Design prototype

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ABSTRACT

In contemporary academic environments progressive architects and urban designers struggle to cope with the prevalent paradigm of research, which still rests on the well-established problem-solution couple. Lately, emphasis is given to 'research by design' that, although it accounts for the peculiarities of design as research method, it does not break with the presuppositions in the way research is pursued. In this paper we recognize the prevalence of two paradigms in research. One that starts with a well-posed research question and seeks an optimal solution and another that originates from an ill-defined problem and potentially leads to a plethora of solutions.

We argue that neither the optimal solution neither a variation of answers secures the imperative of novelty and relevancy of knowledge that can fuel practice and academia. The methods of delimitation of research by specifying the problem a priori in the form of a research question seems to be obsolete since it suggests a research that finds its innovative trope in a space of possibilities already given by the way the question is posed. In this sense design, it can be argued, is degraded to an operative medium for the exploration of that space.

In this paper we propose a different mobilisation of design in research that aims primarily but not exclusively to question the constitution of problems and to turn that question into an affirmative proposal. In order to do this, we trace a transition from variational to differential prototypes where innovation is effected by experimenting with the problematic field and not exclusively with solution space. With problematic we identify the domain through which problems are formed. Design in this case then becomes the process of designation of a problem and the production of knowledge is effected by reframing the problematic.

Without dismissing the historical formation of the disciplines of architectural and urban design, prototypes transgress traditional boundaries and categories allowing for the appropriation of and experimentation with diverse apparatuses and machines. In this sense, not only history reads differently but also problems are constituted differently. Operating with a curiosity to access the nonhuman, those inhuman prototypes aim to penetrate disciplinary boundaries to problematize problems and to articulate artefacts with transformative agency.

"Design research" aims therefore to respond to the themes of curiosity and participation by harvesting a multitude of points of view that form an ecology of prototypes folding inhuman and human agencies. Experimenting with

biological organisms like micro-algal cultures and technological apparatuses, 'designed prototypes' become processes of designation of the problem in an inhuman way. In order to articulate the argument in more pragmatic aspects we look how the practice of ecoLogicStudio has designed an urban bio-digital prototype as research medium, structuring a continuous feedback between research and practice, between design brief and research question.

Within this context design research is executed by apophatic prototypes with transformative agency for an architectural discipline yet to come.

INTRODUCTION

IIn academic environments and professional practices progressive architects and urban designers struggle to cope with their intellectual insights and the production, evaluation and distribution of knowledge that they create in a world that tends to slip their comprehension and it challenges constantly their conventional ideas about their disciplines. Nonetheless, as Murray Fraser (2013) has recently stated in his extensive literature review on design research *"the most accepted mechanism for creating new insight and knowledge in any cultural or academic field, or of attempting to understand the past, or present or future conditions, is through research."* (Fraser, 2013) Normative definitions of research can be found in the literature but what seems to be a contemporary trend is the **sharing ethos** of insights that can be exchanged between disciplines. This is reflected by the revised definition that the Research Excellence framework provided in 2014 and defines research as *"a process of investigation leading to new insights, effectively shared"* (Fraser, 2013). The EAAE provides a more specific working definition to Design Research by describing it *"as the processes and outcomes of inquiries and investigations in which architects use the creation of projects, or broader contributions towards design thinking, as the central constituent in a process which also involves the more generalised research activities of thinking, writing, testing, verifying, debating, disseminating, performing, validating and so one"* (Fraser, 2013).

Murray Fraser (2013) mainly and Michael Hensel (2012), to a certain extent, have both provided a literature review of the development of Design Research in academia and practice, both of them supporting a close integration of the two. A closer reading of the books edited by the aforementioned authors reveals one of the issues that this paper is willing to discuss and to develop in order to reorient Design by Research in the coming years. The prevalent paradigm of Design by Research still rests on a problem-solution couple that is always formed and positioned within an anthropocentric or human-oriented framework. The problem is formulated in such a way as for architecture to serve the human. Research, in other words, is willing to address a human image directly by focusing on its social, political everydayness or indirectly, through technological development. It appears therefore that design as a methodology in architectural research, which operates in academia and practices, is being subjected to and capable of addressing only a given human image. That was and still is the ambition from the operational research tactics of the post-war period as 'design methods' or 'design science', to recent 'research by design'. In this paper we recognize the prevalence of two paradigms in research. One that starts with a well-posed research question and is seeking an optimal solution continuing the premises of 'design science' of 60s and another that originates from an ill-defined problem and potentially leads to a plethora of variated solutions. Our position therefore leaves behind the arguments revolving around 'design science', asking therefore to what extent design is science and focuses on the remark that our epistemological questions are all-too-human.

In this sense we make a decision to suggest three provisional categories: that of the human, inhuman, and nonhuman not as dogmatic categories capable to explain the rather thick reality of research but as means for their respective reconstitution or for their potential replacement by other novel materialisations. Science, in this sense, is the human inquiry that is mediated by inhuman apparatuses in order to produce knowledge about the nonhuman world. If that stands as a standard approach of science that mobilised operational research and 'design science' then it is also suggests science as assemblages of human and non-human agents in the sense suggested by Bruno Latour (1991). What we are missing though in those understandings is what McKenzie Wark has argued recently that *"The sciences cannot help but bear traces of a radical [inhuman] otherness, even when the human discourse that results is saturated in metaphors drawn from mere human and historical social formations"* (Wark, 2015).

To account for those traces of the radical otherness we turn to Eugene Thacker's (2014) definition of "weird media" and the mediation of what is impossible to be mediated that affords in this sense apophatic conception of research. Weird media reveals that it is an ontological excess to the things that we encounter and not only an epistemological subtraction as Kant's constitution of subject object would have it in relation to the thing-in-itself. Weird media are becoming apophatic in the sense that the thing-in-itself cannot be communicated but only by negating the decision to name it as such. For that matter Karen Barad's (2007) intra-active realism becomes operative. The ontological radical other is the inhuman for Reza Negarestani's (2014) reading of the human labour. The *apophenia* therefore as the practice to assume patterns and connections out of noisy data and to draw metaphors from them gets a positive treatment in MacKenzie Wark's (2015) reconception of Bogdanov's "tektology" as a new sharing ethos.

In order therefore to mobilise the above-mentioned concepts we suggest to follow Eugene Thacker (2011) and cut the world into: *"for-us"*, *"in-itself"* and *"without-us"*. This distinction will constitute the premises upon which we will discuss the three prototypes designed as the Ecologic Studio, as cases to reveal a new direction in research that rests on the apophatic mediation of the prototypes that spans between academia and practice. The paper will conclude that the real challenge for design research is not to be found in the epistemological part of the *"world-for-us"* and the *"world-in-itself"* but in a serious consideration for the *"world-without-us"*.

RESEARCH AS PROBLEM-SOLVING: THE ANTHROPOCENTRIC PREDICAMENT

Horst Rittel and Mervin Webber in their *Dilemmas in General Theory of Planning* of 1973 opposed the rigorous and clear definition of problems under Operational Research. The epistemological uncertainty becomes for Rittel and Webber the premise for a revision and rejection of the ways that operational research posed scientific problems. Rittel and Webber concluded that the incomplete knowledge of the problem or the noise or entropy that enters into a system make the articulation of a clear and well-defined problem impossible. However, the critique that they raised to Operational Research methods was still considering research as a problem-solving process within an anthropocentric framework. Their attempt therefore to incorporate uncertainty in the problem-solving couple was simply to account for uncertainty in an epistemological way. The difference between the two approaches is reflected in the difference between logical understanding of reality and meta-understanding of reality, where we adopt the definition of 'meta' by Gregory Bateson (2000).

Neither the optimal solution nor a variation of answers secures the imperative of novelty

and relevancy of knowledge that can fuel practice and academia. No human being can be considered purely logical or purely creative but we all are equipped with a complex mix of skills that define our very unique understanding of reality. The methods of delimitation of research by specifying a priori the problem in the form of a research question seems to be obsolete, since it suggests a research that finds its innovative trope in a space of possibilities already given by the way the question is posed. In this sense design, it can be argued, is degraded to an operative medium for the exploration of that space. While we believe that one of the main characters of design is exactly the one of being able to bridge between logical understanding of reality and meta-understanding of reality. Rittel and Webber will frame this distinction conceptually by giving to the first instance the notion of the 'tamed' problem and to the second that of the 'wicked' problem. The wicked problem deals mainly with the uncertain and as such it is impossible to frame and define it clearly. The epistemic uncertainty of the wicked problems refers either to the incomplete knowledge of a well-defined system, or to noise and randomness that ingress into the system and therefore make impossible any prediction in advance of the course of the system under question. Rittel and Webber's attempt therefore to incorporate uncertainty into problem-solving was to simply account for uncertainty in epistemological way.

The world becomes increasingly difficult to comprehend. For this reason Eugene Thacker (2011) in *In the Dust of this Planet* attempts to slice the world into three categories in order for him to account for what emerges as an unthinkable world. The relevance to research and to design research in particular is of great importance since it is our embeddedness in the world through which we understand it and we produce knowledge of it. The *"world-for-us"* therefore is our world. It is the human world that we inhabit, interact, interpret and give meaning to it. It is the world that, as Thacker observes *"we are at once a part of and that is also separate from the human"* (Thacker, 2011). The world-for-us is not so compliant though as we would like to think. It *"bites back"*, it *"resists, or ignores our attempts to model it into the "world-for-us"* (Thacker, 2011). This is the world that has an agency and therefore an autonomy and it is the *"world-in-itself"*. The world-in-itself is however a paradoxical conception. By the moment we think of it and we act upon it then it is transformed in to the *"world-for-us"*. *"A significant part of this paradoxical world-in-itself is grounded by scientific inquiry – both the production of scientific knowledge of the world and the technical means of acting on and intervening in the world"* (Thacker, 2011). Rittel and Webber's discussion on the tamed and wicked problems is therefore situated within this reciprocal and paradoxical understanding of the world-for-us and the world-in-itself. The impossibility therefore to create a mirror between the world-for-us and the world-in-itself is due to the epistemological uncertainty that is a result either of human beings' cognitive limitations or due to noise and randomness in the data abstracted. The bounds of our intelligibility and the incomprehensible world haven't stopped humans thinking speculatively beyond the limits that define us as human beings, this *"spectral and speculative world is the world-without-us"* (Thacker, 2011). It is only through speculation that we can create metaphors for this world. The world-without-us does not need to have as horizon the extinction of the human. It is the subtraction of the human from the world that is the world-without-us. In these three different conceptions of the world we are glimpsing the possibility of breaking the circle that the correlationist Kantian doctrine (Meillasoux, 2008) has established in epistemology and to inquire into an ontology beyond the phenomenological world.

THE INHUMAN

What we therefore suggest is to reconceptualise Rittel and Webber's discussion on research problems through an additive ontology and a subtractive yet speculative epistemology. Actual entities are first and foremost patterns of relations of other agential
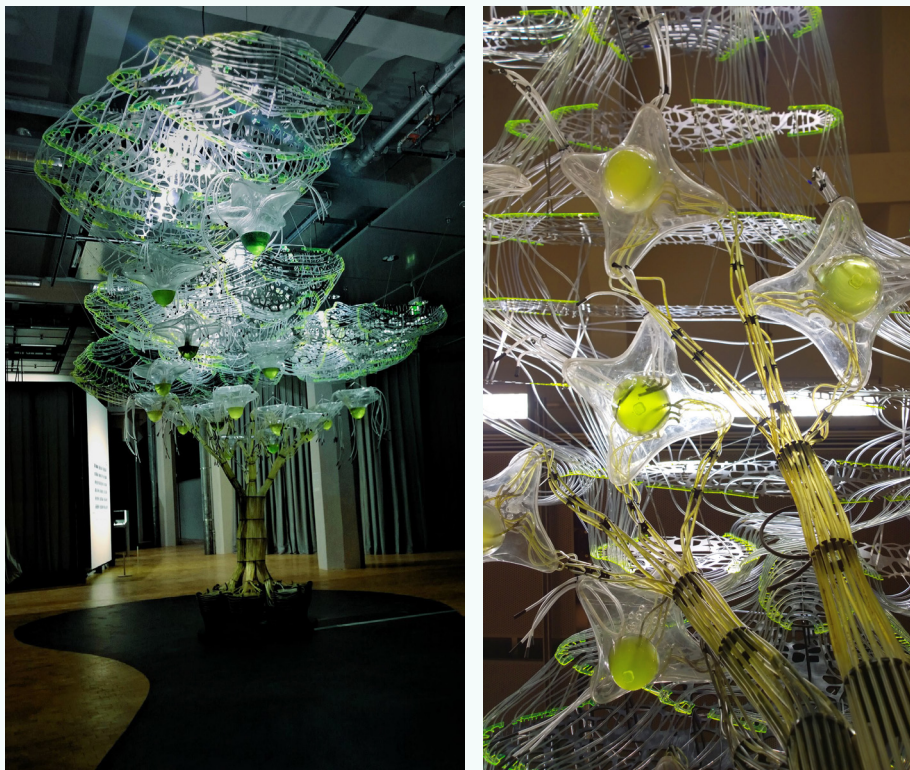
interactions. However, those agents although real are plunged in to the world-without-us which is real but not actualised and therefore virtual. Philosophers like Alfred North Whitehead (1985), Gilles Deleuze (2004) and recently Manuel Delanda (2011) and Karen Barad (2007) have explored the ontological indeterminacy of the world-without-us by constructing respectively different speculative schemes. It is first and foremost that ontological indeterminacy that makes the constitution of the problem not only difficult, but mostly speculative. Rittel and Weber have clearly stated: "*the most intractable problems is that of defining problems*" (Rittel and Webber, 1973). Instead of trying to build on the Kantian limitations of correlative subject and object, that is on epistemological limitations like Rittel and Webber do, the genealogy of the thinkers that we have mentioned argue for an additive ontology, a surplus value that intervenes and problematizes the problem in its resolution.

The intra-active realism of Karen Barad would allow us to discuss an excessive and contingent ontology of things. Karen Barad, a quantum physicist turned philosopher, has argued about the role of quantum indeterminacy on an ontological level, a critique on the Cartesian narrative of substances and discreteness but also a critique on the importance on mere and given agential relations. With the concept of intra-actions and her agential realism that she has developed in her book, *Meeting the Universe Halfway*, Barad opens up the question of knowledge-production beyond the correlationist epistemological trend of the world-for-us and the world-in-itself that underlies most of the current research. The explicit and implicit hierarchical anthropocentrism of design research restricts the formation of problems to a set that corresponds to a general conception in which architecture serves the human. 'Human', in these two instances is recognised as a given

category (either as social-political or affective-parametric) that design and/or technology is obliged to address. Barad's intra-active paradigm meshes the interactions of human and nonhuman agencies into apparatuses. An inhuman, alien, revisionary and constructive force inherent in those apparatuses cuts the world differently into novel materialisations and conceptual categories of the human and non-human that are more fictional and speculative than given and dogmatic.

It is in this sense, however, that philosopher Reza Negarestani tries to rescue this horizontality from the anti-humanist impulses by suggesting a reciprocal presupposition between the inhuman and the human, *"the truth of human significance -…- is rigorously inhuman"* (Negarestani, 2014). Negarestani suggests therefore a verticalism that reinstates humans' rationality and capacity for abstraction and sees the inhuman as the spark for a revisionary and constructive intervention. The task at hand for design research is therefore not a user-oriented design research, but a design-oriented user even if that user is a heterostatic assemblage of nonhuman and human entities, that they do form apparatuses capable of recutting the world differently. It is in this sense that the call for design research of the future parts from the traditional distinction between the tamed and wicked problems, the invocation of the interdisciplinary and the call for participation and increased curiosity. Our position is that all the aforementioned, although still relevant, rests explicitly and/or implicitly on a hierarchical anthropocentrism; the 'world-for-us', the 'world-in-itself'. The question therefore that our prototypes construct is to address the planet as 'world-without-us'. In this sense the prototypes call to rethink research participation and curiosity in a non-hierarchical human-oriented world by allowing the world-without-us to refract the sensible and to recut categories creating new metaphors.

McKenzie Wark(2015) in his recent book *Molecular Red: Theory for the Anthropocene* reconstructs Alexander Bogdanov's concept of "tektology" in an attempt to stress the speculative approach to science, science as the practice of opening views out of the guarded world of humanities discourse.

Tektology therefore is:

> *"… neither a theory nor a science, tektology is a practice which generalises the act of substitution by which one thing is understood metaphorically via another. It is a practice of making worldviews… the wager of tektology is that it might be possible to construct a kind of low theory whose purpose is to experimentally apply understandings of one process to other quite different processes to see if they can be grasped as analogous. It is a kind of detournement that works sideways, from field to field, rather from past to present"* (Wark, 2014).

A tektological orientation, therefore, will allow us to share metaphors that emerge out of our prototypical interventions with the ambition of resonating with other efforts and to scale them up in a planetary scale, which is the domain of real change. Tektology, therefore, is about sharing, not methods and tools but new metaphors.

DESIGN PROTOTYPE
//STEM//

The first of the bio-digital series we are investigating as case studies in this paper was proposed for the London Architectural Biennale 2006 and subsequently was presented in the Italian Pavilion at the Venice Architectural Biennale 2006. This first prototype responded to an interest to work with urban air pollution in a way that would avoid a direct solution

▲ ▶ STEMcloud

of a well-posed problem. It would look at urban prototypes, which at the time we called *ecoMachines*, which would be on one side able to re- describe spatially and materially the architecture of our cities and at the same time reprocess some of its pollutant in an explicit manner. STEM v1.0 in particular was using micro and macro-algae from the local ponds and rivers, which were considered a problem for the local ecology and allowing them to grow into recycled hospital bottles organized in a honeycomb geometry. Architecturally, STEM v1.0 was presented as a living screen able to engage with sunlight and air pollution to generate oxygen via photosynthesis. In terms of its infrastructure, STEM v1.0 proposed a 'transparent system' where the capability of the screen to absorb carbon dioxide is directly reflected in the number of oxygen bubbles produced and in the longer term, in the density of macro and micro-algae present in the system itself.

STEMv1.0 continuously evolves its physical qualities; light is filtered and captured for photosynthesis, oxygen is produced and carbon dioxide adsorbed; the more the light, the more the carbon dioxide, the more oxygen production, as well as density of algal growth, which will in turn increase the screening potential of STEM itself; less light and less carbon dioxide on the contrary will correspond with less growth and more transparency.

The overall systems configuration, its liquid transparency and its breathing potential is initially defined by the radiation gradients in the space; but as the living material starts to grow and evolve, the parameters will influence each other and the system will be subjected to constant transformation and will demand artificial manipulation, or interaction, from the users.

Rather than looking at solving the problem of pollution we looked at an architectural structure that would be able to absorb pollution as part the dynamic system that defines its existence.

//STEMcloud//

The STEMcloud v2.0 series presented at the Venice Architectural Biennale 2008 and to the Seville Art and Architectural Biennale 2008, evolves the morphological aspects of STEMv0.1 as well as human/inhuman interaction – the project proposes the development and testing of an architectural prototype operating as an oxygen-making machine.
STEMcloud v2.0 operates as a breeding ground for micro-ecologies found in the local water bodies such as the river of Seville, the Guadalquivir or the Venice Lagoon, while at

the same time involving the public in the breeding process. The transparency and porosity of the architectural system allows the process to be visually and materially exposed to and interfaced with the microclimate of the gallery; while STEMv1.0 present itself as an almost autonomous machine where the evolution of the system is a result of a continuous feedback machine/environment, in the case of STEMcloudv.20 the public will act as a perturbation as well as involuntary gardener of the system at the same time, by feeding the micro-algal colonies from the local river water with nutrients, light and CO_2 and as a result oxygenating the gallery space. The growth process will be triggered by patterns of interaction with the public and in turn will affect these patterns with its visual effects. Multiple feedback cycles are provoked within the components of the system, with the gallery environment and within the city itself.

This extended model of systemic architecture can be understood in cybernetic terms as a multilayer crossing of feedback loops. Cybernetics provides an operational framework to deal with change and transformation, the two main defining qualities of our new ecological understanding of architecture; the starting point of the experiment is artificially defined by us and provides what scientist call a primed condition necessary to promote interaction.

The basic cybernetic set for the Seville experiment includes 3 components: the urban environments (the river ecology and the gallery space), the architectural machine (STEMcloud) and human behavior (the visitors). These systems are multilayered and diverse and they will interact in a variety of ways: in this sense we can consider the experiment as complex, the outcome of it unpredictable and the question is 'wicked'. It is impossible to tell what kind of equilibrium will emerge within each of the 3 systems; what kind of algae ecologies will grow? How will visitors be reacting to them?

In the impossibility of control, the experiment is about communication: STEMcloud is organized to allow and promote communication among the systems in such a way that a conversation/learning process could emerge. Visitors will be transformed in ecologists, the STEM blocks into microhabitats, the gallery into an oxygenating garden or, perhaps, laboratory. The priming of the system and the channels of communication between systems have been carefully designed and engineered and can be summarized as a series of feedback loops within the more generic cybernetic set previously described.

// HORTUS London 2011 – Paris 2012// intra-action

The etymology of the word garden comes from the German *Garten*, the original meaning of which is enclosed or bounded space, in Latin *hortus conclusus*. H.O.R.T.U.S. engages the notions of urban renewable energy and agriculture through a new gardening prototype; the proto-garden hosts micro and macro-algal organisms as well as bioluminescent bacteria; fitted with ambient light-sensing technologies and a custom-designed virtual interface, H.O.R.T.U.S stimulates the emergence of novel material practices and related spatial narratives.
Flows of Energy (light radiation), Matter (biomass, CO_2) and information (images, tweets, stats) are triggered during the four weeks long growing period, inducing multiple mechanisms of self-regulation and evolving novel forms of self-organisation.

H.O.R.T.U.S proposes an experimental 'hands-on' engagement with these notions, illustrating their potential applicability to the masterplanning of large regional landscapes and the retrofitting of industrial and rural architectural types, as exemplified in the project *Regional Algae Farm* developed by ecoLogicStudio for the Swedish region of Österlen.

▲ HORTUS

▲ ▶ HORTUS

▲ ▶ Urban Algae Folly

isitors are invited to engage daily with H.O.R.T.U.S, inventing new protocols of urban bio-gardening; the biologic diversity within H.O.R.T.U.S is provided by local lakes and ponds; as algal organisms require CO_2 to grow, visitors are invited to contribute by blowing air inside the various containers (photo-bioreactors), as well as adjust their nutrients' content; oxygen is released as a result, feeding the other organisms in the 'briccole' (bioluminescent bacteria) and in the room.

Information flowing daily through H.O.R.T.U.S feeds its emergent virtual garden, accessible via smart phones; its virtual plots are nurtured by the flow of observations posted by each visitor, locally and globally, by lighting levels data streams and by human interaction in real-time. Such virtual organisms offer the opportunity for capturing and sedimenting information and cultivation practices, enriching the material experience of the visitor turned urban 'cyber-gardener'.

//Urban Algae Folly Milano Expo2015 – Braga Praca De La Republica 2016//

The Urban Algae Folly is an intra-active pavilion integrating living micro-algal cultures. The shift, in this case, is from an indoor, almost domestic prototype, to an outdoor public folly. For us this is a built example of architecture's bio-digital future. Microalgae, in this instance Spirulina and Chlorella, are exceptional photosynthetic machines; they contain nutrients that are fundamental to the human body, such as minerals and vegetable proteins; microalgae also oxygenate the air and can absorb CO_2 from the urban atmosphere ten times more effectively than large trees.

The architecture of the *Algae Folly* originates from the evolution of the well-known ETFE architectural skin system; in this instance it has the ability to provide the ideal habitat both to stimulate Chlorella and Spirulina's growth and to allow a comfortable staying for visitors.

Visitors influence the cultivation protocol with their presence and at the same time become part of a public harvesting event where the micro-algae are collected and consumed as gourmet dishes on site. The mechanism of interaction is, in the case of these two follies, more similar to the one of the original STEM than in it is to one of the later H.O.R.T.U.S series, in fact the architectural appearance and shading potential of the folly emerge from the interaction between the human/folly/environment: on sunny summer days the microalgae will grow rapidly thus increasing the shading potential of the architectural skin providing shading for diverse activities; visitors, with their presence, will in turn activate the digital regulation system which will stimulate algal oxygenation, solar insolation and growth.

In any given moment in time the effective translucency, colour, reflectivity, sound and productivity of the Urban Algae Folly are the result of the symbiotic relationship of climate, microalgae, humans and digital control systems. This prototype allowed us to evolve the material system of our bio-digital algae farming prototype so to become more integrated into a dynamic architectural and urban context.

THE WEIRD PROTOTYPE

Every prototype that we have developed and presented in this paper shares the weirdness of mediation. At the core of *weird media* is the idea of *"the mediation of what cannot be mediated"* (Thacker, 2014). A type of communication with that which cannot be mediated can only be achieved by negation. That means negating the subject-object dichotomy or the human-nonhuman one. In this sense Thacker calls us to think the prototypes not as
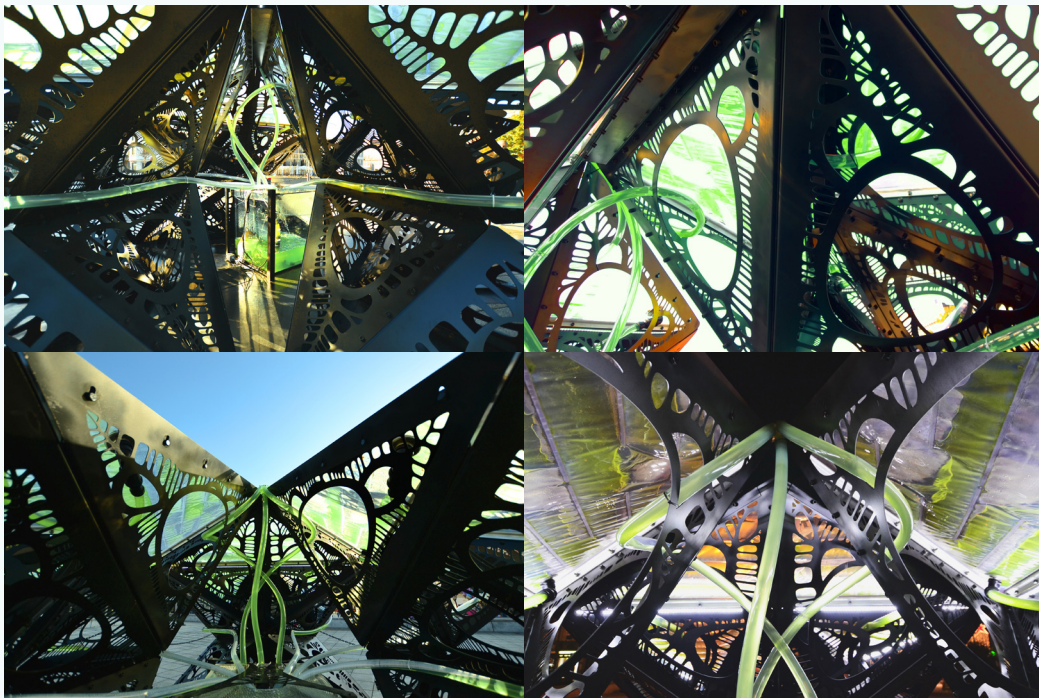
devices, tools, or even objects that facilitate the communication between the world-for-us and the world-in-itself but as a form of mediation that is operative between the world-for-us and the world-without-us. At the time that mediation is negated, a pure communication results that is prior to any dichotomy. We do therefore have a communication between two orders of reality.

"*This is quite different in principle from the modern view of mediation given by*

cybernetics and information theory. There, one has a mediation between two points within a single, shared, consensual reality. While there may also be messages, channels, senders, and receivers, in [weird] media have one important difference: the mediation is not between two points in a single reality, but between two realities" (Thacker, 2014).

Every prototype in its operation as weird media refracts its inputs by materialising new agential entities. In this sense the prototype extends the human's sensorium domain and therefore reconstitutes an agent that is augmented and transformed to feel more than what a human subject can. This is the promise of our prototypes when functioning as weird media.

Thus every single prototype therefore constructs an intra-active ecology on its own. The folly becomes an apparatus and as such creates a platform that folds together processes and refracts new materialisations possible to create new metaphors and speculations for inhabiting a built artefact while participating in the production, distribution and management of energy. It is not an interdisciplinary convergence and neither simply an ecology of participants. It is an intra-active field that constructs an ecology of participants. The agential capacity of the prototype therefore overcomes *"[t]he usual notion of interaction"* and of the participation to the extent that *"assumes that there are individual independently existing entities or agents that pre-exist their acting upon one another. By contrast, the notion of 'intra-action' queers the familiar sense of causality (where one or more causal agents precede and produce an effect), and more generally unsettles the metaphysics of individualism."* (Barad, 2012)

In this sense the prototype brings together human and nonhuman agents organic and inorganic that *"do not pre-exist as such but materialise in intra-action"* (Barad, 2012). The prototype becomes an assemblage of *heterostatic* processes that at certain points 'refract' representations of the human and nonhuman and construct a world-for-us. In this sense the production of knowledge, although saturated with human metaphors and images, bears traces from the inhuman. The whole world becomes an intra-active-ecology in our view and prototypes become apparatuses through which the categories of human and nonhuman are apophatically constructed. The world-without-us therefore that looms at the shadows of the world-for-us is the inherent ontological indeterminacy or contingency that partakes in agential relations in a given moment. These experimental refracted moments therefore should be conceived of as a springboard not for an explanation but for a 'what if' experimentation with the given conditions.

Curiosity in these relational terms of intra-action parts away from the Kantian scheme of what is possible to be known. Curiosity is importance. Curiosity is to access and experiment with the way things form a state of affairs. Curiosity is not transparency. Transparency is rather an unfortunate term in that it implies a concrete reality beyond the epistemological limits of our species. Transparency is epistemological, curiosity is ontological. Curiosity needs the importance that rationality provides but also the sensing that affectivity suggests. It is through the bridging of the importance and the affect that curiosity acquires it full interventionist power as revisionary and constructive agent.

CONCLUSION
It is through this turn to ontology that the prototypes become alien and as such suggest a materialisation of creatures that not only overcome the traditional distinctions of nature-culture, organic-inorganic but open a new path to design research as problem making

prior to problem solving. This ontological turn allows us to rethink the role of apparatuses and media in the design process. Instead of researching the nonhuman world with inhuman apparatuses for the production of human knowledge, as research by design suggests, we turn that around and we argue for the importance of prototypes in research as weird media.

"The task of design research as it is presented is not finding a new or improved version of the world-for-us, and it is not to relentlessly pursuing the phantom objectivity of the world-in-itself. The real challenge lies in confronting this enigmatic concept of the world-without-us, and understanding why this world-without-us continues to persist in the shadows of the world-for-us and the world-in-itself" (Thacker, 2011). That is, the realisation that inquiry and knowledge cannot be addressed by architectural objects and apparatuses as discrete objects in the word-for-us. In the world-without-us their intra-actions materialise representations capable of having a transformative agency in the world-for-us.

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