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Lesson 1

Idea Generation

HACKTEX

Innovative smart textiles & entrepreneurship

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Author(s)

Silvana Laudoni
CIAPE

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Introduction

Idea generation is the act of coming up with new, applicable ideas; it is the activity most often linked with creative problem solving. The idea-generation stage is vital to the success of the CPS process since the concepts developed here are employed throughout the creative process.

Definition of the problem/opportunity

It's essential to have a goal in mind from the start that is both specific and attainable.

Although it may seem intuitive, your chances of really coming up with helpful ideas are better the more precisely you can define your current or perceived problem or opportunity.

Market analysis

To get to the root of the issue, try to collect as much information as you can before beginning. Determine what you already know about it and the further knowledge required.

Brainstorming

In the brainstorming phase, you need to involve the right people according to the identified problem and the objectives you want to reach and stimulate ideas production with the use of different kind of techniques supporting the creativity process.

Idea Selection

The ideas are revised, and the best ideas are selected to be further developed.

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1. Problem definition process

Establish the Need

The worth of the ideas you create will depend in large part on the way you define your problems. The first step is to identify why you need a solution to the problem. To do this, answer these questions:

What is the basic need? First, write your problem down in simple terms. Then, identify the basic need that you'll fulfill once you've solved the problem.

Who will benefit? Finally, in this step, identify all of the stakeholders who will benefit, both directly and indirectly, once you've solved the problem and reached your desired outcome. Write down who these people or groups are, and the advantages that they'll see.

Understand the Problem and Its Wider Context

This step encourages you to look at the problem in more depth, and to look back into the past to see what you can learn from previous efforts.

What's the cause? In this first step, make sure that you've identified all the causes of your problem.

What solutions already exist? Widen your search to include trade journals, field studies, past research, competitors, industry experts, and your personal network.

What are the constraints? factors that might prevent you from implementing a solution.

First, look at internal constraints. Will you have access to enough people, money, and other resources to solve this problem? Are there any stakeholders who might try to block your efforts? Are there any rules or procedures that you must follow? (For instance, a new website would need to align with your organization's brand guidelines.)

Next, look externally. Are there any government regulations or laws that might stall or block your solutions? Is the technology available?

2. Applying Creative Thinking to the advanced and smart textile sector

2.1 Acer's Creative Thinking Framework

Creative thinking Is the ability to come up with innovative and original ideas, concepts, and solutions to problems. It involves breaking from traditional patterns of thought and exploring new ways of thinking and problem-solving.

ACER defines creative thinking has the capacity to generate many different kinds of ideas, manipulate ideas in unusual ways, and make unconventional connections in order to outline novel possibilities that have the potential to elegantly meet a given purpose. ACER's creative thinking construct consists of three strands:

Strand 1 Generation of ideas

Creative thinking is, at its core, a generative process. When a large number of ideas are produced, one or more could be combined to construct a creative product. If many ideas are produced, but they share fundamental similarities, it is likely that the level of creative thinking exhibited by each idea will be similar.

Strand 2 Experimentation

A key element of creative thinking is the ability to 'play' with ideas, both previously existing, and newly-generated. Critical to this process is the ability to consciously consider ideas from multiple perspectives, and to think creatively within the constraints of a task. This can lead to 'new' ideas in the form of processes such as adaptation and synthesis.

Creative thinkers consciously shift their own perspective of a problem in order to redefine the problem's context, and therefore come up with new ways to approach attempts to find a solution. Creative thinkers who demonstrate the ability to shift perspective typically ask 'what if' questions to renegotiate the boundaries of the known constraints of the problem context, and thereby open up new possibilities. Also, creative thinking often involves the adaptation or synthesis of existing ideas, rather than the generation of entirely new ones.

Strand 3 Quality of ideas

Another important element is examining the appropriateness of a solution. The end result should fit the initial purpose and add some sort of novelty element to those that already exist. Novelty is not an absolute concept; it is relative to and dependent on the context. Finally, the idea needs to be elaborated to illustrate its potential for achieving the defined goal, giving it substance and strength.

2.2 Key aspects for an effective brainstorming

Building up the right working group

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For your ideation to be as productive as possible, it is important to involve the right people in the process. Ideally, the group should be small enough to allow for effective collaboration and discussion but large enough to include a diverse range of perspectives. If your plan is to engage a larger group of people to generate ideas, make sure your audience is relevant and well informed on the subject.

The complexity of the value chain, the features, and the technical requirements that an advanced textile product should meet, ask for the involvement of different kinds of actors right from the conception stage. The composition of the working group for a brainstorming session in the advanced textile sector will depend on the specific goals and objectives of the session. For instance, if the objective of the brainstorming session is to come up with new ideas related to a smart textile product in the medical field, the composition of the working group should include different experts who can provide insights on the diverse aspects of smart textile development. Here are some potential roles and areas of expertise that could be included in the group:

Textile engineers: Experts in textile manufacturing and design who can provide insights on how to incorporate smart technologies into fabrics and materials.

Sensor experts: Individuals who specialize in the design and development of sensors, including those used for health monitoring, activity tracking, and environmental sensing.

Material scientists: Experts in the science of materials who can provide insights into the development of new materials that are suitable for use in smart textiles.

Wearable technology experts: Individuals with expertise in the design and development of wearable technology, including smartwatches, fitness trackers, and other wearable devices.

Data analysts: Experts in data analysis and machine learning who can provide insights on how to process and interpret data generated by smart textiles.

Human-computer interaction experts: Individuals with expertise in human-computer interaction who can provide insights on how to design smart textiles that are easy to use and provide a good user experience.

Medical professionals: Experts in healthcare who can provide insights on how smart textiles can be used in medical settings for monitoring patient health and providing personalized care.

Fashion designers: Individuals with expertise in fashion design who can provide insights on how to incorporate smart textiles into fashion products and make them more aesthetically appealing.

Ethicists: Experts in ethical considerations related to smart textiles, including data privacy, security, and the responsible use of personal information.

By including individuals with diverse backgrounds and areas of expertise in the working group, you can ensure that a wide range of perspectives are represented, and all relevant issues are considered during the brainstorming session.

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Define constrains to the challenge

When conducting a brainstorming session, it can be helpful to set constraints or limitations to guide the creative thinking process. Make sure your goals are ambitious and specific enough. One way to get more creative ideas from your audience is to set constraints.

Es: Challenge: Develop a wearable technology product that integrates smart textiles to improve safety for outdoor activities.

Possible constraints:

- The product should incorporate at least two different types of smart textiles, such as fabrics that detect temperature or humidity, or materials that provide light or sound notifications.
- The product should be washable and durable, as it is intended for outdoor use.
- The product should be comfortable to wear for extended periods of time.
- The product should be able to connect to a mobile device or app to provide real-time notifications and alerts to the user.
- The product should be affordable and accessible to a wide range of outdoor enthusiasts, without compromising on safety and quality.
- The product should be designed with sustainability in mind, using eco-friendly materials and manufacturing processes wherever possible.

These constraints provide a specific direction and scope for the brainstorming session, while still allowing for creativity and innovation within the smart textile sector.

2.3 Tools and techniques to stimulate creativity and select ideas

Creativity techniques represent methods that promote creative thinking and its associated skills. They are used for generating creative and innovative ideas by encouraging participation, free thinking, and open discussion with the aim of building on each other's ideas, leading to more creative and effective solutions.

Brainstorming cards

Brainstorming cards are a useful tool for facilitating group brainstorming sessions. Brainstorming cards provide focus and structure to the brainstorming process. They can be used to guide the discussion towards specific topics or themes, ensuring that the brainstorming session is productive and focused. Card-based tools help keep people at the center of the design process and facilitate creative dialogue and shared understanding

There are different kinds of brainstorming cards addressing different purposes. Here we present the *Tiles IoT Inventor Toolkit*, an open-source project maintained by Tiles Technologies and developed by researchers from the Norwegian University of Science and Technology, with the scope to foster human-centered design of novel internet of things user experiences by ideating solutions for the UN's Sustainable Development Goals.

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Tiles provides 100+ brainstorming cards that can be combined to invent a solution to a defined problem / scenario:

- *Domain cards* summarize the goals and the people who will be impacted by your invention
- *Technology cards* provide simple descriptions of technology like: things, sensors, data and user interfaces.
- *Mission cards* spice up your mix by providing provocative design goals.
- *Criteria cards* help to reflect and converge towards meaningful ideas

Image 6: Example of cards contained in the Tiles IoT Inventor Toolkit deck

Tiles has been designed as a flexible tool, adaptable to ideate augmented things for a variety of application domains. On the other hand, which things to augment and how to intervene with technology are often related to the needs and values of specific user groups and contexts. User research outcomes formalized in artifacts like Personas and Scenarios can be used in a Tiles Workshop to focus ideation toward a specific domain, problem, or need for a specific user group, with the possibility to add cards to meet our specific objectives.

The playbook guides participants through a seven-step process for designing an augmented object. The activities participants are asked to perform are the following:

1. Select a user and a context you agree to design for – it helps define the boundaries of the design space.

2. Browse Things cards and select one or more objects that are central to a given user. Use Sensors cards to define the relationships among the objects – it defines what object(s) will be augmented by technology.

3. Define which actions trigger the things by browsing the Human Actions and Services cards – it allows users to define how humans and third-party services interact with the selected objects.

4. Define how the things respond when triggered by browsing Feedback and Services cards – it allows users to define how the selected objects communicate back to the user, either via user interface feedback or via sending information over a data channel.

5. Flesh out ideas on the storyboard section – it allows participants to focus on one idea by sketching how the augmented object is used and what values it brings to the users.

6. Use Missions cards to find ways to challenge one's idea, then go back and refine the storyboard contents. – it provides triggers to diverge by iteratively modifying and expanding previous ideas.

7. Look through the Criteria cards and discuss how well one's idea scores on each criterion – it helps collaborative reflections and trade-off discussions.

The cards in the Tiles IoT Inventor Toolkit can be applied to the smart textile sector and with some adaptations to other advanced textile domains to help inspire and guide the creation of innovative smart textile projects. Here are some steps on how to apply the cards to the smart textile sector:

Choose relevant cards: Select cards that are relevant to the smart textile sector, such as cards with prompts related to wearable technology, sensing, or connectivity.

Use the cards as a prompt: Use the prompts on the cards as a starting point for generating ideas for smart textile projects. For example, if you choose a card with the prompt "connectivity," you could brainstorm ideas for a smart textile project that incorporates wireless communication technology.

Consider the textile material: Consider the type of textile material you want to use in your project, such as conductive fabrics, smart fibers, or e-textiles. Choose tiles from the Tiles IoT Inventor Toolkit that can be integrated with the textile material.

Combine with other technologies: Combine the prompt on the card with other technologies, such as sensors, microcontrollers, and actuators, to create a more complex smart textile project.

Iterate and refine: Experiment with different combinations of cards, tiles, and textile materials to refine your smart textile project idea. Test your project and make changes as needed.

Overall, the cards in the Tiles IoT Inventor Toolkit can be a useful tool for ideation in the smart textile sector, providing prompts and ideas for innovative projects that combine textiles and IoT technology.

The SCAMPER technique

The SCAMPER technique is **a** creative problem-solving method that was developed by Alex Osborn in the 1950s. This technique is used to generate new ideas, improve existing ones, and overcome challenges. The acronym SCAMPER stands for Substitute, Combine, Adapt, Modify, Put to another use, Eliminate, and Reverse:

Substitute: replacing one element with another. This could be a material, a process, or even a person.

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- What other materials could we use instead?

- How would this be different if we used a different approach?

- What if we looked at this from a different perspective?

Combine: merging two or more elements to create something new.

- What if we merged these two products together?

- What if we added this feature to that product?

Adapt: modifying an existing element to make it suitable for a new purpose.

- How could we adapt this idea to a different market?

- What if we changed the size, shape, or color?

Modify: changing an existing element in some way. This could be a physical change or a change in how the element is used.

- What if we simplified this process or changed the steps order?

- What if we made this more user-friendly?

Put to another use: In this step, you take an existing element and use it for a different purpose. For example, you could use a shipping container as a temporary office space or use a smartphone as a remote control for your home appliances.

- How could we repurpose this for a different application or a different industry?

- How could we use this to solve a different problem?

Eliminate: This step involves removing an element to simplify or improve the overall design. For example, you could eliminate a step in a manufacturing process to reduce costs or eliminate a feature in a product to make it more user-friendly.

- What if we took away this feature?

- How could we simplify this by removing unnecessary steps?

Reverse: This step involves reversing the order of things or turning an element upside down to see if there are any new possibilities. For example, you could reverse the order of a recipe to create a new dish or turn a traditional business model upside down to create a new revenue stream.

- What if we did the opposite of what we're doing now?

- What if we looked at this from a different perspective?

Overall, the SCAMPER technique is a useful tool for generating new ideas, improving existing ones, and overcoming challenges. By applying each step of the technique to a problem or situation, you can uncover new possibilities and find innovative solutions.

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Here some examples of SCAMPER technique application to the advanced textiles sector:

Substitute: traditional textile fibers with new, innovative materials such as graphene, nanotubes, or conductive polymers to create textiles with improved properties such as durability, strength, or conductivity.

Combine: different types of fibers, such as natural and synthetic fibers, to create new types of textiles with unique properties. For example, combining cotton and polyester fibers could create a fabric that is both breathable and moisture-wicking.

Adapt: existing textile technologies to create textiles that have new or improved functions. For example, adapting phase change materials (PCMs) to create temperature-regulating fabrics that can help to keep the wearer cool or warm in different environments.

Modify: existing textiles to create new and innovative products. For example, modifying traditional textiles by adding conductive elements such as silver or copper could create fabrics that have antimicrobial properties.

Put to another use: put textiles to new and innovative uses. For example, using textiles as sensors to monitor vital signs, such as heart rate, blood pressure, or body temperature, could create smart clothing that can help to improve health and well-being.

Eliminate: certain aspects of traditional textiles to simplify or improve the overall design. For example, eliminating the need for dyeing textiles by using new materials that have naturally occurring colors could reduce the environmental impact of textile production.

Reverse: the traditional textile production process to create new and innovative products. For example, using 3D printing technology to create textiles could create fabrics that have intricate designs and textures that are impossible to achieve using traditional weaving techniques.

Analyse and select the produced Ideas with the 3 Horizon Framework

Selecting the best ideas from a brainstorming session can be a challenging task. Ideas should be evaluated according to their potential impact, feasibility, and relevance to the topic at hand. Look for ideas that have a similar theme or concept and group them together. This can help you identify patterns or trends in the brainstorming session and make it easier to compare and contrast ideas.

Once you've evaluated all the ideas, prioritize the ones that seem to have the most potential for success. You might want to consider factors such as the level of innovation, the potential impact, the resources required, and the timeline for implementation.

The 3 Horizon Framework is a strategic tool that helps organizations identify and prioritize opportunities for innovation and growth.

Horizon 1: This horizon focuses on the core business of an organization, including its existing products and services. The goal is to maintain and improve the current business to ensure short-term profitability and growth.

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Horizon 2: This horizon involves exploring new opportunities that are adjacent to the core business. These opportunities may involve leveraging existing capabilities to enter new markets or developing new products or services. The goal is to build on the organization's strengths while exploring new growth opportunities.

Horizon 3: This horizon involves exploring disruptive and transformative opportunities that are not currently part of the organization's core business. This may involve investing in emerging technologies, developing new business models, or entering entirely new markets. The goal is to create long-term growth and value for the organization.

When selecting ideas using the Three Horizon Framework, it's important to balance short-term gains with long-term growth potential. By considering opportunities across all three horizons, you can create a balanced portfolio of ideas that addresses current business needs while also positioning your organization for future success.

Want to know more about this topic?

Tiles IoT Inventor Toolkit available here https://www.tilestoolkit.io/

Dr Rafiq Elmansy (2015), A Guide to the SCAMPER Technique for Creative Thinking, Designorate

Sharpe, B., A. Hodgson, G. Leicester, A. Lyon, and I. Fazey. 2016. Three horizons: a pathways practice for transformation. Ecology and Society 21(2):47

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3. Considering the end-user perspective

When developing a new smart/advanced textile product, considering end user perspectives is crucial for creating a successful and marketable product. Here are some key points to keep in mind:

User Needs and Requirements

Understand the specific needs, preferences, and requirements of the end users. Conduct user qualitative and quantitative research, surveys, focus groups, and interviews to gain insights into their expectations, preferences, and pain points, which in turn informs the design process. Consider factors like comfort, style, functionality, and usability, but also accessibility and inclusivity factors to ensure that the product can be used by a wide range of individuals. Account for factors such as size variations, adjustability, and ease of use for people with disabilities. Design the product to cater to different body types and diverse user demographics.

User Experience (UX) Design

Focus on creating a seamless and intuitive user experience. The product should be easy to use, with clear instructions and controls. Consider the ergonomics and fit of the textile product to ensure it is comfortable and well-suited for its intended purpose. Ensure that the textile product integrates into the user's daily routine and lifestyle. Consider factors like washability, durability, and compatibility with existing clothing or accessories. The product should be versatile enough to be used in different situations and environments.

Safety and Health Considerations

Prioritize the safety and well-being of end users. Ensure that the textile product meets relevant safety standards and regulations. Consider factors like hypoallergenic materials, non-toxic components, and proper ventilation in smart textiles to avoid any potential health hazards. In the same time, pay attention to the visual design and aesthetics of the product. Consider current fashion trends and ensure that the textile product is visually appealing and desirable to the target audience. Collaborate with fashion designers or experts to strike a balance between functionality and style.

Affordability and Value

While incorporating advanced features, strive to keep the product affordable and provide value for the end users. Consider the cost-benefit ratio and prioritize features that users perceive as valuable and worth the investment. Determine the core functions and features that will provide value to the end users. For example, if developing smart clothing, consider features such as temperature regulation, moisture-wicking, biometric monitoring, or gesture control. Prioritize features that align with user needs and enhance the overall experience.

Feedback and Iteration

Gather feedback from end users throughout the development process. Conduct user testing and iterate on the product design based on user feedback. This iterative approach ensures that the final product aligns with user expectations and needs.

By considering these end user perspectives, you can create a smart/advanced textile product that is user-cantered, innovative, and capable of meeting the needs and desires of your target audience.

3.1 The Empathy Map

Empathy Mapping is a way to get closer to what people really think and feel about your product, service or situation. An empathy map is a useful tool to understand and empathize with end users during the design phase of advanced and smart textile products. It helps identify users' thoughts, feelings, behaviours, and pain points. Here's how you can create an empathy map for advanced and smart textile products:

Define the User Persona: Start by identifying the specific user persona or target audience segment you want to focus on. Consider their demographic information, needs, preferences, and goals related to the smart textile product. Personas help humanize the design process by providing a clear picture of the characteristics, goals, and motivations of the end users. They serve as a reference point throughout the design phase.

Draw the Empathy Map: Create a visual representation of the empathy map. Divide it into four quadrants: "Think and Feel," "See," "Hear," and "Say and do."

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1. **"Thinks and Feel" Quadrant:** records what the user thinks or believes about the smart textile product. This includes their opinions, assumptions, and perceptions. For example, "I think smart clothing can enhance my athletic performance." Explore the emotions, motivations, and pain points of the user regarding the smart textile product. Identify their frustrations, aspirations, and any emotional factors that may influence their experience. For example, "I feel frustrated when my workout clothes become uncomfortable and sweaty."

2. **"See" Quadrant:** records the visual observations and stimuli that the user encounters. It focuses on what the user sees or perceives with their eyes related to the smart textile product. Users visually perceive the physical attributes of the smart textile product, such as its design, shape, size, and overall aesthetics. This includes aspects like colour, patterns, textures, and any unique visual features. Packaging design, including boxes, labels, or graphics, also falls into this category. Users encounter visual communication related to the smart textile product. This can include advertisements, promotional materials, visuals on websites or social media, images or videos demonstrating the product's features, and any visual content used to convey the value or benefits of the product. Users see other people wearing smart clothing or accessories and notice the benefits or features being showcased.

3. **"Hear" Quadrant:** collects the auditory stimuli and information that the user receives or hears related to the smart textile product. It focuses on what the user hears or perceives through their sense of hearing. Users hear about the smart textile product through conversations with friends, family, colleagues, or acquaintances. They receive recommendations, opinions, or personal experiences shared by others, which can influence their perception and interest in the product. They may explore websites, forums, or social media platforms to gather information and opinions from other customers who have used or experienced the product. Users can interact with sales representatives or customer service agents who provide information, guidance, or assistance related to the smart textile product. They hear marketing messages through various channels, such as radio ads, podcasts, video advertisements, or sponsored content. Furthermore users may hear about the reputation, credibility, or trustworthiness of the brand or company behind the smart textile product.

4. **"Say and do" Quadrant:** the say section, capture what the user says about the smart textile product. This can include quotes, statements, or phrases related to their expectations, desires, or challenges. For example, "I want a smart shirt that tracks my heart rate during workouts. The do section note the actions and behaviours of the user related to the smart textile product. This can include their current behaviours, routines, and interactions with existing clothing or accessories. For example, "I currently wear a fitness tracker while exercising."

Based on user research, observations, and interviews, fill in each quadrant of the empathy map with relevant information and insights. Use post-it notes, keywords, or sketches to capture the user's perspective.

Analyze the completed empathy map. Look for patterns, common themes, and recurring pain points. Identify the key needs and desires of the user that can guide the design of the smart

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textile product. Based on the empathy map, extract design insights and opportunities. Use the gathered information to inform the design decisions, features, and functionalities of the advanced and smart textile product. Consider how the product can address user needs, alleviate pain points, and evoke positive emotions.

By creating an empathy map, you can gain a deeper understanding of your end users' perspectives, which will help you design a smart textile product that meets their needs and delivers a positive user experience.

> **Want to know more about this topic?**
>
> Jonna Häkkilä (2017) - Designing for Smart Clothes and Wearables—User Experience Design Perspective - DOI:10.1007/978-3-319-50124-6_12 In book: Smart Textiles (pp.259-278)
>
> https://www.mindtools.com/abtn3bi/empathy-mapping
>
> https://servicedesigntools.org/tools/empathy-map

Remarks

- The worth of the ideas you create will depend in large part upon the way you define your problems
- Creative thinking is the ability to come up with innovative and original ideas, concepts, and solutions to problems
- Setting up the right working group and defining constraints for the identified challenge will determine the effectiveness of the ideation process
- Creativity techniques, such as brainstorming cards and SCAMPER, represent methods that promote creative thinking and its associated skills. They are used for generating creative and innovative ideas by encouraging participation, free thinking, and open discussion
- The 3 Horizon Framework is a strategic tool that helps organizations identify and prioritize opportunities for innovation and growth.
- When designing a new product It is foundamental to take into accout the user perspectives to be successful into the market

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Further resources

- Creative_Thinking_Tools_Techniques_and_M.pdf
- Tiles IoT Inventor Toolkit available here https://www.tilestoolkit.io/
- https://servicedesigntools.org/tools/empathy-map

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Partnership

Project coordinator
TUIASI - Universitatea Tehnica Gheorghe Asachi din Iasi
www.tuiasi.ro

AEI Tèxtils - Agrupació d'Empreses Innovadores Tèxtils
www.textils.cat

CIAPE - Centro pre l'Apprendimento Permanente
www.ciape.it

CRE.THI.DEV - Creative Thinking Development
www.crethidev.gr

TITERA - Technically Innovative Technologies
www.titera.tech

UB - Högskolan i Borås
www.hb.se

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