

Teaching Children about Fortification Heritage and Puzzles

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SHARED_fort_Heritage | HORIZON MSCA



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4. Explore and Preserve: Build Your Own Fort and Digitalise History

Have you ever built or torn down a fort?



No?

Not even a pillow fort?

Here's your chance!

Compare Italian, Dutch, and French fortification styles, sketch your dream fort, and bring it to life using modular woodcut kits.

Then, see your physical creations transformed into 3D digital models on iPads or phones.

This interactive activity showcases innovative approaches to teaching cultural heritage preservation by blending hands-on learning with modern technology.

Researchers: **Olha Tikhonova, Nazarii Bardiuk, Alena Bagro**

01

MOTIVATION

Seeds of Heritage, Roots of Purpose

Seeds of Heritage, Roots of Purpose

Fortifications surround us

City walls, bastions, and forts are among the most tangible remains of European and colonial history, yet they are often invisible to younger generations.

Heritage starts young

Research shows that early encounters with built heritage shape lifelong attitudes toward preservation and cultural identity.

Hands-on learning works

Puzzles combine spatial reasoning, architectural vocabulary, and playful discovery, making complex geometry accessible to children aged 3 to 18.



Historical plan of Stanisławów (Ivano-Frankivsk)

02

LITERATURE REVIEW

Existing approaches to heritage education for children

Digital Heritage Education: Existing Approaches



Polonika Minecraft Project

Polish cultural heritage recreated in Minecraft, allowing children to explore historical buildings interactively. Demonstrates that familiar digital environments lower barriers to engagement with complex architectural subjects.



Puzzle-based Learning

Physical and digital puzzles have been used in STEM education to develop spatial reasoning. In architectural heritage, they help children understand plan geometry, symmetry, and functional layout without requiring technical vocabulary.

03

THE MOMENT AN IDEA WAS BORN

Fieldwork inspiration from Indonesia

When Monuments Shape Futures



Work with iPad in the field



Work with drone in the field

Inspired Indonesian Children



Local children gathered around us during fieldwork, fascinated by the technology and the fort. Their curiosity was spontaneous, genuine, and deeply moving.

This moment planted the seed: how can we channel this curiosity into structured heritage learning?

From Field to Digital Model



Museum model of Makassar fort

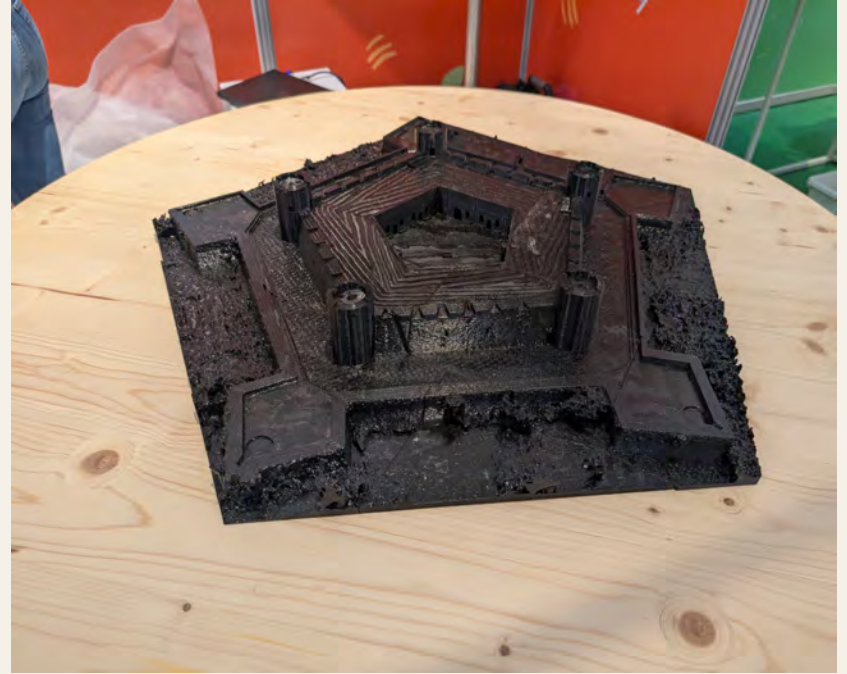


3D-mesh from drone

From Field to Digital Model



From fieldwork in Banda island



3D-printed fort model for workshops

04

IMPLEMENTATION

Science is Wonderful!, Africa Museum, Tervuren, March 2025

Science is Wonderful!

Africa Museum in Tervuren, Belgium, March 13 to 14, 2025



Participants

0.8%

Early Childhood

3 to 6 years

5 participants (aged 3 to 4)

70%

Middle Childhood

7 to 10 years

The largest group

30%

Adolescence

11 to 18 years

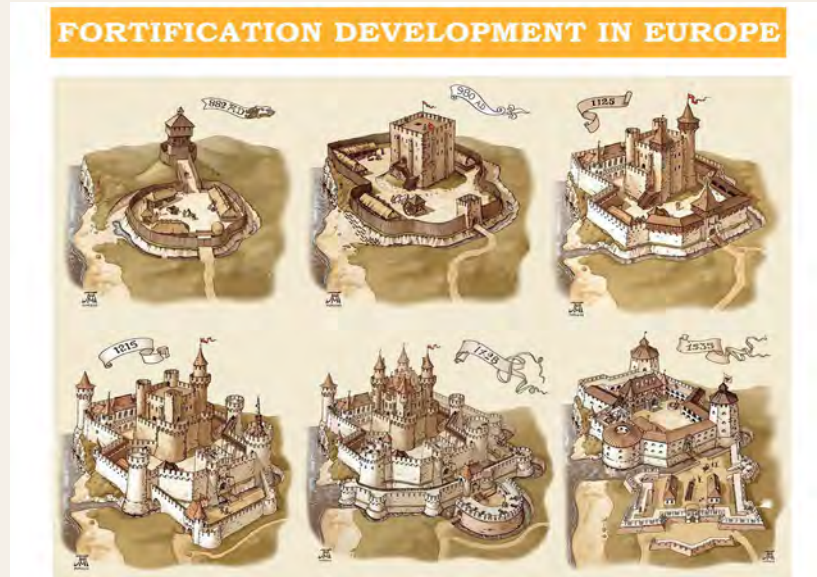
Secondary school students

Stage 1: Introduction and Theoretical Framing



Opening Questions

- Have you ever been to a castle or a fort?
- Do you know the difference between a castle and a fort?



Fortification development in Europe

Children learned to recognise fortifications on maps and photos, explored why societies built forts, and were introduced to the basic terminology: bastion, curtain, flank.

Stage 1: Introduction and Theoretical Framing



Map of Brussels fortifications, 17 century

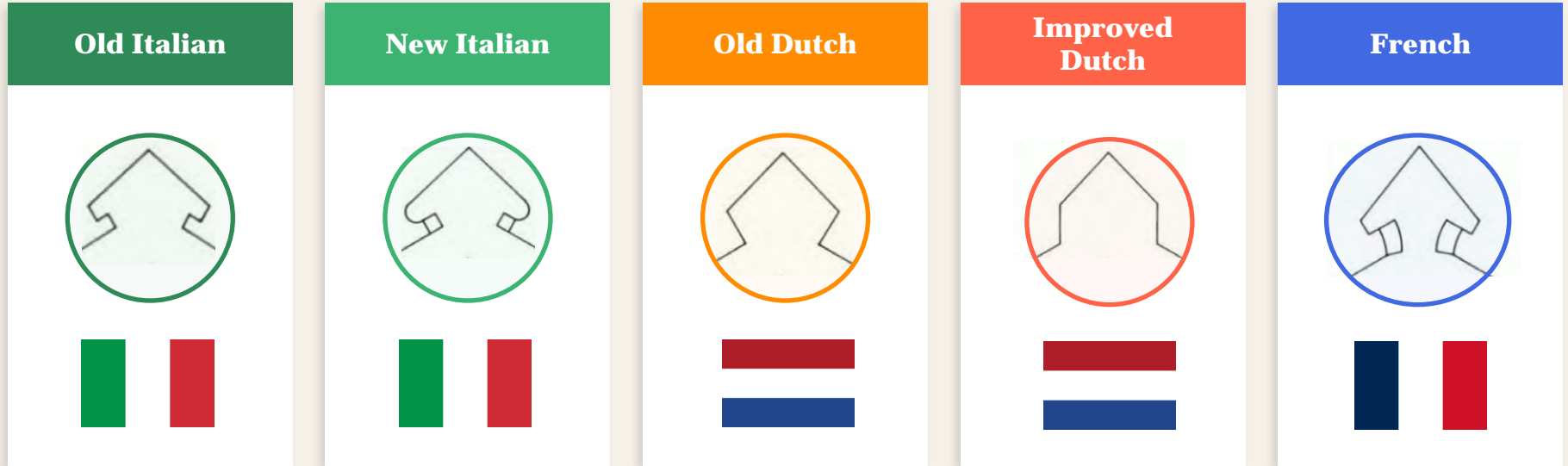


The Anneessens Tower or Angle Tower, Brussels

Remaining section of the walls on rue de Viller, Brussels



Fortification Schools: Five Traditions



Children compared the geometric shapes of five European fortification traditions, learning to identify each school by its distinctive bastion outline and proportions.

Stage 1: Introduction and Theoretical Framing



Stage 2: Hands-on Digital Reconstruction

Digitalization Process

- 1 TAKE PHOTOS**
Capture images from multiple angles
- 2 RECONSTRUCT**
Build point cloud from photographs
- 3 TRIANGULATE**
Generate mesh from point cloud
- 4 SCENE IN RHINO**
Import and process in 3D software
- 5 CUT IN PIECES**
Create puzzle pieces for printing

DIGITALIZATION PROCESS

- 1 COLLECT IMAGES**
- 2 3D RECONSTRUCT**
- 3 TRIANGULATE**
- 4 SCALE IN MESH LAB**
- 5 EDIT IN BLENDER**



Stage 3: Interactive Puzzle Assembly

Children assembled fortification puzzles at two levels:



2D Fortification Plan Puzzles

Paper-based plan puzzles showing bird's-eye views of real forts. Children matched bastion shapes, identified fortification schools, and assembled complete plans from cut pieces.



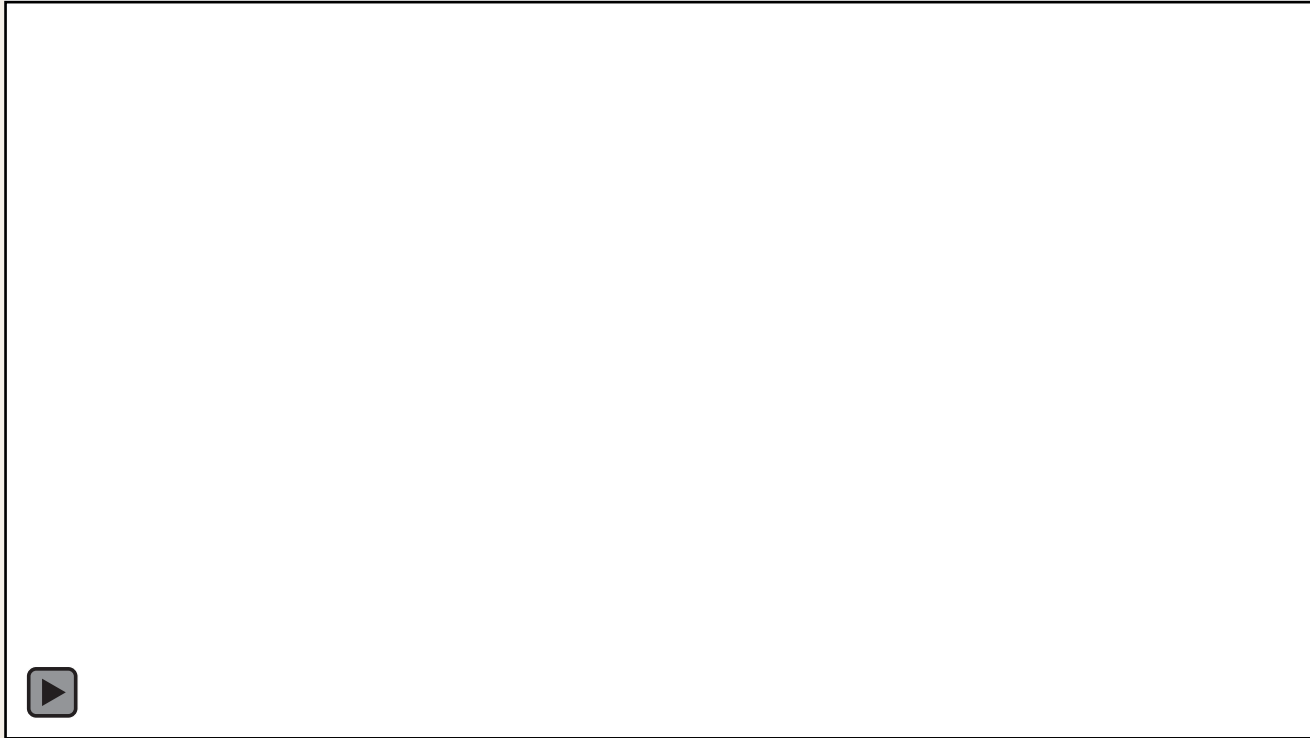
3D Printed Fort Puzzles

3D-printed fort models cut into interlocking pieces. Children reconstructed the volumetric form, developing spatial reasoning and understanding of architectural structure.

2D Plan Puzzles in Action



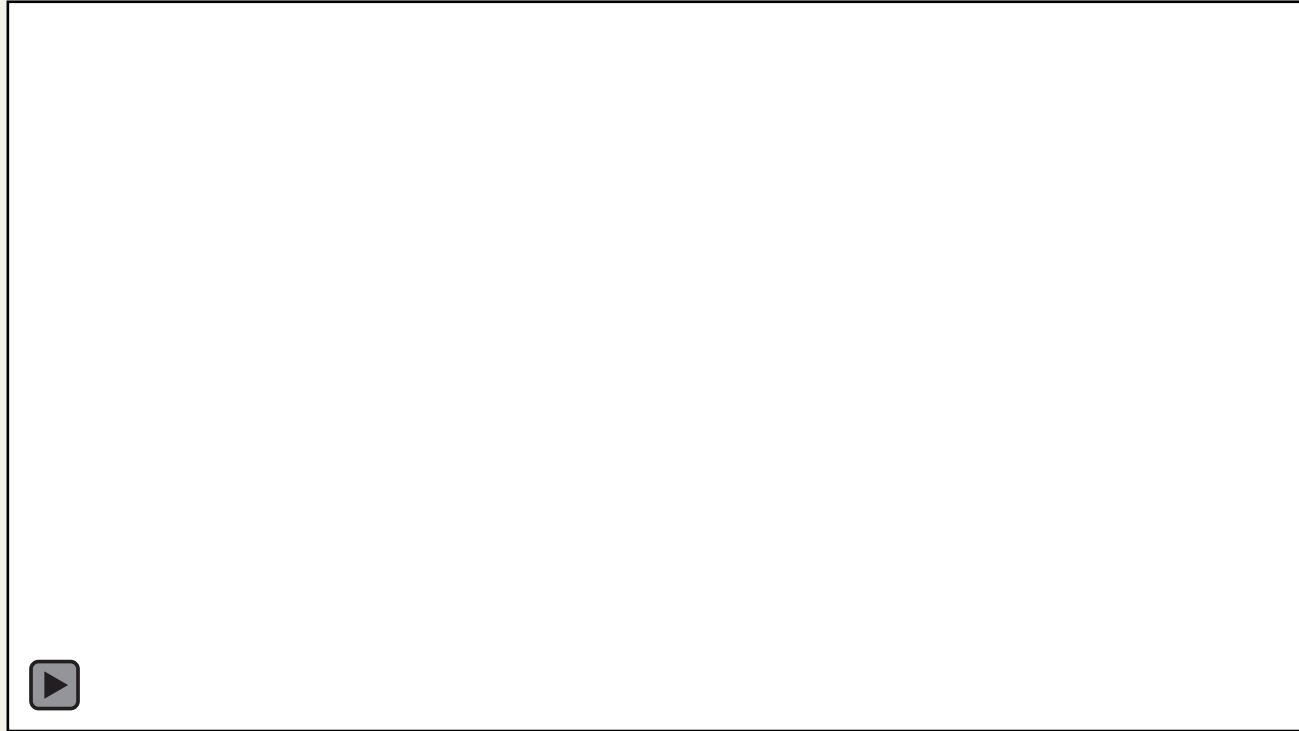
2D Plan Puzzles in Action



3D Printed Fort Puzzles in Action



3D-printed fort model (detail)

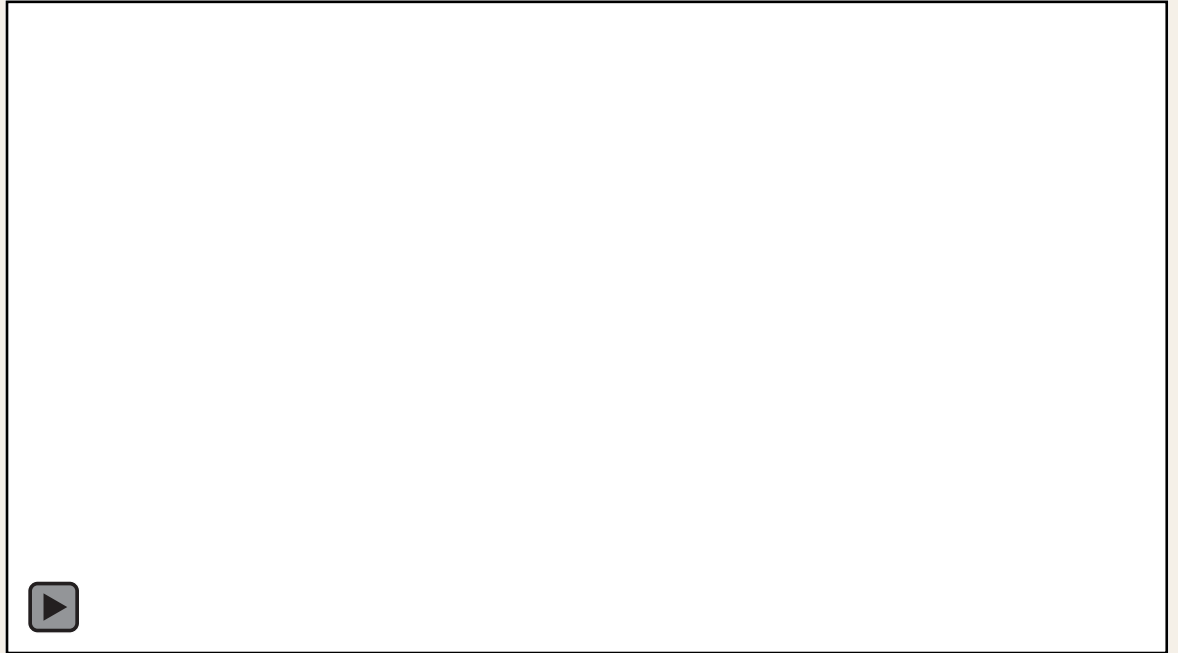


Children assembling 3D fort puzzle at the exhibit

3D Printed Fort Puzzles in Action



3D-printed fort model



Children assembling 3D fort puzzle at the exhibit



The workshop combined structured learning with playful discovery, engaging over 600 participants across two days.

05

OUTCOMES

Learning results and reflections

Learning Outcomes

Activity Component	Learning Outcome
S1. Map Recognition & Photo Identification	Understand multi-layered urban heritage and locate remains of fortifications
S1. Historical Context (Why protect forts?)	Cultivate preservation awareness
S1. Fortification Schools & Terminology	Distinguish fortification schools and elements
S2. Digital Scanning & Preservation	Introduce digital documentation and professional conservation practices
S3. Fort Model Creation & Puzzle Assembly	Enhance analytical, spatial, and architectural reasoning

Key Takeaways



Age-inclusive design matters

The three-stage structure allowed children from 3 to 18 to engage meaningfully at their own level.



Puzzles are powerful pedagogical tools

Physical puzzles translate complex fortification geometry into embodied spatial learning.



Technology inspires curiosity

Digital documentation (iPad scanning, photogrammetry, 3D printing) captured children's imagination and connected research to play.



Heritage connects across cultures

Indonesian colonial forts and European bastion fortifications share a common geometric language that children can discover through puzzles.

Thank You!

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