Spinoza's Geometric Ecologies

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Introduction

This article attempts to examine the material and conceptual relationship between the latest evolution of digital architecture, its turn towards "parametric" languages and materials, and the claim that these methods also establish new environmental characteristics in computation.[1] Set within the context of increasing global pressure for architecture to address environmental issues of sustainability, resource-depletion and pollution, the digital design community has developed a vocal set of agendas through which contemporary high-tech computational architectural design allies itself with environmental interests.

I ask if geometry can indeed be ecological, and if so, for whom, and how can it be of value to architectural design in the twenty-first century? I question the seductive rhetoric of the new parametric discourses to ask if their digital geometric techniques really benefit *diversity* in the architectural community and, more broadly in society, whether they sufficiently address the need for nurturing ecological biodiversity, together with the cultural wellbeing that global and local communities seriously need. I examine a historical example of "geometric thinking" to ask if a "deeper" environmental, conceptual and material mode of analysis exists which can contribute to these debates. Baruch Spinoza's *Ethics* (1677) provides an interesting early-modern example of an unusually "ecological" form of geometric thinking in which rational yet *biodiverse* social, cultural and material realms help to question some of the assumptions that the new geometric architectures claim, including whether more democratic design authorship, material difference and ecological relations are possible.

1. Self-same digital parameters

For designers who work with the new "relational" geometries generated by software such as Rhino and Grasshopper, questioning the relationship between geometry and nature may seem a redundant exercise, since "parametric" technologies have been defined as the means through which to achieve complex and self-evolving digital algorithmic or "biological" morphologies. Patrik Schumacher has defined it as a style that:

> … finally offers a credible, sustainable answer to the drawn out crisis of modernism that resulted in 25 years of stylistic searching … As conceptual definition of parametricism one might offer the following formula: Parametricism implies that all architectural elements and complexes are parametrically malleable. This implies a fundamental ontological shift within the basic, constituent elements of architecture. Instead of the classical and modern reliance on ideal (hermetic, rigid) geometrical figures - straight lines, rectangles, as well as cubes, cylinders, pyramids, and (semi-)spheres - the new primitives of parametricism are animate (dynamic, adaptive, interactive) geometrical entities - splines, nurbs, and subdivs - as fundamental geometrical building blocks for dynamical systems like 'hair', 'cloth', 'blobs', and 'metaballs' etc. that react to 'attractors' and that can be made to resonate with each other via 'scripts'. (Schumacher 2010)

1 I refer to the most recent digital architecture discourses and practices, rather than earlier generations who developed digital architectures, such as Greg Lynn or Bernard Cache. Mario Carpo's *The Alphabet and the Algorithm* (2011) provides a clear outline of these developments.

Colleagues of Schumacher from London's Architectural Association, Michael Hensel and Achim Menges, have used the term "morpho-ecologies" to define a design "framework … firmly rooted within a biological paradigm … [and] issues of higher functionality and performance capacity" (Hensel & Menges 2006: 16). Alternatively, Susannah Hagan has proposed urban ecological parametricism, writing:

> Environmental metrics can be used to generate parametrics. Parametrics are now firmly embedded in experimental design, especially in the digital avant-garde. Here interest is divided between form-finding and the relationship between form and performance in the interests of a new and elegant economy of means. (Mostafavi & Doherty 2010: 462)

Lars Spuybroek's recent book, *The Sympathy of Things* (2011), attempts to generate a genealogical, and unabashedly romantic, account of nature, technology and biological evolution in design through Ruskin and nineteenth-century science. More objectively, Mario Carpo's genealogy of digital architecture defines parametricism as a "function which may determine an infinite variety of objects, all different (one for each set of parameters) yet all similar (as the underlying function is the same for all)" (2011: 40).

Yet for those who are concerned that this most recent fascination with the digital perpetuates the conviction that formal geometric design imperatives can indeed replicate nature, my discussion may also be perceived as misguided on two counts. First, because it appears to continue to restrict ecological architectural research to an idealistic field that falls foul of reductive and market-led, form-driven form-finding, and second, because discussions of advanced technology continue to ignore the *real* complex political, material, environmental and social concerns which *always* constitute the production and inhabitation of architecture. Also, given the fervour displayed in some uncritical claims for its "genetic" diversification and the close identification with ubiquitous technological progress (see my discussion of Antoine Picon below; and Carpo 2011: 142-3), feminist and ecological critics may see it as an obstruction to critically-engaged practice: for example, parametricism's seductive appeal to technocratic markets contrasts strongly with feminist or ecological design that promote low-fi resource recycling, collective authorship or client-led design. However, at a time when mathematics, geometry and computation are presented, yet again, as "new" universal forms of innovation, and when women make up 50 per cent of the students who train in the discipline which is increasingly determined by digital modes of design organisation in the office, a critical and engaged debate about these questions is still important. Below, I therefore also outline how feminist philosophers have *already* convincingly shown that complex material, social and cultural concepts of sexed relations and technicities exist in art, culture, and in science, which have far-reaching value for non-anthropomorphic design agendas. These theories of sexed, non-normative biological difference are necessary for digital architecture because it cites biological processes as the driver for computational production: for example, digital code and scripts are identified as computational "DNA" that "originate" new complex morphological design. Overwhelmingly, however, these discussions also expose the primary purpose to be the generation of new self-similar forms (whether they are topological or geometric). Diverse organic life is reduced to the self-same computational matter, and is frequently underwritten by links back to historical sources such as D'Arcy Wentworth Thompson's classicalal study of evolutionary biological morphology, *On Growth and Form* (1915), rather than sexed understandings that society and environment, mind and matter, are irreducible, coterminous and durational, relations.

Metaphorical alignments between digital code and biological DNA are taken as evidence that architects have now been released from the limitations of human authorship in design processes.[2] In addition, these supposedly bottom-up, non-anthropomorphic design origins are now being associated with materialist philosophies of Manuel DeLanda (2011), and the recent "speculative realist" and "speculative materialist" philosophies of Quentin Meillassoux and Graham Harman, who critique anthropomorphic thinking as negative human-centred perspectives and propose a return to objective "facticity".[3] The aim of these associations is to show that architectural design is further embedded in non-ontological meaning; i.e. non-human notions of production. However, although human responsibility, agency and environmental relations in the built environment are clearly urgent discussions, especially given the complexity of contemporary ecological inter-relationships between human-made "nature" (i.e. the built environment) and non-human nature (i.e. the "natural environment"), whether these particular philosophers' emphasis on scientific concepts of non-anthropomorphic complexity is the correct way, is not "a given". Rather, these philosophers can be accused of perpetuating logic that *still fails* to address other *modern* non-anthropomorphic realities, such as the facticity of capital in architectural design markets, or the depletion of non-replaceable material resources. (Digital architects also forget the long aesthetic and materialist philosophical history that has explored the human-nature versus non-human-nature conundrum since the seventeenth century, including Kant's theory of the sublime, and Marx's theorisation of human-nature relations.) More currently, the feminist philosophers I discuss below (including Haraway and Braidotti) have also shown that western, normative subject-centred philosophy does not address the reality that complex *other* "post-human" (i.e. non-anthropocene) relations and subjectivities have also always existed.

The architectural methods referred to here are therefore linked by the belief that recent computational advances originate new universal solutions for experimental and, by implication, commercial approaches to environmental design. But how can complex material and immaterial architectural or geometric difference really be generated out of these self-same definitions of "biological" and universal differentiation when they still clearly elide the *reality* that biodiversity is constituted in other kinds of difference, especially, sex difference? Surely, these approaches continue to ignore more sophisticated understandings about *other* kinds of geometric and biological thinking that may aid greater biodiversity in architectural processes, participants and products. Uncritical promotion of geometric or topological design technologies as *the* solution to the state of "authorship" in the profession, the structure of our built environment, and our environmental relations, needs to be seriously addressed by designers working in the field: not least because their own professional "ecologies" also need to become more complex and informed about understandings of real biological sex difference and the political realities that exist for today's diverse populations and societies.

Below, I explore how Spinoza's geometric ecology is a highly complex expression of natural biodiversity, common in all beings and entities: neither "designed" to anthropomorphically reflect the subject, nor reducible to universal forms or morphologies, genetic code or algorithms. Rather, these geometric and ecological relations generate absolute *alterity* for all: a special kind of technology – "technicity" (Loo 2011) – precisely because nature *and* the subject are conceptually and materially constructed "in process". Contemporary geometric parametric discourses are therefore distinct from the ecological geometry that Spinoza outlines, which resists the desire for instrumentalising "nature" into simple units of production as part of a utopian application of computational processes in the design process.

2 Carpo also warns against overstating the radicality of agency in the new software (and Web 2.0) technologies, since these have clear authorial hierarchies embedded into them (2011: 126).

3 Sanford Kwinter refers to parametricism and these ideas as either "atrocious" or "very interesting" (2011).

2. Processual geometric subjects and nature

Clearly, Spinoza's seventeenth-century conceptualisation of geometric thinking, subjectivity and environmental relations is not derived from our advanced capitalist, technocratic or global contexts. Nevertheless, his thinking is valuable because it challenges the traditional form/matter distinctions that persist in modern non-Euclidian geometries, for all the claims that digital morphologies break with this tradition. This is because his thinking is primarily concerned with the production of the *subject-in-process*, not with the production of idealistic or pure de-ontologised *forms* of knowledge.

Two key concepts form the geometric ecology of these powers: first, Spinoza's concept of "Nature" or "Substance", and secondly his concept of *conatus*, or self-determining agency. Spinoza's processual geometric ecology is derived from his radical notion of nature, which he calls Substance. It is a complex ecological term because it does not merely designate extended material beings, structures or relations: "Existence belongs to the nature of substance" (Spinoza 1992: 34). Instead, Spinoza employs it to construct a complex, immanent (i.e. divine) biodiversity of life in Nature, most strikingly, in the relation God-as-Nature. In conjunction with Spinoza's other wonderfully complex concept of life, "expression", Substance/Nature immanently constitute a plenitude of realities in different modes and scales: from the divine to the common, and from the non-anthropological entity or environment, to the scale of the singular being. Substance's productive power therefore constructs nature's diversity, its potential for change (*Natura Naturans*), and its various modes of existence (*Natura Naturata*) (Spinoza 1992: 51-2). Together, these powers generate a plenitude of ideas, bodies and entities in the world (cf. Darwin's genetic principle). Consequently, substance is a "univocal" concept of life in all its material (i.e. biological and physical) and immaterial (i.e. psychic and divine) manifestations. However, while constituting every singular and diverse entity, Substance is, in itself, infinite: it is *the* primary "cause" of all realities, or the immanent "life-force" in all things, including importantly, architectural and geometric processes.

So, in contrast to contemporary mathematical and geometric methods that classify natural processes under disembodied/non-ontological mathematical logics, Spinoza's geometric thinking is firmly constituted in sensory realms *as well as* in rational relations. All modes of life in this "natural" architecture are imbued with substance's irreducibly material and immaterial powers. In Part IV, for example, Spinoza explains, in forensic detail, how ordinary people express these qualities in their desires and fears, and in their everyday and common ideas (1992: 156-95). Also, interestingly, in the Preface to this Part, he explains how architectural design judgment is material (built) and immaterial (aesthetic) modes of substance (152-4).

> Spinoza brings all entities, whether they are naturally occurring or human-centred, into a special kind of biophysical process, in a manner that also previews important twentieth-century ecological and vitalist theories, including Arne Naess's "deep ecology", Gregory Bateson's "ecology of mind", and Deleuze and Guattari's "geophilosophy". Notably, this life principle is derived from the divine power of God/Nature, contrasting with computational architecture's scripts which are described as self-organised "genetic" code. In Spinoza's "natural" geometry, biodiversity calibrates all entities at all scales, but not reducible to a simple digit or unit of computational code. As a result, he underscores that human subjects and geometric figures are manifestations of *nature-in-process*.

> This ecological notion of immanent differentiation produces absolutely unique expressions of substance: such as, the specificity of trees, stones, horses or dogs; or the difference between feelings of delight, disappointment, rage or fear; the capacity of the emotions to generate action and transformation, or the diversity of physical and psychic expression in architectural ideas or designs. Spinoza's geometric ecology is therefore always inherently concerned with *diverse living* relationships, not just formal or material self-same relations.

Substance also has a complex ecological meta-structure because it expresses a unique triad of relations between the three special geometric "elements" that Spinoza invents – "attributes", "modes" or "affects", and "common notions". These powerful transitive relations also generate an intense diversification into further geometric elements, such as definitions, axioms, propositions, corollaries or scholia. In addition, this complex triadic ecology of relations between the attributes, affects and common notions is an important historical preview of Guattari's influential ecological thinking in *The Three Ecologies* (1989): "only an ethico-political articulate – which I call *ecosophy* – between the three ecological registers (the environment, social relations and human subjectivity) would be likely to clarify these questions" (Guattari 2000: 19-20).

So, for Spinoza, geometric relations of, and between, bodies are not constructed by disembodied transcendental laws of reason (i.e. ratio), but out of the everyday, common and transformative expressions of body within its own singular environment or habitat. Consequently, we might also say that his attention to the habitus of the subject-in-process previews Haeckel's 1866 definition of the science of ecology that observes the entity in its home, habits, habitat or milieu, or Jacob von Uexküll's theory of *umwelt* (1909) a "biological semiotics" through which he theorised the coterminous existence of the organism with its specialist habitat (e.g. see Deleuze & Guattari 1996: 257; and Grosz 2011). Also, given my concern with a complex *corporeal* technical historicity of geometric expression in the living architectural subjects, architectural history has a significant tradition of examining geometric technologies of bodily mensuration; for example, Pérez Gómez's *Architecture and the Crisis of Modern Science* (1983), or Evans's *The Projective Cast* (1995) and *Translations from Drawing to Building and Other Essays* (1997). Evans, in particular, also finds everyday alterity in these "technicities", but Spinoza's project is distinct even from his analysis, because of its attention to the sense-based differentiation that constitutes the body in its habitat (Rawes 2012).

3. Duration, restraint and "sustainability"?

In a recent essay, "Architecture and mathematics: Between hubris and restraint", Antoine Picon has observed the shift from classical principles of geometry to modern mathematical forms of calculus in eighteenth-century European architectural design. Following Leibniz's and Desargues's respective innovations in calculus and projective geometry, he observes that technical advancements in architectural geometric design fundamentally changed power relations between nature, technology and generative design principles. After calculus, Picon notes, design institutes both the potential for "unfettered" invention and "hubris"; it is a loss of "restraint" which, he suggests, bears a resemblance to the contemporary issue of sustainability. He asks if we need a return to mathematic "restraint" in the face of pressing questions about resource depletion, and the need for architectural design which is not primarily determined by the perception that its "power" is located in principles of autonomous genetic digital production.

To conclude on this point, one may observe that this polarity, or rather this balance, has been compromised today. For the mathematical procedures architects have to deal with, from calculus to algorithms, are decidedly on the side of power. Nature has replaced God, emergence the traditional process of creation, but its power expressed in mathematical terms conveys the same exhilaration, the same risk of unchecked hubris as in prior times. What we might want to recover is the possibility for mathematics to be also about restraint, about stepping aside in front of the power at work in the universe.

> As Picon writes: It is interesting to note how the quest for restraint echoes some of our present concerns with sustainability. The only thing that should probably not be forgotten is that just like the use of mathematics, sustainability is necessarily dual; it is as much about power as about restraint. Our contemporary approach to sustainability tends to be as simplistic as our reference to mathematics, albeit in the opposite direction. (2011: 31)

Picon's scepticism of the supposed freedom that its proponents attribute to modern computational forms of geometric invention reflects my discussion about whether the power invested in these new digital processes really is new, effective, or even desirable for meeting the challenges that face the architectural disciplines and the planet today. His discussion also connects with my concern that parametricism repeats the long tradition of disembodied, neutral, or "unsexed" reason. Picon's argument opens up the much-needed space to ask if an-other ecology of geometric relations is possible. However, whilst his critique of the relationship between geometry, proportion, God/Nature and sustainability certainly reflects the key constituents in Spinoza's geometric ecology, Spinoza's notion of "divine" immanence is more radical than Picon's assessment of the ubiquitous modern geometries. In particular, this is because of the value placed on *an ethics of duration* in the constitution of reality.

Spinoza's unique human mode of existence which is immanent in all human endeavour, the *conatus*, generates geometric, aesthetic and architectural modes of expression, yet it is not a subsumption of substance's power to an instrumentalised or anthropomorphic kind of knowledge or power. Rather, Spinoza defines the *conatus* through an ecological imperative because it is durational and processual, for example, when he discusses the right of the entity to an ethics of duration: "the power or *conatus* by which it endeavours to persist in its own being, is nothing but the given, or actual, essence of the thing" (1992: 108).

Spinoza's elaborate examination of the genealogy between the attributes, affects and common notions also shifts geometric understanding from disembodied logical deduction into a tripartite ecology that generates biodiversity within the living body, and in its transformative micro-scales of differentiation and sense-knowledge. He carefully explains how the emotions or affects produce the most nuanced and singular expressions of these ecological relations in the subject because they are expressed both psychically and physically: for example, at this micro-level, modes are singular, self-caused capacities of mind and body attributes, yet this relation is also expressed uniquely and variously in the affects, depending upon the specific habitat or circumstances. In Parts III and IV, Spinoza explains how the affects express the genetic plenitude of substance in detail. Crucial to the possibility of a self-evolving subject, the affects – such as happiness, sadness, passion, agency, activity, and passivity – comprise the unique *durational ecologies* (or ratios) of the individual's internal and external relations. Furthermore, when the affects constitute the common notions, where the differentiated mind and body are in most "agreement", they establish the third stage of this durational ecology, that is, "sense-reason" (Rawes 2008). Here, the freedom (i.e. the capacity to self-evolve) accorded to the individual is generated out of a ratio or ecology that is genetic, natural, yet also, durational. These unique human powers constitute the continuously transitive subject-in-process that is essential for this durational ecology.

Hence, this immanence is not just an "unfettered" principle of plenitude, but is ecological *because* the relations are always durational. Also, importantly, when it is expressed in the common notions, this geometric biodiversity is accessible *to all*. Common ratios or equality are constituted in this third ecological level because these are common-place intuitions, ideas and bodies. Spinoza's natural geometry therefore produces common-place ecologies and common lives. Common notions are ecologies or "life-places" (Thayer 2003) of diverse human subjectivities and relations. Such biodiversity is not just a neutral or value-free materialism, but has the politics of equality at its core. This communal immanence does not inevitably result in unfettered anthropomorphic progress or unethical infinity, but accords with feminist philosophers' ethical biological, cultural and social ecological thinking *for all* (not just for those who can access these values through the market).

4. Sexed biodiversity

As indicated earlier, recent feminist philosophy addresses the productive multiple, aesthetic, political, and material realities of sex difference for *all* sexes (e.g. Irigaray 1994; Haraway 1991; Braidotti 2006; Grosz 2011). In parametric literature there are moments of acknowledging sexual difference, but this is generally just as a scientific biological material, rather than the more radical, bio-political matter: for example, Carpo cites Greg Lynn's introduction to *Folding in Architecture* (2004): "from the identical asexual reproduction of simple machines to the differential sexual reproduction of intimate machines" (2011: 130); and Spuybroek acknowledges sex difference in Ruskin's critique of Darwin's theory of evolution, but restricts it to a discussion of beauty (2011: 293-4). Thus, despite these brief discussions there is little evidence that it is has been actualised as a real "other" origin of self-determining agency in digital architecture's practitioners, cultures or artefacts.

It is also worth remembering that Arne Naess identified Spinoza's work as a precursor to his "deep ecology", especially for understanding the interdependent complexity of human, natural and built relations without recourse to instrumental or human-centred concepts of life:

> The specific thing to be learned from Spinoza ... is, however, to integrate the value priorities themselves in the world ... Spinoza was heavily influenced by mechanical models of matter, but he did not extend them to cover "reality". His reality was neither mechanical, value-neutral, nor value-empty.
>
> This cleavage into two worlds ... [of facts and values] can theoretically be overcome by placing, as Spinoza does, joys and other so-called subjective phenomena into a unified total field of realities. (Naess 1995: 253-4)

Spinoza's theory of Substance/Nature therefore generates not only absolute biodiversity or alterity in all beings (whether they be women, men, animals, trees, stones, geometric figures, etc.), but in his commitment to a "deep" rather than "shallow" value-specific biodiversity, which can be interpreted as a kind of proto-sexed theory of difference.[4] Feminist philosophers Moira Gatens, Genevieve Lloyd, and Rosi Braidotti have previously explored how Spinoza's affirmation of otherness is indeed a precursor to sex difference (Gatens & Lloyd 1999; Braidotti 2006). As such, its political and materialist biodiversity is a valuable historical example where ecologies of geometry, sense, reason and sex are reconfigured, and which may have valuable consequences for architectural design, especially those practices and theories engaged in geometric thinking. In the *Ethics*, then, geometric ecology might even be a sexed technicity: its psychic and biological modes of differentiation constitute a special kind of technicity for generating ecological biodiversity *in* the individual, society, the environment, and *in* contemporary architectural design processes. Spinoza's thinking resists the reduction of difference to simple human-centred (i.e. anthropomorphic) or instrumental understandings of nature and otherness. His affirmation of complex irreducible difference is essential and common in all entities, human and other; although he does not explicitly describe or identify these as sexed (i.e. *not* gender-neutral) differences. More recent feminist philosophy that develops this sensibility in *critical* anlayses of advanced technology, such as digital architectures, includes Donna Haraway's "sympathetic critiques" of advanced technologies (1991), Rosi Braidotti's digital "ethics of care" (2006), Elizabeth Grosz's feminist analysis of Darwin's theory of sex difference (2012), and Lorraine Code's socio-biological ecological thinking (2006). However, if digital geometric practices continue to remain oblivious to political material and immaterial (i.e. psychic) realities, including sexed difference, their claims for innovation are, paradoxically, limited by weak concepts of production which are seriously out-of-date for the needs of *all* twenty-first-century architects, and their societies' *umwelts*, right across the planet.[5]

5. Geometries of wellbeing

Spinoza's geometric method is also relevant for discussions of "happiness" or, in the current parlance, "wellbeing", again resonating strongly with contemporary discussions about aesthetic, ethical and environmental relationship between the subject and his or her lived habits and habitats – be they socio-economic, cultural or ecological. In this sense, then, the *Ethics* is also a psychotherapeutic text that explores our capacity for relationships and relations through an examination of ecologies of mind, body, nature, action and rest, in all modes of reality and for *all* entities, be they human or otherwise (other-wise).

In Parts II and III, this capacity for wellbeing is explored in the union of body and mind in detail. These geometric relations demonstrate his principle of ecological ratio; for example, the "proportionate" activity of the body that is reflected in the mind of its accompanying body to generate an ecology between the body's affections and its physical expressions (Spinoza 1992: 71). Again, this is an ecology of sense and reason and Spinoza's attention to the ecology (i.e. ratio) between the mind and body reflects current attention to wellbeing which has become a new biopolitical zone of value: think, for example, of the current governmental and policy focus on "happiness" in driving architectural agendas, together with the need to address space-ratios in modern housing (see, for example, the New Economic Foundation's (Un)Happy Planet index (http://www.happyplanetindex.org/), or the RIBA's 2011 report on affordable housing space allocation, "The Case for Space" (RIBA 2011)).

Spinoza's geometric ecologies are therefore not driven by formal values, but by the capacity for the singularity to exist in and through its everyday habits and habitats. Unlike traditional understandings of geometry as disembodied forms of intellect/reason, this sustainable duration in the individual (i.e. wellbeing) is formed through an ecology of sense and reason. Natural geometries, or ecologies, are constructed out of the transitive nature of human emotions, enabling agency or self-knowledge in the individual.

6. Sexed biodiverse geometry and architectures

Biodiverse sexed geometric ecologies are also significant because of the continuing split between matters of "reason" and technology, versus "sense" and subjectivity politics, in many debates about ecological architecture. If current script-based geometries continue to reinforce the neutral/value-free universalism of western thought, and ignore "other" modes of subjectivity that are not restricted to simple models of anthropomorphic nature, matter or life, they perpetuate the self-same identity of neutral architectural identities, processes or histories from which they claim to break. Without a conversation about biodiverse sexed geometry, histories and theories of biodiverse ecologies and technicities that embed real difference will continue to be ignored, and technological and ecological values will continue to be seen as at odds with each other.

This discussion also reflects my concern about the way in which feminist theories of relations still often oppose the possibility that sexed ecologies and technologies can exist together, relying upon the essentialist division between sense "as female", versus reason as an exclusively "male" concern and consequently always negative forms of rational thought. In this formulation, sexed ecologies are effectively consigned permanently to understand ecology as anti-reason (e.g. Irigaray's outright rejection of technology; Irigaray 1993). Without addressing these schisms, feminist architects (male and female) will continue to be consigned to a-technological realms, rather than offering alternative notions of sexed technicities. The issue of ubiquitous technology versus the political, self-directed agency of the subject in environmentally responsive architecture has also been clearly established since the United Nations' 1987 Brundtland Report prioritised economic sustainability, enabling the architectural marketplace to generate sustainable development through anthropomorphically-driven "shallow" or "instrumentalised" technological remediation. Yet feminist discussions of nature and architecture which continue to view technology as *always* damagingly instrumental or alienating to society also perpetuate this exclusive split. However, thinkers such as Braidotti, Haraway and Grosz have offered more challenging accounts of sexed technologies and science which are of value to those in architecture who really desire building truly biodiverse ecologies.

Spinoza's commitment to a technical sense-based ecology firstly therefore enables building new geometric ecologies in the discipline, and consequently, for the societies, and the human and natural environments in which we live and work. Secondly, it enables a re-activation of the relationship between technology and reason *for*, and *by*, sexed subjects, and to question the reliance that feminist ecological critique has placed upon the relationship between sense, sex and the environment, yet to the exclusion of sexed reason and technology from these debates. Ecological difference, then, for Spinoza, is not just concerned with the production of a universal world composed of unique, rational, singular beings. Rather, this geometric biodiversity is unique within the history of geometric ideas for reconfiguring disembodied self-same geometry into biodiverse sexed ecologies.

4 Fritjof Capra writes: "Shallow ecology is anthropocentric. It views humans as above or outside of nature, as the source of all value and ascribes only instrumental or use value to nature. Deep ecology does not separate humans from the natural environment, nor does it separate anything else from it. It does not see the world as a collection of isolated objects but rather as a network of phenomena that are fundamentally interconnected and interdependent" (Sessions 1995: 20).

5 The forthcoming collection, *Relational Architectural Ecologies*, (Rawes 2013) addresses the need for socio-economic, cultural and sexed concepts of nature in architectural and spatial disciplines and includes chapters by Rosi Braidotti, Elizabeth Grosz, Lorraine Code and Verena Conley.

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