



JRC Makers-in-Residence Programme

Nexus Stones - The runes of pollinators

Matteo Villa

2024

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Abstract

“Nexus Stones - The runes of pollinators” is a land installation for public engagement focused on the biodiversity of pollinators. It provides a simple yet engaging and interactive experience to get the public involved in the subject, and also is a research project for new methodologies dedicated to present and possibly engage the general public in relevant policy topics, through immersive land art and storytelling. The project combines a material aspect related to natural elements with digital aspects, exploring new modes and narratives related to these themes, with the goal of creating engagement and interactive learning. It offers a series of resources ready to be used in various formats and contexts.

Acknowledgements

Special thanks to the entire JRC team that contributed to the development of this research, from the perspectives of visions, content, and the productive aspects related to making. And also to colleagues from TheFabLab and Superstuff, digital design and scientific communication laboratories, from which this work has gained momentum and inspiration.

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1 Introduction

“Nexus Stones - The runes of pollinators” is a land installation for public engagement focused on the biodiversity of pollinators. It provides a simple yet engaging and interactive experience to get the public involved in this subject, and also is a research project for new methodologies dedicated to policy engagement through immersive land art.

The following report presents the development of a first prototype of a set of Nexus Stones, and linked toolkit, referring to the initial context of the work, the process and methodology that guided the exploration and final results and conclusions, that serve as the basis for further developments.

1.1 Context

The third edition of the JRC Makers-in-Residence programme, planned for the first quarter of 2024, challenged makers around Europe to design a tangible outcome (e.g., workshop, prototype, artwork, exhibition), original and re-usable to respond to the challenges in one of the following topics, in relation to relevant policy issues:

- Arctic;
- Bioeconomy;
- Biodiversity;
- Public spaces.

This proposal was focused on the biodiversity topic, and in particular about the biodiversity of pollinators.

According to the EU publication *“Science for Environment Policy Pollinators: importance for nature and human well-being, drivers of decline and the need for monitoring”* [1], pollinators are essential for our wellbeing and the survival of ecosystems by aiding plant reproduction, thus ensuring a continuous supply of nutritious and economically significant food, and supporting biodiversity. The alarming global decline of pollinators threatens to diminish these benefits, impacting crop yields, food security, and the quality and economic value of crops. These crops, including fruits, vegetables, nuts, and oils, are crucial for human health, providing essential nutrients and helping prevent diseases like cardiovascular conditions and cancer. Pollinators and the plants they pollinate are integral to ecological networks, enhancing plant health and supporting other species. The loss of pollinators would not only affect pollination services but also degrade ecosystems' carbon storage and flood protection abilities, along with losing the pest control services of certain pollinators and the social and cultural values they provide [1].

A diverse array of pollinators is needed for effective and sustainable pollination across various conditions and environmental changes. While bees are well-known pollinators, other insects such as flies, butterflies, moths, wasps, and beetles, as well as birds, bats, and lizards, play significant roles worldwide. Protecting this diversity is crucial, given the approximately 2,000 bee species in Europe and over 20,000 globally [1]. The decline in wild pollinator populations is attributed to land-use change, intensive agriculture, pesticides, pollution, invasive species, pathogens, and climate change, with land-use and pesticides having a significant impact through habitat loss and degradation.

Addressing wild pollinator decline requires understanding pollinator populations, the plants they pollinate, and the drivers of change, necessitating systematic monitoring and research. This includes supporting taxonomy, the classification of organisms, and leveraging citizen science and technological advancements like DNA barcoding and artificial intelligence for better monitoring. Enhanced coordination and collaboration among researchers, public institutions, NGOs, and businesses are vital for high-quality pollinator research and developing solutions to protect pollinators and ensure their resilience to environmental changes.

Within the context of citizen engagement, the proposal has focused on devising a way to engage and raise awareness among the public through an interactive environmental installation. This installation aims to introduce the topic of pollinators, generate interest, and, hopefully, lead people to become involved in active citizenship.

Effective pollinator protection requires coordinated action at local, national, and international levels. Policy engagement facilitates the development of comprehensive strategies that align with ecological needs and sustainable practices.

1.2 Proposal

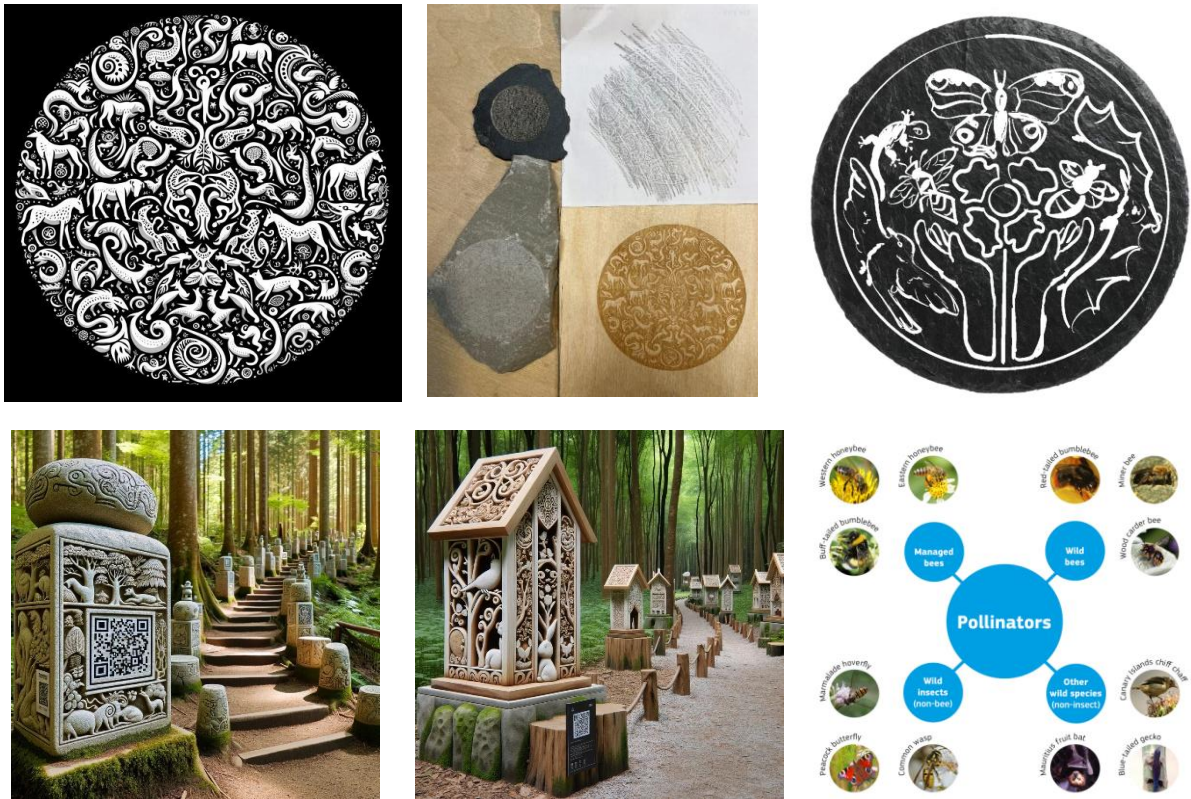
1.2.1 Initial proposal

The initial proposal selected for the JRC Makers-in-Residence programme, entitled "Biodiversity Totem," was a concept for an interactive environmental installation aimed at creating engagement on the themes of an ecosystem's biodiversity, located in a public space, through a simple puzzle mechanism. The initial concept was as follows: in a public space like a park or a trail, a series of Biodiversity Totems are scattered, which are stone structures that feature laser-engraved plates with figures on their surface. These figures represent the organisms of an ecosystem, and each totem displays some figures. By combining the figures present on all the Totems in the set, it becomes possible to compose a complete puzzle that symbolizes the ecosystem. To do this, one can use the technique of frottage, the artistic technique by which it is possible to transfer shapes and textures onto a piece of paper by rubbing a pencil over it. Each Totem could also incorporate QR codes to add augmented reality elements in the form of texts and images, to deepen the topic discussed.

The Biodiversity Totem aimed at being a simple but effective form of engagement on an important theme, bringing attention to the inhabitants and biodiversity of a system in an emotional, interactive, and fun way. To achieve this, the concept of the biodiversity totems is designed so that their appearance is far removed from that of informational signs and captions. Instead, they are meant to appear as mysterious and fascinating elements, akin to relics from another civilization. These are human-made artefacts that simultaneously feel close to nature, adorned with intriguing graphics that encourage exploration and observation. The totems' design aims to captivate the viewer's curiosity, drawing them into a closer relationship with the natural world through an engaging, tactile, and visual experience. By blending the allure of ancient artefacts with the pressing narrative of biodiversity and pollinator conservation, the totems invite passers-by to delve deeper into understanding the interconnectedness of all life forms. This approach seeks to transform passive learning into an active discovery process, making the educational journey about biodiversity both immersive and memorable. Through this, the biodiversity totems stand as silent ambassadors for nature's complexity and beauty, prompting reflection on our role within the broader ecosystem and inspiring a sense of stewardship and wonder.

This initial idea was the basis for discussion and co-design with the JRC team.

Figure 1: Pre-visualizations and initial references. Source: Various authors.



1.2.2 Revised proposal

Maintaining the idea of station-like structures representing elements of an ecosystem related to pollinators, with both analogue and digital interactions, in collaboration with the JRC team, it was decided to rethink the experience so that:

- users/participants could create their own personal drawing using the frottage technique, choosing from a range of possibilities, rather than completing a puzzle. The element of a "treasure hunt" remains in the search for the totems.
- the representations should not only depict pollinators but also the complex system they are part of. It was decided to also include, in addition to animals, the fruits and plants related to pollinators, and the habitats where they can be found and need to be protected.
- the totem exists both as a standalone installation and as a guided workshop.
- the last station should reference the role of human beings and the user themselves in the system. It should contain an element to reflect the participant's image and, through a QR code, link to the JRC's dedicated pages on policy engagement concerning pollinators.

Considering these points, the experience was planned as follows:

1. There are 5 Pollinators Totems/Stones that invite the participants to create a composition of a personal puzzle about pollinators, plants and habitats: the "introductory totem" displays instructions and a map, the "puzzle totems" display a composition of images, and the conclusive totem displays the connection to a webpage, a call to action to participate to policy creation.
2. The installation works as a "treasure hunt", where participants has to find the totems located in an outdoor environment. Whenever they find a puzzle totem, they can choose to use the frottage technique to replicate on a piece of paper one of the three engravings representing the three topics (pollinators insects, plants and flowers, habitats).If they can find the three puzzle totem, they will complete the challenge and fulfil their drawing.

3. Each totem presents a QR code. The QR code, when activated with a smartphone or tablet, triggers an augmented reality experience, which serves to: create a wow effect, transmit a message about pollinators, and show a map as a hint for the treasure hunt. The QR code of the final totem leads to a webpage dedicated to policy engagement.
4. The puzzle totem display:
 - For pollinators
 - a bumblebee
 - a butterfly
 - a ladybug
 - For pollinators
 - a strawberry
 - an apple
 - a blueberry
 - For pollinators
 - wild nature
 - countryside
 - city

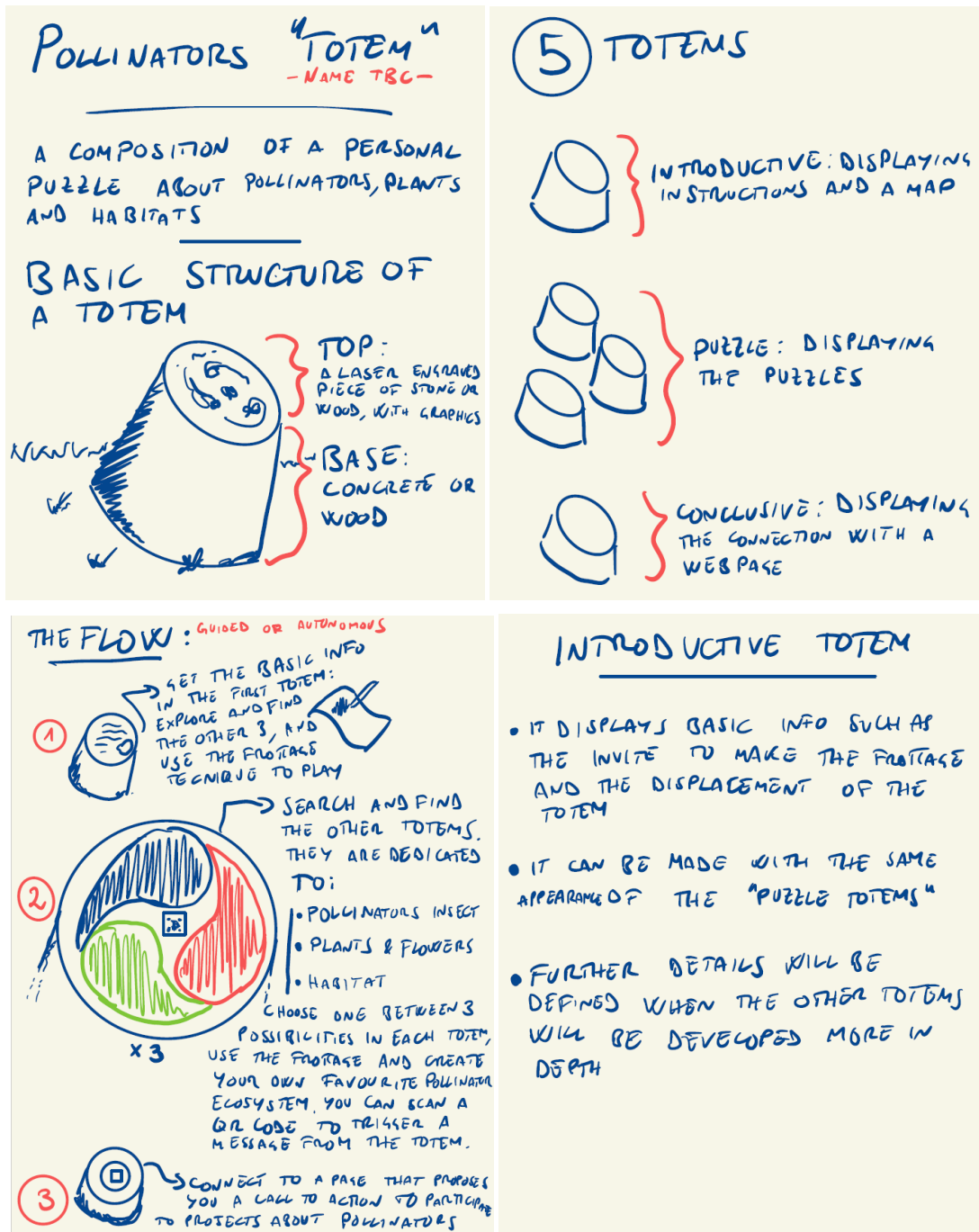
The activity is designed for a general audience but is particularly suitable for young people and families.

The objectives of the installation are:

1. To provide a memorable experience that introduces the importance of pollinators in a straightforward and immediate manner. This goal focuses on creating an impactful first impression that captivates visitors' interest and opens their eyes to the critical role pollinators have in our ecosystems and food supply. By simplifying complex ecological relationships into engaging and intuitive interactions, the installation seeks to make the significance of pollinators accessible to everyone, regardless of their prior knowledge or background in environmental science.
2. To set up tiered interactions that allow for both simple enjoyment and the opportunity to delve deeper into the subject, connecting to the EU's detailed research materials and platforms for active citizenship and participation in policy design. This objective aims to cater to a diverse audience by providing multiple levels of engagement. Visitors can enjoy the installation at a surface level or choose to explore the topic more thoroughly through QR codes and interactive elements that link to extensive resources, research findings, and initiatives for policy involvement. This approach encourages a deeper understanding and appreciation of pollinators, inspiring visitors to become more informed citizens who can actively contribute to biodiversity preservation and policy development. The installation acts as a bridge, connecting the public with scientific research and policymaking processes, thereby fostering a community of engaged individuals who are equipped to support and advocate for the protection of pollinators.

The following notes and sketches represent the draft of the process and of the physical structure of the experience, as agreed together.

Figure 2: Sketches of the experience. Source: Matteo Villa.



3 PUZZLE TOTEMS

■ PUZZLE:
STONE



POLLINATORS:

- BUMBLE BEE
- BUTTERFLY
- LADYBIRD

PLANTS:

- STRAWBERRY
- APPLE
- BLUEBERRY

HABITATS:

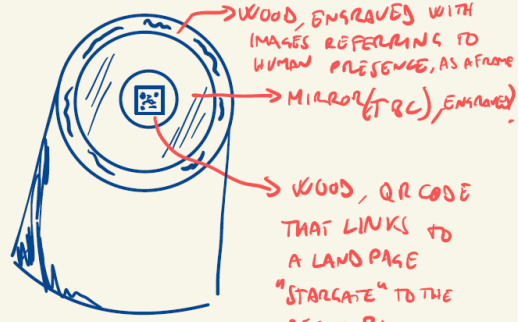
- FOREST/WOOD
- WATER
- URBAN

■ QR CODE: TO TRIGGER AR EXPERIENCE:
A SPECIAL VISUAL EFFECT +
A MESSAGE [3 MESSAGES T80]

■ OTHER VISUAL ELEMENTS: GEOMETRIES OR OTHER NATURAL
DECORATIONS THAT CAN BE USED
FREELY IN THE FRONTAGE

(■) MAP?

CONCLUSIVE TOTEM



→ WOOD, ENGRAVES WITH
IMAGES REFERRING TO
HUMAN PRESENCE, AS A FRAME

→ MIRROR (TRC), ENGRAVED

→ WOOD, QR CODE
THAT LINKS TO
A LAND PAGE
"STAR GATE" TO THE
ASSEMBLY



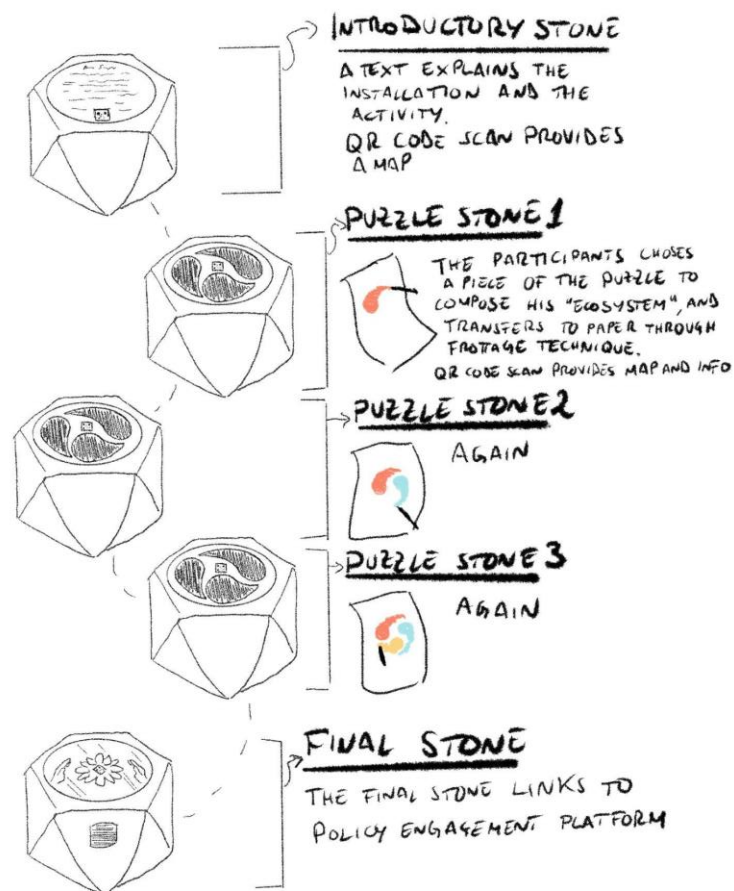
2 Process

Once the objectives and steps were defined, efforts were dedicated to the physical realisation of the installation's prototype, with the purpose of testing its impact and usability. The process explored the use of various techniques and technologies, with an emphasis on style and storytelling components to represent the theme of pollinators, alongside considerations for usability and interactivity. The stages of this detailed process are presented in the following sections:

- Moodboard and References for the Style
- Naming
- Illustrations and Laser Engraving of the Plates
- Bases
- Augmented Reality Layer
- Final Stone and Infinity Mirror
- Landing Page
- The Nexus Stones Assembled and Located in the JRC
- Other Accessories: the Nexus Toolkit

This point serves to realise the concept of the prototype and of the activity triggered by the installation. The following scheme shows the basic steps of the interaction with the installation.

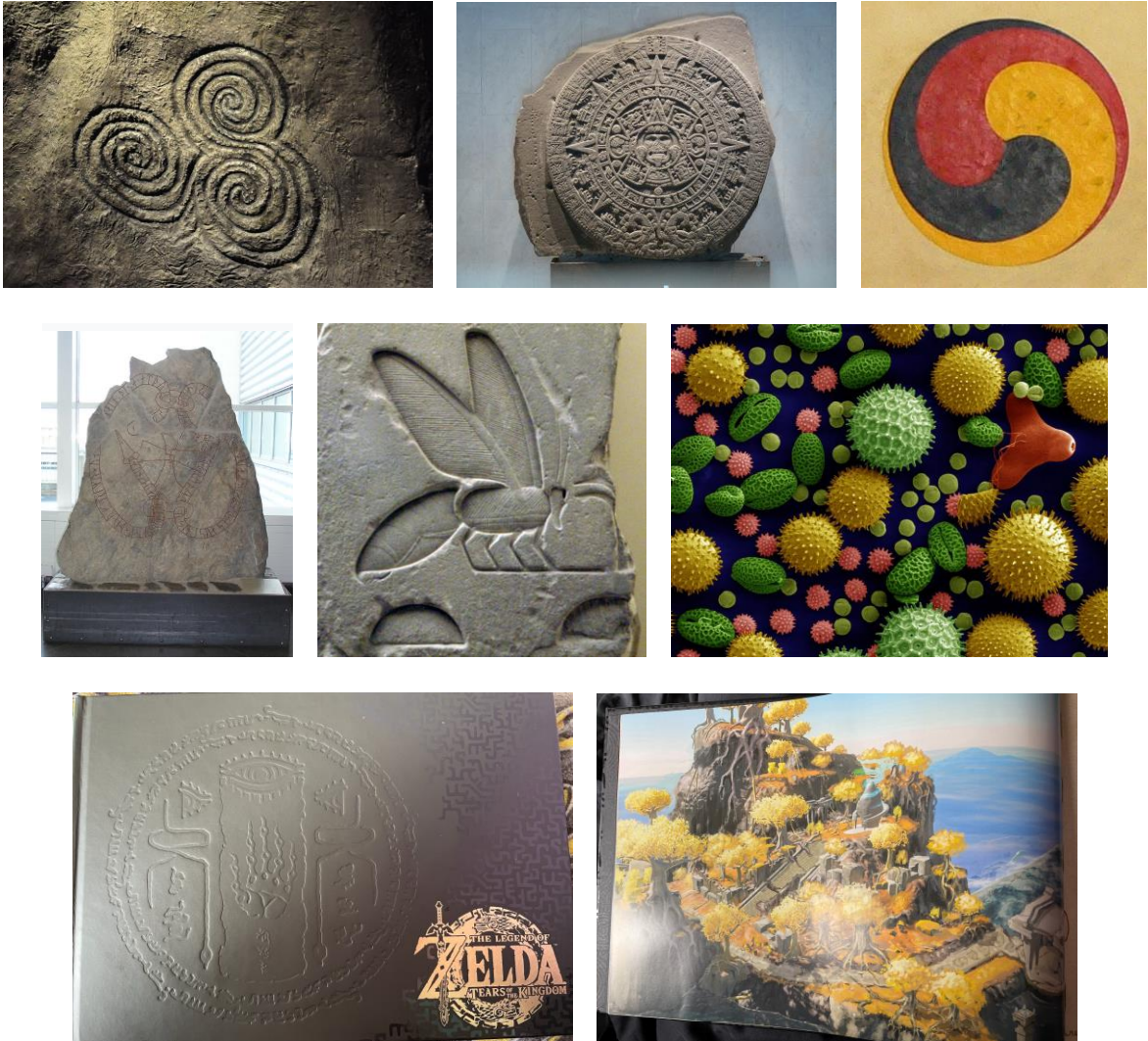
Figure 3: Scheme of the experience. Source: Matteo Villa.

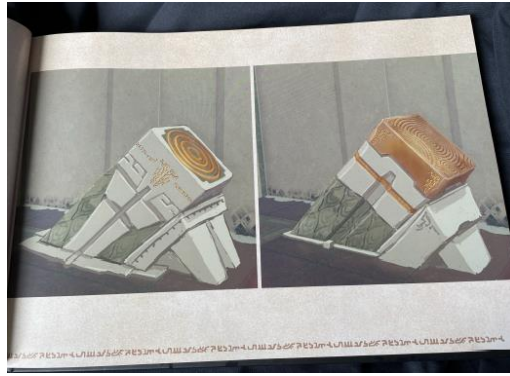


2.1 Moodboard and References for the Style

The initial idea was that the totems would be artefacts linked to the themes of ecosystems, biodiversity, and pollinators, with an evocative and intriguing style. To achieve this, the chosen aesthetics needed to reference powerful and mysterious symbols, using materials that are connected to and blended with nature and the environment as well as figures capable of representing the intersection and union between different parts that harmoniously compose a whole. For this reason, a search for references was conducted in both anthropological (runes, totems, glyphs, and symbols) areas and by looking at the best practices of professionals in world building and immersive storytelling. A notable example selected was from the video game world, the art book of “*The Legend of Zelda: Tears of the Kingdom*” [2], which was awarded Game of the Year in 2023. These stylistic references guided the digestion and framing for policy content, and for the construction of the interactive experience and the user journey in all subsequent phases.

Figure 4: Moodboard and References. Source: Various authors.





2.2 Naming

As the design process continued, it became clear that the structure would be simpler than that of a "totem," becoming more akin to a "stone." In addition to this element, a specific name was sought to represent the spirit of the project, considering these characteristics:

- The name would be "Stone" + "Something."
- This "something" should reflect both the mood and aesthetics of the installation, as well as its contents.
- It should have a mysterious or archaic sound, possibly going beyond the Italian/English choice.
- It should represent the idea of a link, of connection, and therefore of an ecosystem. But also of the bond that users develop with the important theme, and the awareness that they themselves are in connection with the ecosystem.
- It could identify a format beyond the specific theme of pollinators: the interaction dynamic developed by the stones with the necessary adjustments could indeed be applied to other subjects, or to the biodiversity of other ecosystems.

Working with ChatGPT for an in-depth brainstorming, after several iterations, the word "Nexus" emerged. This direct quote from the program illustrates the spirit of the name, meeting the various criteria listed previously.

From ChatGPT 4.0 chat:

Me: So, I would return to a previous idea. I really liked the idea of Pietranesso. However, I would ask you to delve deeper into, perhaps, the Latin version of the word nexus. Can you tell me what the word nexus means and where it comes from?

AI: Certainly, "nexus" is a Latin word meaning "bond," "connection," or "tie." It derives from the verb "nectere," which means "to tie together." The root of this word evokes the idea of connection and interdependence, concepts very suited to describing the complex and vital relationships within ecosystems, such as those between flowers and pollinators. In the context of your project, the use of "Nexus" (or its Italian variant "Nesso") conveys a sense

of deep and intrinsic connection between natural elements, reflecting the vital network of relationships that sustains biodiversity and life itself. Adopting a term with Latin roots adds a touch of mystery and antiquity, reinforcing the idea of hidden wisdom and knowledge to be discovered through the installation.

“PietraNexus” or “PietraNesso” could thus evoke not only the physical connection between the stones and the environment but also a deeper and metaphorical bond with the living fabric of the planet, a bridge between past, present, and future in the stewardship of nature. This choice of name seems perfectly in line with the goal of creating an educational and engaging experience that invites reflection on the importance of pollinators and ecosystem conservation.

The final name of the installation chosen was therefore Nexus Stones, adding the subtitle “The Runes of Pollinators” to specify from the outset the reference to the specific theme.

2.3 Illustrations and Laser Engraving of the Plates

The main interaction of the Nexus Stones, both in terms of storytelling and hands-on activity, is triggered by the illustrations engraved on the stone.

The activity entails that a set consists of 5 stones:

- An introductory stone with instructions and a map
- 3 puzzle stones, with a figure composed of 3 options
- A final stone, with a reference to online policy engagement platforms

The heart of the activity is conveyed by the 3 puzzle stones, which should display:

- For pollinators: a bumblebee, a butterfly, a ladybug
- For plants: a strawberry, an apple, a blueberry
- For habitats: wild nature, countryside, city

For these elements, the Gen AI Dall-E tool was used to produce initial reference images, which were then reworked in the software Procreate with the goal of creating an interlocking figure. This design allowed for the composition of a complete circular figure by choosing options at each of the stations. To this puzzle, the stones also added the presence of a QR code, presented in an unconventional manner, aiming to leverage its unique appearance as if it were a rune that activates a view into another layer of reality. By rotating it 45 degrees, an effort was made to convey this effect. Decorative elements were added around each puzzle to give consistency to the 3 different designs, and to insert a small Easter Egg: in the circular figures surrounding the puzzle, it is possible to read the letters JRC.

The material chosen for the prototype is slate stone: it provides a good contrast effect when worked with a laser cutter and allows for the creation of a certain relief.

With a style consistent with the puzzle stones, the illustration of the concluding stone was also designed, depicting the human element in the form of two hands approaching a flower as a gesture of care.

The introductory stone features textual elements to guide participants through the experience of the installation.

Since the first potential location for the implementation of the Nexus Stones is Ispra, an Italian site of the JRC, the introductory stone features a text in Italian. Here it is in both Italian and English.

Introductory text in Italian:

Gli animali impollinatori sono molto importanti per gli ecosistemi e per la vita di noi esseri umani. Il loro lavoro è fondamentale, infatti, per la riproduzione delle piante alla base della nostra alimentazione, le piante con cui ci nutriamo tutti i giorni. Conoscere e preservare la loro biodiversità è un modo per rafforzare la nostra relazione armoniosa con la natura.

Questa Pietra Nexus è l'inizio di un percorso per conoscere gli impollinatori, un percorso per osservare chi sono, con quali piante interagiscono e quali sono gli habitat in cui vivono.

In quest'area sono dislocate quattro altre Pietre con cui interagire. Su di esse sono rappresentati e incisi gli elementi di un ecosistema, intrecciati fino a comporre una figura completa.

Interagendo con le Pietre è possibile comporre il proprio ecosistema, scoprendo ogni volta un dettaglio in più.

Cerca le Pietre Nexus, e scegli uno dei tre elementi raffigurati su di esse, servirà a comporre il tuo ecosistema.

Carta, pastelli e matite possono servire a ricalcare la sezione scelta tra le possibilità, fino a comporre una propria figura, per portarla con sé.

La scansione digitale può dare qualche suggerimento e informazione in più!

Introductory text in English:

Pollinator animals are very important for ecosystems and for the life of us humans. Their work is crucial for the reproduction of the plants at the base of our diet, the plants we eat every day. Knowing and preserving their biodiversity is a way to strengthen our harmonious relationship with nature.

This Nexus Stone is the beginning of a journey to learn about pollinators, a path to observe who they are, with which plants they interact, and what habitats they live in.

In this area, four other Stones are placed with which to interact. On them are represented and engraved the elements of an ecosystem, intertwined to compose a complete figure.

Interacting with the Stones allows you to compose your own ecosystem, discovering more details each time.

Look for the Nexus Stones, and choose one of the three elements depicted on them; it will help compose your ecosystem.

Paper, crayons, and pencils can be used to trace the chosen section among the possibilities, until composing your own figure, to take with you.

Digital scanning can provide some more tips and information!

Figure 5: Gen AI references. Source: ChatGPT.



Figure 6: Stones designs: Source: Matteo Villa.

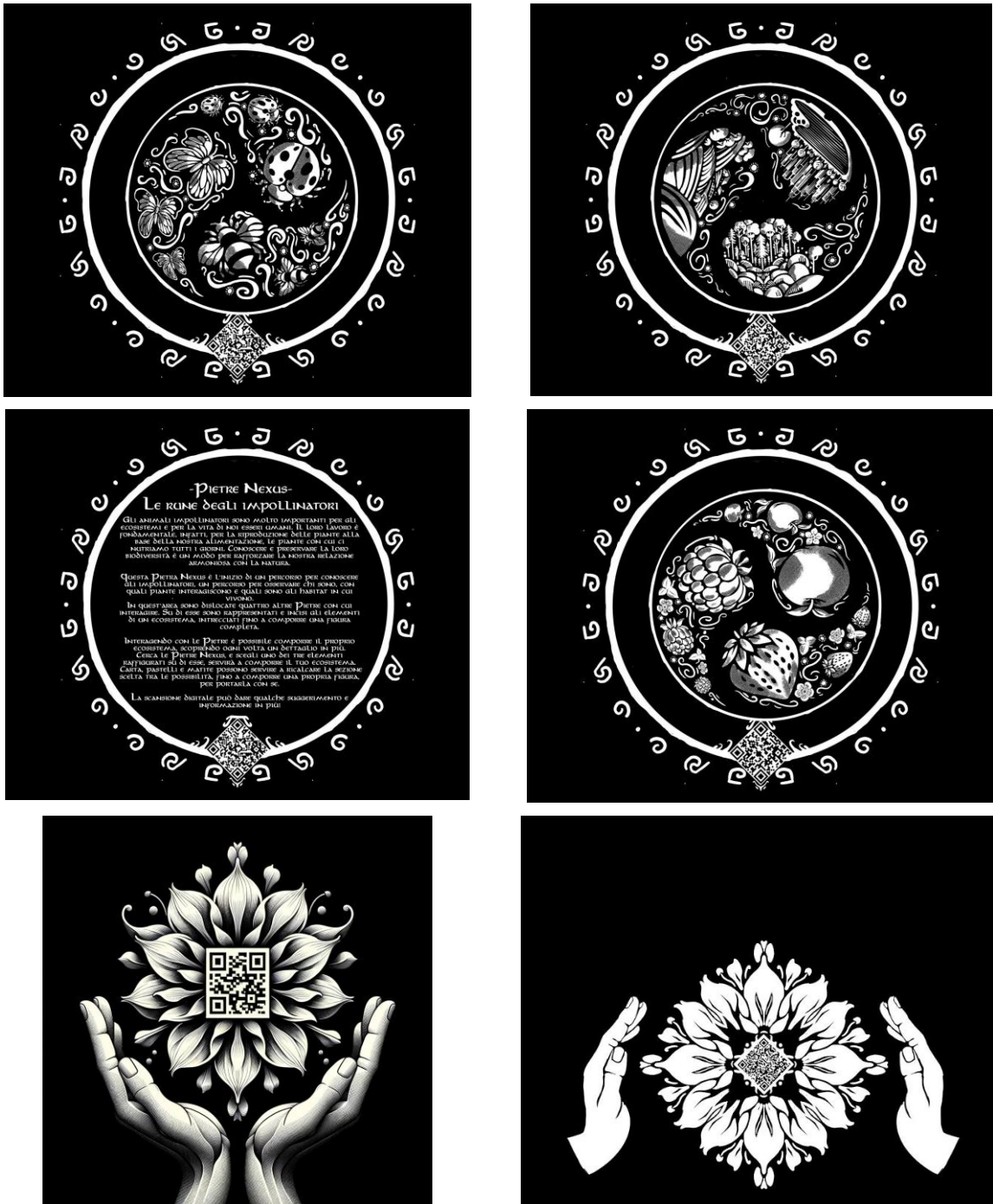
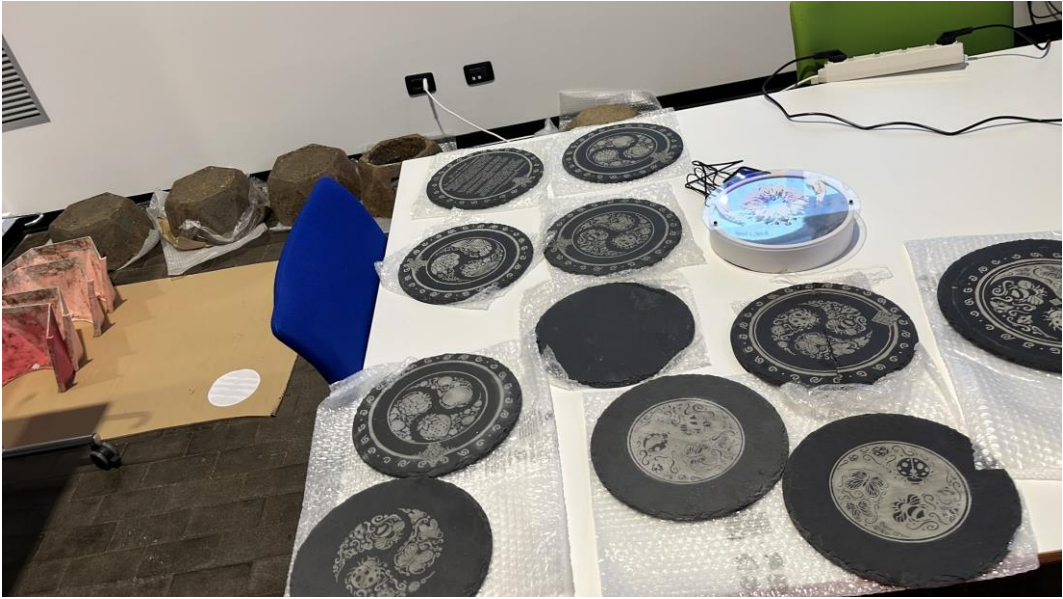


Figure 7: Laser engraved stones. Source: Matteo Villa.



2.4 Bases

The laser-engraved stones are designed to be set into a corresponding base, serving not only a structural purpose but also adding aesthetic value and contributing to the storytelling aspect of the installation. The bases are designed to be low, not only for practical reasons related to transportability but also to embody a symbolic value. This design choice encourages individuals to lower themselves, physically bringing them closer to nature and the ground. Such an action is not just a matter of convenience or aesthetics; it is a deliberate invitation to engage more intimately with the installation and, by extension, with the natural environment it represents. By bending down to interact with the Nexus Stones, participants are prompted to adopt a position of humility and curiosity, fostering a deeper connection with the earth and its ecosystems. This physical act of getting closer to the ground can serve as a metaphor for reducing the distance between humans and nature, emphasizing the importance of understanding, respecting, and preserving the natural world that sustains us.

The initial material chosen for the bases was concrete, due to its durability and strength. However, it was found to be very heavy, prompting a shift towards hypertufa, which is lighter and possesses a more natural appearance, and lets plants grow upon it. Hypertufa is a lightweight and porous material made from a mixture of several ingredients. The common components of hypertufa are:

- Portland cement
- Peat moss
- Perlite or vermiculite (for added lightness and porosity)
- Water

These ingredients are mixed together to create a substance that mimics the appearance and properties of natural tufa rock, a type of limestone. Hypertufa is popular among gardeners and landscape designers for making planters, sculptures, and other outdoor decorative items

To balance the rugged look of hypertufa with a sense of order and to introduce an element of ambiguity, a design was chosen that combines rough textures with regular shapes. This juxtaposition is intended to provoke thought and engage visitors on a deeper level, encouraging them to ponder the relationship between the natural world and human-made structures.

To create this effect, a 3D printed mould made of PLA (polylactic acid) was produced. PLA is a biodegradable and eco-friendly material derived from renewable resources, such as corn starch or sugarcane, which supports the installation's commitment to sustainability. The use of 3D printing technology allowed for precise control over the shape and texture of the bases, enabling the creation of a design that complements the aesthetic.

Figure 8: Building process of the stone bases. Source: Matteo Villa.



2.5 Augmented Reality Layer

To enhance interactivity, emotional impact, and the “wow” effect, and to add another layer for content sharing, it was planned to incorporate augmented reality elements triggered by the QR codes present on the stones.

Each augmented reality scenario, featured in the stone puzzles, includes 3 elements:

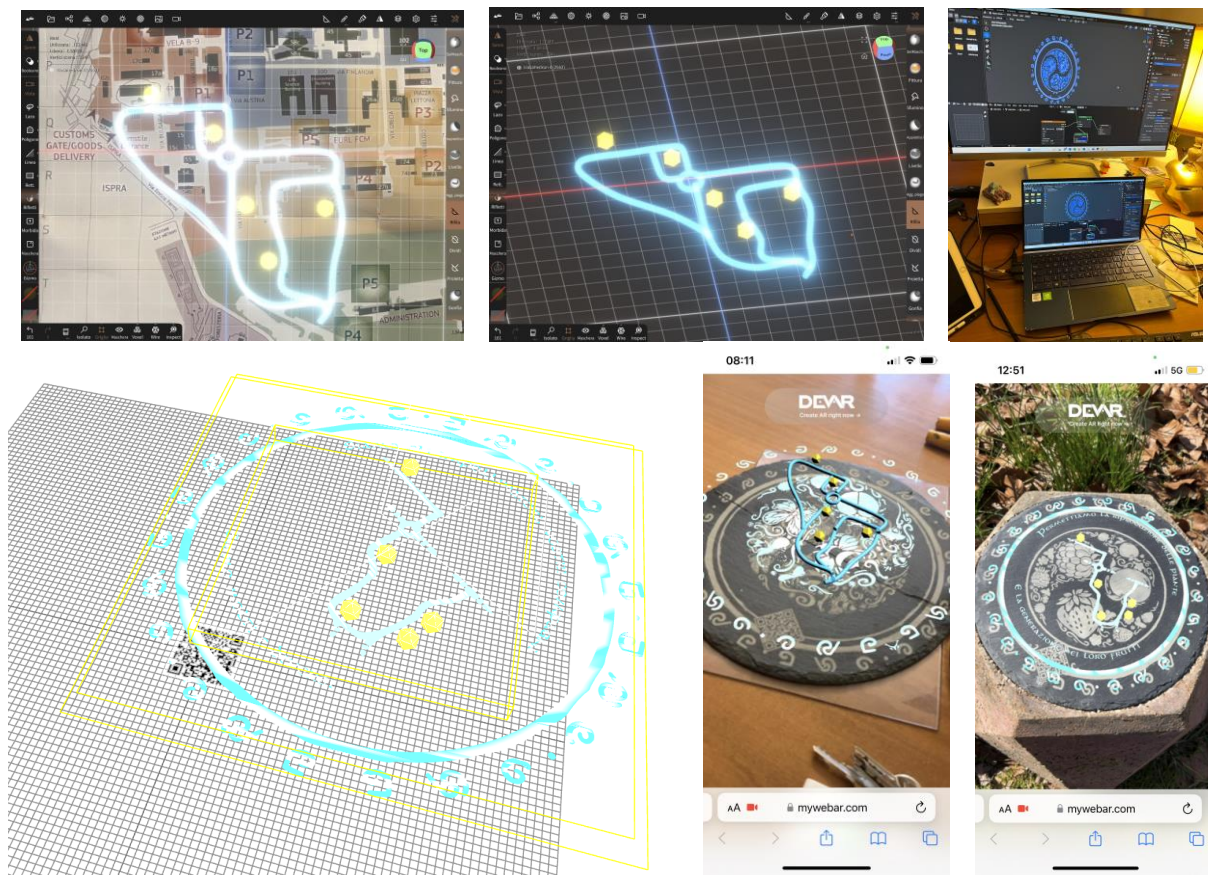
- A stylized map showing the distribution of the stones in an area
- The animation of the JRC runes rotating, and the reproduction of the stone puzzle design
- Dedicated phrases for each of the three puzzles (pollinators, plants, habitats). The phrases, in Italian and in English, are:
 - *Siamo gli impollinatori, vostri compagni. Siamo molti e diversi.*
 - *We are the pollinators, your companions. We are many and varied.*

 - *Permettiamo la riproduzione delle piante. E la generazione dei loro frutti.*
 - *We enable the reproduction of plants. And the generation of their fruits.*

 - *Condividiamo molti habitat con voi. Viviamo tutti insieme.*
 - *We share many habitats with you. We all live together.*

The elements of the scenarios were created using 3D modeling and animation softwares such as Blender and Nomad Sculpt. The AR scenario linked to the QR code was developed using the free web app Mywebar.

Figure 9: 3D models and AR design. Source: Matteo Villa.



2.6 Final Stone and Infinity Mirror

The final stone was distinguished from the other's, having the following features:

- Instead of the usual black stone, at the top, there is a mirror: the idea is to suggest to the participant that he himself, reflects and sees his own figure, becoming part of the ecosystem.
- The mirror is not just any mirror: by activating the panel on the side of the stone, the "infinity mirror" effect is triggered. This was achieved through a double mirror, LEDs, and a solar panel that serves both as a power source and as a sensor for activation. The idea is to also include a small interaction and a little surprise effect in this part, suggesting that the participant is not only part of the system but is not alone: in front of him, there is a portal that connects him to the possibility of taking personal action for pollinators.
- Above the mirror, there are graphic elements: two hands, a flower with a QR code at the centre that links to a landing page.

Figure 10: Final stone: infinity mirror and interactive portal. Source: Matteo Villa.



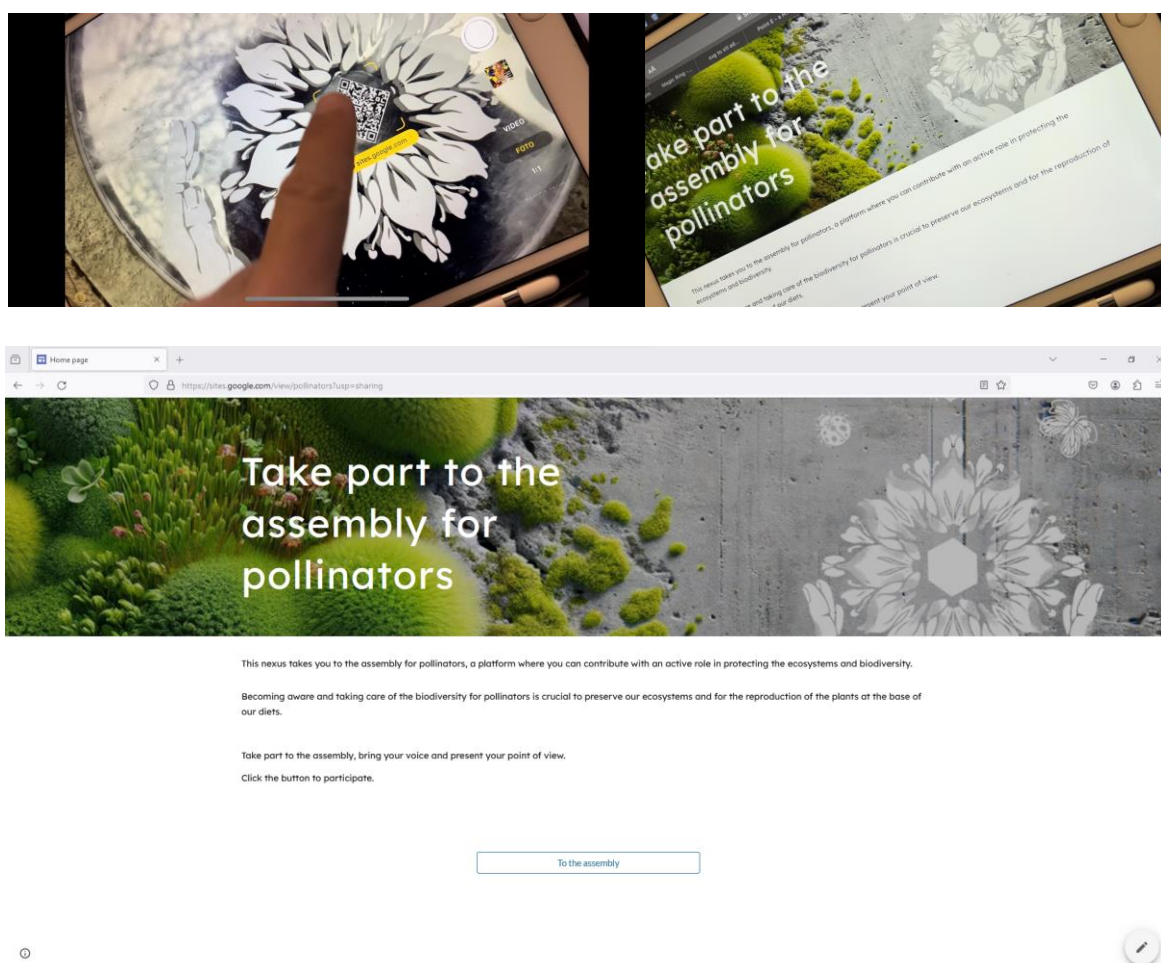
2.7 Landing Page

Once scanned with a smartphone or tablet, the QR code connects with a landing webpage that introduces the participants to policy engagement through digital platform.

A mock-up page was made with Google Site, with some basic information and text that link the flow of the interactive activity to policy engagement.

This final step concludes the user journey with a call to action, with the objective of connecting the play/emotional experience with the possibility to take part active citizenship processes.

Figure 11: Landing webpage. Source: Matteo Villa.



2.8 The Nexus Stones Assembled and Located in the JRC

With all the structural parts available, it was possible to assemble the 5 Nexus Stones. Once ready, they were distributed in a central green area of the JRC in Ispra (Italy) for testing.

A path was chosen, accompanied by a trail, starting from the JRC Makerspace and ending in an area previously dedicated to wooden constructions useful as dens for pollinators insects.

Figure 12: Nexus Stones assembled. Source: Matteo Villa.



Figure 13: Nexus Stones placement. Source: Matteo Villa.





2.9 Other Accessories: the Nexus Toolkit

Once the first prototype of the Nexus Stones was completed, it was possible to reflect in depth on the “user journey” and on the ways they can be used. Two considerations were made:

- The experience of the Nexus Stones can be facilitated in the context of a workshop for small groups, where a guide introduces the theme, accompanies the activity, and is available to delve deeper into the topic of the biodiversity of pollinators and their importance in the ecosystem.
- The experience of the Nexus Stones, in the form of a treasure hunt, can be replicated without necessarily engaging in the construction of the entire Stone. Thus, a more simply replicable mode in terms of materials and construction process was sought, one that would maintain the spirit of the activity.

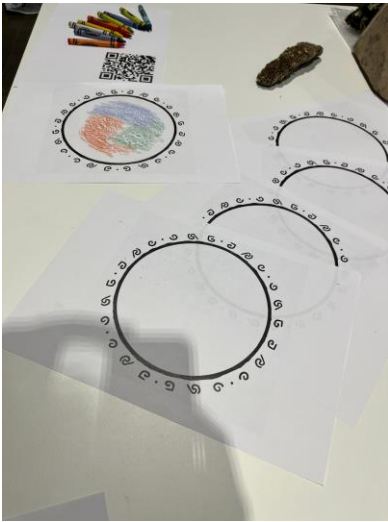
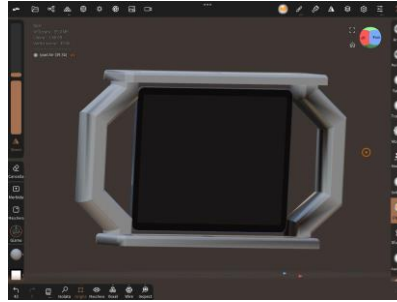
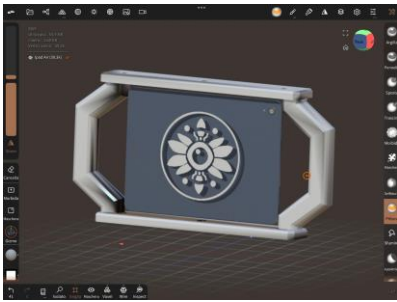
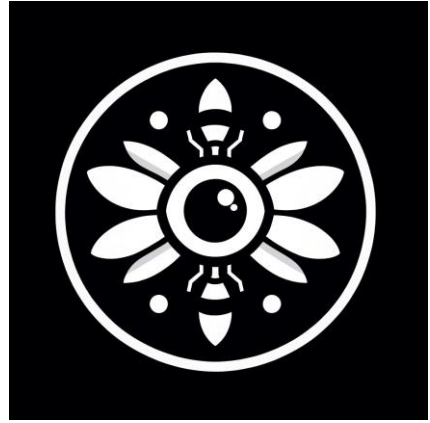
For the workshop mode, two additional accessories were designed to contribute to the immersive experience:

- A sticker and a tablet stand provided by the guide to participants for exploration, with the idea that a technological tool like a tablet can be seen in a more imaginative way. The image of the sticker was generated via AI, with the instruction that it should have a certain level of symbolism and abstraction, evoking elements like an eye (considering that the tablet is used to observe, uncover hidden AR images) and pollinator wings (considering that participants “fly” from one Stone to another like pollinators).
- A paper template that mirrors the JRC runes circle, serving as a frame for the frottage work.

For the “light” mode, Nexus Medallions were designed: laser cut wooden disks that reproduce the same designs of the Stone set. Those organising the activity can place the medallions in a park or environment, using ropes or masonry nails.

All these resources, together with the stones, constitute the Nexus Toolkit.

Figure 14: Other Accessories: the Nexus Toolkit. Source: Matteo Villa.



3 Results

The final result is a prototype of a toolkit with a collection of resources: the Nexus stones, which can be used as a free environmental installation or in workshop mode, integrating some accessories (templates and tablets), and the Nexus medallions, which allow for replicating the same dynamics in a less demanding way in terms of setup, and more portably. These experiences are connected to the online policy engagement platform. This prototype is a research artefact useful for exploring the hypothesis of land art as means to engaging citizens on important themes, through experiences that leverage cognitive, emotional, and social dimensions.

4 Reflections

4.1 Main challenges

The challenging aspects are related to creating a good user experience and a good frottage experience in relation to the materials used (stone, hypertufa). Further research and resources could be dedicated specifically to this theme, in order to incorporate storytelling into a concrete support that is simple, effective, and immediately usable.

Additionally, it would be useful to find open-source augmented reality platforms.

4.2 What could be done next

Further developments, in addition to refining the material aspects of the prototype, could be dedicated to finding application contexts and field testing with users, such as in parks, library gardens, and municipal green spaces.

A potential collaboration with the National Science and Technology Museum Leonardo da Vinci in Milan is currently explored and contact in this direction has already been established. The Museum has a department dedicated to Public Engagement with Science which is working on the topic of pollinators, and an outdoor-park, which could potentially be a setting for the Stones.

Furthermore, the prototype can be the subject for other grants dedicated to sci-art collaboration, such as those promoted by Ars Electronica in Linz. The topic of biodiversity, food systems and pollinators are often object of the brief of such kind of grants, and the Nexus Stones can be further developed in these contexts.

5 Conclusions

This work has enabled the creation of an interactive path useful for citizen engagement and scientific communication, blending technological, natural, and storytelling aspects, adopting a transdisciplinary approach (combining digital and analogical technologies with immersive storytelling and science engagement) useful in contexts where the aim is to unite different fields of knowledge and communities. It provides a set of educational resources ready for educators, researchers, and policymakers, but above all, it is a prototype useful for raising research questions about engagement methods that combine relevant scientific themes and immersive installations in public spaces.

6 References

[1] European Commission, Directorate-General for Environment, *Pollinators – Importance for nature and human well-being, drivers of decline and the need for monitoring*, Publications Office, 2020, <https://data.europa.eu/doi/10.2779/070>

[2] NINTENDO, *The Legend of Zelda: Tears of the Kingdom – Artbook/Recueil d’illustrations*, 2023.

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