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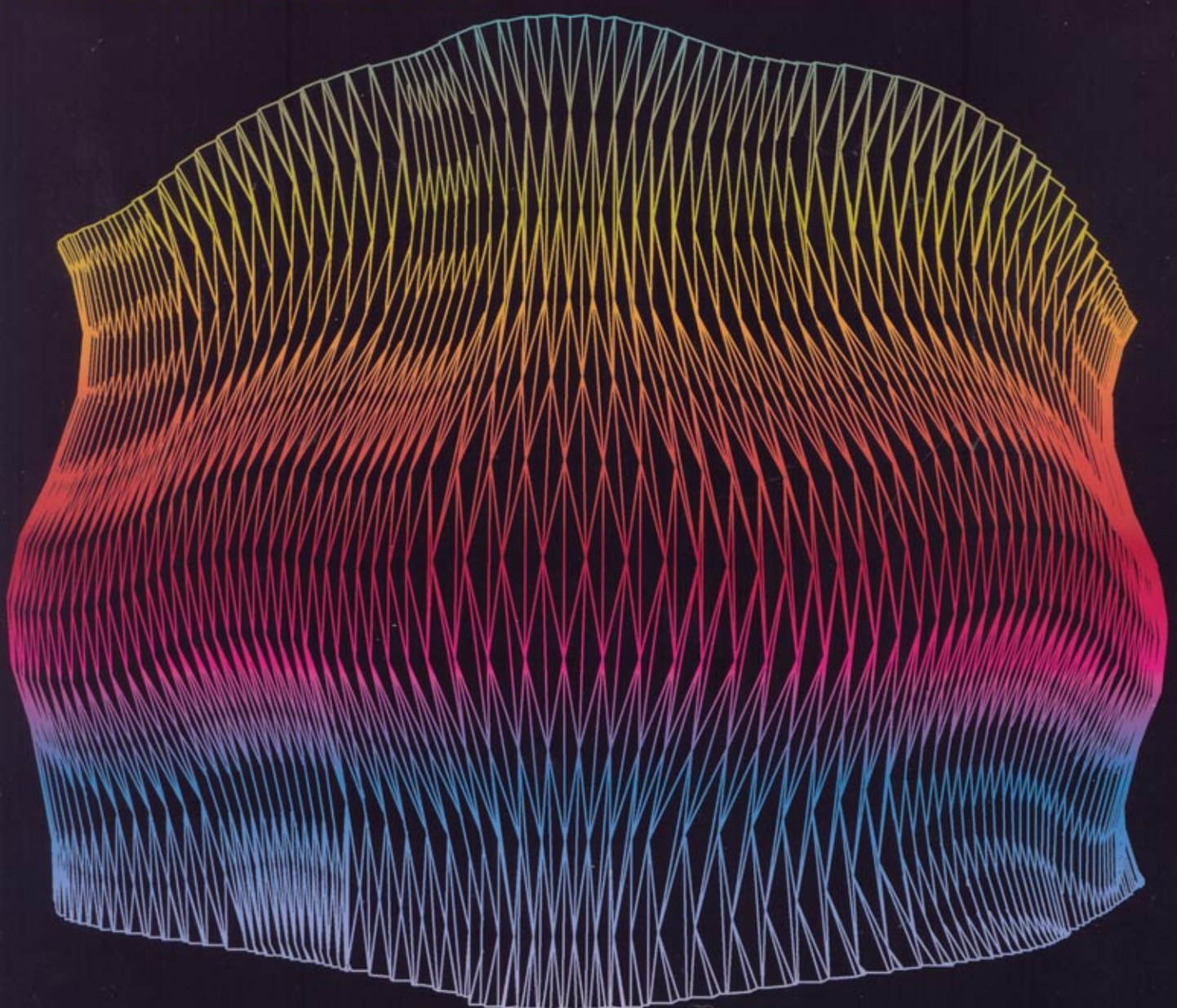
landscape

Folding the land

Why Leonardo da Vinci and the wrinkles on your face are changing the language of landscape



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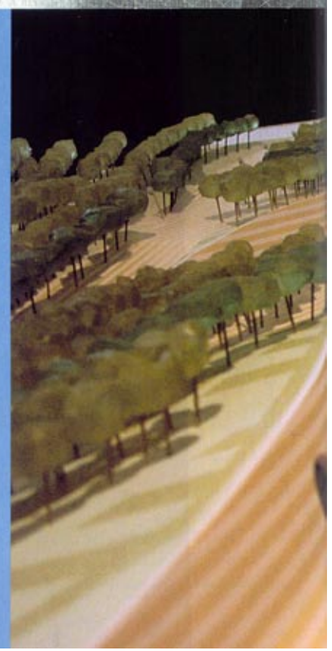
bend me, shape

Leonardo da Vinci's illustration of 'The Study of Drapery'



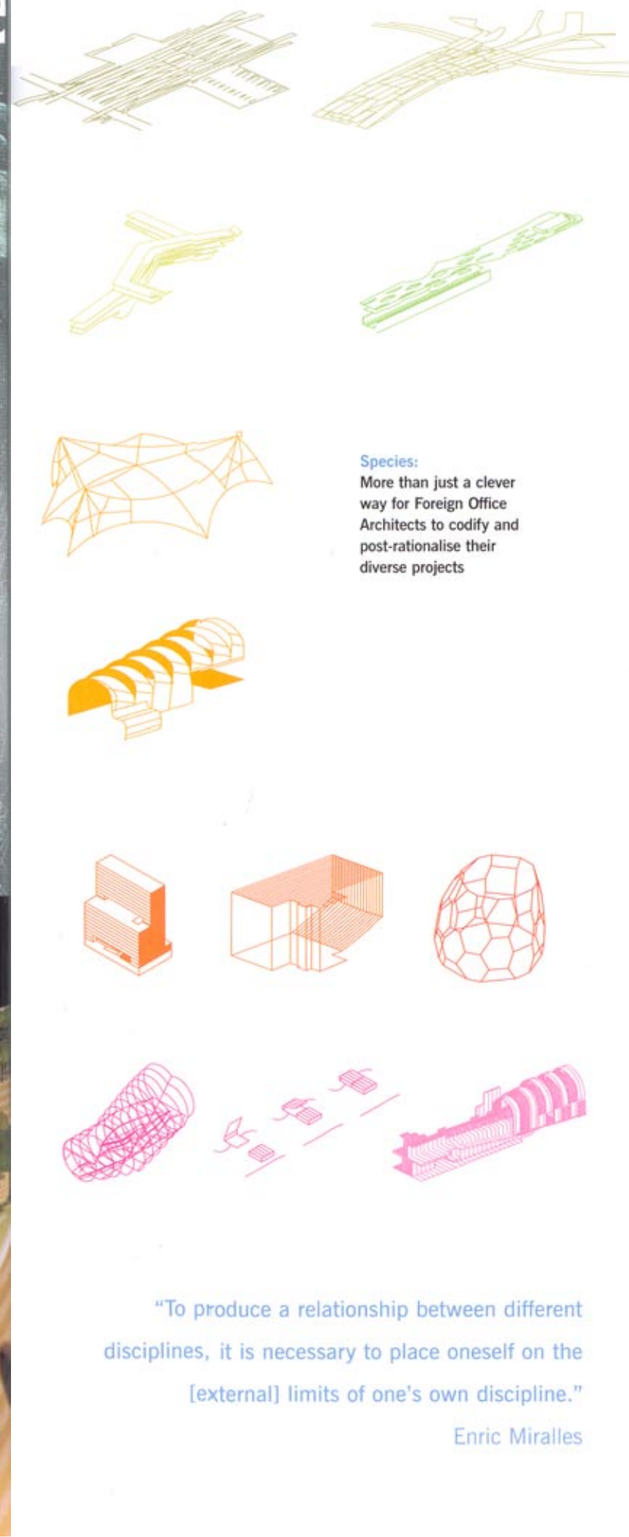
What links a Leonardo da Vinci study, Cambridge University's Department of Applied Mathematics and Theoretical Physics and the Coastal Park in Barcelona? **Christopher Gray** reveals all and discusses how folding landscapes are defining a new language of surface

Lakshminarayanan Mahadevan and Enrique Cerda of the Department of Applied Mathematics and Theoretical Physics at the University of Cambridge are fascinated by drapes. No, they are not into home decoration, but are experts in the physics of folding, wrinkling and creasing. The pair recently published a study entitled 'The Elements of Draping',[1] in which they present equations that accurately predict the way fabric folds and drapes under gravity for the first time.

This ground-breaking work follows on from their significant research into wrinkles, in which they broke the boundaries of classical theory to predict not simply the position of wrinkles, but also their amplitude and wavelength.[2] Such revolutionary research offers the possibility for progress in a broad range of fields outside applied mathematics, including fashion design, computer game rendering and, of course, topographical modelling.

But the scientists are not the first to be intrigued by the concept of such "complex patterns [arising] from simple causes in the mundane world"[3]: they cite examples of Renaissance artists such as da Vinci studying the intricate draped form of a fabric thrown across a model's knees in chiaroscuro studies.[4] Understanding of such complex forms has until now progressed little beyond these visual studies, which may seem surprising considering the universality of wrinkles: from macro-level deformations of the Earth's crust in the Scottish Highlands to the crow's foot creases at the corners of our eyes.

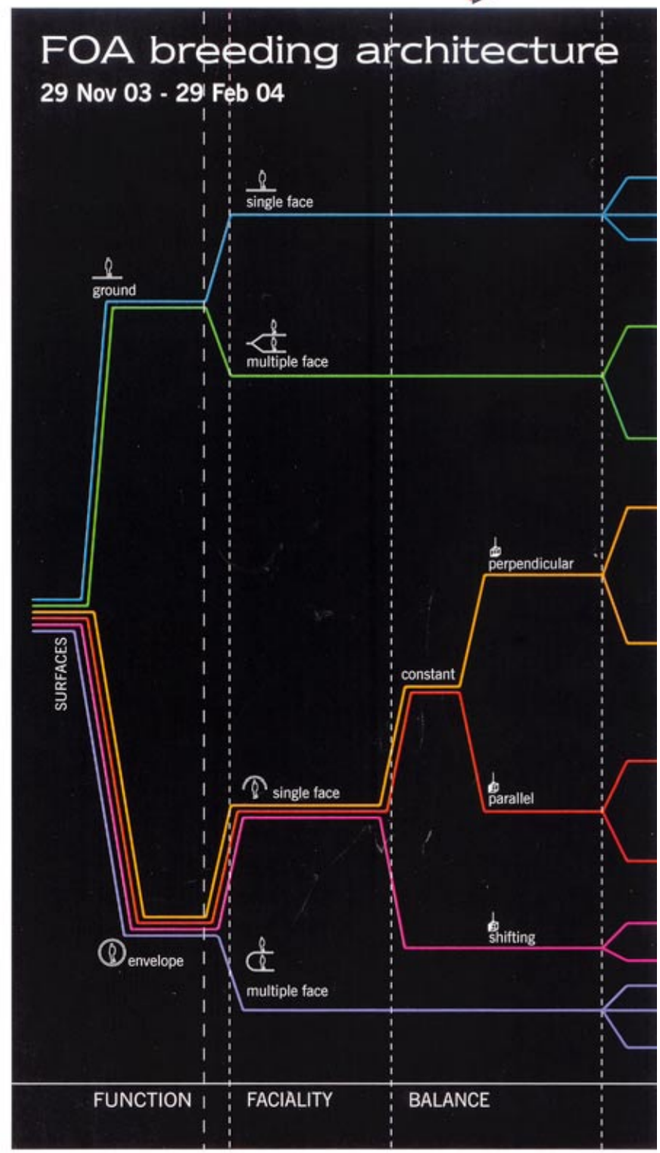
Such new research could be of great interest to landscape architects and architects, who have long been fascinated by the folding and deforming of surfaces – in theory and in practice. An understanding of how the manipulation of topographies and surfaces impacts our perception of space has always been key to the creation of great spatial designs, and with the



Species:
More than just a clever way for Foreign Office Architects to codify and post-rationalise their diverse projects

"To produce a relationship between different disciplines, it is necessary to place oneself on the [external] limits of one's own discipline."

Enric Miralles



One of the simplest creatures to have evolved within the FOA's system is their soon-to-open coastal park and auditoriums in Barcelona. A newborn of the species, grosifa_pin (ground:single-face:pinched), the park is part of developments for the cultural festival Forum 2004 and will open this month.[9] Located on the waterfront where the city's Via Diagonal and River Besòs intersect, the park "explores the organisationally complex landscapes that emerge from topographies artificially generated by a mediated integration of rigorous modelled order".[10] In short, it takes coastal sand dunes as its organisational prototype, and weaves a network of different programmes throughout the landscape. The result is a circuit of activities: artificial surfaces woven through natural surfaces to create a landscape rich in section as surfaces fold and perforate constantly.[11]

It is too early to judge how the coastal park fits into its distinguished family lineage; however the project may show the potential to expand its present limited definition. Even though it is a complex park, it is reduced to just three differentiating attributes, whereas architectural forms can receive

to continue, fold B to B

me

current vogue for organic yet artificial folded forms in landscape architecture and architecture,[5] this awareness is becoming increasingly important.

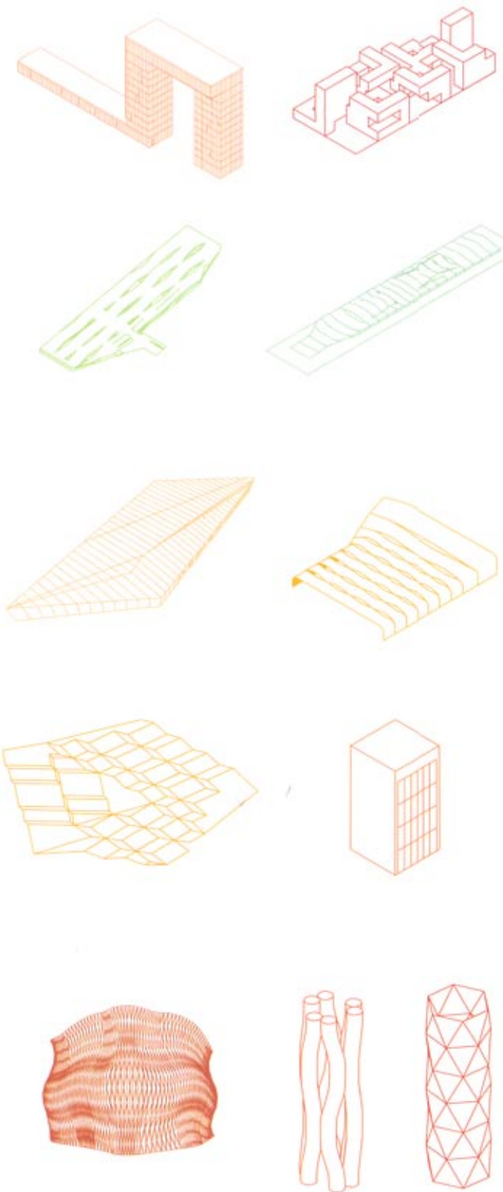
Cerda and Mahadevan are not the only people currently interested in defining complex geometries that have evaded careful definition. Foreign Office Architects' recent exhibition Breeding Architecture[6] and the accompanying publication read as a textbook for their ideas of defining "a lineage of projects through seven categories of surface diversification".[7] FOA become taxonomists: they appropriate the biology term phylogenesis[8] to describe their carefully constructed organisational tree diagram that classifies surfaces by attributes into branching paths.

Under their classification, the first major lineage split is by function, separating ground surfaces from enveloping surfaces. Subsequent branching narrows species definition under categories such as faciality (how many surface faces are inhabited); discontinuity (whether there are discontinuities in the surface such as ripples, pinches or perforations); and orientation (how the surface relates to gravity). A route down this tree-map ultimately produces a species name followed by the common name – which of course turns out to be the FOA project name.

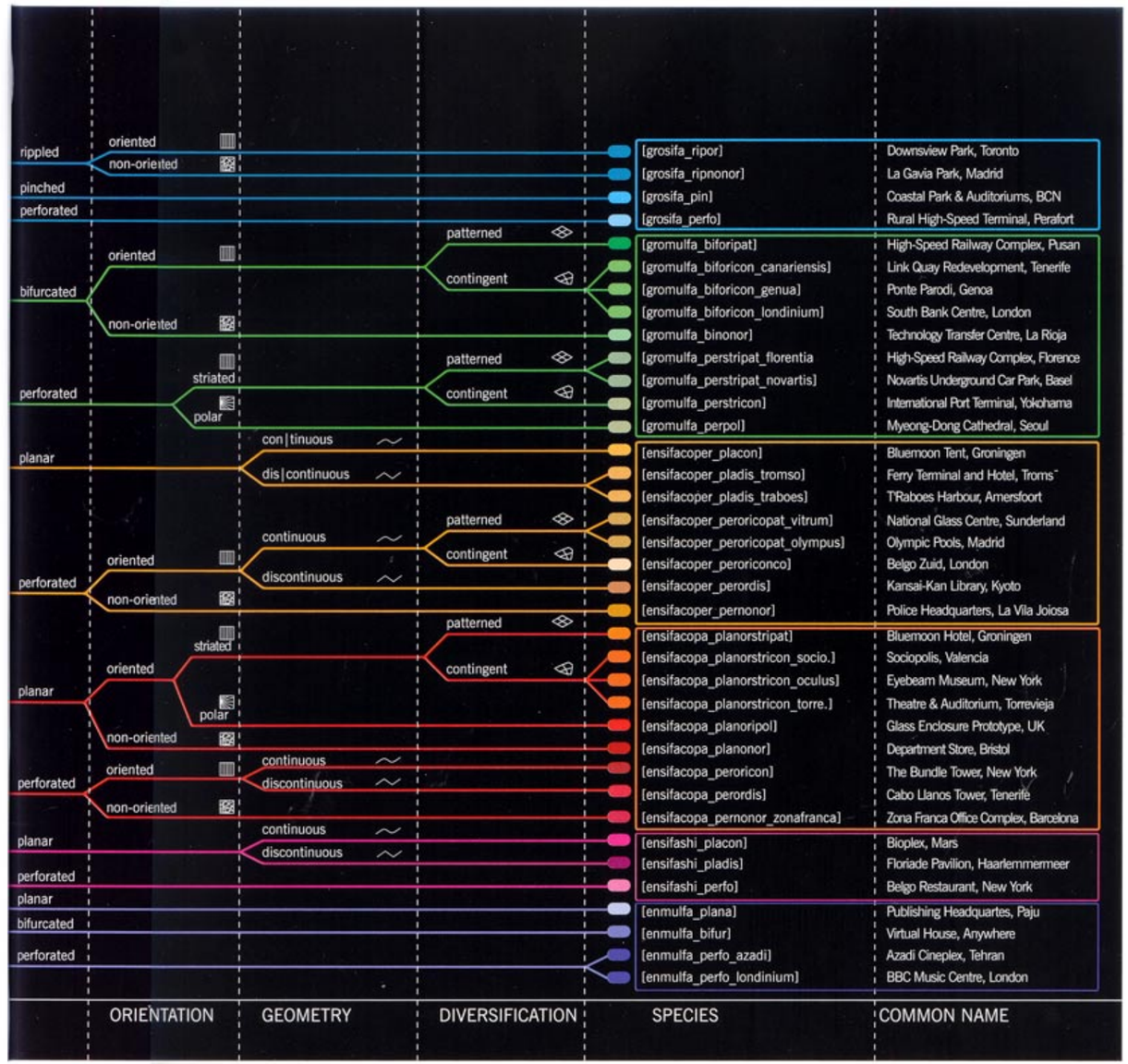
Quite a strategem, but this is more than just a clever way of codifying and post-rationalising their diverse projects. FOA has made a real attempt to examine which operations and conditions make certain surfaces behave in ways that other surfaces do not: they have made a careful study of which surfaces are produced under which circumstances. By specifically defining each attribute in the process and by detailing the options within each category, a relatively objective definition can be assigned to a particular surface, along with a particular image of what may be expected when experiencing the surface.

common lineage

The system's strength lies in the use of categories and attributes that are applicable to both landscapes and buildings. Under the system, surfaces are defined in a way that reveals common lineage between what might otherwise be thought of as unrelated projects: a project traditionally defined as a building ends up among relatives that would ordinarily be categorised as landscape. For example, the extraordinary international port terminal at Yokohama is defined as gromulfa_perstricon (ground:multiple-face:perforated:striated:contingent), which is closely related to the FOA's proposal for the South Bank Centre: gromulfa_birforicon_londinium.



Species:
Surfaces are defined in a way that reveals common lineage between what might otherwise be thought of as unrelated projects



as many as six. But landscape projects are slow burning – they have the capacity to evolve and to develop new characteristics over time. Initially defined as a relatively base species, the humble grosifa_pin could become FOA's most complex creation yet.

So why all this discussion of taxonomy, crow's foot wrinkles and Renaissance artists? Perhaps it is because we are currently in a period of architecture and design where the power of computers to model complex organic built forms is being exploited, resulting in the development of a new design language that works for both architecture and landscape architecture. Could such a common language lead to closer cross-disciplinary understanding and ultimately better-designed landscapes, buildings and spaces?

If landscape architects are part of the development of such a design vocabulary, there is an opportunity not only to ensure that landscape issues are given value alongside built issues, but also to challenge territory that may have been lost to others. Related professions have started the process; it is now up to ours to develop the dialogue to shape the landscapes of the future. ■

Footnotes

1 Cerda, E, Mahadevan, L and Pasini, JM, The Elements of Draping, Proceedings of the National Academy of Sciences USA, 17 February 2004, vol. 101, no. 7, pp. 1806-1810.
2 Cerda, E and Mahadevan, L, Geometry and Physics of Wrinkling, Phys. Rev. Lett. 91, 2003.
3 Cerda, E, The Elements of Draping, p.1806 .
4 da Vinci, L, Garment Study for a Seated Figure, 1470–84, oil on canvas, 26.5 x 25.3cm, Musée du Louvre, Paris.
5 For examples of such a drift in contemporary landscape architecture see practitioners such as George Hargreaves, Kathryn Gustafson and Enric Miralles or, for an architectural perspective, Frank Gehry, Greg Lynn and Morphosis.
6 Breeding Architecture, an exhibition at the Institute of Contemporary Arts, London, 29 Nov 2003-29 Feb 2004.
7 Breeding Architecture, exhibition text.
8 "The sequence of events involved in the evolutionary development of a species or taxonomic group of organisms." Definition from WordNet, a lexical database for the English language, developed by the Cognitive Science Laboratory at Princeton University, http://www.cogsci.princeton.edu/~wn/index.shtm
9 Fägerström, C, View from Barcelona, Architectural Review 2003, vol. 213, no. 1276, pp. 43-45.
10 Barcelona: £1.5bn project to regenerate the waterfront at Besòs for Forum 2004, Architecture Today, no. 136, p. 9.
11 Indeed such technical grading operations required the development of a specific precast concrete unit paving system that was capable of pinning the ground at steep slopes. Zaera Polo, A, Recent Works, University of Pennsylvania, Philadelphia, November 2002.
12 See Czerniak, J, ed. Case: Downsview Park Toronto, Prestel, 2001, for FOA's competition entry to the Downsview Park Competition which can be read as an early development of ideas ultimately expressed in their Barcelona project.