

# Radical Authenticity: Exaptation in Architecture

What use is half a wing? In “Exaptation – A Missing Term in the Science of Form” Stephen Jay Gould and Elizabeth Vrba argued for a new way to address this evolutionary question.<sup>1</sup> Instead of following a step-by-step process towards the development of a particular trait towards optimal fitness, exaptation hijacks a characteristic and deploys it for something entirely different and unexpected, what Gould and Vrba call its useful ‘effects.’

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In the case of a wing, given that feathers have the ability to trap air, it is believed that their initial development was adapted for insulation against cold weather. When added to upper appendages, subsequent adaptations allowed the animal to further regulate its body temperature at will. As some feathers curved to tuck more closely to the body, they began experimenting with airflow and flight, thus transforming a temperature regulating condition into an entirely new set of possibilities for airborne mobility. Feathers that were fit for their current role of temperature regulation were thus coopted for flight, in other words, “Adaptations have functions, exaptations have effects.”<sup>2</sup>

Exaptation operates within an open framework where feedback of the unexpected can alter a course of action – a state in which a combination of unrelated consequences may not necessarily adhere to a linear development, but instead intermingle into an emergence of novel characteristics. In *Where Good Ideas Come From* Steven Johnson describes recent technological exaptations that have led to unanticipated developments, many which have significantly altered the way we function and work today. The punch-card, originally developed by French weaver Joseph-Marie Jacquard for mechanical looms in the early 1800’s, was coopted years later for the programming of early computers. Similarly, the vacuum tube, initially created to amplify electronic signals, was later hijacked to represent and denote zeros and ones leading to the development of binary code computing.<sup>3</sup> Today’s internet is created both through classical notions of adaptation – incremental functional improvements with each generation (or versions) that insures it remains useful for the expanding exchange of information – and exaptation, perhaps demonstrated by its unanticipated cooption into a significantly powerful, bottom-up political tool recently deployed by activist uprisings against entrenched authoritarianism.

Benefits of technological exaptations can be tracked along a trajectory of contemporary building technology as well, such as in the development of the commonly



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used material for thermal building insulation. Resulting from a test gone awry, the Owens Corning Company was founded in the 1930's when a botched production method for casting glass ended in a pressurized overflow of a fine stream of glass threads.<sup>4</sup> While these fibers were at first directed towards the development for the strengthening material hybrid know as Fiberglas, it was eventually discovered that, similar to feathers, when loosely packed together these threads were very good at entrapping air. Thus, what was originally intended as a structural project was unexpectedly coopted, by its effects, into a thermal product for wall and ceiling insulation. In other words, the evolution of today's fiberglass batt insulation was not solely the result of a methodical development for producing construction insulation, but rather a matter-based exaptation that spurned the initial, known qualities of glass and into an unruly massing of thermal threads.

Other co-opted technologies can be found in the adoption of handheld technologies that are now placing smart systems in homes and offices via the readily available interface effects of computing. One system, Savant Systems LLC, successfully synthesizes the intuitive phenomenon of the iPad directly into its architectural layout for regulating thermal, lighting, and entertainment comfort (and for that matter, anything else that relies on electronic information). While the iPad was initially developed to make desktop computing mobile, Savant Systems<sup>5</sup> has coopted its ease of mobility into new territories for regulating architectural switching, thus disrupting the usual tectonics of control. By omitting the need to rely on fixed wall locations in every room, switching can now migrate between server and a distributed array of hand-held tablets placed at will, fully independent of their physical location in space. The traditionally rooted switch has taken flight.<sup>6</sup>

Any open system will lead to highly unpredictable outcomes (again, think of the progression of feathers for warmth to the hacked capability for autonomous flight). This is not a straight-line progression. When applied to the design of buildings and cities, exaptation presents a sequence of opportunistic thinking, one that borrows from diverse disciplines, cultural influences, and technological cooption into the evolutionary trajectory of architecture. Making reference to

Figure 1: *Materialized: Salt Prints*, 2013  
Model produced by Emerging Objects with Faulders Studio; 3d printed salt, epoxy finish; 60.9cm x 50.1cm x 20.3cm; collection FRAC Centre (photo Kent Wilson).



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Figure 2: Electrical feed and server closet for *FRAMESpace Residence*, San Francisco, 2012; Faulders Studio (photo Thom Faulders).

population-dense metropolitan areas, Stephen Johnson observes, “The value ... lies in the unlikely migrations that happen between the different clusters. A world where a diverse mix of distinct professions and passions overlap is a world where exaptations thrive.”<sup>7</sup> From new language expressions to the proliferation of creative subcultures, agile and highly synthesized cross-cultural ‘hacking’ will generate the most surprising inventions.

And yet, while today’s largest cities continually expand into globalized populated centers, we see a simultaneous emergence for architectural homogeneity as well, forming a collection of a world-wide array of self-similar hubs. Mega developments in both existing and rapidly emerging cities throughout the world scale-up rapidly via the shared connectivity of imported design influences, building production technologies, and flows of capital. Rather than building signifiers that produce difference and variation, the open city of today is pressured to create bland icons of progress precisely to accommodate a seemingly globalized conception of modernization in lieu of local distinction. Perhaps, these forms of architectural migration have their limits: difference does not thrive, but becomes sanitized and smoothed in a race to the bottom towards uniformity. In writing about the latest high-rise building trend in Manhattan, architectural critic Paul Goldberger reports how a majority of the recent pencil-thin towers cater to an international crowd of super-rich global travelers who own dwellings in multiple cities. What is new, he argues, is that cities like London or Hong Kong are being physically altered by developers who put up buildings solely with these buyers in mind,<sup>8</sup> transforming the city while adding little to the uniqueness of its day-to-day culture. Today’s central district of Shanghai or New York – what’s the difference?

**PROJECT: FROM SABKHA TO SIGN**

The city of Dubai in the United Arab Emirates embodies this super-charged realm, building primarily for a global audience – both for direct inhabitation, while more importantly, as a speculative symbols with an eye for business elsewhere. Thus, we might say that its primary global presence is not constructed as physical location per se, but of an anticipated modern representation. We can witness this as the city rapidly builds of towers that could quite literally be anywhere. Due to the limitations of population size and material resources, Dubai’s speculative real-estate mandate for high-speed growth all but insures that it imports building design, construction expertise, and materials and technique from afar. The Burj Khalifa Tower, certainly in being the tallest building in the world today, amplifies this condition. Its consortium of influences includes architectural design and structural design by Skidmore, Owings and Merrill in Chicago; general contracting by Samsung Construction and Trade of South Korea, Besix of Belgium, and Arabtec of the UAE; project management by Turner Construction Company of the U.S., with assistance by Grocon Pty Ltd of Australia; foundation construction by Bauer Spezialtiefbau of Germany and Middle East Foundations of the UAE; cladding by Schmidlin of Switzerland; glass provided by Guardian, a U.S. company; construction contracting by Al Naboodah of the UAE and Laing O’Rourke of England; and a host of many other international conglomerates.<sup>9</sup> The Burj Kahlifa is truly an impressive undertaking, and its roster for shared global expertise underscores the new realities that produce architectural complexities through open networks of effort.

Intentionally set it in contrast to these processes, our speculative *GEOTube Tower* proposal for a new city icon in Dubai seeks to challenge this reliance on fully

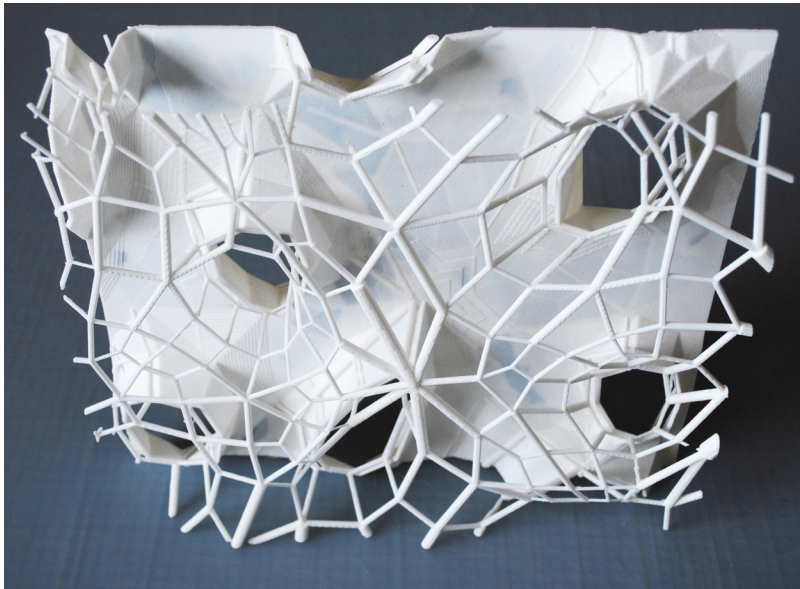
imported construction. Could aspects of a tall building be 'grown' into place from local conditions? We proposed a bottom-up architectural paradigm wherein its building components could be generated through mineral accretion rather than constructed; would be in continual formation rather than ever fully completed; and would thus be created in place rather than imported from afar. In so doing, we explored processes that could create a radicalized form of authenticity.

Dubai is built upon distinct geological conditions of salt flats, known locally as sabkha plains. These encrusted plains are time-based formations created through the presence of extreme climate temperature and humidity in combination with high mineral salinity of the gulf. The extreme temperature variations generate thermal contraction at night and expansion during the day, resulting in a distinct polygonal cracking upon its top surfaces. The world's highest salinity for oceanic seawaters is found in the Persian Gulf (a record shared with the Red Sea). Typical salt content for the planet's oceans is 35 parts per thousand (annotated as 35 o/oo). The Persian Gulf (also named the Arabian Gulf) is an impressive 40 o/oo, caused by the high evaporation rates in the region through atmospheric temperatures and low fresh water influx. During the design inquiry we proceeded to address an open-ended a set of question related to the concepts of exaptation: could architecture hack the effects of the salty ground itself into something useful? Towards this end, might the building effectively recreate these conditions vertically to establish a unique and highly visible iconic tower?

With an open structure and an exposed membrane skin, the vertical planes of the proposed 170 meter tower are proposed to be continually misted with Persian Gulf salt water via an external vascular water system. The outcome is a growth of salt deposits upon its expansive surfaces exposed to the city. As the saturated saline seawater is sprayed onto the skin mesh, the water continually evaporates due to the warm average temperatures, ranging from 75 degrees in winter to over 106 degrees Fahrenheit in the spring and summer. Aiding in this evaporation are the prevailing on-shore northwesterly winds during the day (shamal), and the off-shore southeasterly winds during the night. Regional rains are minimal, averaging approximately 80mm annually. When rains do arrive, they constructively aid in cleansing and washing away loose particles from the forming salt skin. Annual



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Figure 3: New towers erected in the sand, Dubai, 2012 (photo: Thom Faulders).

Figure 4: *GEOTube Tower* 3d Print Close-up, 2009 Faulders Studio; Z-Corp 3d print; 20.5cm x 7.5cm x 20.5cm; collection FRAC Centre (photo: Faulders Studio).



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Figure 5: *Materialized: Crystalline Growth*, 2013  
 Faulders Studio; salt crystallization over 3d printed  
 substrate; 20.3cm x 50.8cm x 19.7cm; collection  
 FRAC Centre (photo: Kent Wilson).

sandstorms (Al-Haffar, Barih Thorayya, Al-Dabaran, etc.) similarly provide a constructive role in scrubbing down rough edges and loose particles.

As we find in any slow-acting, ‘plastic’ geologic formations - such as flowing lava beds, barchan sand dune migration across the desert, or stalagmite mineral aggregation – the crystalline skin of the *GEOtube Tower*, by nature, could never be fully controlled. Crystallization processes will surely ebb and flow, weatherized decay may form at exposed edges, surface discoloration could occur via airborne minerals, and uneven build-up of crystalline aggregates would surely form around surface details and openings. Architecture is not typically adept at harnessing material unpredictability, yet this is precisely the motive behind this kind of open system in this proposal. Hacking the effects of the sabkha plain would insure that the crystalline surfaces emerge into a bright and highly visible tower, while at the same time transforming and solidifying with new phenomenal effects. As is true in any truly open system, it must be ‘played out’ in time, and therefore could not be conceived as fully predictive tectonic design element. As Moshen Mostafavi and David Leatherbarrow claim, “Finishing ends construction, weathering constructs finishes.”<sup>10</sup> Rather than viewing this as a destructive conditional problem confronting all buildings, the *GEOtube Tower* directly co-opts these transformative forces of weather and exapts it for construction, not degeneration.

In *Landform Building* Stan Allen writes, “Landform building is less interested in the imitation of natural form and more interested in programmatic possibilities that are opened up by the creation of artificial terrains. Landform building favors program, process, and affect over formal similarity.”<sup>11</sup> Architectural exaptation borrows a trait not to mimic it, but to adopt its qualities towards another useful purpose. Hacking the fundamental material principals that formed the region’s salt plains into a highly visible surface for a tower – i.e. one that would potentially

attract business and tourism – is our attempt to conceptually explore strategic exaptation. These potentials also include the co-opting of industrial processes and infrastructures (for salt production) towards an ‘out of discipline’ architectural outcome; inverting the expectations of narrative content, thus turning rogue minerals into productive building matter; and ultimately, the disruption of normative building processes towards emerging possibilities for fully grown buildings.

Invited to participate in the international exhibition *Archilab 2013: Naturalizing Architecture* at the FRAC Centre in Orleans, France, we realized the need to further present this project as a time-based material investigation. The physical and chemical properties for growing of crystals would always happen at full scale, regardless of the scale of the working substrate. Limited by the size and shipping constraints of the exhibition, we opted to produce a scaled-down 3d printed open mesh version of a representational building portion of the tower skin. Wetting and drying the lightweight substrate with a saline solution over the course of 60 continuous days gave us a significant built-up and surprisingly robust mineral surface that fully encrusted and absorbed the initial structure. In this manner, surface patterning and irregularities were born, not designed.

Chief exhibition curator Marie-Ange Brayer states “Architecture henceforth shows itself as a hybrid, composite organism, in interaction with its environment, gaining knowledge from material, an intelligent and effective system. Material is powered in an endogenous manner and algorithms will reconstruct these mutations. The properties of the material’s morphological inherence create an object, immaterial or material, multi-level, with a variety of scales, from nano to



Figure 6: *Crystalline World: Subhedral*, 2013  
SOMarts Cultural Center, San Francisco; Faulders  
Studio; polystyrene, mixed media; 8' x 8' x 10';  
(photo: Brendan Williams).

macro-scale, a plural entity spanning all fields of conception and production.”<sup>12</sup> When open architecture spans a diversity of fields using a cross-platform menu of interdisciplinary techniques, exaptation is likely to occur. Analogous to a sub-hedral crystalline structure – that is, a crystalline formation comprised of both known geometric facets (euهدral) with unpredictable granularity (anahedral) – exaptation reifies architecture’s capacity to create the unexpected.

#### ENDNOTES

1. Stephen Jay Gould and Elizabeth Vrba in “Exaptation – A Missing Term in the Science of Form,” *Paelobiology*, Vol. 8, No. 1 (Winter), 1982.
2. Ibid.
3. Steven Johnson, *Where Good Ideas Come From: the Natural History of Innovation*, Riverhead Books, New York, 2010.
4. See [www.owenscorning.com](http://www.owenscorning.com) for general information regarding the company’s heritage.
5. There are numerous companies working with these interfaces; the author has direct experience designing with the Savant System.
6. For redundant back-up purposes, owners typically opt to install physical room controls as well, though this is not needed for system function. It remains to be seen if and when these will be omitted altogether.
7. Steven Johnson, *Where Good Ideas Come From: the Natural History of Innovation*, Riverhead Books, New York, 2010.
8. Paul Goldberger, “Too Rich, Too Thin, Too Tall?” *Vanity Fair*, May 2014.
9. Burj Khalifa (Burj Dubai), [www.designbuild-network.com](http://www.designbuild-network.com).
10. Mohsen Mostafavi and David Leatherbarrow, *On Weathering, The Life of Buildings in Time*, The MIT Press, 1993.
11. Stan Allen and Marc McQuade, editors, *Landform Building*, Lars Muller Publishers and Princeton University School of Architecture, 2011.
12. Marie-Ange Brayer and Frederic Migayrou, *Naturalizing Architecture*, FRAC Centre, Orleans, 2013.