RESEARCH ARTICLE

Codesign with more-than-humans: toward a meta co-design tool for human-non-human collaborations

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Abstract

What does more-than-human mean? How can we, as humans, understand that our ecology is only one of the many that do exist within the world? Furthermore, in which way should we step aside to let all ecological actors exercise their agency? And, more specifically, what should be the role of design and designers in tackling complex issues and in contributing to a major shift in thoughts? These questions fostered a reflection on the relation between possible futures and the design practice itself and set the basis for the creation of a *provotype*. A *provotype* (from "*provo*cation" and "proto*type*") is a conceptual product or an artifact whose objective is to foster reflections and provoke discussions mainly concerning social and environmental sustainability, innovations, and technologies, leaving gaps to be filled with the audience imagination.

The research reported in this contribution deals with issues and questions that fall under the umbrella of the topic of alternative biopolitics in future scenarios: how can we co-design with more-than-human actors? In which way can symbiosis between different entities be achieved? What is the meaning of interspecies justice, and which should be the steps to follow to fulfill it? And, finally, maybe the most significant question to focus on: how can communication between different entities be fostered? The designed *provotype* consists of a fictional event ("The first Multispecies Symposium") which takes place in 2100, further helped the researchers in opening new reflections that made it possible to experiment with participatory design and to finalize a tool that can be used to share and expand reflections about futures without hierarchies, not human-centered, sustainable progress and hope, participative futures.

Keywords: *Provotype*, Research through Design, Speculative design, Alternative biopolitics, Design fiction, More-than-human, Design research

Introduction

Human actions are strongly reshaping the world we live in. The effects related to the global exploitation of resources have been influencing the whole planet, leading to severe changes within the ecosystems. As a consequence, the current geological epoch has been called the Anthropocene to emphasize the influence of the human being on the Earth's status [1]. In the last years, several actors have been focusing on the definition of new goals and strategies to foster the transition toward more sustainable ways of living, i.e., the United Nations 17 Sustainable Development Goals [2]. Nevertheless, current efforts are mainly influenced by a hierarchical mindset where the human perspective constitutes the predominant point of view. Actually, human activity also influences other species, and, as humans, we should realize that our anthropocentric perspective represents only one of the many ecologies within our world [3–5]. In other words, the assumption of humankind's primacy should be overcome to embrace a post-human vision of the world [6].

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Although several interrelationships co-exist between humans and non-humans, the rights and the agency of non-human entities are still scarcely recognized. Within this context, new shared future visions are emerging through collective imagination approaches, influencing the societal transformation processes toward non-anthropocentric perspectives [7–9]. Recently, speculative scenarios of non-hierarchical interrelationships have been developed considering non-humans as living or non-living entities with their own rights for the definition of new political ecologies based on more-than-human futures, i.e., the International Rights of Nature Tribunal and the Parliament of Things [10–12].

What does more-than-human mean? How can we, as humans, understand that our ecology is only one of the many that do exist within the world? Furthermore, in which way should we step aside to let all ecological actors exercise their agency?

A shifting role of design

As mentioned before, the anthropocentric perspective of human beings often does not consider the rights and interests of non-human entities. We are currently acting as part of a separated context from the rest of the world, lacking an interconnected *pluriverse* vision [4]. More specifically, what should be the role of design and designers in tackling complex issues and in contributing to a major shift in thoughts?

Design contributed and contributes to the establishment of this hierarchical anthropocentric perspective by spreading human-centered models of production and consumption, leading to the current unsustainable changes in the ecosystems [13, 14]. However, design research and practice are starting to assume a different role within this context, recognizing that an ontological shift should be reached. In particular, design for sustainability is demonstrating its contribution to sustainable development, helping in "designing for social equity and cohesion" and enlarging the perspective from an environmental to a socio-technical point of view [15]. Within this context, cradle-to-cradle design and biomimicry design emphasize the regenerative approach linked not only to future human generations but also to non-human species [16, 17]. Anthropocentric hierarchies are therefore changing going through a more inclusive consideration of non-human entities, i.e., models of inspiration, participants in the urban development, or even innovators [18]. In other words, designers have been assuming a posthuman perspective that focuses on the non-hierarchical interrelationships between humans and non-humans, both living and non-living, accounting for their agency. Human ecology is always entangled with other entities, showing blurred boundaries with respect to the anthropocentric view [19, 20]. This *more-than-human* link between different species paves the way for new expertise, tools, and opportunities that designers should start to deal with [13]. In addition, a paradigm shift is required to foster the sustainable transition from a socio-technical and environmental perspective, and design can represent the way to facilitate this change [21].

A shifting role of design is therefore recognized at two different levels, which can be linked: (i) for the transition toward new sustainable models of production and consumption, shifting to a non-human-centric point of view, and (ii) for the interconnection of human and non-human entities for collaborative futures. Focusing on this second aspect, speculative design can significantly contribute to reaching a concrete shift, giving the possibility to critically reflect on possible future scenarios [20, 21]. To this end, the approach of speculative design could help in creating a set of alternative possibilities to increase the awareness of the entanglements with non-human entities [22]. Furthermore, the non-hierarchical consideration of human and non-human agencies can promote new connections with other fields of design such as participatory design and co-creation [23, 24]. Participatory design is generally used to foster the creation of collaborative ideas on a given topic, relying on the potential to generate new concepts by involving different perspectives in a non-hierarchical way [25]. Even if this approach has been initially focused on human participation, it also represents an effective tool to consider different agencies by engaging with different stakeholders [26, 27]. Despite the communication issues between different entities, considering non-human entities as participants of the design process allows to create more democratic networks, formulate non-hierarchical relations, and, consequently, reflect on the more-than-human agencies and interests [27–29].

Collaborative approaches are becoming prominent also in other sub-areas to tackle the issues of sustainability transition, including interspecies justice and more-than-human perspectives, i.e., design futures and speculative design. New future scenarios can be created through the collaboration of different actors to address complex and uncertain challenges on socio-technical and environmental topics [30], define future research agenda [31], and develop new tools for policymakers and decision-making processes [32, 33]. Speculative participatory projects and design fiction outcomes, i.e., workshops, videos, and performative storytelling, are also creating new interdisciplinary connections between participatory design, speculative design, and futures research [34, 35], envisioning new potential intersections.

These questions and topics, arisen during a Ph.D. activity led by Politecnico di Milano, fostered a reflection on the relation between possible futures and the

design practice itself and set the basis for the creation of a *provotype.*

Introduction to the concept of *provotype*

A *provotype* (from "*provo*cation" and "proto*type*") is a conceptual product or an artifact whose objective is to foster reflections and provoke discussions mainly concerning social and environmental sustainability, innovations, and technologies, leaving gaps to be filled with the audience imagination [36]. For this reason, a *provotype* aims to provoke reflections and new questions related to a specific phenomenon that is still under debate. As the word *provotype* suggests, this critical and provocative reflection is mediated through a prototype or a designed artifact, which means thanks to a concrete experience with it. Contrarily to a prototype, a *provotype* is focused on future possibilities and does not represent the final definition of a design proposal. As a matter of fact, a *provotype* may appear as an unfinished prototype, since it aims to explore future possibilities through the prototyping of a provocation and can be implemented according to the contributions derived from the audience participation. A *provotype* can therefore detect new gaps by framing alternative presents or even future perspectives and visions since its goal is not to give well-defined answers to a problem but to detect possible issues and questions related to the future complexities [36, 37]. To foster the generation of new research questions, the critical situations and problems related to the provocation have to clearly emerge during the experience with the *provotype* according to the audience for whom the artifact is designed for. As a result, *provotype*s can assume different shapes, and several ways can be investigated for their creation, such as developing physical models, intangible artifacts, and design fictions.

Critical provocations can directly impact design research. To this end, the use of *provotype*s represents a valuable tool to conduct Research Through Design [38–40], and several examples demonstrate the concrete contribution given by *provotype*s [37, 40, 41]. In light of the above, *provotype*s can be employed for the collaborative creation of speculative scenarios that emphasize the reflection on more-than-human interrelationships and agencies, as well as new collaborative futures.

Tools and methodology

The research reported in this contribution deals with issues and questions that fall under the umbrella of the topic of alternative biopolitics in future scenarios. Alternative biopolitics may be considered as a new kind of politics of all living beings, which must be recognized for their value, agency, and rights [42]. Biopolitics is,

therefore, a strategic relationship that should produce a new government of all the forms of life [43].

Starting from these arguments and reflections, some questions and concepts naturally emerged: how can we co-design with more-than-human actors? In which way can symbiosis between different entities be achieved? What is the meaning of interspecies justice, and which should be the steps to follow to fulfill it? And, finally, maybe the most significant question to focus on: how can communication between different entities be fostered [14, 27, 28, 44]?

Design futures cannot be considered as consolidated methodologies, but rather as complex and transdisciplinary approaches that exploit and upgrade tools and methods belonging to other fields of design or to other disciplines to fulfill their goals [45]. Speculative design is a particular design approach [46], belonging to the area of design futures, whose aim is to foster critical reflections regarding possible, plausible, probable, and preferable future [47], through the creation of diegetic artifacts and scenarios [48], and the application of the principles of design fiction [49] and storytelling [50].

During the Ph.D. Summer School, some tools, developed by the Fuel4Design (F4D) research team, have been provided by the faculty and the experts to be used during the given time in order to foster reflections regarding the aforementioned questions and to develop the provotype [51]. The overall process (Fig. 1) followed to produce the expected results can be divided into three main phases: scanning (phase 1.1) and framing (phase 1.2), mapping the plurality of futures (phase 2), and, finally, provotyping (phase 3).

The scanning and framing operations are needed to grasp the current trends, the situated weak signals, and the drivers of change, to map actual situations and possible spaces for intervention and dialogues. Weak signals can be defined as early indicators of change that constitute raw information and material to enable anticipatory actions, while drivers of change are forces, factors, and uncertainties that create a change. The aim of this first stage has been the in-depth understanding of the topic of discussion analyzing it both from the current situation and from possible future directions, and it can be considered as blue-sky research [52]. A further aim of this phase is to make sense of the obtained data and information while clustering and categorizing them to be used in the next phases.

Different tools were used in this phase such as PESTLE analysis, Future Philosophical Pills, and the Trends Timeline [49]: the PESTLE analysis is used to identify the Political, Economic, Social, Technological, Legal, and Environmental drivers able to shape and modify the future regarding particular topics. This kind of inquiry
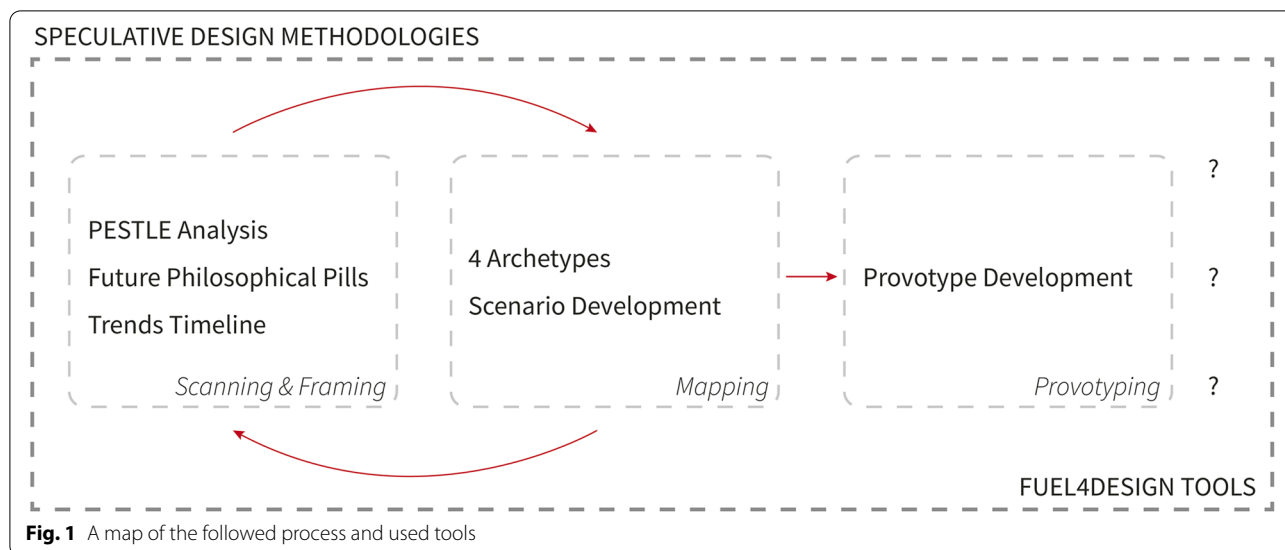
Fig. 1 A map of the followed process and used tools

includes both looking at information and looking for information. It is one of the tools that derive from other areas of knowledge, in this case, business analysis and strategic management [53], where it is usually applied to strategic analysis and market research. It is interesting to note the shift in the scope of application of the tool: from a purely technical, business-oriented tool, it becomes a qualitative tool for an overall scanning of the context and the topics taken into consideration.

The Future Philosophical Pills are a set of concepts and ideas that offer critical perspectives able to question, challenge, and unsettle established assumptions around futures. This tool, designed by the F4D research team, aims to mobilize design practice and projects by disrupting, amplifying, and critiquing ideas around the future. While applying this tool, the aim is to interrupt existing or in the making design projects leading the process into a discursive practice. They are organized in two decks: the pills, which are philosophical terms, and the prompts, which, instead, are suggestions, questions, provocations, and nudges. By combining them, it is possible to create opportunities to make meaning, generate inspiration and build knowledge.

The Trends Timeline, a common tool in various disciplines, helps the researchers and the practitioners in positioning the gathered trends, drivers of change, and weak signals in a designed spawn of time to understand the degree of possibility that given events may occur and to position them correctly in time, understanding which ones belong to a short-term future, which ones to a medium-term future and which ones, finally, to a long-term future. Starting from the previous mappings, and leaning on reports and scientific documentation, it

is possible to hypothesize and place on the timeline the potential futuristic events.

The second phase revolves around the mapping of the plurality of the future to understand the future complexity and contextualize the provotype within a designed scenario. In this stage, most of the gathered insights can be mixed to design a solid and consistent scenario. The scenario serves to give shape and a coherent image to the envisioned world. This helps to better situate the design project and to look at a particular future scenario from a deep and comprehensive perspective.

Two tools had been provided during this phase which are 4 Archetypes and Scenario Development: the first one, originally developed by Dator [54], is used to identify the uncertainties of the future and to investigate the idea and concept developed regarding the different drivers of change. The aim is to embrace the complexity and the plurality of the future and to highlight potential project focuses. Following this tool four scenarios may be developed: the grow scenario, in which the context naturally evolves following a predictable course of events; the collapse scenario, in which, instead, the system degrades and it fails due to an emergent crisis; the discipline scenario, where the behaviors adapt to growing internal or environmental limits; and the transform scenario, where new technologies, business, social, or environmental factors can radically change the situation.

The last tool provided helps the researchers and the practitioners in choosing the scenario to be developed and within which position the provotype. After completing these phases, it has been possible to start the development of the provotype: this stage is about the creation of a discursive and provocative prototype to

create a reflective space around the focal issue under investigation.

The first Multispecies Symposium

The path and tools described above have opened new reflections and allowed to identify the key questions from which to develop the *provotype*.

Resuming a reflection by Chapman on the current condition, to escape the cage of our anthropocentrism could be one of the greatest challenges and, as Crabu states during the Ph.D. Summer School 2021 organized by the Polimi Ph.D. program in Design, design could be "a potential way to shape a more-than-human alter-biopolitics, able to consider the entangled network between technoscience and interspecies relationship, so to challenge the current capitalist regime in which design, as a way of knowing/intervening in our common world, is currently embedded" [55]. We, as humans, need a change of direction, shifting away from the human-centric view and imagining new ways of living and relating to the environment in which we live. But how to provoke people, and especially designers—through the design of a provotype—to change their point of view? How to encourage them to shift their perspective, to force themselves to start again from thinking that is no longer anthropocentric but more-than-human-centric? How to feed the debate about how to leave behind the idea of design practice that we have inherited from the industrial revolution and the logic of consumerism? These were the main research questions from which the imaginative and experimental work was articulated.

The aim was therefore to design a tool that could stimulate the imagination of a post-human world [6], in which the hierarchies between humans and non-humans are canceled, in favor of new ways of relating based on mutual listening and multi-species collaboration, trying to answer the research questions mentioned above. This led to the *provotype* project, which on the one hand allowed the researchers themselves to open new areas of reflection, and on the other to experiment in the field of fiction design by finalizing a tool that can be used to share and expand reflections on futures without hierarchies, not human-centered, sustainable progress and hope, participative futures.

The provotype is based on a fictional event, "the first Multispecies Symposium," which takes place in 2100. In terms of method, the experimentation consists of several stages: the creation of a fictional scenario, to help imagine a socio-political context of origin; the definition of a timeline: a succession of events starting from the present and evolving up to 2100, useful to contextualize the fictional event; the fictional event itself: the provotype.

Fictional scenario and timeline. Towards the inter-species justice, from the rights revolution of nature to a new era of cooperation

The first step in designing the *provotype* was the creation of a fictional scenario to help researchers imagine future worlds and solutions. The exercise was to build on current events and themes to develop a timeline culminating in 2100 with the beginning of a new era of inter- species cooperation formally marked by the 1st Multispecies Symposium, the actual *provotype*.

It is useful to mention the timeline because it lays the groundwork for the event that constitutes the *provotype*, by providing the opportunity to develop in-depth reflections.

The starting point, 2021, concerns the current situation: environmental and social crisis, desertification, migration, decolonization, pandemic, endangered species, etc. Within this framework, the main focus of interest was directed to the controversial topic of biopolitics, nowadays exploited to exercise human control and the need for "alter-biopolitics" in a more- than-human perspective.

Against this catastrophic framework, some states have already started to recognize the rights of nature [12, 56, 57] or enact environmental protection laws. Starting from the current scenario, we have therefore assumed a positive development based on inter-species justice.

The first temporal "phase" of the fictional scenario consists of two opposite "sides" who try, for different reasons and in different ways, to let their ideology become fundamental. Another pandemic leads the majority of people to understand our role as humans in different crises. This radical shift has been called the "Rights Revolution of Nature," and it brings different legal, political, and social transformations, and it results in a balanced collaboration between humans and more-than-humans. In a more long-term phase. More-than-human co-design becomes a tool for collective cooperation, and technology is used to create fluid communication between different beings and entities. In this scenario some fictional key events represent the milestones that bring to a new era:

2030 (short-term)

First dialogue between a man and his dog through technology and design.

#cooperation between human and non-human

2045 (mid-term)

The rights of nature tribunal is now a strong and widely recognized institution.

#rights of nature

2060 (mid-term)

The first plant constitution is signed.

#plant constitution

2080 (long-term)

A more-than-human Artificial Intelligence (AI) redesigns and implements the legal basis for more-than-human and human relationships.

#inter-species justice

2100 (long-term)

Fictional event: the 1st Multispecies Symposium opens a new era of inter-species cooperation. Humans represent a very small part of the new society. AI support inter-species communication.

#inter-species cooperation.

Fictional event: the provotype. The 1st Multispecies Symposium

Starting from the narrative flow constituted by the milestones of the timeline, the *provotype* is based on the mechanisms of identification of the researchers in non-human beings, in a sort of roleplay.

The 1st Multispecies Symposium formally marks the beginning of a new era of inter-species cooperation, an era in which technology becomes the medium that enables and facilitates communication between the species involved.

The symposium, therefore, relies on a digital platform. The interface is similar to those commonly used for remote meetings, but the participants are representatives of different species: bees, corals, trees, bacteria, and fungi. The species selected for the *provotype* (Fig. 2) are significant in terms of their heterogeneous characteristics and allow to open parallel reflections on multiple levels, touching on themes such as hierarchies and the place of humanity in the ecosystem; inter-species cooperation for the collective good; the relativity and partiality of the human-centric vision; and the role that design and AI could play in facilitating communication between species that use different languages and have different conceptions of space and time.

The storytelling is organized as follows: the conference is introduced by the AI itself, which does not only act as technical support but becomes a real interpreter, the mediating tool allowing inter-species communication. The event and the debate are structured as a dialogue between beings:

AI speaking: "Today is a historical day, the first day of the 1st Multispecies Symposium, which hosts representatives from more than 150 k species across the whole natural realm.".

Bees delegate: "zzzZZzzzZZzzzZzzZzzzzzzz…".

Bees translation (by AI): "We've always lived on the planet in harmony with other beings, and our needs are simple: trees, pollen, water, and some spaces. We want to directly address the human representatives, asking them what took so long to understand that we, like all the other beings, are part of a higher system and so strongly necessary for balance".

Plants delegate: *Roots tremble*.

Plants translation (by AI): "Our roots vibrate together with the soil and the water. Our branches are home for the animals. Our leaves dance with the wind. We watch the sun that flows inside us".

Bacteria delegate: *Chemical signals*.

Bacteria translation: "We live inside and outside everybody. We are everywhere and we exist since the beginning of everything. You should listen to us, we can
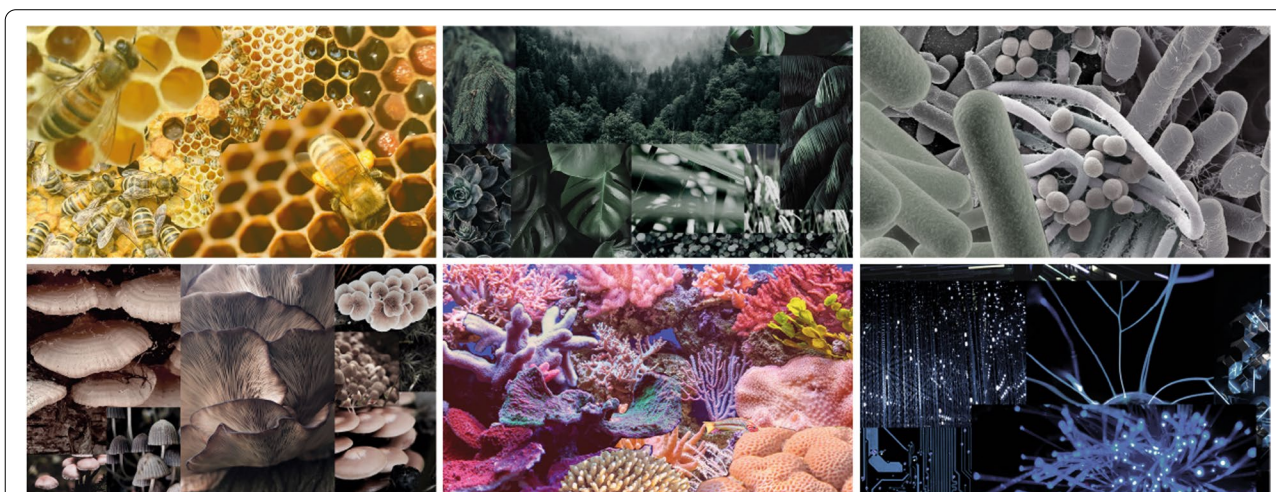
Fig. 2 Visual elements of the provotype of the 1st Multispecies Symposium for the simulation of the species representatives (from left to right: bees, mushrooms, plants, corals, bacteria) and the technical supporter of interspecies communication (bottom right: Artificial Intelligence). Each frame simulates the visualization via interface of the species taking the floor during the symposium

narrate the tales of the Planet, we bring inside us the memory of the eras".

Mushrooms delegate: *Vibrations*.

Mushrooms translation: "We can dissolve the wastes and create the water, the minerals, and other substances that feed the plants. We are fundamental for the beginning of new biological cycles, and we can also be the end of them. We can live in symbiosis with other beings because we have understood long ago the necessity to collaborate".

Corals delegate: *…*.

AI: "It seems that we are experiencing some technical issues. The system advised me that we are not able to translate what the coral's representative is saying. Sorry for this impolite inconvenience".

The experience ends with all the speakers communicating together according to their own languages.

The event was performed by the researchers during the closing of the Summer School, which was held remotely. The remote context made it possible to really simulate the symposium through an audio-visual presentation. The performance opened new reflections and provided ideas for future developments.

Conclusions and next steps

What has been understood through the development and the production of the *prototype* is its ability to evolve from research output to a shared and collaborative tool to reflect on co-design with other living entities.

To fulfill this objective, two further approaches, based on the same prototype, have been considered: the first one has been named "*Open Interspecies Debate*", and it is based on the active audience involvement in the fictional event; so, one representative from the human species and more representatives from other species will take part in the debate to foster the human identification with the others and the reflections upon an interspecies collaborative world, where a human-centered perspective should be strongly avoided.

The second hypothesized approach, defined "*Post Symposium Debate*", consists of a passive audience involvement but also in the process of a decision made by the human audience regarding what to say during the next symposium. This second path should help in reflecting on humans' role in a posthuman world, understanding what the first-person contribution to ecosystems should be, and in highlighting the necessity for no hierarchies between species.

After the production of the prototype, it became apparent how much the *prototype* itself is inevitably influenced by the human-centric and temporally localized view of the researchers. The mode of interaction and the type of artificial intelligence that enables it was imagined based on current models. Another point of reflection for future insights could be to try to imagine in a deeper way the developments and role of AI in the imagined future scenario. As a matter of fact, AI might develop as a proper specie entity with its own needs to be expressed during the multispecies symposium.

In keeping with the idea of relativity and bias in the researchers' views, new questions arise about the different perceptions of time and space we have compared to other entities: for example, how would a collaboration between humans and non-humans be fostered, assuming a time and spatial comprehensive perspective? Again, what are the feedback types among different species? Visual, auditory, haptics, or other? It is extremely important to try to solve these questions if we want to evolve and assume a more ethical role as a real part of the complex world we live in: we must understand that different ontologies and epistemologies do exist, apart from the ones that can be defined as human.

Again, if we reflect upon how we should fulfill these goals, it seems that technologies such as Artificial Intelligence and algorithms are going to be the most promising, obviously if developed without the human biases they appear to have today: one interesting example of this argument is Unanimous AI, an animal-based AI, that works following the mental schemes and patterns of animal to make decisions [58]. Another fundamental role that technology is the facilitation of communication processes between humans and other species: it is difficult to imagine human beings communicating with animals and plants without the support provided by new communication technologies.

So, the whole *prototype* refers to the field of speculative design, not only because it has been developed starting from its principles and methodologies but also because it implies a leap in time to dispose of the right technologies, to be created, and to happen.

For the next project steps, and to switch from theoretical research to a sort of action research, the operation that should be undertaken consists of a testing phase, able to deepen and highlight the strengths and the weaknesses of the tool and identify new opportunities for its further development and refinement. As mentioned before, *prototype*s need to be iteratively modified according to the new questions that emerge from the interaction with the audience, hence the tool itself should be further refined after the testing phase.

To conclude, it should be time to assume a posthuman perspective while developing design research and projects, to understand the worldly centrality of the whole environment and ecosystems, and to reflect on the role that humans should fulfill in posthuman ontologies and epistemologies. A fictional event as the "First

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Multispecies Symposium" represents an effective way to focus on a complex topic by changing the participants' perspective in a guided way, trying to emphasize the possible biases encountered during the two designed activities, which means the "*Open Interspecies Debate*" and the "*Post Symposium Debate*". People and designers may be provoked by means of a provotype, which can be seen as a promising tool to engage different stakeholders to reflect on complex topics such as sustainability transition challenges, interspecies justice, and the perspective-shifting toward post-humanism. Finally, a provotype, in particular in the form of a collaborative fictional event, stimulates people's contribution to complex socio-technical issues, increasing their awareness and attention to the more-than-human world we live in.

Authors' contributions
All co-authors equally contributed to the research and the drafting of the publication. All authors read and approved the final manuscript.

Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
Not applicable.

Competing interests
Not applicable.

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