TRANSMIXR

MAKING MEANINGFUL IMMERSIVE XR EXPERIENCES WITH CHILDREN

A Field Guide for Cultural Heritage

Funded by the European Union

This project has received funding from the Horizon Europe programme under the Grant Agreement 101070109.

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Credits

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Acknowledgements

This resource was developed through the ongoing work of TRANSMIXR, a Horizon Europe innovation project bringing together researchers, practitioners, and industry experts to explore meaningful applications of immersive media across diverse application areas including; news, broadcasting, performing arts, and cultural heritage.

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February, 2026.

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Image: Testing *The Space Archivists* with children, Cinekid 2024.

A note to the reader

This field guide outlines the process of designing immersive cultural heritage XR experiences with children. We first highlight why it is imperative to include children as active co-designers. Then, we provide practical, step-by-step considerations and guidelines on how to include children, using our own *Space Archivists* VR game as a real life case study. Relevant literature is linked throughout the guide for the interested reader via clickable paperclips.

Introduction

Children are a target audience of many XR experiences in the cultural sector, which aspires to find new ways to engage young audiences with heritage collections. Immersive experiences can create a sense of intimacy and immediacy, provoke emotional responses, and make complex topics more approachable.

> Making assumptions about children's needs often results in experiences that fail to captivate them.

As with adults, children want to connect to personal interests and experiences, and are inspired by different storytelling modes and media (e.g. competition, sandbox environments, or playful narrative frames).

However, designs that make assumptions about children's needs often don't take into account differences in how they pay attention and process information, resulting in experiences that fail to captivate their audiences.

In order to truly engage children, designers must understand their interests and needs, and use their input to create appropriate learning and engagement scaffolds.

This field guide will help you get started by asking guiding questions, which also appear together in Appendix 1: *Guiding Questions Template*. The methods and examples in this guide are for cultural heritage audiences, but can easily be applied outside of the sector.

Reading tip!

You may also find further inspiration in our 2025 guidebook, *Creating Meaningful Interactions with Cultural Heritage in Immersive Environments*.

Read the guide

Did you know?

Children process information differently than adults

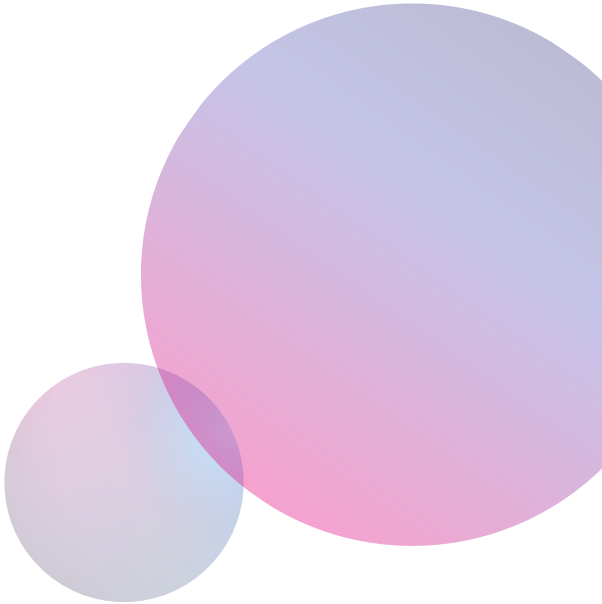
For example, they attend to attributes like color and shape, as well as subjective factors like personal connection.

What children pay attention to differs by age and developmental stage

For example, children between the ages of 8 and 10 often prefer to learn new things through open exploration, whereas their slightly younger peers are more likely to attend to directions to guide their interactions.

These individual and developmental differences highlight the need to **include children as co-designers throughout the design process, from ideation to evaluation.** This allows you to make complex archival topics inclusive, accessible, and engaging, and saves development time and production costs.

For more on children's developmental differences, see .



Reading tip!

While a range of design practices with children exist , we focus on the **Cooperative Inquiry method**, where children and adults work as design partners in a collaborative manner .

Is this field guide for you?

1. Cultural Heritage Professionals

This guide encourages you to consider the unique design needs of young audiences, and to explore innovative ways of including children in the XR design process. Whether you're a curator, archivist, or museum educator, we hope to spark new ideas and practical solutions that allow you to create richer culture and learning experiences.

2. XR Professionals & Design Companies

This guide will inspire you to expand your portfolio and push the boundaries of audience engagement. Considering how to include children in the XR design process will help you deeply engage younger audiences in the cultural heritage sector.

3. Immersive Design Students and Researchers

This guide will help expand your understanding of children's co-design methods for XR, inspiring academic inquiry, sparking innovative projects, and providing a foundation to evaluate and reimagine engagement models.

4. For anyone else interested

Are you not a cultural heritage professional, XR designer, or student in this field, but nonetheless interested in learning more about children's co-design for XR? Then, of course, this guide is also for you!

How to use this field guide

This field guide is intended to support you through the co-design process. It provides you with guiding questions and considerations in a four-part sequence.

1. Setting the Scope

In **Part 1: 'Setting the Scope,'** you will begin by exploring your project objectives and limitations. After defining your goals, guiding questions will help you determine your target audience.

2. Using Co-Design Techniques

In **Part 2: 'Using Co-Design Techniques,'** we will dive into the different stages of the iterative design process, highlighting relevant co-design methods and techniques.

3. Planning Your Sessions

When you know where you are in the process and which method you want to use, **Part 3: 'Planning Your Sessions,'** will help you develop a protocol to test your assumptions.

4. From Research to Outcomes

Finally, in **Part 4: 'From Research to Outcomes,'** we will briefly overview the process of how to translate your data into concrete design choices.

To illustrate this iterative four-part sequence, this resource ends with a working example from the immersive social VR game, *The Space Archivists*.

Ready to begin?

Let's dive in!

Part 1: Setting the Scope

Project Objectives and Limitations

1a. What are your goals? What are you trying to achieve?

The first step of the design process is to understand your project objectives. When defining your goals, think about the experience outcomes you want for your project, such as getting your audience to experience a new perspective on a historical event.

1b. What are your limitations or constraints?

When defining your goals, it is also important to consider the factors or constraints that will influence your project's design or scope.

Consider: Are you constrained to a medium (e.g. VR) or topic, or are working with limited budget or time? Are you designing for a particular physical space, or creating an experience that must travel easily?

Choose an End-User Audience

1c. Who is your target audience, and why?

Is it a niche group or does it include a range of end users? What needs or challenges should be considered for this demographic?

Tip!

All prompts and questions asked in this field guide are collected in **Appendix 1: Guiding Questions Template.**

Click here for the template

Age considerations

Keep in mind that children are developmentally different from adults, and from each other. See for more details on the following factors:

- **Cognitive**: Children have different information processing capacities and biases at different ages.
- **Physical / Form factor**: XR headsets may be too large for young children's heads, or may not fit correctly (e.g. for interpupillary distance). See for more considerations.
- **Motor control**: While adults typically process information faster than children, children often find it easier to adapt to XR controls.
- **Gender differences**: Girls tend to develop faster than boys of the same age, both cognitively and physically.
- **Age ranges**: Consider developmental variations between groups: e.g. how accessible is the language or the media to an 8 year old vs. a 14 year old?

Other considerations

1d. Are you designing for a specific demographic? How might these characteristics affect a child's interaction with an experience?

Considerations to keep in mind:

- Background knowledge
- Cultural or religious background
- Language skills
- Cognitive/physical disabilities
- Digital literacy
- Experience with relevant technology (e.g. games)
- Socio-economic factors
- Communication skills
- Intro/extroversion

Image: Testing *The Space Archivists* with children, Sound & Vision 2025.

Part 2: Using Co-Design Techniques

Design Process Stages

2. Where are you in your co-design process? What design dimensions should you account for?

The XR design process consists of many stages. In the first stage, you might understand and empathize with your audience. Then you might define your goals, and ideate on a concept.

Next, you can prototype, test, and iterate on the design. Each of these stages is in itself an iterative process that can/should be informed by user feedback. You can use the Design Thinking Mindsets toolkit from IDEO as starting inspiration.

In the next section, we describe design needs for the UNDERSTAND, EXPLORE, and MATERIALIZE stages, and present related co-design techniques.

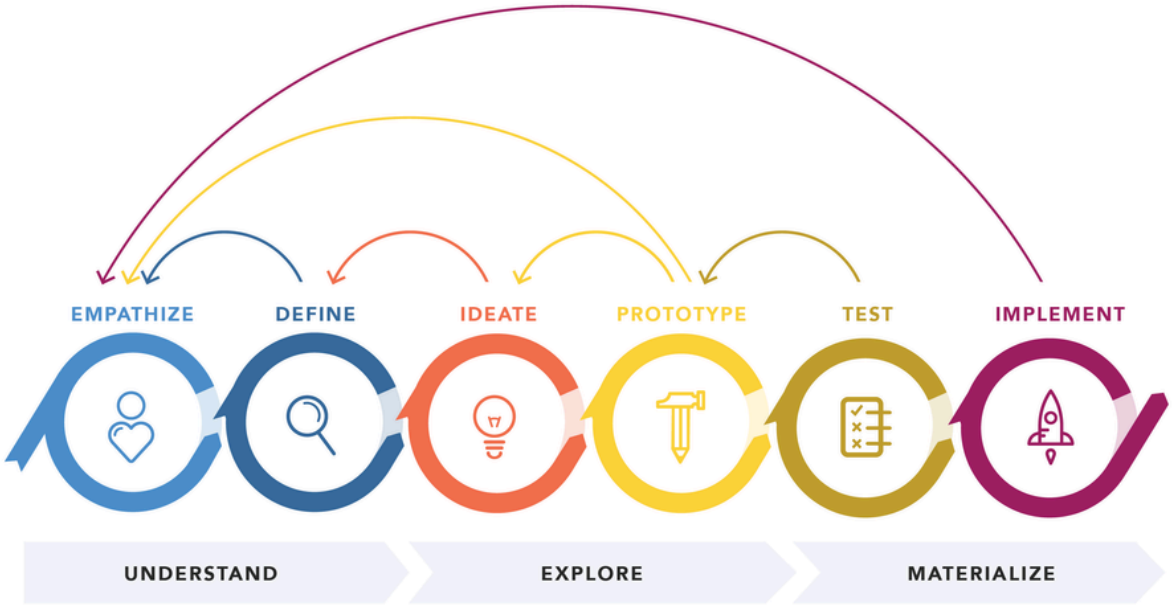


Figure 1: An overview of the design process, as described by NNGroup.

Understand

At this stage, you may have a broad idea of what you want to do, but it may not be clear who your target audience is, or what type of experience you want to create. Here, involving children will help you understand your audience interests and needs, and will help you scope your goals and topics. Some design techniques that fit really well with this stage:

- **Mission to Mars & Kidreporter**, fictional inquiry techniques that encourage children to explain their brainstorm ideas through the lens of "contacting Martians" or acting as a reporter. These techniques allow them to explain their thinking to adults without making assumptions about previous knowledge .
- **Comicboarding**, a storyboarding technique that allows children to work with adults to explain their ideas. Children are given the option of narrating their ideas while an adult illustrates them .
- **Would-you-Rather**, a scenario ideation technique that allows focus groups to consider technology tradeoffs, dilemmas, tensions, and risks through a conversation choice selection process .

Highlighted technique: Layered Elaboration

This technique enables iterative design without destroying original ideas by layering transparency sheets over paper prototypes. First, small teams of children and adults are given a clipboard with a transparent sheet overlay on top of an original design. Groups use permanent markers in a specific color (to later identify annotations) to draw or write their recommended changes on top of the transparency. Teams then present their designs to another, while an adult records common themes. After this, another transparency layer is added on top of previous ideas, and the clipboards are exchanged with another team. In the next round, children continue to add more ideas onto their transparency.

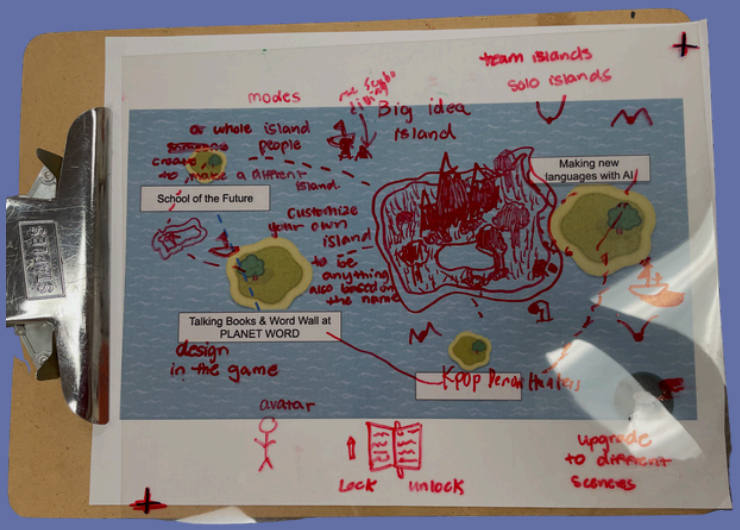


Image: An example of the Layered Elaboration technique. Photo credit: Elana Blinder and Kidsteam.

Design Technique Dimensions

While there is no one correct approach, each co-design technique can be considered in terms of different participant design needs and costs, shown in figures 2, 3, and 4.

You can use these dimensions to choose an appropriate method for your design. Refer to page 5 of for a full description of these dimensions.

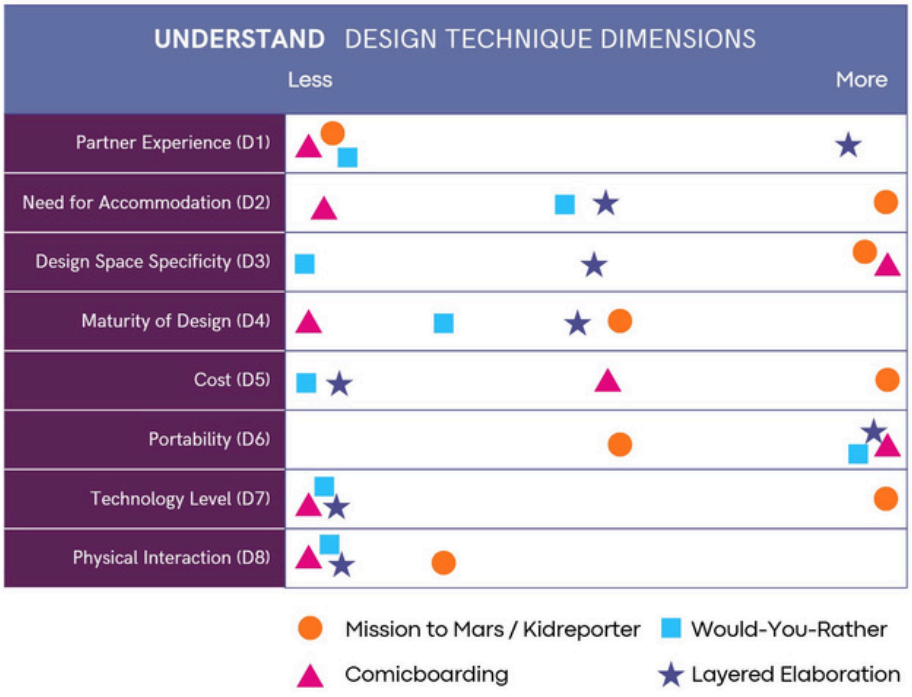


Figure 2: An overview of technique dimensions for the stage *Understand*.

Design Technique Dimension Example:

The **Comicboarding** technique does not require children to have design experience (D1), and does not require special age or cognitive accommodations (D2). The technique can also be used for both a specific or unconstrained design space (D3). The maturity of design dimension is generally at an early stage, as the ideas are being generated on the spot by the designers (D4). As Comicboarding requires hiring an artist, the cost (D5) is moderate, however it is highly portable (D6) as the output consists of drawings on paper. Since only paper and drawing supplies are needed, the technology dimension (D7) is also low. Finally, physical interaction (D8) is low as designers and an artist sit and work together.

Explore

Once you come up with a clear goal, the explore stage can help you **brainstorm different opportunities and goals, validate your concept,** and **prototype your ideas**. The following low-fidelity techniques fit well with this stage:

- **Comicboarding,** storyboarding technique described above.
- **Mixing ideas,** a technique to integrate individual ideas into one new design. This is particularly helpful for younger children, see .
- **Big Props,** a method in which design partners use props to act out gestures and motions in order to prototype dynamic interactions. This is often used as a followup to the **Bags-of-Stuff** technique, see .

Highlighted technique: Bags-of-Stuff

This is a low-fidelity prototyping technique through which co-designers create models of new technologies using bags containing a mix of household art supplies (e.g. construction paper, glue) and found objects (e.g. paper towel rolls, popsicle sticks). The children and adults work in small groups, each consisting of one to three child partners and at least one adult. Each group presents their designs to the full team, while an adult records "big ideas" on a large white board ("big ideas" are those that are repeated among the groups and receive the most attention in the whole group discussion). *Note: the materials you use can depend on individual project circumstances; e.g. when designing AR experiences, supplies can be limited to two-dimensional arts and crafts items such as colored paper, markers, and foam board.*

Image: An example of the Bags-of-Stuff prototyping technique.

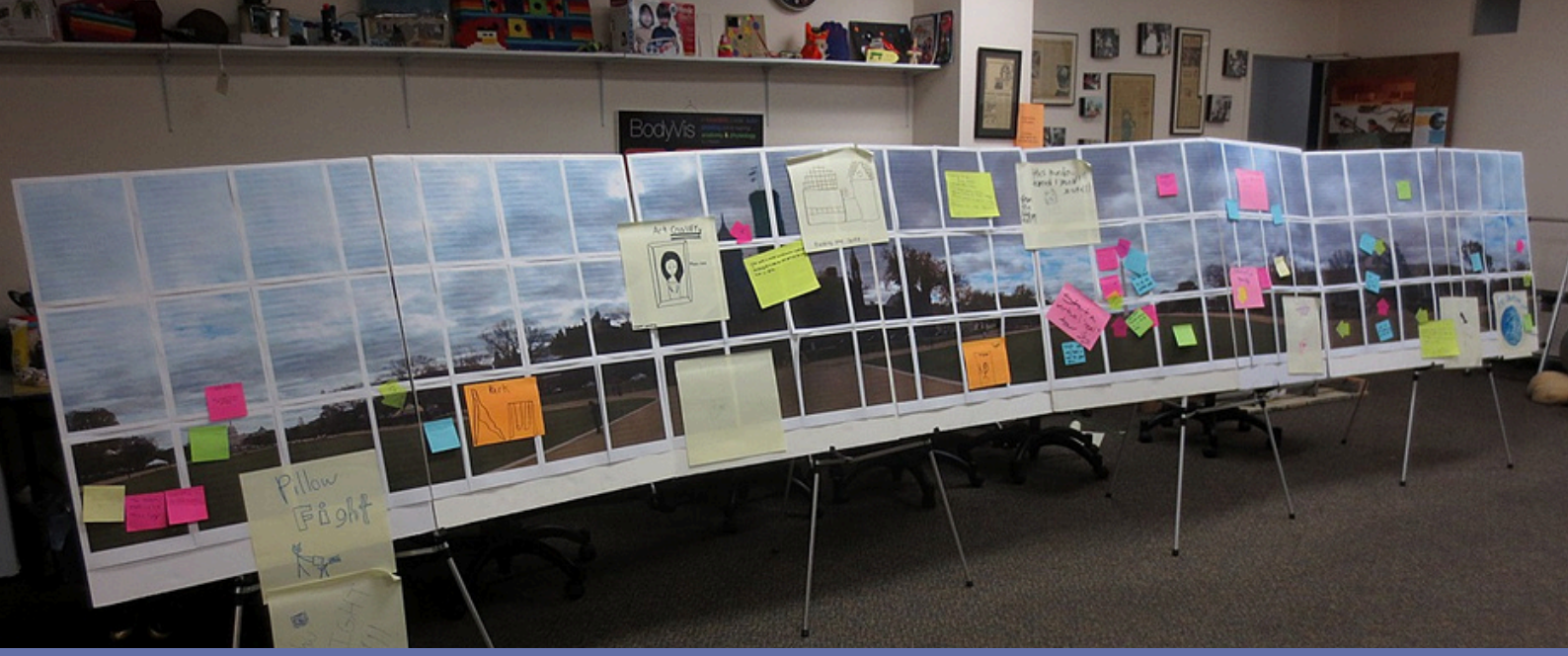


Image: An example of the 360-Degree Co-design technique.

Highlighted technique: 360-Degree Co-design

This is a low-fidelity prototyping technique for 360° XR experiences. To create the basic representation of the scene on which you want to design, take the mid-region of a 360° photograph as a starting point, and print it as a tiled set of posters connected on a set of art boards. The boards can be spread out across a floor during a design session, and children can annotate them with ideas using different size and shaped sticky notes.

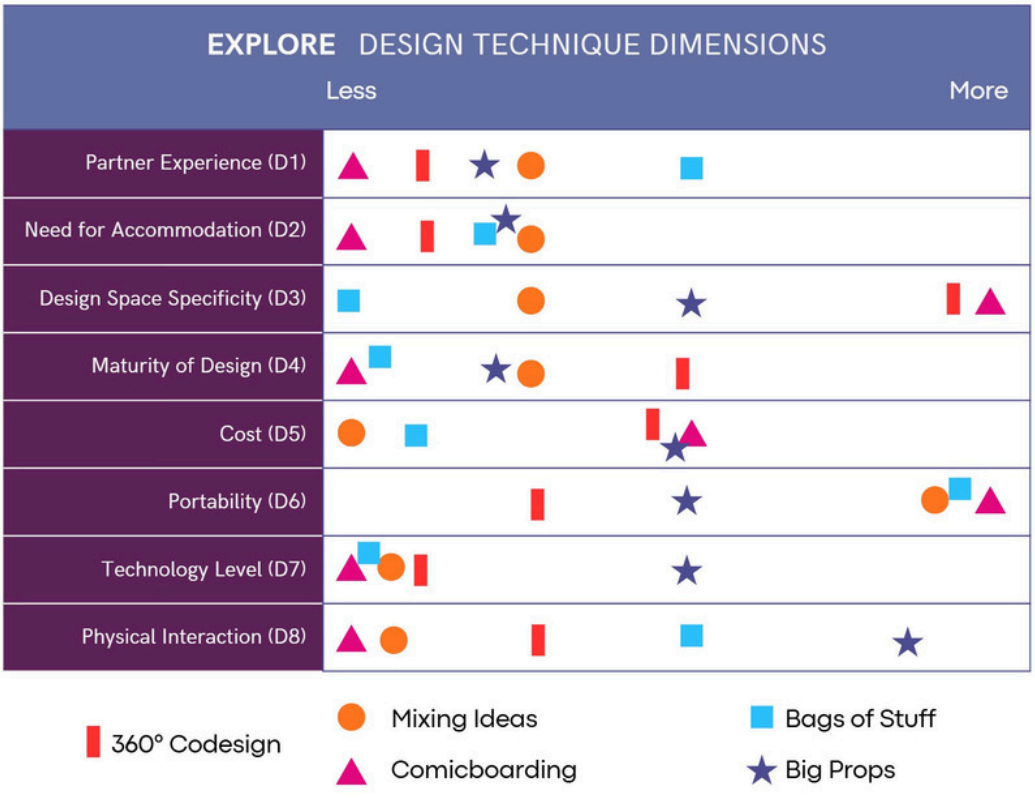


Figure 3: An overview of technique dimensions for the stage *Explore*.

Materialize

Once you have a prototype, it is important to evaluate how well it works with your target audience. At this stage, co-design techniques can help you understand how well your concept works, and help you catch bugs and usability issues. The following iteration and evaluation techniques work well at this stage:

- **Line-Judging,** a simple voting system for children that uses spatial movement to communicate votes along a spectrum (highly negative to highly positive), see .
- **Fun Toolkit,** a set of tools for measuring how much fun children have with technology. The tools include a Smiley-o-Meter (a Likert-scale adapted for children), a Fun Sorter (in which children are asked to rank the relative fun of a variety of activities), an Again-Again table (measuring if children want to do an activity again), and This-or-That, a method of pairwise comparison, see .
- **Focus groups & group discussions,** adapted for children. These adapted methods take into account children's abilities, sensitivities, and age considerations .

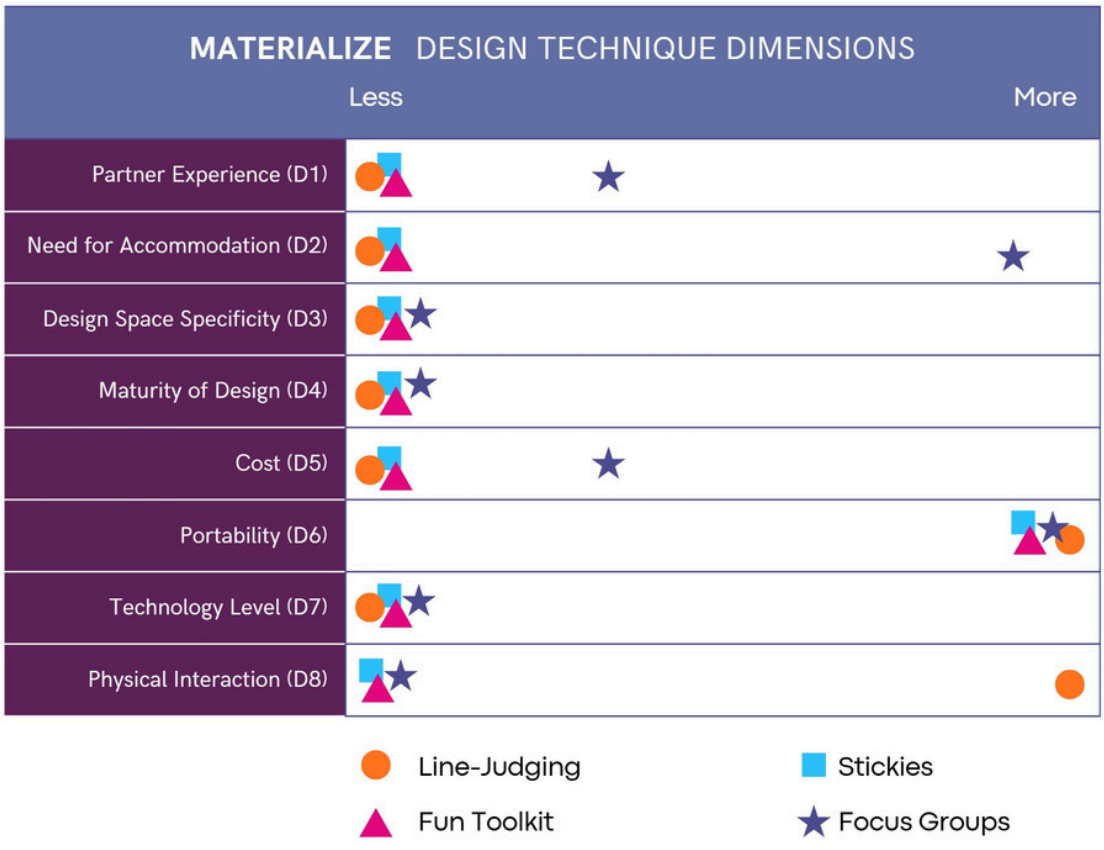


Figure 4: An overview of technique dimensions for the stage *Materialize*.

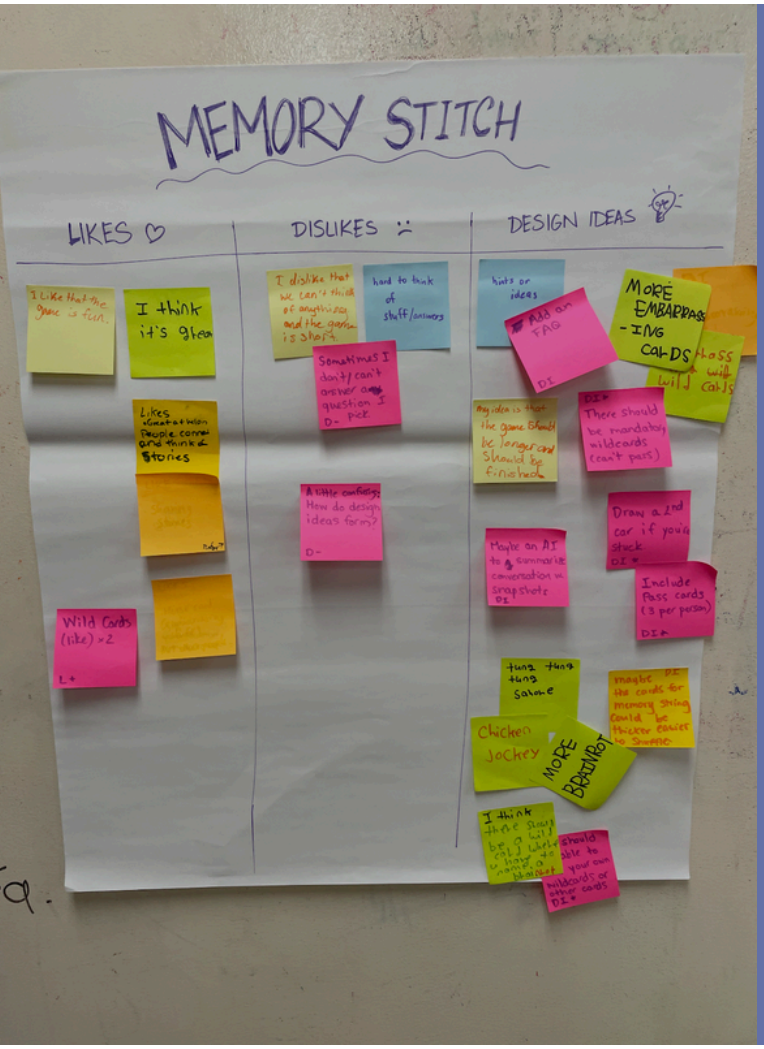


Image: An example of the Stickies technique.

Highlighted technique: Stickies

A technique for indicating likes or dislikes of a design idea. On small pieces of paper with mild adhesives (sticky notes), children record their likes, dislikes, and design ideas for a prototype (one idea per note). As with Bags-of-Stuff, an adult then clusters the notes into "big idea" themes. Finally, the whole group discusses the themes, and adds any notes or annotations to the session outcomes.

Design tip!

Investing in evaluations at different levels of fidelity can help you save development time and costs. We advise testing low-fidelity paper prototypes before developing a higher-fidelity version of your experience. Prototypes at different phases may test different components: for instance, a low-fidelity prototype may test core mechanics, while a higher fidelity prototype may test dynamic interactions or user aesthetics.

Part 3: Planning Your Sessions

Decide on Goals

3a. What do you want to learn?

Based on where you are in the design process, do you want to generate ideas, create prototypes, or gather feedback on a specific concept?

Being explicit about your testing goals is crucial. Children have limited attention, and need time and guidance to provide useful feedback. The more clearly you know what you want to find out, the easier it will be to design your study.

Choosing a Co-design Group

3b. Who are your co-designers?

What groups of children are available to participate? How big is the group? Do they match your target users? Do they have experience with design? Do they know each other? Several questions must be considered when assembling a co-design team. Note that if your target group includes a range of ages, you may want to run multiple co-design sessions (e.g. with younger and older children).

Consider the following as you assemble your co-design group:

- **Representativeness**: How representative is the testing group of the target audience? Try to recruit children with similar ages, interests, and values.

- **Experience with content and design**: How experienced are children with co-design? How much do they know about the topic? Children with design experience are likely to engage more deeply than children without such experience. Further, the less topic knowledge children have, the more onboarding they will require. (see for a discussion on children's content and design expertise).

- **Group dynamics & incentives**: How shy or outgoing are children in your co-design group? How well do they know each other? Do they get along? How large of a group will you work with? Will children work as one big group, or multiple small groups? What incentives do they get for participating?

The Recruitment Process

Recruitment can be very challenging, and you should plan for it early in your process.

Here are three ways to kick off recruitment:

1. **Recruit from your network:** Are there any colleagues, friends or relatives with children that meet your criteria? Send them a message!

2. **Recruit from existing groups:** You can also get in touch with local organisations or initiatives (e.g. a local school, day care, library, or a children's cultural hub). Setting up a partnership will allow you to recruit multiple children at once.

3. **Recruit through a marketing campaign:** Still no luck? A campaign might help you further. You can use social media, newsletters, or spread posters and flyers in places that parents with children are likely to visit.

Whatever means of recruitment you choose, remember to always include:

- An incentive: why should the children join? What's in it for them?
- An email address or website link where parents can get more information;
- An online survey to confirm participant eligibility, and help ensure you get an appropriate mix of ages and genders.
- And of course, a sign-up sheet for your study.

Reminder!
All prompts and questions asked in this field guide are collected in **Appendix 1: Guiding Questions Template.**

Click here for the template

Designing Your Study

3c. What design techniques should you use, and how can you structure an effective session?

In part 2, we described several co-design techniques that are appropriate for different stages of the design process. It is ultimately up to you to choose one that fits the needs of your research and research group. As described above, technique selection depends on factors such as the design problem, the level of experience of team members, and the stage of the project.

While there are many ways to create session plans, we describe a standard format created by the University of Maryland's Human-Computer Interaction Lab (HCIL) Kidsteam research group. Notably, in this group, children regularly engage in design practices, weekly or biweekly. Since they often work together, many of the children become comfortable with the facilitators and with one another.

You can use this structure to draft a co-design session plan that addresses your specific questions and goals. Session time will vary depending on the size and experience of your group. It is also valuable to have at least one person on the team who is familiar with various brainstorming and/or co-design efforts. The session lead does not have to be a co-design expert, but they should be close to the main project (e.g. be a primary stakeholder) who understands the issues/questions surrounding the design prompt.

Design tip!

Designers are often onboarded onto projects that are already in development, where many key decisions have already been made. Do your best to choose appropriate questions given your resources and stage in the design process.

Session Structure

Design sessions are typically broken up into five sections over 2 hours (1.5 hours for the design session, and 30 minutes for the session debrief).

1. Snack Time: First, children come together for a 20 minute relaxing snack time. Snack time allows for a transition between school or work, with children and adults coming together to build relationships through informal discussion.

2. Question of the Day: After snack time, team members gather together in a circle on the floor to discuss the upcoming session. To get the group thinking about the design theme and to activate prior knowledge, a question of the day is asked to every member in the group (adults as well as children).

3. Design Activity: Next, the children and adults transition to the design activity. Various design techniques can be used during this segment of the session, such as *Stickies* or *Bags-of-Stuff*. Depending on the total number of team members, the larger group is divided into smaller sub-teams for the design tasks.

4. 'Big Ideas' Group Discussion and Shareback: At the end of the session, children and adults regroup to present ideas and discuss common or unique themes. During this time, all co-designers are allowed to add points, request clarification, or ask related questions. Once all sub-groups have presented, the session lead summarizes the notes on the 'Big Ideas' board, pointing out common themes and/or unique ideas, and asks group members if everything was captured correctly and completely.

5. In-Situ Debrief: After the design session is over, adult co-designers meet briefly (e.g. for 30 minutes) to review and elaborate on major themes that arose through group discussion. Any artifacts from the session (e.g. *paper prototypes, storyboards, digital whiteboards, screenshots, audio/video recordings,* or *photos of "Question of the Day"* and *"Big Ideas" boards*) are collected and photographed for post-session analysis to compare to final themes. During the debrief, adult co-designers also plan for the next steps in the inquiry or design process.

Prompts and Follow-up Questions

3d. What prompts and follow-up questions can support your session?

It is valuable to create a set of guiding prompts or clarifying questions that can promote extended discussions around the design artifacts. For instance, when brainstorming about an XR experience for sorting archival media, you might ask, *"are the images connected together in a story?"* or *"how do you know when you made a sorting mistake?"*

It is also helpful to create a set of follow-up questions that the session leads can ask the team. This might include, *"can you tell me why you are adding <that> feature to your storyboard?"* or *"what else would you add or combine here?"*

Additional Considerations

Consent: When collecting any kind of data, you will need to follow a consent process and get parent and child approval to participate in your research. This process (and the associated forms!) varies by country and organisation, and it is important to make sure that the language in the child consent forms is easy to understand. Even when doing informal research, make sure to get signed permission from parents to collect data, such as audio recordings, photos and/or videos, and check that participating children understand and agree to having their data collected.

Time: Children have limited attention spans, so several short activities are more fruitful than longer activities. We recommend a full session to last no more than 1.5 to 2 hours, broken up into several activities.

Group Structure: Children respond differently when they design alone, in pairs vs. in a group, and/or when working with adult partners. Our experience shows that small groups (3-5 kids) with 1-2 adult partners work the best for generating ideas.

Adult Facilitators: It is advisable to work with adults that children are comfortable with. Facilitators should also attempt to reduce adult-child power dynamics by wearing casual clothes, using their first names with the child-co-designers, not asking kids to raise their hands, having a shared snack-time, and by co-designing together (See and for more information. Also see Chapter 11 of).

Notetaking: Have a clear understanding of how notes are being recorded, and make a plan to review those notes.

Part 4: From Research to Outcomes

Synthesizing data

An important step of the research process is synthesizing captured data (e.g. audiovisual recordings and design artifacts) into a high-level understanding of learnings and needs. These can help you make a set of choices about how to apply these insights in your work. Interpretation can happen "in-situ" (right after a session) or as part of a longer reflective analysis.

As you synthesize the data, consider: what did you uncover that you didn't know? What do you still not know?

Take a look at these practical guides from designkit.org. A good first step is to make sense of your learnings as a group, and share any inspiring stories from your experience. As you share, listen for moments when the topic fits into a larger system. Then you may look for patterns and themes, and use these to create insight statements about any "aha" moments. Then you may begin to integrate feedback and iterate on your design, inviting co-designers and other stakeholders to participate in a collaborative synthesis process.

You can also take a look at the GLID technique for interpreting children's co-design data and artifacts.

Appendix 1: Guiding Questions Template

Part 1: Setting the Scope	
1a. What are your goals?	
1b. What are your limitations or constraints?	
1c. Who is your target audience, and why? What needs or challenges should be considered for this demographic?	
1d. How might your answers from 1c affect the interaction experience?	

Part 2: Understanding the Process	
2. Where are you in your design process? What co-design dimensions should you account for?	
Part 3: Preparing the Co-design Experience	
3a. What do you want to understand or learn?	
3b. Who are your co-designers? Are they representative of target uses? Do they have experience with design?	
3c. What design techniques should you use, and how can you design an effective co-design session?	
3d. What prompts and follow-up questions can you incorporate into the session?	

Appendix 2:
The Space Archivists Case Study

We use the design of The Space Archivists VR game, created for the media museum of the Netherlands Institute for Sound & Vision (NISV), as a case study to showcase the different components of the design process. As you navigate each section, refer back to the case study sections, then write down your answers for each prompt in the template in Appendix 1. See for a more detailed description of our co-design processes.

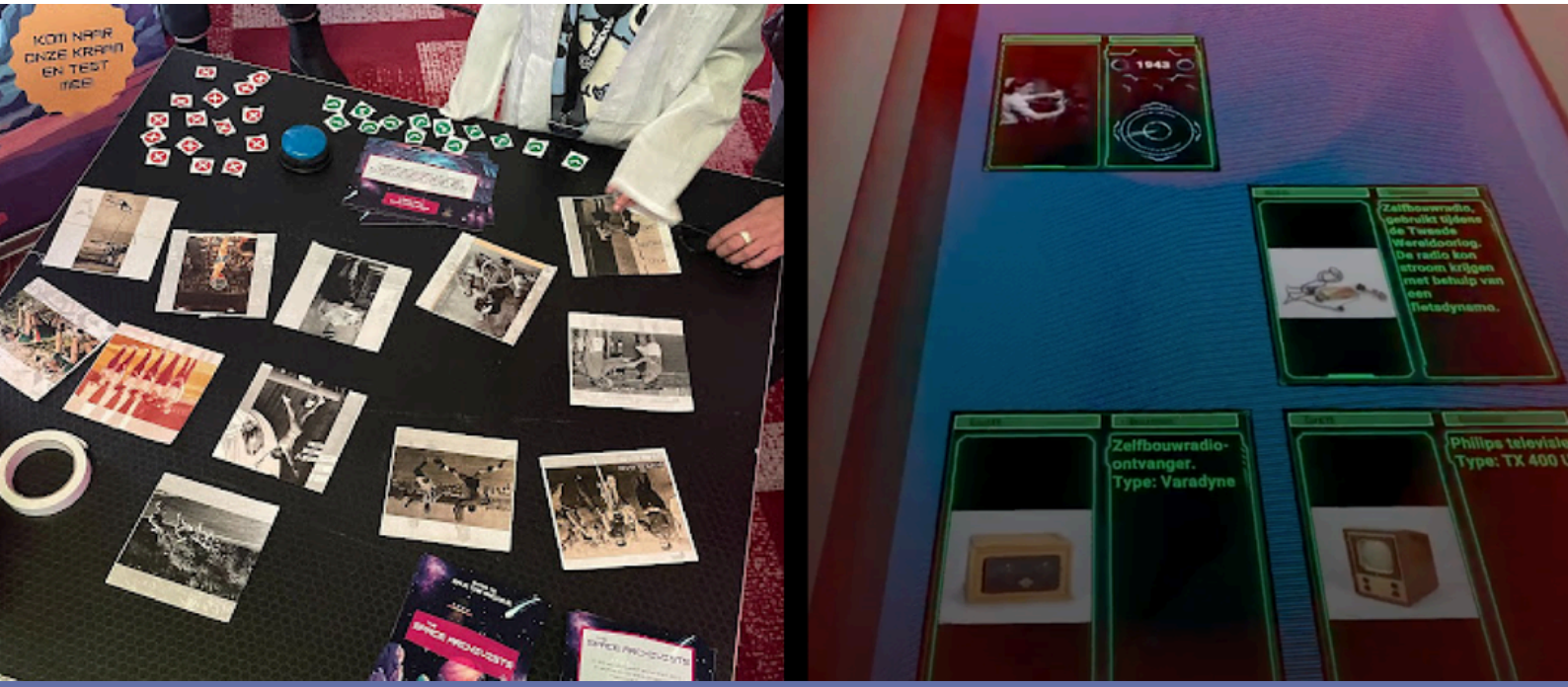


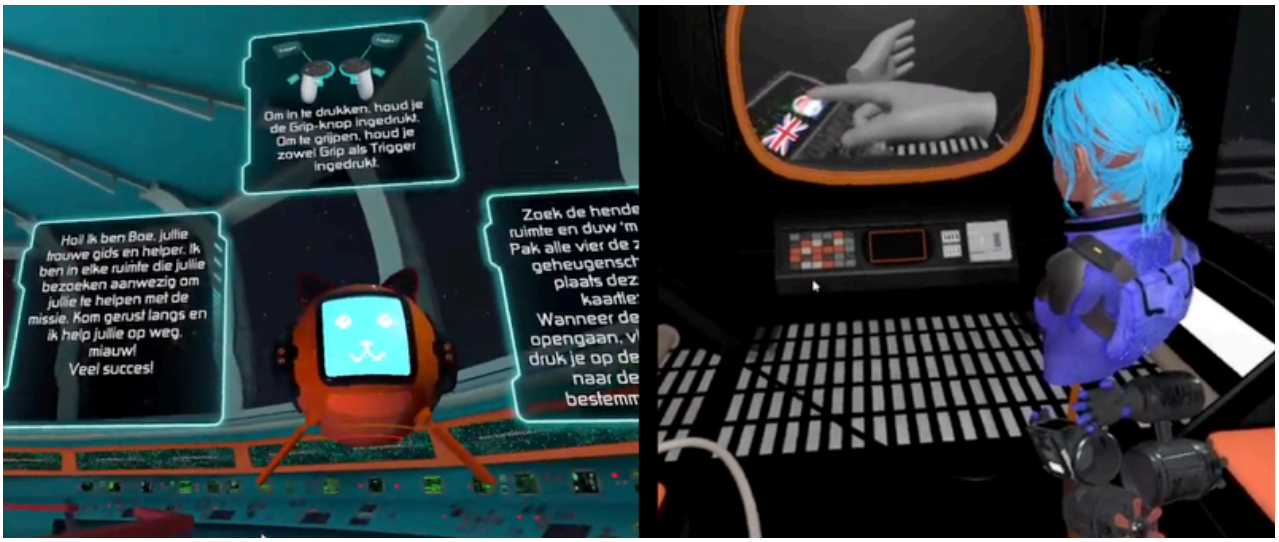
Image: Interaction with media in *The Space Archivists* game.
Left: low-fidelity testing with children at the Cinekid festival in Amsterdam.
Right: Interaction in the final VR game.

Part 1: Setting the Scope	
1a. What are your goals?	Our high-level goals were to give children that visit the NISV museum 1) an understanding of what an archivist does, and 2) a sense of the breadth of the archive. We also wanted them to 3) directly interact with archival media and metadata in the game.
1b. What are your limitations or constraints?	The TRANSMIXR project consortium included a VR development studio and a research lab focused on social VR dynamics. Based on those partnerships, we knew that we were going to build a VR game with a social component. Further, including 2D archival materials (mostly images) and metadata was a project requirement, so we had to create an experience incorporating those materials.
1c. Who is your target audience, and why? What needs or challenges should be considered for this demographic?	Our target audience included children ages 8-14, and parents or grandparents with whom they visited the museum. Considerations included that the experience had to be accessible and engaging for 1) young children as well as older adults, 2) Dutch and English speaking audiences, and 3) visitors with a variety of background knowledge and linguistic abilities. As we were not able to design an adaptable experience (due to budget and time constraints), we had to create a single experience that would be enjoyable for users across a broad age spectrum.
1d. How might your answers from 1c affect the interaction experience?	Two big considerations were social dynamics and XR/game experience. Players could include pairs of young children, a younger child with an older friend or sibling, or a child with a parent or grandparent. In addition, players had a range of game and XR experience. Together, these factors affected players' abilities to both navigate the space and solve the game together.

Part 2: Understanding the Process

2. Where are you in your design process? What co-design dimensions should you account for?

We began *The Space Archivists* project at the UNDERSTAND stage, with a semi-defined goal and end-user audience, and the knowledge that we were building a social VR experience. When working with children at the museum, it was important to use design techniques that did not require them to have previous design experience (D1). We also wanted to create a VR experience, so our design space was somewhat constrained (D3). Finally, we needed early stage design techniques (D4) that were relatively low cost (D5).



Images: Screenshots of *The Space Archivists* game.

Part 3: Preparing the Co-design Experience	
3a. What do you want to understand or learn?	We had several questions during the design process. First, we wanted to (UNDERSTAND) what interests children had related to media, and to (EXPLORE) possible game mechanics using metadata.
3b. Who are your co-designers? Are they representative of target uses? Do they have experience with design?	To answer questions from 3a, we worked with two groups of children: 1) to gauge topic interest, we conducted group discussions and co-design sessions with children ages 8-14 at NISV, and 2) when ideating on metadata interactions and game mechanics, we worked with children ages 7-11 from Kidsteam. The choices were based on our goals: museum children were more representative of our audience, however the Kidsteam children were more familiar with co-design processes.
3c. What design techniques should you use, and how can you design an effective co-design session?	One of our goals was to understand how children can interact with metadata, and what kind of game mechanics they would be interested in. We ran two Kidsteam sessions to answer these questions. In the first session, we asked children to describe the properties of toys and physical objects to understand how they interpret metadata properties. Then, in the second session, we used the Bags-of-Stuff technique to co-design playful interactions that involved metadata. As well as generating ideas, our co-design sessions helped us surface children's needs for working with data representations.
3d. What prompts and follow-up questions can you incorporate into the session?	In the first Kidsteam session, we prompted child co-designers to interpret abstract data patterns from the Dear Data Project. Then, when prototyping with the *Bags-of-Stuff* technique, we asked them to describe what data they were exploring in their designs, how it was being represented, and how players interacted with it (see section 4.2 of 📎 for a description of the example).

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This project has been funded by the European Union as part of the Horizon Europe Framework Program (HORIZON), under the grant agreement 101070109.