

# BEYOND-HUMAN PERSONAE: VISUALISING ECOSYSTEM PERSPECTIVES FOR SUSTAINABLE INNOVATION

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## ABSTRACT

The evolving field of design and engineering education is increasingly focusing on ethical, social, and environmental issues, demanding innovative approaches that integrate ecosystem services and social entities into the design process. This contribution introduces the concept of 'Beyond-Human Persona' - a novel approach - that seeks to embody the needs and roles of non-human entities within ecosystems, thereby fostering a more inclusive and holistic approach to design. By focusing on examples such as field larks, bats, and wild bees, this contribution demonstrates how applications and tools can encourage biodiversity measures and adhere to animal-aided design principles. The utilisation of AI-assisted visualisation tools is explored to simplify complex ecological and social challenges, providing a clearer understanding of the interconnectedness of life, and facilitating the creation of more effective, sustainable and biodiversity-conscious designs.

*Keywords: Non-human persona, more than human design, planet centred design*

## 1 INTRODUCTION

The realm of human-centred design has long acknowledged the user as its core subject. Yet, the present environmental shifts echo the imperative to expand the focus to a broader perspective. Recognising that ecosystems are active participants in design processes, this paper seeks to integrate non-human entities into the design lexicon. This shift aligns with recent findings on species decline, highlighting the urgency for 'Beyond-Human Design Personae'. Such integration is not merely innovative; it is a necessary evolution of our design ethos to preserve the interdependent web of life. Within product development approaches Personae are fictitious, specific and archetypal characters that are used as prototypical representatives of certain user and target groups. They help companies to further develop their products by enabling them to better reflect the needs, goals and expectations of their customers. Personae<sup>1</sup> are therefore used to ensure that the company's products are aligned with the needs and expectations of customers [1].

By developing a persona, a company can better analyse what its target group needs and where possible opportunities and weaknesses lie in the user orientation and the product itself. By identifying with the target group, the development becomes more tangible for the project team [2].

The method has become established due to its low complexity and adaptability [3]. The usefulness for target group reflection, also in product development, was the top priority [4]. In the product development context, the method is mainly used to ensure that the results are aligned with the needs and expectations of the target group [5].

## 2 OBSERVATIONS OF A SHIFT TO RECOGNITION OF NON-HUMANS

A review of human-centred design literature extends methods to non-human contexts. Trends toward non-human personae in design are evident, with an emphasis on including these perspectives in areas like smart city planning and sustainable systems. Tomitsch et al.'s work [6] highlights a move toward more inclusive practices, recognising non-human stakeholders. Social science perspectives suggest

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<sup>1</sup> In this contribution, personae represent the plural of persona, which is used as a mouthpiece for certain types of users. The understanding of the term is based on that of Kocoschko et al. [7].

simplifying design choices may promote sustainable behaviour, highlighting the crucial interplay between humans and ecosystems.

In social sciences and product development, the concept of 'non-users' provides insights for extending human-centred design to include specific needs [8]. The exclusion parallels seen in user groups are akin to the neglect of non-human stakeholders in design narratives.

This contribution proposes a framework that considers the full spectrum of stakeholders, both human and beyond-human. Through mapping, empathising, narrative creation, and impact analysis, it advocates for an integrated approach that enriches design with ecological empathy and cooperative coexistence. These strategies not only enhance the design process but also aim to foster sustainable practices that respect the symbiotic relationships inherent in our ecosystems.

This contribution sets the stage for the presentation of the authors own methodology, which is informed by the latest in interdisciplinary research and grounded in practical design challenges.

### **3 PROPOSALS FOR THE IMPLEMENTATION OF BEYOND HUMAN ASPECTS**

The following sections outline and highlight the relevant steps in the development process, including the AI alternatives. The proposal is based on the identification of elementary human needs and transposed to categories that are also found in the life cycle assessment. This is followed by a reflection and decision between human persona and non-human persona, which leads to a discussion of possible visualisation techniques. Possible tools for their realisation are then considered.

#### **3.1 Integrating basic human psychological needs**

The aim is to succinctly integrate Hassenzahl's basic human needs [9]; autonomy, competence, relatedness, popularity, stimulation, and security - as motivational drivers in environmentally conscious design, extending these principles to beyond-human personae. For instance, leveraging the need for popularity can encourage adoption of sustainable behaviours, promoting environmental care as a pathway to enhanced social status [9]. Incorporating Desmet's 'design for virtue' encourages ethical behaviours benefiting the environment, aligning with needs like relatedness and competence, while 'design for pleasure' focuses on creating enjoyable experiences, linked to stimulation and pleasure, fostering positive environmental relationships [10]. This integration helps design products and experiences that meet human needs and promote ecological empathy, leading to sustainable, fulfilling design practices that bridge human and environmental well-being.

#### **3.2 Personae generation based on well reflected categories**

In this approach of creating Beyond-Human Personae, the authors propose to utilise typical Life Cycle Assessment (LCA) impact categories such as Climate Change, Land Use, Eutrophication Potential, Biodiversity, Pollutant Release, Acidification of Ecosystems, and Water Use as the foundation for developing individual personae. Each category forms a unique persona tailored to the specific product or project, reflecting its distinct environmental impacts and needs. Categories not relevant to the product are omitted, while key aspects like Biodiversity can be further subdivided and detailed if deemed highly relevant. This methodology ensures a profound integration of ecological considerations into the design process, promoting a comprehensive approach to sustainability.

The integration of LCA impact categories alongside the Sustainable Development Goals (SDGs) [13] forms a crucial foundation in our design process. This approach acknowledges that no individual designer possesses complete insight into the complex interplay of environmental, social, and economic entities. However, by grounding our personae in these established frameworks, we aim to capture a more holistic view of sustainability concerns. The LCA impact categories offer detailed insights into environmental implications, while the SDGs provide a broader perspective on sustainable development, encompassing social and economic dimensions. Together, they enable our personae to represent a more complete picture, reflecting the vast array of interdependencies within our ecosystem and encouraging designs that are mindful of their multifaceted impacts on both human and non-human entities.

#### **3.3 Beyond Human vs. Non-Human**

The distinction between non-human and beyond-human personae is crucial for a reflexive and immersive discussion of the aspects in impact onto a persona.

In comparison, non-human personae focus solely on entities without human attributes, exploring perspectives distinct from the human experience. However, when considering beyond-human personae, the vision is extended to include entities that not only exist independently of humans but also those that are intertwined with human activities and decisions. By doing so, we acknowledge the integral role of interconnectivity in driving meaningful changes in behaviour and design practices, ensuring that our efforts contribute positively to the broader ecosystem.

Conversely, every human persona is developed with an explicit consideration of how it interacts with and impacts beyond-human entities. In each beyond-human persona that detail its impact on human needs, human health, and well-being, illustrating the shared existences of everything and its profound interconnectedness. This reciprocal consideration forms the bedrock of our strategy, aiming to cultivate empathy and responsibility across our design practices.

Integrating Hassenzahl's basic human needs provides insights into how design can harness these needs to foster sustainable behaviours and attitudes. Moreover, applying Desmet's 'design for virtue' and 'design for pleasure' aligns our design intentions with ethical standards and enjoyment, enriching the user experience while promoting environmental mindfulness.

### 3.4 Possible Visualisation Strategies for the Personae

When it comes to visualising the complex relationships within ecosystems, the choice between AI-assisted tools and images from the impact research phase is context-dependent, influenced by entities such as resources, time, licensing, and environmental impact considerations. AI tools can generate innovative, clear visualisations of interactions and impacts, offering flexibility and creativity in depicting ecosystems. Conversely, images from research provide grounded, authentic insights directly linked to specific environmental studies, potentially offering a more nuanced understanding. Furthermore, the classic visualisation through a sketch artist is a creative and very engaging option. All three options have their strengths which are shown in *Table 1*. The decision on which method to use should be tailored to the project's specific needs, available resources, and the desired level of engagement with the audience, ensuring the most effective and responsible conveyance of complex ecological relationships and sustainability issues.

*Table 1. Visualisation methods and their strengths and weaknesses*

Feature	AI-Assisted Tools	Photos	Manual Drawing
<b>Strengths</b>	Flexible visualisations; high variety in depicting ecosystems.	Grounded, authentic insights; directly linked to environmental studies.	Emphasises critical, impactful aspects through human interpretation and creativity; provides clarity and engagement.
<b>Flexibility</b>	High - can generate a wide range of visuals on demand.	Medium - dependent on available research imagery.	High - artist can adapt and focus on key elements as needed.
<b>Authenticity</b>	Medium - may lack specific real-world details.	High - based on actual data and observations.	High - captures human perspective and prioritises relevance.
<b>Resource Intensity</b>	Medium to high - depends on computational resources and software.	Low to medium - depends on access to and processing of research images.	Low to high - depends on the artist's skill and time investment.
<b>Engagement</b>	High - innovative visuals can attract attention.	Medium - authenticity resonates with informed audiences.	High - human touch can enhance relatability and emotional connection.
<b>Best for</b>	Exploring complex interactions and futuristic concepts.	Providing evidence-based insights and grounding discussions.	Highlighting key concepts and engaging audiences with a human-centric approach.

The choice between AI tools and photos and manual drawing is more than a matter of convenience; it reflects our commitment to matching the visualisation technique to the unique ecological and social context of each design problem.

### 3.5 Tools

To support the creation of Beyond-Human Personae, several tools can be utilised. The Idemat-app is instrumental for classifying environmental damages and relevant categories based on the materials used [11]. The Sustainable Strategy wheel [12] aids in identifying central problems of products throughout their life cycle. Digital whiteboard tools like Miro or FigJam facilitate the creation of personae by allowing for collaborative and visual mapping of persona characteristics and impacts. Looking forward, the development of a specialised tool to generate persona texts and images could significantly streamline the process, offering customised outputs that directly reflect the environmental considerations and sustainability strategies pertinent to each product.

## 4 METHODOLOGIES

The methodology for integrating beyond-human personae into the design process involves several key steps:

1. **Mapping Out Affected Entities:** Identifying the broad range of entities affected by design decisions, from individual organisms to entire ecosystems inspired by LCA categories, planetary and social boundaries or the Sustainable Development Goals of the UN [13]
2. **Research:** Investigating the behavior of ecosystems and the specific needs of the entities within them.
3. **Identifying Needs and Impacts:** Describing the needs of non-human entities and assessing the positive and negative impacts of design decisions on them.
4. **Empathising with Non-Human Entities:** Engaging in imaginative empathy to understand the experiences and needs of non-human entities and their connection to human needs.
5. **Story Creation (optionally beneficial):** Developing narratives that encapsulate the roles and perspectives of these entities within their ecosystems and create stories affecting humans.
6. **AI-Assisted Visualisation:** Utilising AI tools to visualise the entities and their interactions within ecosystems, refining these visualisations based on iterative feedback.
7. **Inclusion in Decision-Making:** Conceptualising non-human entities as stakeholders in the design process, ensuring their needs and perspectives are considered in decision-making.

This methodology enables us to operationalise the beyond-human persona concept, making it a tangible asset in sustainable design endeavours.

## 5 DISCUSSIONS

The integration of beyond-human personae into design education and practice offers a pathway towards more sustainable and innovative solutions to environmental challenges. By broadening the scope of design considerations to include the complex web of life, future designers and engineers can develop projects that are not only innovative but also ethically and environmentally responsible.

## 6 CONCLUSIONS

The 'Beyond-Human Personae' approach represents a significant paradigm shift in design and engineering, advocating for a more inclusive, sustainable, and biodiversity-conscious approach. By leveraging AI-assisted visualisation tools, engineers and designers can easier and faster understand and incorporate the needs and perspectives of a broad range of non-human entities, leading to innovations that respect and sustain the intricate web of life that supports us all. This contribution contributes to the discourse on ethical, social, and environmental issues in design and engineering education, offering practical insights and methodologies for integrating more-than-human perspectives into the design process. By doing so, it not only addresses pressing environmental challenges but also paves the way for a future where design is truly inclusive and sustainable. In conclusion, this paper not only contributes to the discourse but also calls for a sustained commitment to expanding the boundaries of inclusive design.

## OUTLOOK

Future work will expand the beyond-human persona framework, testing it in various design contexts and evaluating its effectiveness. It is anticipated that this will lead to more ethical, sustainable, and innovative design practices that contribute positively to both human and non-human entities. As a look into the future, further refinement of the non-human persona framework will involve cross-disciplinary collaborations, underlining the universality and adaptability of the presented approach.

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