

INDETERMINACY: Making a New Set of Shapes, or a Mediated Theory Transfer?

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The borrowing of theories between all types of disciplines has a long, but not always happy history. At best, theories imported from other areas can offer new, revitalising insights and approaches to a field. On the other hand, a discipline may become distracted by imported theories that may prove to be irrelevant, misinterpreted or misused. Some suggest that theory transfer, in the strictest sense, is an impossibility as it presupposes a 1:1 relationship between the elementary properties of two different areas, which clearly cannot exist (Mayntz 1997, 307-308). Yet it cannot be denied that architects have always been, and continue to be, greatly influenced by developments in other fields. Conde (2000, 81) claims that "architecture cannot remain aloof from the phenomena that have occurred in other fields". Clearly there are both benefits and challenges in this process of transference. It has been suggested that the evolution of a plausible, "new" architecture may in fact be undermined by the unchecked or excessive importation of "foreign" ideas (de Sola-Morales 1997, 23-25). Yet if architecture were to attempt to exclude external influences, the profession would separate itself from the wider culture of the times and inevitably suffer atrophy.

Assessing the costs and the benefits of imported ideas may be clarified by an examination of how theories come to be transferred. Mayntz (1997, 307-308) suggests that theories can be transferred in one of two ways: either directly, or indirectly. In a direct transfer, methods and models remain largely at the level of verbal analogies and metaphors. There is little re-interpretation in such an exercise. Examples of direct theory transfer, purporting to produce brand new theories within new domains of knowledge, are, according to

Mayntz, numerous. What might pass as a theoretical innovation in one discipline is at times nothing more than the translation of already well-established parts of a theory from one field into the conceptual language of another. Various terms and techniques can be re-applied in a general descriptive sense, but the relationship between the two fields remains quite superficial. The result is little more than a semantic innovation that adds nothing to the substantive knowledge of the field. This kind of theory transfer generates little new insight. Whether the transfer of ideas is drawn directly or used in a wide, metaphorical sense, such attempts hardly amount to more than a kind of verbal "curve-fitting" (Mayntz 1997, 307).

In contrast, indirect theory transfer involves a process of mediation, whereby methods and models from one field go through a process of generalisation and successive re-specification. Mayntz notes that if superficial references are avoided, and instead a substantive borrowing from a discipline takes place, then a kind of mediated theory transfer may occur. Such a transfer implies the re-interpretation and tailoring of a previously field-specific theory to meet the demands of the new field. "The potential fruitfulness of such transfer efforts rests in the explicit re-specification, and hence authentic theory building, that they can involve" (Mayntz 1997, 308). In the process of re-interpreting the original theory, important aspects are abstracted, and may at times be lost. Mayntz notes that such losses and generalisations are necessary if the theory is to fit and gain acceptance within the new field.

Old classifications which once organised the intellectual map into independent disciplines, media, genres and

modes are no longer considered descriptive of new realities. The main organising principle of the current intellectual situation is the "collapse of distinction, an opposition or hierarchy, between the critical-theoretical reflex and artistic practice" (Conde 2000, 61). This dissolution of distinction encourages the movement of theories between once discrete disciplines. One such theory is 'indeterminacy', which has been identified in a range of disciplines, and is being explored in the natural sciences, mathematics, biology, the arts and architecture.

The etymological origin of the word "indeterminacy" can be traced to the definition of "determinare" which means to limit or set limits. 'De' means 'from' and 'terminare' means 'to limit'. Indeterminacy is thus related to that which does not have verifiable, defined, specified limits (Conde 2000, 61). Indeterminacy can be understood as the suspension of the precise meaning of an object, a consequence of the redefining of the limits in which the latter is inscribed, or as a concept with no fixed centre, no conventional associations or a priori conceptualisations. Indeterminacy occurs both within, and between, a host of disciplines (Conde 2000, 61).

The onset of the twentieth century saw concepts like natural law; order and certainty become a matter of doubt for both theoretical and experimental scientists. Almost concurrently, biologists discovered that life phenomena had to be approached as chains of changes. Similar changes were recorded in the social sciences that dealt with animal and human collectives. Mathematics, considered a model of exactness up until this time, had to refine its tools in order to explain the observations emanating from the empirical sciences. The canonical concepts of order, rationality, and linearity, synonymous with the twentieth century, together with the concept of creation were to be redefined. The notion of indeterminacy offered an alternate means of understanding the ephemeral, fragmentary, discontinuous, multiplicitous, chaotic characteristics of the post-modern world. Scientific thinking, based on order and exactness, could not reject indeterminacy, given indeterminacy's capacity to explain much of what was observable in nature, by seeking to "re-connect to the deep chaos of modern life and its intractability before rational thought" (Harvey 1999, 307).

In regards to architecture, the notion of indeterminacy and its relationship with chance has been used to explore the limits of traditional technique and the creative process. Chance is manifest in process, in the application of indeterminacy as a compositional device, where chance is but one means of achieving a state of indeterminacy ... the front against logic. (Gove 2001,

32) This challenge to logic, and the introduction of chance, is a technique embraced by a range of contemporary architects exploring the development of a "new" architecture. The work of practices such as OMA, Peter Eisenman Architects, Frank Ghery, Greg Lynn FORM, dECOi, UN Studio, Lab architecture studio and MVRDV explore these notions in a variety of ways. To understand the architectural response to indeterminacy within a larger context, it is instructive to look at how indeterminacy has been explored within other creative fields.

The experimental creations of the composer John Cage (1912-1992) demonstrate an interest in indeterminacy. Cage did not conceive of his work as "experimental" in the sense of wishing to judge his activity as either a success or a failure. He understood his work to be experimental in the sense that it was an act whose outcome was unknown (Conde 2000, p. 74) Cage's work explored the generative fringes of many disciplines. 'Chance operation', a term coined by Cage is the basis of his work (Ellis 1991, 3). Ellis described Cage's generative process as a random method of choice-making in terms of what note to play or what instrument to be used in a musical composition. This concept is based on an interpretation of the universe as being in a state of flux or ordered chaos. This method produces an almost infinite variety of choices to make in terms of available sounds and silence. This process is described by Conde as one that operates on a different level of indeterminacy, an approach which takes account of the non-resolution of the state or final interpretation of the art object. The art object, as understood by Cage, takes account of non-resolution, leaving indeterminate the final interpretation of his work.

The work of Mark Goulthorpe of dECOi architects not only explores the notion of indeterminacy, but also draws inspiration from disciplines outside of architecture. A recent source of inspiration for Goulthorpe was the exploratory dance of William Forsythe's Frankfurt Ballet. What attracted Goulthorpe (2002, 1) to Forsythe's ballets was the sense that behind this latent energy, this distilled complexity, was a process, a creative attitude that one sensed as extreme yet focused, sufficient to create these 'precisely indeterminate works' (Goulthorpe 2002, 1). Forsythe's process can be described as an "orchestrated laboratory of experiment" or a process of "disequilibrium" (Goulthorpe 2002, 1). Goulthorpe was not interested in a literal appropriation of the forms of the dancers, but rather, was drawn to the question of process and the manner of Forsythe's deconstruction of classical ballet. Goulthorpe (2002, 1) sensed that both architecture and ballet were burdened by a similar sedimentation of

historic expectation, and that the Frankfurt Ballet was attempting to deconstruct the classical tradition of dance. Goulthorpe notes that this type of approach to creative endeavour challenges the rational, linear, deterministic ideology that is common to architectural production. Improvisation is the key to this process; it deploys chance to continually suggest multiple new forms, within precisely defined yet constantly changing parameters.

In a manner similar to Forsythe, Goulthorpe pursues process relentlessly, with the intention that the accumulation of process may usurp the product, or that the product becomes just one of a plethora of possibilities contained within a matrix of open-ended possibilities. Goulthorpe favours a design approach that adopts generative strategies that are based on "chance processes of a critical nature" (Goulthorpe 2002, 1). Technologies that explore the weird productive capacity and embedded logics of generative software are utilised in an attempt to usurp the ideology of control that tends to restrict formal practice. Goulthorpe believes that the idealising discourse and linear strategies of conventional forms of design are challenged by these new approaches. He embraces chance processes that are non-linear in their creative and receptive capacity. He utilises unstable and incomplete formative strategies. These techniques all suggest a shift in the balance of how architecture is created and experienced.

The influences of indeterminacy on both the design and realisation of physical space are described by architects in various ways. For example, Sejima Hasegawa seeks an architecture of elusive uncertainty and ambiguity where multiple meanings proliferate. Indeterminacy allows her to "float uncertainly without having decided upon a goal or point of arrival" (Hasegawa 1998, 67). She describes her methodology as one of disappearance and regression, bringing into abrupt existence what lies awaiting. She attempts to decisively break away from ideology, -isms, and all present structuring of contemporary culture and society. Lim (2001) believes that spaces that exude indeterminate qualities may offer the potential to become effective instruments of contemporary intellectual, artistic, cultural and sociological discourses. In creating such spaces, interdisciplinary ideas, concepts and notions collide with and constantly undergo a cyclic process of fragmentation and integration, shifting in and out of confusion and clarity. For Lim, spaces of indeterminacy are anchored in the post-modern. They are pluralistic, fuzzy and complex. The scale of such spaces may vary greatly from substantially large areas to small in-between spaces.

The conceptualisation of indeterminate space has also been explored by Beigel and Christou, who have developed a concept of 'specific indeterminate space' (Beigel and Christou 1996, p.18), which defines indeterminate space as "uncommitted or free space". These specific spaces have an enigmatic emptiness. Such a space is waiting for something to happen, a space where one can be alone or in a crowd. It is a space that attracts temporary proximity of different uses, densification of use and change of use. They note that there exists a contradiction in describing a space as both specific and indeterminate. However, they note that "the exclusion of specificity has tended to create out-of-place, characterless buildings..." (Beigel and Christou 1996, 18). They believe that specificity is required to facilitate attributes of attraction and "charge", creating 'magnets' that according to Cedric Price "generate new forms of use, safety, information, views, spectacles and contemplation" (Price 1996, 25). Specific indeterminacy is also a concept that has been explored by Rem Koolhaas who claims that:

If there is to be a "new urbanism" it will not be based on the twin fantasies of order and omnipotence; it will not be the staging of uncertainty; it will no longer be concerned with the arrangement of more or less permanent objects but with the irrigation of territories with potential; it will no longer aim for stable configurations but for the creation of enabling fields that accommodate processes that refuse to be crystallised into definitive form ... (Koolhaas 1995, 969)

This brief summary discussion of a selection of practices and their responses to indeterminacy begins to illustrate the power of the idea as it moves across the theoretical terrain of architecture.

The information age has presented architects with a new operating environment that offers an alternate approach to the design and the fabrication of buildings. Indeterminacy within the design process can now be explored in ways not previously imagined. "Computational, digital architectures of topological or non-Euclidean geometric space, kinetic and dynamic systems, and genetic algorithms, are supplanting earlier forms of architecture" (Kolarevic 2002, 117). The implications are vast, as architecture is recasting itself, becoming in part an experimental investigation of topological geometries, partly a computational orchestration of robotic material production and partly a generative, kinematic sculpting of space (Zellner 1999, 8-9). Kolarevic claims that "digitally driven design processes characterised by dynamic, open-ended operations are unpredictable, but consistent transformations of three-dimensional struc-

tures are giving rise to new architectonic possibilities" (2000, 117). New digital computational concepts and modelling tools increasingly allow indeterminacy to be a factor within the design process.

While the design process may increasingly be digitally driven, this does not make redundant the role of the designer. The capacity of digital computations to generate new architecture is highly dependent on the designer's perceptual and cognitive abilities and how these abilities are used within the continuous processes that generate the evolving forms. The designer makes synchronized interpretations and manipulations of a computational construct in a complex discourse that is continuously reconstituting itself. It is an exercise described by McCullough (1996) as a 'self-reflexive' discourse in which graphics actively shape the designer's thinking processes. It is precisely this ability of "finding a form" through dynamic, highly non-linear, indeterministic processes that gives the digital media a critical, generative capacity in design. The role of the computer in such a process is not to prefigure built form in the sense of presenting an anticipatory image, but rather to allow a form to emerge from the complex interplay of constraints (Massumi 1998, 17). These forms may undergo multiple variations. Kolarevic notes that there is, however, nothing automatic or deterministic in the definition of actions and reactions. They implicitly create fields of indetermination from which unexpected and genuinely new forms might emerge. The computer becomes a tool of indeterminacy. The role of the designer is to interpret and select from the infinite variations of form and space generated by the digital technologies.

Greg Lynn, and his architectural practice of FORM, is one of the major protagonists in using the computer as a tool of indeterminacy. Lynn's design process charts the potential of the computer file from initial form generation through to factory mass customisation, for he believes that this approach to design allows for infinite variation within the parameters that circumscribe the architectural project. Indeterminacy operates for Lynn as a catalyst for morphogenesis, that is, the generation of new form. Lynn qualifies this potentiality for new design processes by stating "the challenge for contemporary architectural theory and design is to try to understand the appearance of these tools in a more sophisticated way than simply a new set of shapes" (Lynn 1999, 17) The architecture produced by Lynn, both built and unbuilt, is an exploration of a different geometry, one that is no longer tied to a transcendent value system, but rather is an appropriate expression of contemporary secular reality.

In rejecting a rational, deterministic, Cartesian design process, Lynn explores an alternate approach to design that appropriates theoretical influences from a range of disciplines such as the natural sciences, philosophy, mathematics and biology. These disciplines provide more than semantic innovations. They provide Lynn with new ways of conceiving, and expressing indeterminate form and space. They allow force, motion and time, which have perennially eluded architectural description due to their 'vague essences', to be explored (Lynn 1999, 17). Devices that manipulate gradients, flexible envelopes, temporal flows and forces supplant the traditional tools of exactitude and stasis. In drawing on these other disciplines, Lynn avoids the mere superficial translation of external theories. Instead, with the assistance of digital technologies, he reinterprets and tailors previously field-specific theories to meet the demands of the discipline of architecture. Indirect, mediated theory transfer occurs.

In his design for the Cardiff Bay Opera House, Lynn explored a series of indirect theory transfer methods. The notion of "symmetry breaking", drawn from the mathematical theories of William Bateson, was used in the generation of indeterminate, anexact forms.

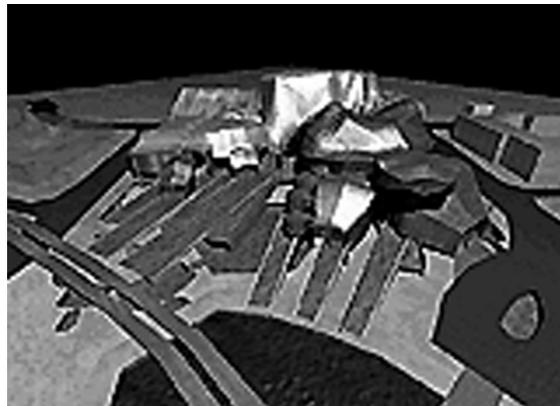


Fig. 1. Aerial image of Lynn's proposal for the Cardiff Bay Opera House competition. (http://www.basilisk.com/CICARDIFF_608.html)

The competition brief for the Cardiff Bay Opera House was explicit about two expectations. First was the requirement for a symmetrical horseshoe opera hall. Second was the urban design concern that the building should establish a strong and innovative relationship to the historic site of the Oval Basin. Lynn viewed these requirements as being at odds with each other. On the one hand, there was the intent to produce innovative, 'new' architecture. Yet formal symmetry was specified. Consequently, Lynn took this inherent contradiction as a catalyst for the project. He set about generating new concepts of order and difference that were distinct from accepted notions of typology and variation. The resistance to fixed types and the pursuit of random

mutation provided a provocative basis for the organisation and exploration of dynamic architectural concepts of symmetry.

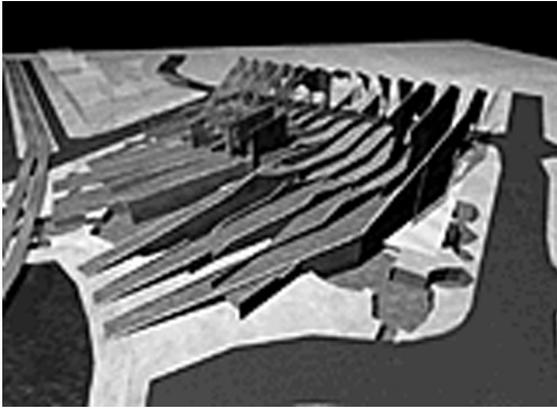


Fig. 2. Skeletal model image of Lynn's proposal for the Cardiff Bay Opera House competition. (http://www.basilisk.com/CICARDIFF_608.html)

For this project, Lynn reinterpreted the theory of symmetry and discontinuous variation developed by William Bateson in 1894. Bateson's theory addressed the relationship between order and variation and homogeneity and heterogeneity. Bateson developed a rule that stated that "a loss of information is accompanied by an increase in symmetry" (Lynn 1998, 67). He proposed that the decrease in asymmetry and the increase in homogeneity was a result of a loss of information within a system. He argued that where information was lost or mutated, growth reverted to simple symmetry. Thus, symmetry was not an underlying principle of the essential order of the whole organism, but was instead a default value used in case of minimal information. Bateson claimed that "organisms are not attributed to any ideal reduced type or single organisation; rather, they are the result of dynamic non-linear interactions of internal symmetries with the vicissitudes of a disorganised context" (Lynn 1998, 69). Within Bateson's description of an organism, Lynn identifies an analogous description of the generative fields that influence new, indeterminate form and space.

The term "symmetry breaking" is used by Lynn to describe his process of mediation and re-specification of Bateson's theory of symmetry. The process of symmetry breaking, as used by Lynn, involves the incorporation of information into a system from the outside. In accordance with Bateson's theory, the loss of information leads to homogeneity, therefore the addition of new information releases the system's own latent heterogeneity. Lynn applies the concept of symmetry breaking to architecture as a means of exploring diverse, flexible, and adaptive systems. He concludes that the primary outcome of symmetry breaking is a shift from the exact

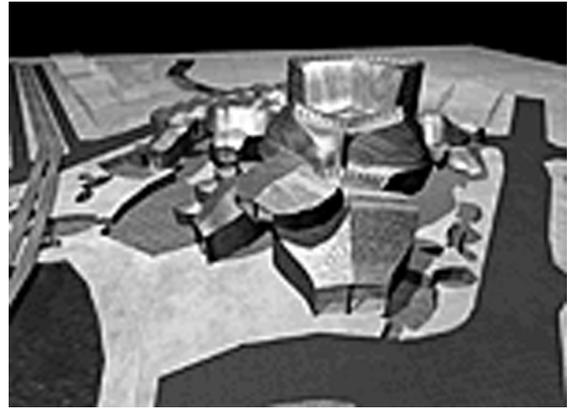


Fig. 3. Model image of Lynn's proposal for the Cardiff Bay Opera House competition. (http://www.basilisk.com/CICARDIFF_608.html)

form, such as symmetrical forms that can be reduced eidetically, to the anexact form, that is, forms that can be described with local precision yet cannot be wholly reduced. Lynn's anexact forms result from indeterminate growth stimulated by the introduction of differential and unpredictable external influences. Lynn notes that "this dynamic combination of internal directed indeterminacy and external vicissitudinous constraints leads to organisations that cannot be reduced to any ideal form or single cause" (Lynn 1998, 70). Lynn notes that in the design of the Cardiff Bay Opera House, "directed indeterminate growth became the motto for this approach, where a series of intuitions about abstract organisations were formulated as directives that would be triggered and guided by external constraints" (Lynn 1995, 13). This resulted in the creation of particular generative fields that emanated from the manipulation of the contextual constraints.

Lynn develops architectural designs that challenge conventional ideas about architectural design methods. Computer animation software has allowed the development of complex aggregate forms and a class of topological geometric types that exhibit the qualities of multiplicity and motion. Lynn's work has integrated digital technologies in the design process in an increasingly innovative manner. The technology is used as a tool to investigate design decisions dynamically through animations and the moving section, and to express the project both in two and three dimensional representations. The computer generates forms in response to programmatic exigencies and models forces on the site, using the advanced inverse kinematics capabilities of sophisticated digital technologies. This charting of forces on the site then manipulates the design. Lynn views digital technologies as a set of tools to investigate architectural form and space. This is undertaken within the framework of theories based on performance

parameters that are only now being theorized in architecture.

Lynn is one of a number of architects who are no longer prepared to accept architectural rules imposed from above (Lynn 1998, 10). Rather than being tied to a static value system he searches for an appropriate expression of contemporary society. Lynn's architectural work contributes to a subtle anti-classical discourse of contradiction, complexity and multiplicity. He utilises techniques that reveal the strengths of a given program without immediately instrumentalising them in a concrete design.

His line of reasoning is one of anti-subjectivism. His architecture is no formalistic whim, but a logical step in a post-humanist architectural theory. (Bouman, 1998, 8-9).

Lynn rebels against the "increasing and implacable inertia in architecture that takes the form of a reactionary lethargy" (Lynn 1995, 92). He believes that there is "virtually no movement in architecture and if architects are going to participate in the mobile, often immaterial forces shaping the contemporary city, they must embrace both an ethics and a practice of motion" (1995, 92). This involves the assumption that the classical models of pure, static, timeless form and structure are no longer adequate to describe the contemporary city and the activities that it supports. Architects have traditionally embraced systems of regulation, proportion and geometry in a search for wholistic order. In contrast, Lynn calls for a new order based on a rigorous theorisation of diversity, difference and indeterminacy. Lynn's generative processes challenge normative methods of design and practice. Lynn's approach to design and to the production of space and form embraces the notion of progressive assimilation of differences. His process is unpredictable at the outset, and its outcomes are irreducible at the conclusion.

His re-interpretation of theories from outside his own discipline is an example of an indirect mediated theory transfer. This results in an investigation of the underlying structures of external theories and established principles from other often-disparate disciplines, to which he subsequently attaches metaphysical meanings. Lynn is not merely making new forms, but is attempting to develop new ways of creating form. By embracing the capacity for indeterminacy within contemporary digital technologies, Lynn attempts to make architecture that makes sense with the broader cultural concerns of society.

This approach stems from a view held by Lynn (1999, 13), that deterministic techno-rationalist exactitude tends to reduce architecture to a fixed and universal language of stasis. In Lynn's opinion what makes architecture so problematic is that the discipline has maintained an ethic of stasis. He concludes that "because of its dedication to permanence, architecture is one of the last modes of thought based on the inert" (Lynn 1999, 9). Rather than designing for permanence, techniques for obsolescence, dismantling, ruination, recycling and abandonment through time warrant exploration. Lynn's desire for timelessness in architecture is intimately linked with his interests in formal purity and autonomy. It is Lynn's view that challenging these assumptions, by introducing architecture to models of organisation that are not inert, will not threaten the essence of the discipline, but will advance it. Lynn's quest is the discovery of a different geometry, one that is no longer tied to a transcendent value system, but is an adequate expression of contemporary secular reality.

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