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The Un-designability of the Virtual.
Design from Problem-solving to Problem-finding

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For the new – in other words, difference – calls forth forces in thought which are not the forces of recognition, today or tomorrow, but the powers of a completely other model, from an unrecognised and unrecognisable *terra incognita*.

Deleuze, *Difference and Repetition*, 1994, p. 136

We should, however, understand all objects as part of a process of emergence,
the made as part of the making, not the unmade.

Lars Spuybroek, *The Architecture of Continuity*, 2008, p. 146

We are the product of contingent events, material histories,
webs and networks of anonymous forces.

Robin Mackay *The Medium of Contingency*, 2011, p. 3

Introduction

This chapter offers a speculative proposal for a new theoretical framework in design research underpinned by two key ideas: morphogenesis and the virtual.

Morphogenesis describes a process of form generation through growth, differentiation and continuous variation whereby new forms emerge from the unpredictable interplay of dynamic forces and the relentless movement of matter. In the context of this chapter the notion of morphogenesis encompasses not only the emergence of form through the unfolding of matter, but also those generative processes – be them systemic (organizations, collectives, structures), conceptual (ideas, beliefs, cultures) or behavioural (experiences, practices, enactments) – which possess similar morphogenetic capacities. In a morphogenetic perspective, then, systems, thoughts and practices emerge - like form does - from the interplay of continuity, variability and contingency, rather than being imposed by an ideal blueprint.

I draw on Gilles Deleuze's ideas around the virtual (Deleuze, 1991) to investigate these morphogenetic processes in all their variability. In the context of the present chapter the virtual is taken as what problematises the possible by inserting contingency in the process of the emergence of the new. Thus, a tension exists between the virtual as what is uniquely placed to engender true innovation, and its aleatory and unforeseeable nature – akin to the tension existing in design between form-making, on one side, and the need to acknowledge, and work with, the contingent, on the other. On these grounds, a new framework for design research is proposed: a shift from problem-solving to problem-finding. This is underpinned by the idea of the undesigned at the core of design itself, and explored through a morphogenetic model.

Beginning with material morphogenesis, the chapter asks: If matter is constructed in dynamic terms, as a flow whose self-organizing properties are emergent rather than given, immanent rather than static, how might this inform a new way of thinking about the design process and the designer's role? What are the implications for design if matter is liberated from the impositions of hylomorphism? The chapter then broadens the scope of these questions by considering the effects of an expanded morphogenetic model in relation to design as a whole.

An initial response comes from looking at Deleuze's ideas on the virtual and its actualization, which, I argue, should to be taken on board by design to inform a problematizing paradigm with which to rethink the conditions of the emergence of the new. If the actualization of the virtual is to be understood not in terms of things, but in terms of events; as something ultimately unexpected, strange and unforeseeable; as something with the power to unlock a different future by provoking change and engendering transformation, then it seems clear to me that design is bound up with a similar set of concerns. How is the new being produced? How to catalyse the unexpected, unforeseeable differential of the event that, alone, has the force to create change and produce innovation? How to capture stories from the future so that they give tangibility to a present in the making?

To clarify what is meant by the term 'design' in the context of this chapter: I contend that design is never a thing, but a process. A process of speculation, invention and change, which always produces tangible implications that affect behaviours and lives. Such a notion of design as the process of changing what is into what can be, always engaged with the not-yet, strongly resonates with Deleuze's assertion that philosophy

is a creative practice precisely because it is always engaged with the creation of the new (Deleuze, 1995). One of the key tasks of philosophy, for Deleuze, is precisely to figure out under which conditions the new is created (Deleuze, 1995). The production of the new is bound up with a creative evolution and cannot be conceived outside a duration. This means that the new is not something transcendent, a mysterious founding break, or a drastic interruption of the known. Rather, it is something completely immanent happening in time. The production of the new, then, always concerns the virtual. This is also why we cannot talk about design without, in some way or another, engaging with the virtual. After all, the virtual is always process and production, rather than a product; a container of manifold tendencies and propensities that can be actualized, rather than a fixed sequence with a teleologically predetermined goal; an urgent, insistent, unpredictable force that inserts itself into (and breaks apart) the tangibility of concrete reality. To look at design through the lens of Deleuze's virtual is, therefore, relevant, timely and charged with possibilities for design.

However, a word of warning is necessary. To think design *with* Deleuze does not mean extracting ideas from an established philosophical corpus and then applying them to design.¹ The point is not a philosophy 'applied' to design or, worse, a philosophy wanting to monitor design's output. Rather, in line with Deleuze's practical philosophy (Deleuze, 1988) this is about a processual, *in-fieri* way of proceeding (albeit not a method), a way of redesigning the relationship between thinking and making through a non-linear, emergent, open perspective. An applied philosophy, on the other hand, could not be more distant from Deleuze's philosophical empiricism, which he describes as "analyzing states of things so as to

bring out previously nonexistent concepts from them” (Deleuze, 2006, p. 304).² Such an act of sheer, wild creation is what empiricism is about: “the most insane creation of concepts ever seen or heard” (Deleuze, 1994, p. XX). In a radical reversal of canonical philosophy, what comes first for the empiricist is an existent state of things out of which new concepts (and new practices) are to be extracted. As far as this chapter is concerned, then, such a state of things out of which new concepts and new practices are to be extracted is given by design’s own process-oriented nature; and what is to be mined from it as a “previously nonexistent concept” is the notion of the *undesigned*: the amorphous and problematizing complicity of vagueness and contingency to be found at the core of design.

The chapter begins by looking at architecture theorist Sanford Kwinter’s work on morphogenesis, in particular his take on matter’s capacity for self-generation and the model it affords to describe the emergence of the new. Then, it goes on to draw on Deleuze’s book *Bergsonism* (1991) to emphasize how the virtual and its actualization, and the distinction between the virtual and the possible, should be taken as key theoretical resources for design research. Finally, Deleuze’s discussion of the notion of the problem serves to illuminate a new way of thinking about design through a model that, by reframing design’s boundaries as a subject discipline, proposes a shift from design as a problem-solving to design as a *problem-finding event*.

Matter, morphogenesis and design

Drawing on the 20th century’s panoply of paradigm shifts that have taken place in the sciences, Kwinter (2007) remarks how matter’s capacity to self-organize spontaneously must be taken into account by those who design and create physical

artefacts. While this observation is not in itself particularly original, Kwinter's notable insights consist in stretching the idea of emergence and evolution of form - morphogenesis - to every aspect of the world, well beyond architectural form generation. In this perspective, morphogenesis concerns not only tangible forms but the capacity of systems, thoughts and practices to organize spontaneously, and to be self-generative too. A great deal of Kwinter's work (1998, 2002, 2007) reiterates these issues by focusing on self-organizing systems and the creation of form capable of evolving and changing through space and over time. In the essay *Landscapes of Change: Boccioni's "Stati d'animo" as a General Theory of Models* (1992) Kwinter examines different models of the possible and the extent to which they are able to embody and capture the real. Classical hylomorphism, for instance, explains the genesis of form through the linear imposition of a blueprint onto passive matter. This model is however limited in its scope and applications insofar as it allows only a number of possibilities to be reproduced. Put differently, hylomorphism does not allow novelty to manifest itself, nor it affords genuine space for the new to emerge. Rather, in this model "the state of a system at a given moment can be expressed in the very same terms (number and relation of parameters) as any of its earlier or later states" (Kwinter, 1992, p. 53). In other words, while this model can explain how a body moving through the system incurs change, it cannot however account for the change occurring to the system as such. Thus, the only variations hylomorphism is able to capture are those expressed by perpetual self-identity – when a body changes only in degrees (quantity), but not in kind (quality).

Deleuze explains the limits of hylomorphism by saying that the couple matter-form cannot account for determination as it is "completely internal to representation"

(Deleuze, 1994, p. 275). For this reason the changes occurring within the hylomorphic model cannot produce genuine innovation as they lack the capacity to engender the emergence and variety of form.

The opposite proposition to the hylomorphic model would be to say that matter is endowed with morphogenetic capacities of its own, and is able to self-organize, self-generate, and change as an effect of its continuous folding and unfolding. New forms emerge from the interplay of forces. Thus, there are forms because there are processes. No longer is there an ideal form imposed by an external agency, or an ideal design blueprint. Rather, form emerges from virtualities being ceaselessly actualized. This is how the new is created and the not-yet comes to be. Furthermore, for Deleuze and Guattari (1988) matter is alive with the potential of its endless evolution, and everything is formed through differentiation and individuation of the same substance.³ The categorical difference between matter and form is bypassed. What is celebrated instead is “the prodigious idea of Nonorganic Life” (Deleuze and Guattari, 1988, p. 411) where “the essential thing is no longer forms and matter, but forces, densities, intensities” (ibid, p. 343). This view of matter as inherently spontaneous and capable of self-organization has been promptly taken on board by architecture theory (Leach, 2009)⁴ and, more recently, by design theory (Marenko, 2015). Indeed, materialist philosophies have a great deal to offer design: a way to think about matter not as something passive and inert that obediently follows an external imposition - be it the Law, or the Royal science, or a design blueprint – but as an active raw matter-energy–movement that generates all that surrounds us through self-initiated emergent processes. It is this flow of matter, rather than the structures created, to constitute our immediate reality (DeLanda, 1999). Our present (and future) reality is pure difference that emerges via matter flowing through time. Thus, the potential for change and for

the emergence of the new is lodged in this relentless unfolding of explosive matter.⁵ Philosopher Manuel DeLanda (1992, 1999, 2002, 2004, 2009) and architect Lars Spuybroek (2008) have both championed this brand of radical and vitalist materialism from the two different standpoints of philosophy and architecture. Both DeLanda and Spuybroek articulate in their work the philosophical and practical implications of focusing not only on matter's properties, but on its capacities – capacities for continuous variation. This distinction between capacities and properties is important. While properties are quantifiable and measurable, capacities express instead what matter *can* do, its overall power to affect and be affected, in other words its entire *pathosphere*. It is clearly on capacities rather than properties that morphogenesis and material variability depend (DeLanda, 2009).

We can now begin to ask: What are the implications of this morphogenetic perspective for design? Can design rely more on what has been called *material information*⁶ (Leach, 2009) as its generative driver, and not as an afterthought to consider after the design phase has happened? Material information concerns precisely a way of engaging not simply with the properties, but with the capacities of matter as the actual drivers of the design process. It also means to bypass the idea of inert matter endlessly malleable, and shift instead from form to formation, or else, from form-making to form-finding (Leach, 2009). This perspective has important consequences for design. First, it prompts design to question its relationship with materiality, specifically some of its assumptions about how objects come to exist. By grasping matter through the morphogenetic model - where matter is never static but coalesces in a continuity of different stages - design can theorize the production of the new not as the by-product of an external agency, but as the outcome of a process

where continuity, variability and contingency are interwoven. By rethinking matter in terms of events and processes, rather than in terms of things and objects, design can shift its focus from the teleological fixation with the final outcome and with a customary concern for the user, to how to acknowledge, map and harness the virtualities that constitute design's own manifold domain.

It is useful at this point to draw on Deleuze's shift from moulding to modulation (1993) that allows for the interplay of materialities and temporalities to swing back at the centre of the process of creation of the new (Marenko, 2015). This allows us to see the design process through the specific lens given by the process of actualization of the virtual.

Before discussing this in more detail, it is also worth noting another crucial effect of the morphogenetic perspective: it compels design to downplay and rethink the traditional role of the designer as the overarching and overseeing star. Philosopher Brian Massumi, who has written widely on the intersection between the virtual and architecture, remarks how

New form is not conceived. It is coaxed out, flushed from its virtuality. The architect's job is in a sense catalytic, no longer orchestrating. He or she is more a chemist (or perhaps alchemist) staging catalytic reactions in an abstract matter of variation, than a maestro pulling fully formed rabbits of genius from thin air with a masterful wave of the drafting pencil (Massumi, 1998, p. 18).

What becomes privileged instead is the abstract regimes of forces that deploy the new, manifest in the design process. Put differently, *any* design process, whether it goes on to produce an object, a building, a city, an artefact, a service, or an experience, is nothing but a distribution of forces and intensities traversing, and temporarily solidifying into, matter. It is this process – which is, as we will see below,

the actualization of the virtual - that affords the capture of the new. Insisting on morphogenesis is therefore an entry point in deploying Deleuze's virtual to rethink design as a process.

Let us now turn to Deleuze's thoughts on the real, the actual and the virtual so to illuminate further the role his ideas can play for design research.

Deleuze: realization and actualization

Deleuze distinguishes between the process by which the possible becomes real (realization) and the process by which the virtual becomes actual (actualization). The possible is a mode of anticipatory resemblance and doubling up of the real, a sort of pre-planned, pre-formed version of what exists already. Precisely because it does not involve anything unexpected, the process of realization is always predictable. On the other hand, the transition from the virtual to the actual (actualization) is a process rooted in, and generating, genuine innovation. On this point it is worth quoting Deleuze at length:

Now the process of realization is subject to two essential rules, one of resemblance and another of limitation. For the real is supposed to be in the image of the possible that it realizes. (...) And, every possible is not realized, realization involves a limitation by which some possible are supposed to be repulsed or thwarted while other "pass" into the real. The virtual, on the other hand, does not have to be realized, but rather actualized; and the rules of actualization are not those of resemblance and limitation, but those of difference or divergence and of creation (Deleuze, 1991, p. 96).

In the first case only a limited number of possibilities are reproduced and there is no space for novelty to manifest itself - an apt description of the hylomorphic model. In the second case, we have a model where the unfolding of matter and the unpredictable interaction of forces at play allows the emergence of new forms, of the not-yet - that is, morphogenesis.

If the real is what already exists here and now, and the possible is what *can* exist, it follows that the possible is determined by, and ultimately dependent upon, the real. In other words, it is by knowing what is real that we can predict the probability that it might turn, one day, into the possible. Thus, we can predict which possibilities will be realised in the future starting from the reality we know already. However, until we stay in the realm of the possible we only have access to a sort of mechanical evolution that adds existence to what is already known, and already exists. Consequently, there is not much space for the unknown and the radically new to manifest themselves. This is why, for Deleuze, the possible is a “false notion, the source of false problems” (Deleuze, 1991, p. 98). In what sounds like a veritable warning against overplanning and retrofitting by design, he continues:

We give ourselves a real that is ready-made, preformed, pre-existent to itself, and that will pass into existence according to an order of successive limitations. Everything is already completely given: all of the real in the image, in the pseudo-actuality of the possible. Then the *sleight of hand* (emphasis added) becomes obvious: if the real is said to resemble the possible, is this not in fact because the real was expected to come about by its own means, to “*project backward*” (emphasis added), a fictitious image of it, and to claim that it was possible at any time, before it happened? In fact, it is not the real that resembles the possible, it is the possible that resembles the real, because it has been abstracted from the real once made, arbitrarily extracted from the real like a sterile double. Hence, we no longer understand anything either of the mechanism of differentiation or of the mechanism of creation (Deleuze, 1991, p. 98).

What is remarkable in the passage above is that it contains two expressions that lend themselves exquisitely to a Deleuze-driven reading of design, as an exhortation (of sort) to dislodge design from the realm of the possible in order to nudge it into the realm of the virtual. First, the *sleight of hand* can be interpreted as referring to design as cunning science, deception, and craftiness; design as *metis*.⁷ *Metis* is astute intelligence, “the ability to act quickly, effectively and prudently within ever-

changing contexts” (Johnson, 1998, p. 53). It emphasizes a local knowledge that is end-oriented, rather than process-driven. Second, to *project backward* refers to the act of retrofitting what is fabricated “in the image of what resembles it” (Deleuze, 1994, p. 212) - what Deleuze calls the “defect of the possible” (ibid.). In design terms, it is about denying the encounter with the unexpected that may emerge in any process-driven design, or else manufacturing such encounter so that it fits the original design blueprint. The value of looking at design through the lens of Deleuze’s virtual appears increasingly clear. I will return to this topic later. For the moment, let us examine in more depth the nature of the virtual and its actualization. To start with, it is important to reiterate one aspect concerning the nature of the virtual. The virtual is fully real, only not actual, and it should not be confused with some “vague notion”, nor “with the possible which lacks reality” (Deleuze, 1994, p. 279). Deleuze remarks that “the virtual must be defined as strictly a part of the real object – as though the object had one part of itself in the virtual into which it plunged as though into an objective dimension” (Deleuze, 1994, p. 209). The virtual, that is, the embryonic, far from being undetermined, is completely determined, and yet it is only a part of the object. Another part is determined by actualisation. Put differently, every object is double, made of “unequal odd halves” (ibid.) that however do not resemble each other. This is why, continues Deleuze, imagination plays such a crucial role in the process of actualisation. For an object to be actualized is to create difference and divergence, something that has not been seen before. But it is imagination only that “crosses domains, orders and levels, knocking down the partitions coextensive with the world, guiding our bodies and inspiring our souls, grasping the unity of mind and nature; a larval consciousness which moves endlessly from science to dream and back again” (Deleuze, 1994, p. 220).

Moreover, the actualization of the virtual is always a matter of difference and divergence. “Actualization breaks with resemblance as a process no less than it does with identity as a principle” (Deleuze, 1994, p. 212). This is why only actualization is “genuine creation” (ibid.) and true difference takes place only in the inventive drama of actualization, when a contraction of virtuality occurs that contains the germs of yet more virtual events to come. Only actualization, then, is genuine creation because it breaks with the principle of identity, while opening up new problem frames that question the existent. Here we reach the most remarkable aspect of actualization as far as design is concerned. Actualization is nothing but the creation of problems. It is always problematic, and it is creative precisely because it is a problematic and problematizing event. The possible is problematized by the introduction of the unforeseen, and this is what opens up to the creation of the new. In design terms this means to acknowledge the presence of an undesigned at the very core of design, as a force to work with if genuine innovation is to be achieved.

(More or less) predictable adventures in time

The insistence on the processuality of matter and equally on design as a process, as the result of a continuous actualization of the virtual, is as crucial as it is easily overlooked. The reason why we register reality as static is because what really are fluid states are perceived as static crystallizations frozen in artificial isolation, while they are (very) slowly thresholding one into the next. Each form is only a temporary phase in a process in which each phase seems to contain all the others. Put differently, each form seems to contain virtually all the potential forms belonging to the same continuum. To use Kwinter’s expression, forms are not fixed things, but “continuous

metastable events” (Kwinter, 1992, p. 59), “always new and unpredictable unfoldings shaped by their *adventures* in time” (Kwinter, 1992, p. 60 – emphasis added).⁸

The actualization of the virtual is precisely this *adventure* in time that involves a developmental passage from one phase of form into another. Kwinter explains:

Once time is introduced into this system, a form can gradually unfold on this surface as a historically specific flow of matter that actualizes (resolves, incarnates) the forces converging on the plane. These are the phenomenal forms that we conventionally associated with our living world. What we have generally failed to understand about them is that they exist, enfolded in a virtual space, but are actualized (unfolded) only in time as a suite of morphological events and differentiations ever-carving themselves into the epigenetic landscape (Kwinter, 1992, p. 63).

A suggestive example of how these “adventures in time” manifest themselves is given by smart materials. Smart materials can change in response to changing external conditions and can sense, and respond to, variations in their surrounding through a combination of intrinsic properties and context-based circumstances of use. An instance of this behavioural capacity is given by self-healing concrete (Howes and Laughlin, 2012).⁹ The key issue is that responsiveness inserts *time* into material variability. In other words, smart materials are coproduced in a duration, and this is why they can also be described as *becoming materials* – capable of undergoing their very own adventures in times (Bergström, Clark, Frigo, Mazé, Redström and Vallgård, 2010). Moreover, smart materials’ capacities allow us to think of matter on a continuum, with more or less pronounced degrees of predictability. For instance, DeLanda examines the opposite poles of this continuum and describes industrially produced steel and glass as “well-disciplined materials” (DeLanda, 2004, p. 20). These materials have been stripped of impurities and transformed into reliable resources, and are both homogenous (uniform in composition) and isotropic (with

identical properties in all directions). Thus, their behaviour is entirely predictable, and their performance is rigorously standardized.¹⁰ On the opposite side of the spectrum we find smart materials possessing a richer material complexity, richer material information and higher morphogenetic driver capacities. These capacities are not restricted of course to smart materials only. Wood, for instance, as we are going to see shortly, is heterogeneous, anisotropic and subject to irregularities.

Two design precedents are briefly described below to illuminate this. Both show the variability of matter whose highly contingent singularities emerge under specific conditions. Both show how responsiveness can be embedded in matter – whether in a no-tech responsive architectural object, or in a hybrid material between the organic and the inorganic.

The first example is *HygroScope* (2012), a meteorosensitive morphogenetic design experiment that uses computational morphogenesis and exploits the behavioural capacities of wood to explore responsive architecture (Fig.1).¹¹ Designed by architect Achim Menges and hosted by the Permanent Collection of the Centre Pompidou in Paris, *HygroScope* exploits the dimensional instability of wood in relation to moisture content to create a climate responsive architectural morphology. Suspended within a humidity controlled glass case, the model opens and closes in response to climate changes with no need for any technical equipment or energy. Mere fluctuations in relative humidity trigger the changes of material-innate movement. The material structure itself is the machine.

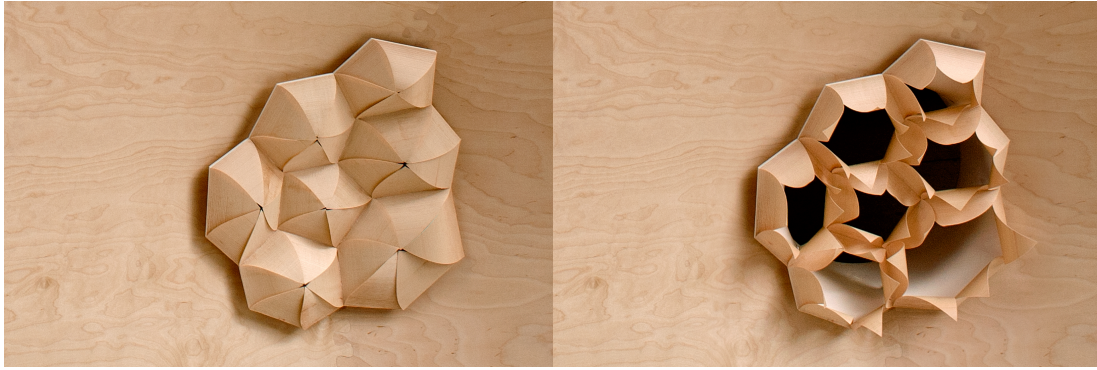


Fig. 1
 HygroScope: Meteorosensitive Morphology.
 Permanent Collection, Centre Pompidou Paris
 Achim Menges. Institute for Computational Design ©ICD University of Stuttgart
 2012

The second example is the *Amoeba* surface-adapting trainer, a conceptual prototype that seeks to probe the future of new protocell-based materials by using 3D printed biotechnology to create a second skin around the wearer's foot (Fig.2).¹²



Fig. 2
 Amoeba Protocell Trainer. Conceptual prototype.
 Shamees Aden ©Shamees Aden 2012

Protocells synchronise to the individual foot thanks to their responsive and reconfigurable capacities. They adapt in real time to the current activity of the runner by adding extra support in high impact areas. Protocells and CLE (Cell-like Entities) are hybrids in between the living and the nonliving engineered from lifeless liquid

chemicals manufactured artificially in laboratory conditions. Although they rely on the basic principles of living organisms (biomolecular reaction networks that couple genome to a function), and exhibit behaviours usually associated with living organisms (adaptation to the environment, movement, self-aggregation in colonies) they do not qualify as living, as they cannot reproduce or evolve. protocells and CLE are the result of bottom-up, emerging processes and this differentiates them from the reengineering of living organisms in synthetic biology, which is a top-down approach. Currently focused on the design of smart biosensors to capture physical, chemical and biological environmental variations, protocell research has the potential to revolutionise not only the way materials are *made*, but how they go on *making* the world.¹³

These examples intend to show, albeit succinctly and partially, that what counts, above all, is the ‘adventure in time’ their material variability expresses. However, it must be also understood that the deployability of the morphogenetic model should not be restricted to material-led instances only. On the contrary, if these examples show the possibilities of a morphogenetical model for design where the material is the key driver, the potential of this model lies, I argue, in its scalability to other design typologies. The question is, then, can morphogenesis be applied to design instances characterized by the coexistence of material and immaterial elements such as for instance product/service systems (PSS)? Services and product/service systems are mostly composed of intangible functionalities, and the most relevant of these immaterial dimensions is time. Thus, PSS can be described as “a series of events distributed in time, in which users are supposed to interact with a predesigned set of elements” (Morelli, 2002, p. 11). Unlike products which exist both in space and time,

and are produced and consumed at different times, services exist only in time: “services come into existence at the same moment they are being provided and used” (Morelli, 2002, p. 5). It can therefore be said that the pre-use of a service (its blueprint) corresponds to that service’s *potential* state, while the use proper of said service (when it actually takes place, or its kinetic state) is its *actualization* (Shostack, 1982). Taken together, these two interwoven states of a service – the virtual and the actual – create an ecology with specific, designable characteristics, but also, I maintain, with undesignable ones. It is at the actualization phase where the untapped and not fully predictable potentialities of the virtual take place.

As pointed out earlier, design is not a thing, but a process. Increasingly, it is about the creation not just of products, but of ecologies of products, services, and experiences, where tangible touchpoints are no longer the key unique outcome. Rather, the tangibility of these touchpoints serves to accompany and signpost the user’s journey across the service blueprint provided. If a designer’s perspective should focus on how a product/service system ecology “*takes form* in all of its phases” (Morelli, 2002, p. 17), then it is important to adopt a design model that pays attention to how both the material and the immaterial dimensions cohabit and to the constellation of experiences potentially emerging from it. This is why we must look more closely at the transition from the virtual to the actual.

The virtual: problem and contingency

The transition from the virtual to the actual should be seen as the problematic and problematizing relationship between what is and what could be. As mentioned earlier, actualization is the creation of problems; and the reality of the virtual is to be a

“problem to be solved” (Deleuze, 1994, p. 212), a problem which goes on to create – not contain - its own solutions. This is why the actualization of the virtual has plenty to offer design, if we take design, as we do in this chapter, as the process of capturing and materializing the not-yet. In other words, by focusing on the problematization inherent to the transition from the virtual to the actual, design can shift from a problem-solving to a problem-finding enterprise. An approach that moves away from design simply intended as problem solving has also been described as a shift from “designing solutions to designing possibilities” (Jensen, 2014, p. 39). This possibility-driven approach is deeply rooted in the complexity of human experience, and its unpredictability and contingency.

This focus on problem-finding resonates with what Deleuze asserts in *Bergsonism* (1991) where he writes that “true freedom lies in a power to decide, to constitute problems themselves...the truth is that in philosophy and even elsewhere it is a question of finding the problem and consequently of positing it, even more than solving it” (Deleuze, 1991, p. 15). To articulate this point, Deleuze makes a clear distinction between discovery and invention. Discovery has to do with simply stated problems that already contain their own solution. Existing solutions needs simply to be uncovered, and such uncovering, or discovery, concerns something that already exists and would certainly happen sooner or later. Invention, on the other hand, is what “gives being to what did not exist”, and manifests what “might never have happened” (ibid.). Invention, then, concerns the creation of the terms by which a problem will be stated. It is invention, rather than discovery, with which design should be firmly involved.

Indeed, for Deleuze, the activity of thinking itself is often misconceived as the search for solutions to problems, a prejudice that has its roots in the social and pedagogical system of formal education (the school), where the teacher is the person who poses the problem and the pupil the person who solves by discovering i.e. uncovering the correct solution (Deleuze, 1991, p. 15). Real problems, on the other hand have no given solution and that is why they *are* problems: because they must generate solutions through the interplay of divergent, unplanned components, a process whereby the virtual keeps on insisting and resisting. The known, the already established are disrupted by the unexpected that enters the process of creation as an agent to contend with, as a force to be reckoned with and, crucially, as a material to work with.

For design, the lesson is clear. No real problem is given which contains *apriori* its own solution. If it does, then it is not a real problem, but a mere “solution rearranged into an interrogative form” (Evens, 2010, p. 153) – still dwelling in the realm of the possible. Instead, a real problem will be truly engaging with creation precisely to the extent it deals with the unexpected and the contingent out of which the new emerges – the realm of the virtual. For design, this is a profound lesson against retrofitting and in favour of creativity and innovation. It prompts design not to be satisfied with an outcome-oriented, problem-solving identity, but to be relentlessly seeking to engage with new modes of interrogating and questioning the existent. The existent calls for design’s very own questioning. “Something in the world forces us to think. This something is an object not of recognition but of fundamental *encounter*” (Deleuze, 1994, p. 139). What needs to be remarked is the contingent nature of this encounter, and the fact that, no matter its form or tone, this encounter “can only be sensed”

(ibid.). Put differently, this encounter is not about recognition, that is, a way of experiencing the sensible in known ways by recalling it or imagining it. Rather, what is sensed “moves the soul, ‘perplexes’ it – in other words, forces it to pose a problem: as though the object of the encounter, the sign, were the bearer of a problem – as though it were a problem” (Deleuze, 1994, p. 140). The force of the encounter suggests that there is always something accidental about the virtual. The virtual is accidental because it follows no internal plan or teleology. “There is no preconception in the virtual, only a working out, a working through”, to use digital media theorist Aden Evens’ expression (Evens, 2010, p. 150). Anything can happen. In this sense the virtual is unintended. It embraces the unexpected. It cannot be predicted in its outcomes. Therefore, to engage with the virtual concerns experimentation (not prediction), risk (not predetermination), urge (rather than deliberation). Ultimately, it is always about the virtual seizing you, not you using the virtual as an instrument. Ultimately, the virtual cannot be mapped or indeed planned. The virtual cannot be designed. To engage with the virtual we must therefore be prepared to leap into the unknown, deal with contingency, and the new problems that arise from it.¹⁴ For philosopher Robin Mackay contingency at its simplest “refers to the attempt to think events that take place but need not take place: events that could be, or could have been, otherwise” (Mackay, 2011, p. 1). If we take contingency as “that which thinking can grasp only as event”, then what is firmly emphasized is the unpredictability, the indeterminacy proper of the event, something “that happens to us, that comes from outside, that simply ‘strikes’ without any possible prevision” (Mackay, 2011, p. 2).¹⁵

Armed with these insights on the two interrelated aspects of the virtual - the problem and the contingent - we can now draw some provisional thoughts on what they might

mean for design, as well as speculate on how they might inform a new model of design research. The process of design is possessed by an obvious tension between the desire to capture and determine form, on one side, and the need to acknowledge and work through contingency on the other. A tension exists, in other words, between form-capture and the undesignability of the virtual; between the expected, safe solution to the problem or issue at stake (realm of the possible), and the unpredictable, yet truly innovative operation that only can deliver the new (realm of the virtual). This aleatory, problematizing, yet utterly material, force is what I call the undesigned within design.

The undesigned within design

As mentioned earlier, the virtual should not be confused with the vague. However, in *The Architecture of Continuity* (2008) Spuybroek persuasively articulates a logic of vagueness to describe a new type of morphogenetic, intensive architecture which deserves attention. Drawing on logician Charles Sanders Peirce's definition of vagueness as potential - "potential means indeterminate yet capable of determination...the vague always tends to become determinate, simply because its vagueness does not determine to be vague...It is not determinately nothing (Spuybroek, 2008, p. 247) - Spuybroek explains that vagueness always exists in between two determinate states, affording the lack of determinacy necessary for the new to emerge. This brings to mind Deleuze's "entire machine of determination and indetermination" (Deleuze, 1994, p. 276): thought creates difference precisely as what straddles these two. In Deleuze's terms vagueness becomes a groundlessness swarming with differences: "what, after all, are Ideas, with their constitutive

multiplicity, if not these ants which enter and leave through the fracture in the I?”

(Deleuze, 1994, p. 277).

If continuity is the plane of immanence, vagueness has to do with the indetermination of the virtual, the unforeseen. Yet, it is not a state of amorphous indeterminacy. In the same way in which nonlinearity, rather than a rupture with the line, expresses line's own bendability, so vagueness demands rigour, clearly stated rules and scripts to generate the determinate out of the indeterminate. Continuity and variation produce things incessantly, but they produce discrete objects, not “slime or oceans”, says Spuybroek. In fact, continuity *is* vagueness insofar as “it understands things in the opposite way to what we know as elementary, not as prior to relations but as a posterior result of relationality. It is a universe where relationality is a given, and things – objects, beings, events – emerge from it” (Spuybroek, 2008, p. 144). If the encounter of continuity and variation underpins the process through which design grows and evolves in time and in a range of scale (from the giga to the nano, from the object to the system), Spuybroek insists that this process should always be viewed within a historical framework. “The new doesn't emerge out of nothing, not even from a fully mobile state; it emerges from that which is already organized” (Spuybroek, 2008, p. 188). This seems obvious, but needs restating as it emphasises the role of contingency in producing the rupture with the existent which, alone, creates innovation. Contingency becomes another agent in the process, another force, a medium to work with as it “introduces a new kind of precarity into our dealings with the present and the future. It reveals that we are ‘worked’ out from inside and out by anonymous materials” (Mackay, 2011, p. 3). The forces of contingency are assimilated here to materials. Tangible, raw, substantial and, like matter, subjected too to the process of morphogenesis and material variation.

The problematizing combined force of vagueness and contingency, as the interwoven components of the virtual, should strike a chord with design, insofar as they seem to contradict the essence of what design is conventionally taken to be, namely, the intentional planning, the ideal blueprint, even the cunning deceit (*metis*, again) - as philosopher Vilém Flusser famously wrote.¹⁶ This conventional view is challenged by insisting on the contradiction and the resistance that the problematizing complicity between vagueness and contingency brings to design. Vagueness and contingency are here taken as two complementary disruptive forces impinging upon the design process. Vagueness, as the continuity of immanence out of which all things are created through a process of morphogenesis and emergence. Contingency, as its aleatory by-product, the unforeseen *terra incognita* ensuring that no drive to resemblance, no retrofitting impulse can sneak in and taint the process. As such, vagueness and contingency constitute the undesigned at the core of design.

Concluding remarks

Of all the tensions design is currently traversed by and of all the propensities that propels it outward (dematerialization, digitalization, social innovation, critical interrogation of the existent), the most relevant to the aims of the present chapter concerns a renewed sensitivity towards materiality taken in its morphogenetic capacities. This should be accompanied and expressed by the contribution of ideas drawn on various brands of philosophical materialism. The extent to which these ideas can percolate into design theory and practice will have an impact on the design of the future, and on the future of design. The challenge for design and for designers is to take on board, embrace and question materialist interrogations in an affirmative, critical and innovative way. Design needs to interact with a broad notion of

morphogenesis, and relate to morphogenesis not as something concerning only a materiality to be appropriated and imposed upon. Rather, morphogenesis should be acknowledged, explored and embraced as a key interlocutor of design research through practice, so to eschew the limits and traps of design's self-appointed teleological destiny. Furthermore, as the chapter has shown, a morphogenetic perspective indicates that design should view in a different light the materiality it engages with. No longer passive matter that obeys laws, but active matter informed by morphogenetic principles. In this immanent model the designer no longer imposes a form, but can only tease it out of the material. To think of the designer as a facilitator does not mean however to substitute a modernist god with an essentialist one. The designer becomes the individual able to tease form out of the formless, precisely because s/he is engaged in, and interacts with, the manifold forces emerging during the design process. As DeLanda puts it:

We may now be in a position to think about the origin of form and structure, not as something imposed from the outside on an inert matter, not as a hierarchical command from above as in an assembly line, but as something that may come from within the materials, as form that we tease out of those materials as we allow them to have their say in the structures we create (DeLanda, 2004, p. 21).

But we have to be cautious here. We cannot say that matter contains already the form that the designer will tease out. This is precisely the difference between the possible and the virtual this chapter has outlined. What must be emphasized is the non-linearity of the process, its aleatory and contingent nature, its problematizing effects. These, taken together, can prompt design to interrogate reality while engaging with the unpredictability of form-finding. In this process, whose outcome cannot be known in advance, where intensities impinge on each other, the designer applies force on matter in the same way as matter acts upon the designer – both never merely reacting.

Thus, if form-finding is the result of a collectivity of agencies, where the designer themselves is thought of as another raw material with his/her own capacities and affects, whose virtualities are actualized alongside the unfolding of matter, then design becomes the formidable process (yes, the adventure) whereby the conditions that allow the *not-yet* to become the *now* cannot but hinge on the unforeseeable, unpredictable, *undesigned* at its very core. It will be only by an experimentation that engages with the aleatory, contingent, problematizing force of the virtual, that the new can be captured from the future and become the tangible outcome to which design aspires.

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¹ See Marenko and Brassett (2015) for a recent work that engages design with the philosophy of Deleuze and Guattari. In particular, see the editors' Introduction to the volume.

² The secret of empiricism, says Deleuze, is precisely this: "Empiricism is a mysticism and a mathematicism of concepts, but precisely one which treats the concept as object of an encounter, as here-and-now, or rather as an *Erewhon* from which emerge inexhaustibly ever new, differently distributed 'heres' and 'nows'. Only an empiricist could say: concepts are indeed things, but things in their free and wild state, beyond 'anthropological predicates'. I make, remake and unmake my concepts along a moving horizon, from an always decentred centre, from an always displaced periphery which repeats and differentiates them" (Deleuze, 1994, p. XX).

³ The reference is to Spinoza's single substance (Deleuze 1988), as well as to Henri Bergson's idea that matter is made up of "modifications, perturbations, changes of tensions or of energy and nothing else" (Bergson 1991: 201). For Bergson both matter and other form of life are different modalities of the same singular *élan vital*.

⁴ Architect theorist Neil Leach (2009) has written about the paradigm shift from the postmodern insistence with appearance to new concerns with performance and material functionality as an indicator of a growing interest in morphogenesis.

⁵ As architect Peter Eisenman reminds us “it was Leibniz who first conceived of matter as explosive. He turned his back to Cartesian rationalism, and argued that in the labyrinth of the continuous the smallest element is not the point but the fold” (Eisenman, 1992, p. 425).

⁶ Emphasising the etymology of the words, Leach writes how “*form* must be *informed* by considerations of *performative* principles to subscribe to a logic of material *formation*” (Leach, 2009, p. 34).

⁷ Media theorist Robert Johnson describes the concept of metis as “probably the most unexplored, yet possibly the most powerful, aspect of user knowledge” (Johnson, 1998, p. 53). It derives from the ancient Greek mythology where Metis was the name of Zeus’s first wife – who Zeus swallows as soon as she conceives Athena.

⁸ The term adventure used by Kwinter to describe the process of actualization of the virtual (1992) reoccurs in philosopher Keith Ansell Pearson (2002).

⁹ Self-healing concrete “reacts to environmental triggers and heals itself when stressed. Regular concretes contain calcium hydroxide, but a recent development in self-healing concrete contains a healing agent sodium silicate, which reacts with the calcium hydroxide when cracked or damaged. This create a gel-like material that hardens in about a week, blocking the pores in the concrete and re-strengthening the weakened material” (Howes and Laughlin, 2012, p. 196).

¹⁰ Not to mention the socio-technical implications of such a homogenization procedure in the form of a deskilling in the craftsmanship required to handle and work these materials, with labour and trade implications.

¹¹ <http://www.achimmenges.net/?p=5083>

¹² The Amoeba shoe has been developed by multidisciplinary designer Shamees Aden, an MA Textile Futures graduate from Central Saint Martins London, in partnership with scientist Dr Martin Hanczyc from the University of Southern Denmark to fabricate a tangible protocell shoe for 2050. <http://shameesaden.com/>

¹³ See the special issue of *AD Architectural Design* (2011) on Protocell Architecture, 81, 2 (in particular Armstrong).

¹⁴ Contingency, as Keith Ansell Pearson notes, is at the centre of Henri Bergson’s philosophy: “Bergson’s thinking of creative evolution places a notion of contingency at the centre of its concerns and conceives duration precisely in terms of an interruption and discontinuity” (Ansell Pearson, 2002, p. 74).

¹⁵ On contingency in relation to diagrammatic and uncertainty, in particular with reference to computational design see Marenko, 2015a.

¹⁶ See “About the Word Design” in Flusser’s seminal collection *The Shape of Things: A Philosophy of Design*, pp. 17-21