Paperfuge exemplifies how simple materials and creative thinking can result in groundbreaking tools that are just as effective as their costly counterparts. The key to innovation in frugal science lies in understanding the needs of end users and designing accordingly.

Empathy and Contextual Understanding: Frugal science is deeply rooted in empathy. By understanding the limitations faced by people in low-resource areas, innovators like Prakash can create tools that address real-world challenges, rather than creating technology for its own sake.

Interdisciplinary Inspiration: Prakash's approach to frugal science demonstrates the importance of looking outside one's own field for inspiration. By combining elements of biology, engineering, and traditional crafts, Prakash has shown that some of the most effective solutions are those that integrate diverse perspectives and techniques.

Scalability and Sustainability: Frugal science is not only about creating one-off solutions; it's about building tools that are sustainable and scalable. Tools like the Paperfuge can be produced at scale, helping bridge the healthcare gap in remote areas while maintaining affordability.

Empowering Communities: A significant outcome of frugal science is the empowerment of communities. By enabling local production and training, frugal science can help communities become more self-sufficient in managing healthcare and scientific needs, ultimately leading to improved health outcomes and independence.

Video 4: TED talk on Foldscope by Manu Prakash 2012G

Manu Prakash's TED talk on the *Foldscope* introduces his invention: a paper-based microscope that can be assembled like origami, designed for affordability, durability, and accessibility in science education and healthcare. The Foldscope costs about 50 cents to produce and can achieve magnifications up to 2,000 times. Prakash was inspired by his experiences in rural areas where access to conventional microscopes was challenging due to their cost, fragility, and the difficulty of use in various environmental conditions. This tool enables anyone to explore microscopic worlds and diagnose diseases such as malaria and tuberculosis in low-resource settings, where such diagnoses might otherwise be impossible.

Prakash explains that the Foldscope is particularly transformative for global health, as it allows medical professionals and laypersons to examine blood samples, environmental organisms, and more, directly in the field. The device's simplicity makes it accessible to children, fostering early engagement with science. It has been used worldwide, with users encouraged to share images and discoveries through a collaborative online platform, turning science into a social, exploratory process. The Foldscope exemplifies "frugal science," where cost-efficient, effective tools can make science more inclusive and accessible.

Learning and Outcomes:

1. **Inclusivity in Science:** By lowering the barriers to entry, the Foldscope allows anyone to conduct scientific experiments, making science education accessible to millions.
2. **Healthcare Applications:** In remote and under-resourced regions, this low-cost microscope can help diagnose diseases, improving health outcomes.
3. **Encouraging Curiosity:** The Foldscope promotes hands-on learning and scientific curiosity, particularly among young people who might not otherwise have access to such tools.

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4. **Environmental Impact:** With its lightweight and recyclable design, the Foldscope reduces waste compared to traditional scientific equipment.

Prakash's work serves as a model for designing tools that meet the needs of diverse users across the globe, proving that scientific discovery doesn't have to come at a high cost. This vision of "frugal science" continues to inspire the development of affordable tools that enable learning and innovation, regardless of geographic or economic barriers.

Video 5: Bike cup holder Stanford Design Thinking Process

The video "Bike Cup Holder" from Stanford's Design Thinking process introduces viewers to the concept of rapid prototyping, a core practice in design thinking. The video focuses on the practical application of the design thinking process, guiding a team through the journey of solving a problem with a human-centered approach.

The key elements covered in the video include:

1. **Empathy and User-Centered Design:** The team begins by understanding the user's needs—riders who want to have a convenient cup holder while biking. This requires putting oneself in the shoes of the user to ensure the design solves a real problem.
2. **Ideation:** The group brainstorms several potential solutions to the problem. They consider various design ideas and refine them, focusing on simplicity, ease of use, and integration with the bike.
3. **Rapid Prototyping:** The team quickly builds a low-cost, functional prototype of the bike cup holder using simple materials. The prototype is created with the understanding that the goal is not perfection but the opportunity to test and improve based on feedback.
4. **Testing:** The prototype is tested by real users, and feedback is gathered. This phase emphasizes the importance of testing designs early and often, as it provides valuable insights that guide further refinement.
5. **Iterative Process:** The video demonstrates the iterative nature of design thinking. Each prototype is refined based on the feedback received, with the design becoming more effective and user-friendly over time.

Outcomes and Learnings:

- **Rapid Prototyping:** This video highlights the importance of creating quick, simple prototypes to test ideas rather than spending extensive time and resources on perfecting designs upfront. This approach allows for faster learning and iteration.
- **Empathy and User Feedback:** Successful designs come from truly understanding the user and gathering continuous feedback. The cup holder prototype was shaped based on real-world feedback from bike riders.
- **Design Thinking in Action:** The process of ideation, prototyping, and testing is emphasized as a repeatable cycle that encourages creative solutions. Even in seemingly simple design challenges, a structured approach ensures innovation.

The video reflects Stanford's design thinking principles, which stress that innovation comes from understanding the user and testing ideas early and often.

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Video 6:The Design Thinking Process

The **Design Thinking Process** is a structured, human-centered approach to problem-solving that promotes innovative solutions by deeply understanding user needs. The process is typically divided into five key stages:

1. **Empathize** – This first step focuses on understanding the people you're designing for. Through interviews, observation, and engagement with users, designers seek to understand user needs and emotions to build empathy. By immersing themselves in the users' experiences, designers can uncover unmet needs and motivations that form the basis of the problem-solving process.
2. **Define** – Using insights from the Empathize phase, designers then articulate a clear problem statement or "point of view" (POV). This stage is critical for narrowing down the focus to specific issues and framing the problem from a user-centered perspective. A well-defined problem statement provides direction and sets the tone for ideation.
3. **Ideate** – In this stage, designers brainstorm a wide range of potential solutions, thinking expansively and creatively. Here, quantity and variety of ideas matter more than immediate feasibility, allowing teams to explore unconventional solutions without constraints. Techniques like "brainwriting" or role-playing may be used to enhance creativity during ideation.
4. **Prototype** – Prototyping involves creating scaled-down versions of a few potential solutions. Prototypes are tangible representations of ideas that can be tested and iterated upon, allowing designers to see what works in practice and quickly improve upon their ideas. This stage is iterative, with multiple versions often developed to incorporate user feedback effectively.
5. **Test** – In the final stage, the prototypes are tested with real users, and feedback is collected to refine the solutions. This phase can uncover new insights about the problem or identify additional design changes needed, leading back to earlier stages if necessary. Testing ensures the solution is effective and truly meets the users' needs before full implementation.

The process is iterative and non-linear, meaning teams may revisit earlier stages based on new insights or testing results. It is particularly effective for solving complex, undefined problems and encourages creativity and user-centered design. This approach is widely used in product design, UX/UI design, and various other fields.

Video 7:What Is Design Thinking

Design Thinking is a human-centered approach to problem-solving, drawing from design methodologies to foster creativity and innovation. It emphasizes understanding user needs deeply and framing challenges from their perspective. Unlike traditional problem-solving, which may prioritize a quick-fix, Design Thinking seeks lasting and meaningful solutions by immersing into the problem context.

The process is generally outlined in phases, commonly starting with *empathy*, where designers engage with users to gather insights into their experiences. Then comes *defining* the problem based on observed challenges, followed by

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ideation, where teams brainstorm multiple solutions without judgment. The next stage, *prototyping*, involves creating simplified models of ideas, allowing for early feedback and improvements. Finally, *testing* puts prototypes in real scenarios, gathering insights for further refinement. This iterative, non-linear nature of Design Thinking enables continuous learning and adjustment to ensure solutions effectively meet user needs.

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Design thinking is emphasized for its iterative nature—it encourages revisiting stages as necessary. Additionally, it fosters collaboration and cross-disciplinary work, as diverse perspectives contribute to better problem-solving. This approach has been used successfully across industries, not just in product design but also in service and system design, focusing on delivering solutions that truly meet user needs

Key Takeaways and Learning Outcomes

1. **User-Centric Approach:** Design Thinking prioritizes understanding the user, setting it apart from other methods that may focus more on problem or solution details rather than user impact.
2. **Iterative Process:** Each stage informs the next, but designers often return to earlier stages based on new insights, emphasizing flexibility and ongoing learning.
3. **Broad Application:** Though it originated in product design, Design Thinking is widely applicable across various fields—from business and education to social innovation—because of its adaptable, human-centered methodology.

Learning Outcomes: By embracing Design Thinking, teams can develop solutions that are not only innovative but also more aligned with real-world needs, fostering a culture of empathy, creativity, and continuous improvement.