ISSN 2729-7640

ALFA
ARCHITECTURE PAPERS
OF THE FACULTY OF ARCHITECTURE AND DESIGN STU
www.alfa.stuba.sk

2/2026 (Vol. 31)
DOI: 10.2478/alfa-2026-0008

Research article

Co-creativity between human, nature, and artificial intelligence

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Article information
Sent: Feb 11, 2026
Accepted: May 13, 2026
Published: Jun 12, 2026

Abstract: Creativity is an unconditionally unique characteristic of the human brain. This is how it is perceived by the majority of people; this thought is what gives the illusion of human exceptionalism towards Nature. This article challenges that and questions whether creativity could exist beyond humans. It reinterprets creativity not only as an inherent part of the natural world (which humanity still belongs to), but also as something that does not require consciousness or intent (meaning an author) and can be expressed by natural and digital systems alike. The study observes creativity from different perspectives: classical philosophical definitions of creativity, different typologies of creativity in psychology and neuroscience, including the theory of functional network connectivity of the human brain in creative processes. It examines the differences and similarities in how creativity manifests in self-aware humans, non-conscious Artificial Intelligence, and the collective intelligence of Nature. The practical experiment showcases a framework of co-creativity between Human, Nature, and Generative Artificial Intelligence. Utilising the complementary properties of the Triad, the paper explores how a personalised dataset can influence bioinspired and local specific design. The developed AI-assisted Biodesign workflow was used to generate novel architectural solutions that integrate both human-centric and nature-inclusive perspectives on form-finding and problem-solving design strategies.

Keywords: biodesign, creativity, artificial intelligence, architecture, co-creativity

1. Introduction

Humanity constantly tries to separate itself from the natural world. Human exceptionalism has been explained for centuries through the Aristotelian *animal rationale* (Kraut, 2022): while all living things possess life, the ability to reason and express logical arguments was highlighted as uniquely human. By the 20th century, the view shifted towards the idea that humans are uniquely capable in *"symbolic imagination and intelligence,"* and Cassier proposed, *"we should define man as an animal symbolicum"* (Cassirer, 1944, p. 26).

Neuroscience provides anatomical support for this distinction. One of unique features of human brain is Prefrontal Cortex (PFC), which is more structurally complex than in other species (Donahue et al., 2018). The PFC enables higher-order cognitive functions and contributes to idea generation and execution. This is a *specialised human evolutionary adaptation* that allows us to exchange and debate ideas, imagine possible futures, create tools, symbols, and culture—the ability often recognised as creativity**.** What if creativity is not the exclusive domain of conscious minds, but a distributed phenomenon emerging across natural and artificial networks alike, without consciousness or intention?

The motivation of this article is to explore the extension of human creativity through non-human creativity; Nature, understood as an ecosystem, and AI (specifically Generative AI (GenAI) or generative neural networks (GNN)). The practical part focuses on AI-assisted Biodesign workflow based on a Co-creativity approach that utilises input from all three agents to create novel architectural solutions that merge human and nature perspectives to achieve location-specific design that supports both human habitation and the needs of ecosystems. Suburban areas around Portland, Oregon, USA, were selected as a test site due to the close interaction between humans and wildlife in this area.

Throughout architectural history, architects have copied visual forms of natural structures. However, the development of modern computational approaches, such as parametricism gave artists and engineers the ability to deconstruct, analyse, and simulate natural systems and processes algorithmically, opening new possibilities for collaboration with Nature through technology. Nature could become a partner for humanity through Nature-inclusive design enhanced by AI, building a bridge between the natural world and human cultures and mitigating challenges for mutually beneficial coexistence. This opens a new form of collaboration—Co-creativity that blends human inspiration with natural systems that AI is capable of revealing through imitation and pattern recognition.

2. Creativity

2.1. Defining creativity: Human, AI, and non-human perspectives

Despite the assumption that human creative ability is unique, the definition of creativity is surprisingly varied between researchers. They highlight different aspects of the complex phenomenon of creativity, which stems from Mel Rhodes's classic 4Ps model of creativity (Rhodes, 1961): person, process, product, and press (environment). Most of them focus on the person or the product, defining creativity as "*the ability to produce or develop original and valuable work, theories, techniques, or thoughts*" and state that one individual can be more creative that another (American Psychological Association, 2025). However, some view it more as a trait or *"a disposition—involving both the ability and the motivation —to produce things that are new and valuable"* (Paul and Stokes, 2024, p. 1), and argue that it can be learned and trained. Berys Gaut argues that creativity requires *agency* and express itself through "*the exercise of choice, evaluation, understanding, and judgment*" (Gaut, 2014).

The most widely accepted definition is the standard definition of creativity: "*Creativity requires both originality and effectiveness*" (Runco and Jaeger, 2012). By adding "potential" to the static standard definition "*Creativity requires potential originality and potential effectiveness*" Giovanni Corazza transforms it into a dynamic phenomenon (Corazza, 2016) and shifts creativity beyond an anthropocentric view into the *dynamic universal creativity process* (DUCP) (Corazza and Lubart, 2020). The adoption of the dynamic creativity framework allows the inclusion of the less common view that creativity does not require conscious input or intentionality, as expressed by Adrian Currie and Derek Turner. They argue that "*non-intentional creativity carries the same aesthetic and epistemic value"* (Currie and Turner, 2023, p. 124).

The study aims to understand how differently creativity emerges in the self-aware human mind and within non-conscious AI and Nature; therefore, it is essential to look more closely at each of these entities individually.

2.1.1. Human creativity

Modern neuroscience considers the human brain as a set of interconnected large-scale Functional Neural Networks. Arne Dietrich (2004), a psychologist and neuroscientist, offered a framework for creative insights based on the networks that are essential for creativity. The Default Mode Network (DMN) is responsible for internally focused thoughts, mind wandering, and the wakeful resting state; it supports spontaneous and emotional generation of ideas. The Executive Control Network (ECN) is associated with goal-oriented tasks and attention, and is responsible for working memory and executive focus, it relies on previous knowledge and experience (Borders, 2020). Both work in an antagonistic way, when one is active, the other is suppressed (van den Heuvel & Hulshoff Pol, 2010).

Recent research demonstrates that "*greater creative thinking has been linked to the coupling of the DMN and the ECN*" (Chen et al., 2025, p. 54). Furthermore, it highlights that creative people are highly flexible in switching between these networks and show a strong balance between them. While the Functional Neural Network framework represents only one aspect of brain activity and does not account for other aspects of personality or the development of practiced, embodied skills—such as painting or dance. The specificity of neural network theory allows researchers to redefine Creativity in a more technically grounded way: *"Creativity is a mental state that requires an optimal balance between spontaneous thought generation and goal-directed processing*" (Chen et al., 2025, p. 54).

If human-specific cognitive attributes are excluded from this definition, it can be further generalised as "*Creativity is a disposition that requires an optimal balance between spontaneous generation (ability), and goal-directed processing (motivation)".* This definition follows the DUCP umbrella, leaving space for context and inconclusiveness in the process, and enables a non-anthropocentric evaluation and comparison creative ability of both AI and Nature.

2.1.2. Biological non-human creativity

Nature does not create in the human sense. There is no conscious intent or foresight; it operates though distributed agency of species, influence each other through environmental feedback, reshaping the ecosystem and themselves through evolutionary processes. Although there is a wide range of research of animal creativity, in this article, the creativity of Nature is represented through plant self-organisation and stigmergic processes within ecosystems.

In "Creativity Without Agency", Currie and Turner (2023) challenge the anthropocentric view on creativity by making the striking point that creativity does not require intent and disputing the traditional definition that "creative products need not be original or need not be valuable" (Currie and Turner, 2023). Non-originality is very common in nature, as seen in convergent evolution, where similar solutions are reinvented multiple times in different species in response to similar environmental challenges. Non-valuable decorative features point to aesthetic choices within species that were sharpened by millennia of sexual selection.

Although the typology of creative processes offered by Margaret Boden (2004) was developed for Artificial Intelligence, for this research it aligns well with the distributed intelligence of ecosystems, since Nature as an ecosystem-level process and AI do not have cognitive organs or emotional capacity (Currie and Turner, 2023).

Combinatorial creativity is the ability to generate novel and unfamiliar variants of pre-existing parts or ideas. In Nature, sexual reproduction is a prominent example. Through gene exchange, each offspring receives a unique combination of genes from both parents. Occasionally, these new combinations prove especially successful, and over generations they can lead to the emergence of entirely new species.

Exploratory creativity can be explained through an analogy with parametric design, where multiple parameters are explored within a design space—a domain of different constraints and opportunities against which the chosen parameters are tested. In evolutionary terms, the environment functions as such a design space. Nature explores and creates multiple solutions that fit into a given environment by "searching" through already defined phenotype and changing features of species in response to environmental pressures.

Boden's third type of creativity is Transformational. This is arguably the rarest form of creativity, whether in human culture or in Nature. In this case, innovation is so influential that it changes the rules of the game, like the Gutenberg press. In the planetary evolution of life, there were several transformational events. The major one, the Cambrian explosion (approximately 540–530 million years ago), during which major changes in atmospheric chemistry and geological formations triggered an unparalleled emergence of new body plans and life forms, some of which still exist today.

This typology reveals that Nature has the *ability* to spontaneously generate solutions such as mutations, genetic recombination, or adaptive radiation. Goal-directed evolutionary processes (environmental and selective pressures, survival strategies in rapidly shifting environments) provide *motivation* for Nature to continuous invention and diversification of life forms. Nature is a constant inspiration for designers and engineers who apply biomimetic approaches, observing and studying the solutions already developed in the natural world. Humans usually focus on a single species at a time, and those inspirational species often have shorter lifespans than humans, allowing enough time and opportunity to study them within a human time frame. Recognising Nature as a creative entity unlocks the opportunity for humanity to Co-create with it, not only during our lifetimes, but as multigenerational collaboration.

2.1.3. AI creativity

Since the release of DeepDream in 2015 (Mordvintsev, Olah and Tyka, 2015), audiences were stunned by strange images generated by the programme and recognised the creative potential of Generative AI, reopening the debate “Can AI be truly creative?” with new intensity. Neuroscience's progress in understanding how the human brain learns and thinks is reflected in the principles of Artificial Neural Network (ANN) architecture and the training process. Both rely on layered processing and pattern recognition, although the efficiency differs. The human brain does not require large amounts of data to learn; this capacity was optimised by evolution. As Benjamin Bratton (2025a) notes, “AI will teach us as much about what thinking is that we will teach it”.

One of the main training methods is reinforcement learning. While one ANN is “daydreams” and generates images based on the prompt and the data it was trained on, the other ANN judges it against the data set and selects the most relevant. The training algorithms teach ANNs to predict results that can be perceived as creative results. As Runco calls it, “Artificial creativity”, because it lacks the properties required for human creativity: agency, intentionality, and authenticity (Runco, 2023). However, unintentional AI creativity can be useful to the human author in achieving their creative goals.

Combinatorial Creativity is arguably the easiest to replicate by machines. In a way, it is a mosaic or collage of parts that can be randomly reassembled. Machines can do it tirelessly through brute force. They can sort, test, predict, and filter out combinations that might be relevant to the prompt they were given. Generative AI shines in *Exploratory Creativity*, because it operates within a structured conceptual space that is defined by stylistic domains or rule sets. It is the inherent quality of GenAI architecture; images are generated from random noise under the influence of parameters such as seeds or prompts and are constrained by the training dataset. Every change produces different results for the same prompt, and the variety is limited only by time and computing power.

Early versions of Generative AI were more prone to “hallucinations”, generative mistakes that are easy for humans to understand but difficult for machines to resolve (Fig. 1). A lack of understanding of real physics produced uncanny, dreamlike images, and it best illustrates the exploratory nature of GenAI. The human author behaves as curator and adds meaning even knowing there was none. These early versions, which match the unmatchable may appear more creative than improved contemporary ones that generate images so mundane that they are often indistinguishable from real ones.

As the most radical form of creativity, *Transformational Creativity* is the most challenging for AI. This type is rule-breaking, genius-like innovation. Boden believes that while it is extremely difficult, it is not impossible. She saw the answer in evolutionary AI systems that “can make random changes in their current rules so that new forms of structure result” (Boden, 2016). Boden also acknowledges that the transformational potential of AI is constrained by its lack of autonomous values. In practice, programmers decide the criteria and fitness goals for evolutionary changes in AI. As a result, AI cannot reinvent itself to make this leap into the “unthinkable”. Looking back at the proposed definition of creativity, Generative AI demonstrates both ability and motivation to generate solutions based on prompts and instructions; but in comparison to Nature, ability here is the function for which Gen AI was created, and motivation in this case is rather external—the prompt that AI receives is a goal it needs to achieve.

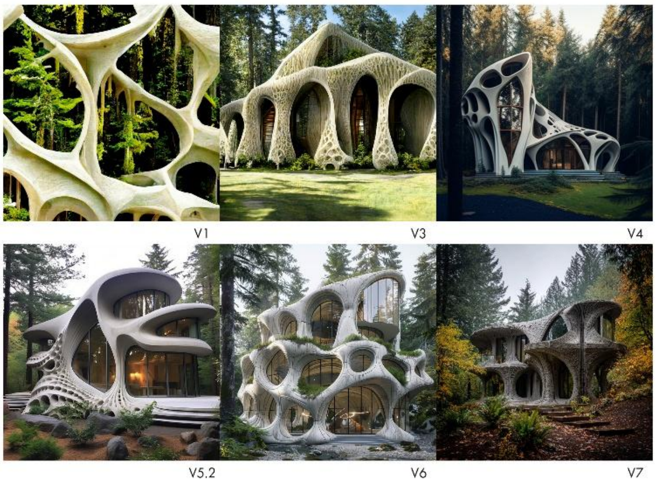

Fig. 1. Comparison of Midjourney versions 1, 3, 4, 5.2, 6, and 7. (Source: Authors, 2025)

2.2. Co-creativity framework

The creative abilities of the human brain, AI, and Nature belong to different levels of complexity described by the DUCP framework; material (Nature as the universe itself), biological (Nature as ecosystems), psychosocial (Human), and technological (AI) levels. Under the DUCP umbrella, all three entities can be united into Co-creative Triad. Here Creativity can be fully deliberate and self-aware, as in the human mind and “represents a small fraction of the DUCP, <...> characterised by intentionality and intelligence” (Corazza and Lubart, 2020). Creativity can also emerge without intent, as in Nature, or without conscious understanding of the creative outcome, as in GenAI. By drawing on the strengths of all three, a human author can explore a plethora of solutions, analyse them quickly and evaluate the best Nature-inclusive implementation.

In “AI Creativity and the Human-AI Co-creation Model” (Wu et al., 2021) researchers identified correlations in which the human mind and AI properties complement each other. Current AI technologies are efficient at pattern recognition, but narrow, task-specific, and lack emotional and social flexibility as the human mind. When Nature is added to the complementary diagram, it breaks the Human-AI dichotomy, adding a new non-anthropocentric context, supporting both sides or standing on its own (Fig. 2). Natural processes belong to the category of Hyperobjects that are “massively distributed in time and space relative to humans” such as climate, big data, or cosmic time (Morton, 2013). Human inability to comprehend them is a major obstacle to incorporating Nature into the Co-creative framework. However, what the human mind cannot understand about natural intelligence through time, AI tools can help bridge this gap and extend human comprehension.

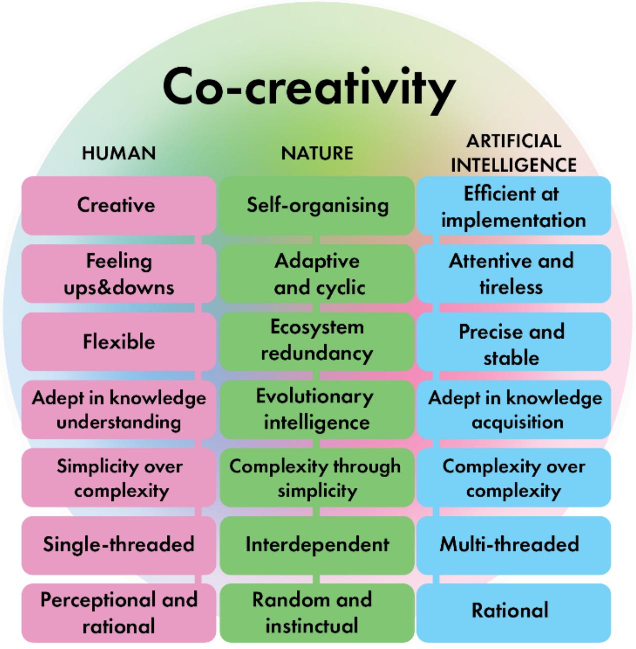

Fig. 2. Human-AI-Nature complementary properties. Based on the scheme of Wu, Zhuohao & et al., 2021. (Source: Authors, 2026)

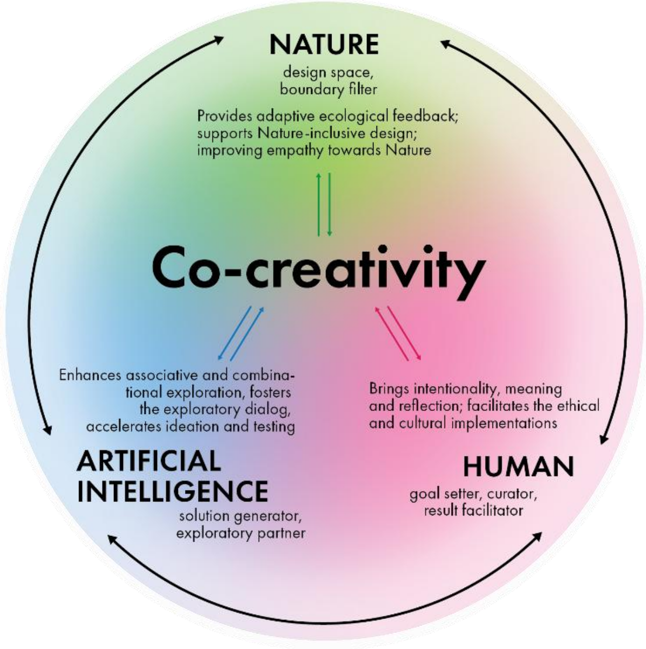

Fig. 3. Co-creativity Triad: Human-AI-Nature. (Source: Authors, 2026)

The complementary properties of Co-creativity Triad have the potential to enhance the six phases of product development proposed by Wu (Wu et al., 2021):

Perceiving: Nature provides context and seasonal cycles; AI collects and analyses large amounts of data from multiple sources, helping a human partner focus on what matters most, reducing cognitive overload.

Thinking: Nature provides immediate feedback and evolutionary logic for AI's expansion of the creative search for solutions and "help human think deeper, wider, and through" (Wu et al., 2021).

Expressing: Generative AI assists a human partner in exploration beyond their technical skills, enabling creative thinking over lack of training; Nature participates through spontaneous interactions, growth, and flow, leading to unique forms.

Building: Nature co-builds with living materials through self-organisation methods while AI-enhanced systems predict building configurations and manufacturing steps.

Testing: Natural processes (growth-decay) validate virtual AI-assisted simulation supporting biodiversity and resilience though the seasons.

Collaborating: A human partner curates the Triad by utilising the narrow but powerful abilities of AI; and co-directs the outcome with Nature through seasonal cycles.

AI-driven biomimicry has the potential to look beyond shape exploration and build novel solutions that compress natural cycles of testing ideas over generations within a human creative context through AI's ability to overcome the limitation of time and experiences. Co-creativity is a powerful workflow that extends the human mind, expanding the ability to perceive, understand and express ideas and concepts that are not achievable by a single standalone person. It is a creative dialogue where the human author is a facilitator or a guide of the process (Nguyen and Ho, 2026), while Humans, AI, and Nature participate in a reciprocal loop (Fig. 3) and their complementary capabilities might trigger an emergent effect of Co-creativity where *none of the participants fully controls the outcome*.

To summarise the theoretical part, the following definition is proposed: *Co-creativity is a context-defined and distributed phenomenon in which human cognition, artificial intelligence, and Nature's adaptive intelligence converge and interact as complementary agents, producing novel outcomes that exceed the creative capacity of any single system acting alone.*

2.3. AI-assisted Biodesign workflow in practice

The goal of this experiment is to test AI-driven bioinspired design approach based on the Co-creativity Triad to generate novel architectural solutions that combine both Human and Nature perspective in a specific location and design context.

Suburbia is a high-tension zone between human-made environments and natural ecosystems, a perfect subject to evaluate the Co-creativity principles and their potential impact. Suburban sprawl is a threat to biodiversity and one of the leading causes of species decline worldwide (Fitzgerald, 2019). With low population density, it takes more land and fragments habitats. But paradoxically, suburbs have the potential to protect and support biodiversity on the local level by creating native plant gardens and supporting wildlife corridors for small species.

The developed AI-Assisted Biodesign workflow is based on suburban metropolitan areas around Portland, Oregon, which has one of the largest urban forests in the US. This unique landscape allowed close proximity to wildlife areas between suburban neighbourhoods.

3. Workflow exploration: Materials, data, and methods

3.1. Methodology

Artificial Intelligence is a fast-growing industry; there are many discussions and concerns that surround its rapid development. However, the ethics of the AI industry is outside the scope of this research. Choosing open-source tools is part of the ethical consideration and a demonstration not of a specific technology, but rather of the approach how nature-based data can be used in GenAI to enhance bioinspired design. At the time of writing this article, there are solutions that might be more advanced and easier to use, but they are also less transparent and controllable.

Generative AI models are trained on large amounts of data, whereas Nature is always location-specific. To support the locality, the core of the workflow is based on:

1. a lightweight fine-tuning technique, *LoRA (Low-Rank Adaptation)*, for additionally training a chosen large AI model on *new concepts, styles, or subjects* without retraining the entire model,
2. a personalised data set for LoRA training that represents Pacific Northwest ecosystems and was created by the authors of the article,
3. Other tools: Kohya v25.2.1 for custom LoRA training (Maltais, 2023); the generative text-to-image FLUX.v1 model by Black Forest Labs (2024); ChatGPT v4o by OpenAI for linguistic operations on data set (OpenAI, 2026); ComfyUI v0.3.60 for a custom generative pipeline (Comfy, 2026).

3.2. Preparation of data set

A curated data set of 56 photographs of Oregon biomes, such as rainforest and meadows, was collected across different seasons and locations (Fig. 4). The technical requirements were consistency in style, quality, and specificity to make a strong LoRA that would be able to influence generated images. The main goal was to collect the most typical landscapes; the photos that were selected are as mundane as possible, without artistic post-production.

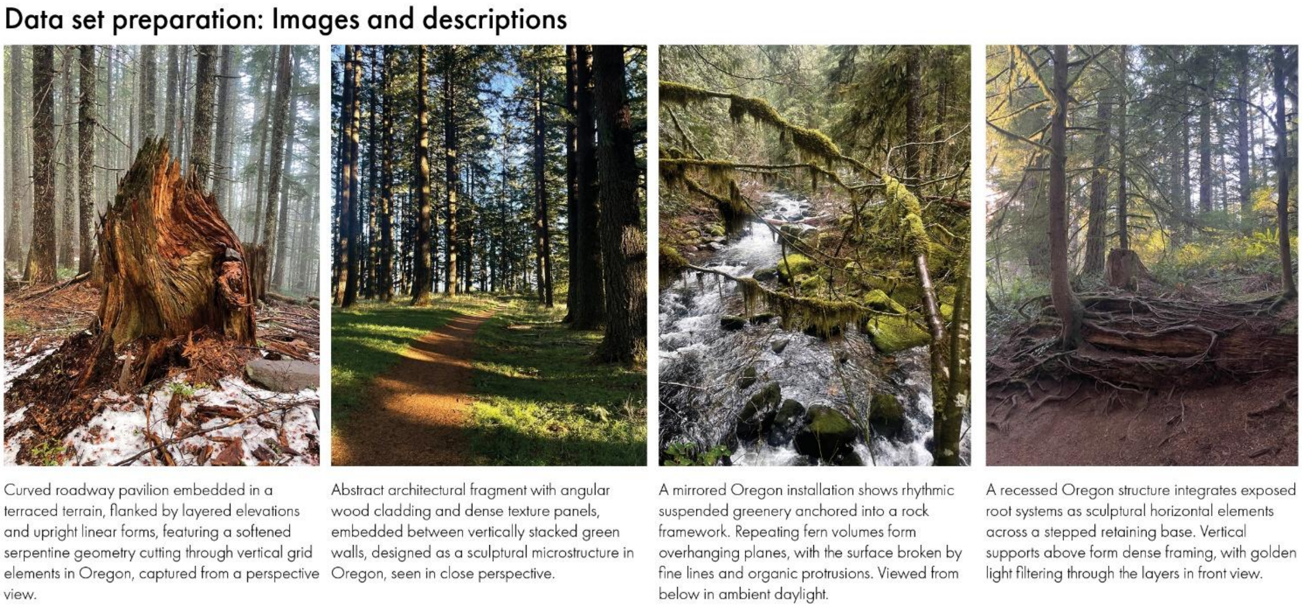

Fig. 4. Data set samples. (Source: Authors, 2025)

The main step in data set preparation is captioning. The research proposes a different captioning method by using AI's ability to recognise hidden patterns while also being prone to AI hallucinations. Instead of describing each picture as accurately as possible, the PNW Nature data set was described metaphorically, framing natural elements as architectural. Such captioning aims to achieve several things. Firstly, the AI model will establish new connections and find more similarities in *Human-made architectural decisions* and *Nature-made biodiverse structures*. Secondly, it forces AI to 'hallucinate' in a controllable way, blending both worlds and allowing the AI model to have more freedom during generation in comparison to the base Model and mitigate its biases while keeping the physical aspects of architecture realistic.

3.3. Pacific Northwest LoRA (PNW LoRA) training

During the training process, there are stages (epochs) that summarise the state of the training process. *An epoch is one full pass through the entire training dataset.* If the epoch number is too low, it might not be enough to see the influence of LoRA, if it is too high, the model is overtrained, and the result is just random noise. The best results were shown by training session 11 (out of 12), epoch 9–11 (Fig. 6 and 7).

The prompt used for all image generations was:

A visionary futuristic mansion house in the forests of Oregon, growing from the ground with its environment like a living organism. The parametric bioinspired structure mimics natural growth patterns – twisting root-like columns, petal-layered roofs, and ribbed facades made from mycelium concrete. Constructed from 3D-printed bioconcrete with no hard edges – just fluid transitions from moss-covered walls to canopy-integrated terraces. Located by the lake.

The main trigger word for this LoRA is *Oregon,* it was added to the main training parameters. Other highlighted ones are also part of the data set captioning, so they were used in prompt construction to make sure LoRA is triggered.

4. Results

After multiple experiments with different settings, it is noticeable that using an additionally trained LoRA on top of the base model helps achieve more striking visual results tuned to location-specific design intent. The outputs are evaluated, firstly, by technical quality of AI behaviour in response to the PNW LoRA, secondly, by how the Co-creativity Triad framework is represented in the proposed solutions.

4.1. AI behaviour analysis

To test *model responsiveness* the same prompt was used for both Midjourney and FLUX without PNW LoRA, they follow the prompt too literally (Fig. 1 and 5). The output tends to be more generic in its representation of the forest and in style, and the architectural structures being organic in shape are clearly separate from the natural environment.

FLUX with PNW LoRA demonstrates immediate differences in style and atmosphere. The architectural structures become more fluid and organic and seamlessly integrate into the described landscapes, responding to training settings that guide LoRA to see more connections between natural structural elements and apply them to architectural forms.

Latent-space coherence: A critical aspect of LoRA training is preventing overtraining. In Samples 1 and 2 (Fig. 6 and 7) the same LoRA and influence values demonstrate inconsistent overtraining. In one case it went quickly into meaningless results, while the other outputs remain stable throughout all epochs and parameters, producing more nuanced solutions.

The PNW LoRA bio-influence: Both sample series (Fig. 6 and 7) showcase the specificity of Pacific Northwest biomes, in some generated images, there is clear influence from the data set like a foggy environment that was not part of the prompt but prominent in data set photos. Native flora like Douglas firs, sword ferns, and rhododendrons are clearly identifiable.

4.2. Co-creativity framework

The process during the design exercise follows the reciprocal loop of the Co-creativity Triad (Fig. 3). In the outputs generated by PNW LoRA, the proposed solutions are noticeably influenced by all three entities. The human author sets a design problem: a Nature-inclusive private house in the PNW region and guides the data set aggregation and GenAI to create the outcomes. GenAI uses the provided data and generates results in which the architectural structures that emerge from the landscape and appear to have grown through generations, rather than being built and then integrated into the local biome, highlighting the unique atmosphere of a lush evergreen forest.

The role of Nature in this speculative vision is more passive and represented in the photographic data set. If such a project becomes a reality, it requires real-world validation and ecological modelling. In this scenario, Nature will provide feedback on what geometry and what type of bioconcrete scaffolding is more suitable for local plants to populate and what animals/insects will utilise the structure for their habitat. Finally, the human author facilitates the process and chooses the generated outcomes that align strongly with the intent to blur the line between human-made and natural, represent PNW ecosystems authentically while offering the most unique architectural solutions. If the result is not satisfactory, the human author can collect more examples, improve the dataset, and repeat the process to generate new solutions.

The outcomes should also be evaluated through the lens of Boden's typology. If the generated images demonstrate the described properties of the typology, they can be marked as “perceived as creative” and after that subjective human interpretation can be applied to decide which ones are more successful or have the potential for further development.

Combinatorial creativity: Across samples, there is a variety of human-made and nature-inspired structures. Depending on the curation of settings, the outputs provide more conventional solutions with only elements of nature (Fig. 5), or a more complex mix of entwined visuals (Fig. 6 and 7). Architecture behaves like an organism providing unique relationships within the form-function dichotomy.

Fig. 5. FLUX model images with low LoRA influence. (Source: Authors, 2025)

Exploratory creativity: LoRA strength, Guidance, and Epoch numbers are the main parameters for the workflow, providing a wide range of adjustability. The human author can explore a gradient of solutions between Human-driven and Nature-driven design. In samples 1.1 and 1.2 (Fig. 6) the architecture surrenders to Nature, while in sample 2.1 the human-made structure provides a scaffold for the native flora. The most noticeable exploration appears in sample 2.2 (Fig. 7); here the AI-driven parameters provide a synthetic “timeline” for architectural transformation through time. In this specific exercise, there was no goal to approach Transformational Creativity and change the architectural design method. Although, on the personal level of an individual creator such workflow can be a transformative tool in the search of personal aesthetics based on inspiration from local Nature.

The outputs offer long-term relationships for the coexisting of different species, where architecture is a human-made scaffold that becomes populated by plants over time providing feedback on the needs of the surrounding ecosystem. Both human sensitivity to function and aesthetic and the sheltering needs of smaller animals and insects are entwined in the nature-inclusive structure. The results of this exercise offer a speculative future for PNW communities. Blending the edge between human and natural habitats allows for systemic solutions to unite disconnected patches of greenery into wildlife corridors connecting houses to urban parks and larger forest areas. Solutions and ideas that might be unconventional for private single-house architecture, but at the same time not too alien to be impossible; they are within the range of successful adoption of innovation.

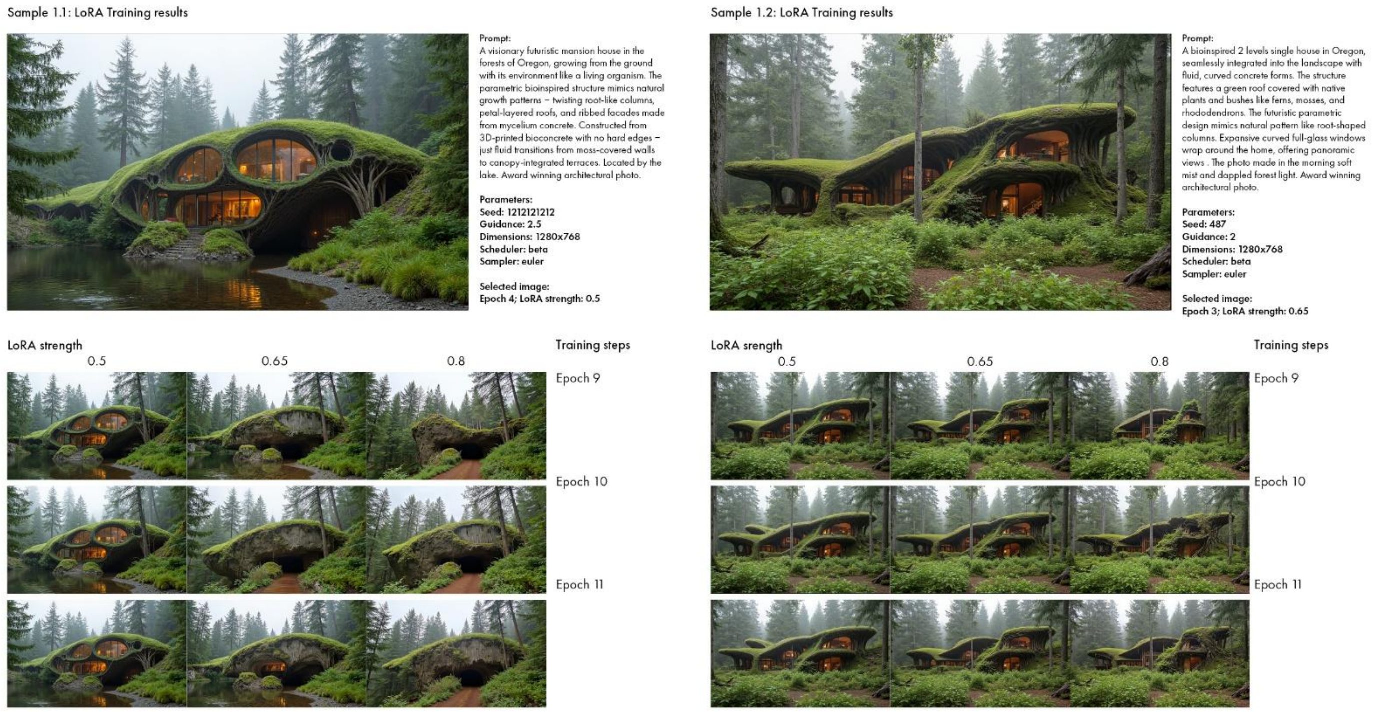

Fig. 6. Samples 1.1 and 1.2. (Source: Authors, 2025)

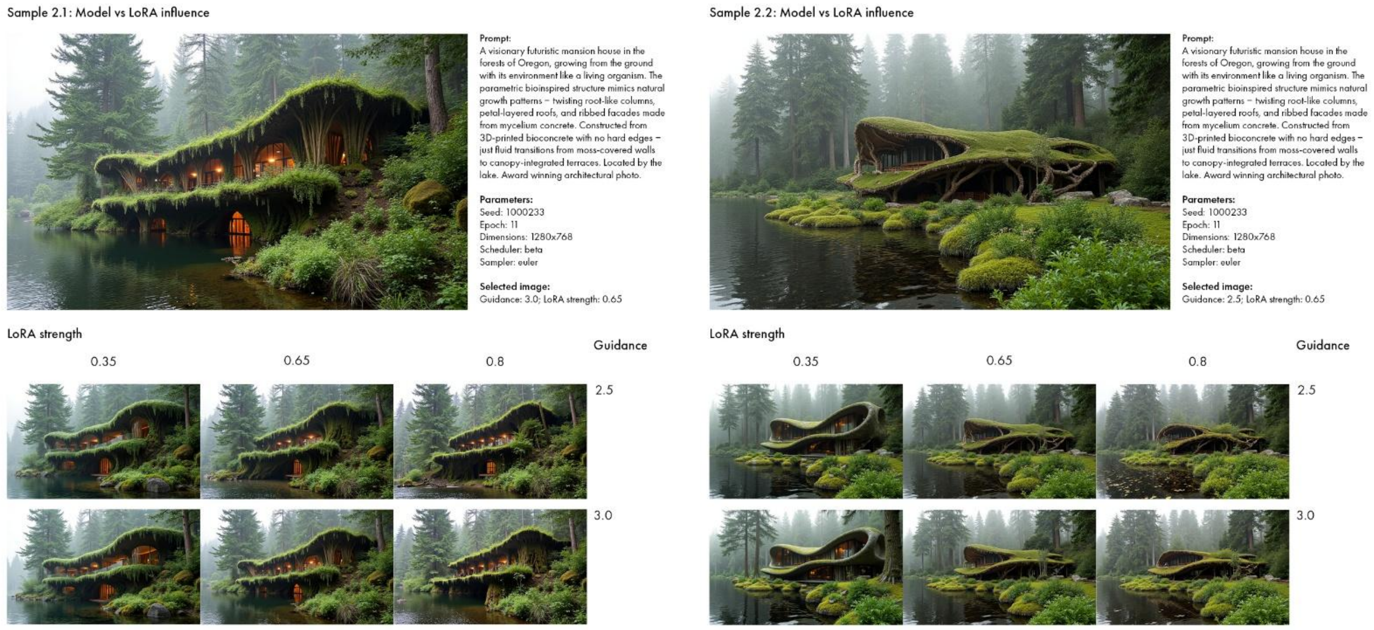

Fig. 7. Samples 2.1 and 2.2. (Source: Authors, 2025)

5. Discussion

The workflow validates the proposition that Generative AI enhanced by personalisation becomes a mediator and gives Nature a creative voice through nature-inspired ideas without undermining architectural integrity. Personal inspiration from Nature blends a specific aesthetic choice with the acuity of AI intelligence, generating solutions with unexpected and inspiring morphologies within a very narrow design context with great variety. Nature's capacity for resilience and adaptation provides evolutionary intelligence and adds value to human spontaneous ingenuity and AI performance capabilities. The balance between the technical parameters of the AI model and the LoRA influence provides a unique basis for design decisions. AI parameters become design variables that simulate ecological succession and material transformation, improve manufacturability, and inform ecosystem balance throughout the intended lifespan of the creation. This aligns with the proposed framework of how the Co-creativity Triad can influence development phases.

As with any new technology, there are always concerns about its benefits and dangers. A major ethical concern for current generative AI models is that they are trained on human-produced content, thus inherently biased, reflecting human aesthetics and cultures. In the presented experiment, the AI model is an example of such biased GenAI, the proposed method of additional LoRA training helps mitigate bias, but mostly at the aesthetic levels. To make the Co-Creativity Triad more nature-centred, Nature-based AI models need to be built with minimal human influence. One potential solution was demonstrated by Refik Anadol Studio in the digital environmentalism project "Large Nature Model: A living art (LNM)", the largest generative AI model trained on the ethically sourced data of scientifically verified examples of different species of flora and fauna (Anadol, 2024). The LNM generates species correctly and distinguishes the differences between them across a broad spectrum of biodiversity. Such a data set is unique, and an open opportunity to use it for design ideation and biologically informed solutions.

Additionally, Generative AI can mislead designers regarding ecological feasibility; therefore, future research should expand towards ecosystems of AI models that integrate multiple types of data from multidisciplinary fields such as diverse regions, seasonal changes in flora, and animal migration patterns. Although the practical experiment explored only a limited aspect of how location-specific GenAI can be used for bio-inspired architecture, there are similar design approaches applied to projects at different scales. Projects such as Fab Tree Hab (Terreform ONE, 2025) and Project Eden (OXMAN, 2025) are successful implementations of Human-AI-Nature Co-creativity through computational tools, creating adaptive multispecies habitats. Such projects rely on highly skilled cross-disciplinary teams, institutional support, and require extensive knowledge as well as physical and digital resources. As technology progresses and the quality of Nature-based data sets improves, the implementation of AI-assisted Biodesign will become more widely available.

6. Conclusion

Contemporary challenges require innovative solutions, and human creativity has become a prime skill in almost every profession for pushing boundaries for innovation. The success of human creators "will depend fundamentally on their adaptive performance related to non-routine tasks, requiring flexibility of mind, capacity to take decisions based on incomplete information, intuition, problem solving ability, artistic and aesthetic sense" (Corazza, 2016). Creativity is a broad term; the discussion about its definition demonstrates that opinions about who can be creative and what activities count as creative depends on the point of view – anthropocentric or Earth-centric. This work explored how understanding biological and digital creativity can transform creative search and the development of innovations across multiple fields, such as architecture, design and art.

The practical exercise illustrates how the Triad can be applied – the strengths of all three agent offset each other's weaknesses providing a co-creative symbiosis of human imagination, machine intelligence, and Nature's adaptability. Control and balance between the Human-made and Nature-made is a topic that deserves further exploration and observation. As was stated at the beginning of the article, humanity's juxtaposition with Nature is known behaviour. True Co-creativity lies in releasing a certain degree of control and accepting this aspect as a creative process of Nature. The shift from Human-centred to Earth-centred design offers new opportunities to innovate and explore aspects of creativity that were not accessible to human creators before. This is more than collaboration; it is a unique phenomenon – a universal process embedded in Earth itself (Corazza and Lubart, 2020).

Co-creativity offers a holistic distributed creative approach to Biodesign with consideration for other species and supports Earth-centred sustainable solutions that continuously adapt throughout the product's lifetime to make human material culture neutral or beneficial to Natural ecosystems and humanity. Bratton states that the Earth executes a planetary computation (Bratton, 2025b). Geological processes, evolutionary solution testing, artificial satellites, and AI-systems are all part of these computational forces that shape the planet. Through this lens Earth-centred design can be an end goal of human tech. Although technology has separated humanity from nature, it can eventually build a bridge back and reintegrate humanity with its biological origins. Co-creativity emerges when human symbolic reasoning, AI pattern recognition, and Nature's adaptive intelligence converge into a planetary computation. This research opens further discussion on how non-harmful, nature-inclusive design aided by technology can be developed through co-creative tools Human-AI-Nature.

Declaration of generative artificial intelligence (AI)

During the preparation of this work the authors used ChatGPT in order to improve readability and grammar, generative AI such as Midjourney and FLUX during the experiment to generate result images. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication. As the final step, the paper has undergone proofreading by journal professionals.

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