Architecture through Drawing

Alessandro Melis

The act of drawing has long been the foundational stone for architectural expression. Through the chaotic lines on a canvas, we can understand exaptation as a unique path to diversify architectural drawing frameworks, moving towards environmentally-conscious perspectives.
In discussing ecological stances, it becomes clear that creativity, especially in architecture, emerges through drawing as manifestations of the intricate mechanisms of biological evolution. This interconnected viewpoint allows to see drawing not merely as a representation tool but as a transformative method to rethink environmental transformations strategies, such as architecture. through the lens of exaptation.
Exaptation, within the realm of drawing, can be perceived as a concept where an existing drawn design or motif evolves to encapsulate new functionalities, either diverging from its primary representation or evolving from an erstwhile non-representational state. From an evolutionary biology standpoint, exaptation enriches the Darwinian interpretation of change processes, prompting us to consider how architectural drawings have evolved beyond mere functional representation. The essence of exaptation suggests that evolutionary processes, even in the world of architectural drawing, don't commence in isolation but continuously adapt existing motifs and designs, thereby turning potential constraints into creative opportunities [Melis, Pievani 2022].
Historical and contemporary drawing examples, spanning diverse cultures and epochs, show how drawn illustrations can serve as catalysts for revolutionary architectural and urban transformations. Such drawings underscore the potency of lateral thinking in bridging imagination

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Fig. 1. Alessandro Melis, Shining Dark Cities Series, Termite Nest V, 2012

with tangible outcomes, particularly during challenging times. Our inherent cognitive abilities, especially evident in the adaptive nature of drawing techniques, highlight the evolutionary repurposing of design motifs and techniques over time.

Drawings at the Intersection of Evolutionary Biology and Architecture

Drawing, as a fundamental tool in architecture, has always transcended mere visual representation. When approached from the standpoint of evolutionary biology, architectural drawings can present a canvas of exploration into biological mechanisms, structures, and principles.

While many scholars have engaged in interdisciplinary studies linking recently expanded biological taxonomies with fields such as economics and technology, the relationship between architectural drawings and the aforementioned evolutionary taxonomies remains strikingly underrepresented in current research. Past studies, such as those examining biomimicry, hint at this connection by drawing analogies between organismal form and function and architectural design in a Leonardesque manner. This can also be seen as an advanced manifestation of classical analogies, comparing human body phenotypes to architectural styles, as evident in past illustrations and renderings [Melis, Pievani, Lara-Hernandez 2024].

Such drawings, while mostly focusing on the superficial, phenotypical level of mimicry (emulating photosynthesis, for instance), don't truly harness biology as a catalyst for innovative design principles. Drawing, in this context, could elevate the study beyond mere imitation, making it a vehicle for a transformative design mindset, especially when confronting global challenges tied to our current design ideologies.

The concept of autopoiesis, inspired by living organisms, offers another profound intersection. Just as a drawing delineates the foundational structure and essence of a building, autopoiesis envisions buildings as living systems, each element interacting and evolving in its environment. Yet, architectural studies rarely venture into the evolutionary depths of exaptation in their sketches and blueprints, often settling for deterministic overviews [Melis, Pievani 2022].

Drawings can, therefore, serve as a bridge between the deterministic and the evolutionary. The parallel between natural selection and architectural design, when visualized

Fig. 2. Alessandro Melis, Piranesiana, 2012.

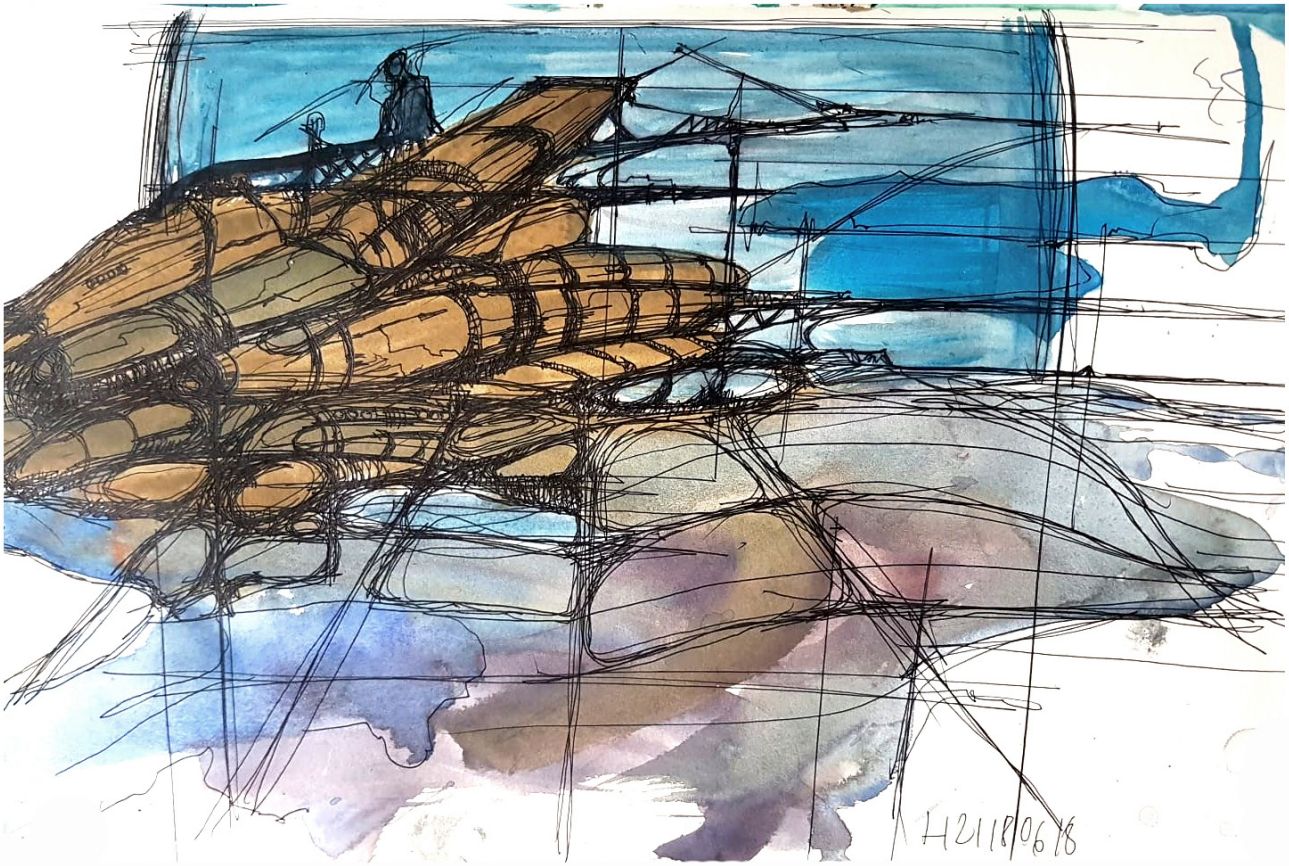
Fig. 3. Alessandro Melis, Biotech Highrise I, 2016.

through drawings, could foreground the importance of understanding design mechanisms rather than focusing solely on the end-product.
The concept of exaptation, for instance, challenges the traditional design approach of 'reverse engineering'. This retrospective approach often fails in architectural drawings because the historical origins and present functionalities might differ.
By introducing evolutionary biology's nuanced perspectives into architectural drawings, we can enrich our design approach. We can create sketches that not only portray a building's structure but also its adaptability, resilience, and evolutionary potential. Such an approach aligns with the holistic definitions used by biologists and architects alike, especially when drafting designs for sustainable projects [Melis, Pievani, Lara-Hernandez 2024].
In essence, the harmonious fusion of architectural drawings with evolutionary biology provides innovative, responsive, and resilient design methodologies. By moving beyond mere imitation of nature, drawings can channel biology as a potent force for redefining architectural principles, especially as we navigate the intricacies of global crises.

Drawing Evolutionary Pathways

In the world of artistic representations, particularly drawings, the concept of adaptation refers to the continuous evolution and honing of techniques that cater to an artist's expression or the audience's interpretation. Historically, adaptation in art has often been viewed as a process of refining specific techniques or styles for particular objectives. Much like in biology, where scholars discuss adaptation as a fundamental concept in understanding human and non-human evolution, artists too have constantly adapted their methods to suit new purposes or respond to changing cultural contexts.
However, just as biological evolution has concepts that go beyond mere adaptation, so does the evolution of artistic expression. Darwin's proposition regarding complex traits that originate for one purpose but later are repurposed for another resonates in the art world. Think of early cave drawings, initially perhaps a means of communication or recording, which over time transformed into intricate art forms and storytelling mediums.
Jay Gould and Elisabeth S. Vrba's concept of 'exaptation' [Gould, Vrba 1982] can be paralleled in the drawing realm. Drawing techniques or styles developed for one purpose can be repurposed for another, much like the 'spandrel' metaphor borrowed from architecture.
In simpler terms, just as the word 'adaptation' typically suggests changes crafted for specific functions in biology, in drawing, it may point towards techniques cultivated for a particular artistic goal. Analogous to the exaptation of bird wings for different functions, drawing techniques may evolve and be repurposed.
One remarkable example of this in art is how certain stylistic choices, initially developed for aesthetic purposes, later find utilitarian roles. A doodle or a freehand drawing might initially have no concrete function but can be co-opted into logos, designs, or even architectural concepts. This resonates with the idea of genes emerging from the redundant 'junk DNA'.
The correlation between adaptation and exaptation in drawing leads to major shifts in artistic styles and methodologies, much like the evolutionary transformations Gould and Vrba described. The techniques initially developed for one kind of drawing might be the very catalyst for innovation in another.
In the realm of drawings and artistic representation, form does not always precede function. Just as the physical form of a structure in biology does not necessarily dictate its function, the initial strokes on paper don't always determine the final outcome in art. This notion, reflecting a general evolutionary pattern can be mirrored in art – techniques evolve spontaneously, independent of any new objective they may later serve [Melis, Pievani 2022].
Taking this understanding forward, much like the human body and DNA are full of potential exaptations, the world of drawings is ripe with techniques and styles waiting to be repurposed. The evolution of drawing styles, tools, and techniques parallels the evolutionary pathways in biology, suggesting a broader interconnectedness of life and art. Just as *Homo sapiens*' physical abilities emerged and later found newer avenues, drawing techniques developed over centuries await their Renaissance in the hands of future artists projects [Melis, Pievani, Lara-Hernandez 2024].
When thinking about the evolution and role of drawing in human history, it's beneficial to juxtapose its present-day significance with its earliest manifestations. From a philosophical viewpoint, we can interpret the importance of drawing as both an artistic form (intended purely for its aesthetic transcendental quality) and a method of communication. Tracing back to our ancestral lineage, we

Fig. 4. Alessandro Melis, Geocity V, 2018.



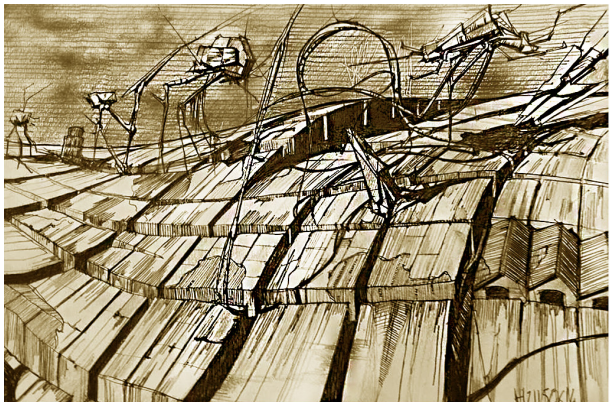


Fig. 5. Alessandro Melis, Hybrid cities series, Surgery city, 2015.

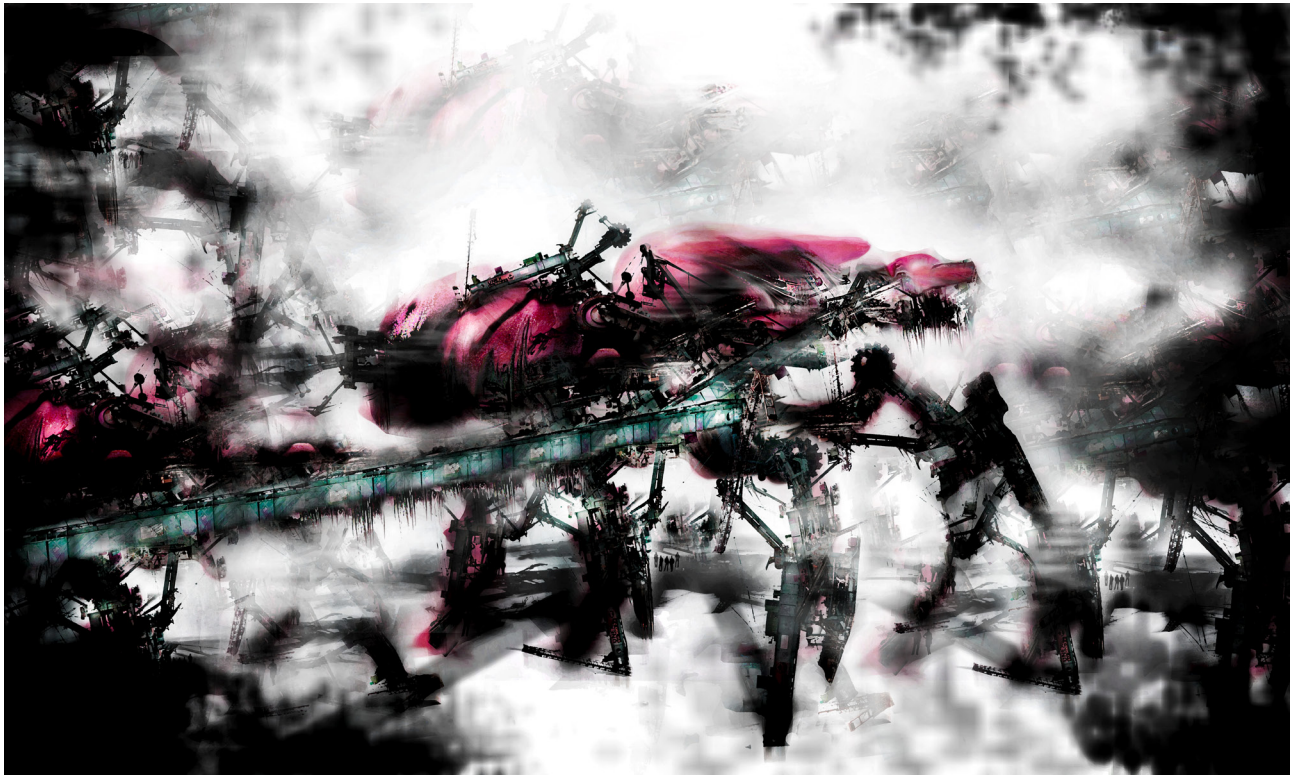
might discover insights that, while not always poetic, are undoubtedly enthralling. Drawing might be interpreted as an evolutionary side effect born out of imperfect development. But in biology, 'imperfection' isn't a negative term; it's a catalyst for innovation. However, labeling this as 'creativity' can seem amiss, especially when one realizes it deviates from a divine sense of creation. Drawing is akin to retrieving information from our brain's archive, an archive that isn't as orderly as we might believe. This makes art a fast way to interpret a myriad of nonlinear, cognitive data. The ultimate human objective –assuming evolution allows for such terminology– is not to dissect this data but to harness it for continued existence.
Human brain evolution, especially between 200,000 to 150,000 years ago, marked the dawn of a creative age [Pringle 2013]. This creative spark became evident in cave artworks around 40,000 years ago, highlighting the connection between brain evolution, cognitive growth, and artistic flair. Advancements like imagination and conceptual thinking became the cornerstones of artistry [Wilson 2017; Mithen 1996; Boden 2003]. Art's emergence can be seen as exaptation in action, with certain brain areas initially designed for different functions adapting to cater to artistic pursuits [Melis, Pievani, Lara-Hernandez 2024]. The cognitive and neural progress of early Homo sapiens paved the way for advanced thinking, resulting in masterpieces like cave paintings. Such works, rich in symbolism, attest to the escalating creativity of our forebears.

Europe boasts several historic cave art landmarks. The Chauvet-Pont-d'Arc Cave in France, housing art believed to be 36,000 years old [Chauvet, Brunel Deschamps, Hillaire 1996], features several animals like mammoths and lions, revealing the artist's prowess and kinship with the environment.
Such art further emphasizes exaptation's role, especially in reshaping natural landforms, a topic touched upon in earlier discourse.
Likewise, the Lascaux cave in France, with its 17,000-year-old art, displays a range of animals, like bison and deer, cleverly using cave's natural shapes to intensify three-dimensionality.
Similarly, Spain's Altamira Cave showcases vibrant animal depictions from about 15,000 years ago [Clottes, Lewis-Williams 2017]. Their vividness and expert application of color and light underscore the artists' precision and craftsmanship.

Deep time drawing

Throughout various cave art sites worldwide, one can frequently spot hand outlines and imprints alongside depictions of animals. These hand representations hold a distinct place in the annals of primitive art, spanning different regions and timeframes.
Creating a hand outline involves placing one's hand against the cave wall and applying pigment around it. This method results in a negative silhouette of the hand, crafted using various colors. On the other hand, direct imprints are formed by first smearing pigment onto the hand and then pressing it onto the surface [Melis, Pievani, Lara-Hernandez 2024].
For instance, the El Castillo cave in Spain houses hand outlines that date back over 40,000. Meanwhile, France's Pech Merle cave offers both hand imprints and those accompanied by animal drawings, illustrating the varied art forms of the period.
The underlying reasons for these hand depictions are open to interpretation [Clottes, Lewis-Williams 2017]. They could symbolize spiritual beliefs, serve as a conduit for connecting with mystical forces, or represent individual or group identities, possibly from participating in certain rites. Alternatively, these hand images might simply be an expression of artistry and personal identity.
Heather Pringle [2013] suggests that such artistic expressions emerged from our ancestors' capacity for abstract

Fig. 6. Alessandro Melis, Spider, 2017.



thinking, especially during trying times, steering away from linear thinking. This art form might have enabled early humans to handle vast amounts of information through symbolic representations. Future generations, in turn, would interpret these symbols using various analytical methods.
The considerable time and effort dedicated to creating these artworks indicate they likely held evolutionary benefits. The consistent joy derived from these aesthetic experiences backs their significance [Melis 2021], showcasing creativity as an evolutionary response to emerging challenges.

Gender Roles in Cave Art to Understand Exaptation

Our inability to comprehend the evolutionary advantages of non-deterministic trends often leads to misconceptions and biases. While the emergence of drawing stems from exaptation's inclination towards variability, redundancy, and diversity –serving as a reservoir of possibilities– a reductionist deterministic perspective can hinder the recognition of opportunities. For instance, cave art has historically been associated with males, predominantly tied to hunting rituals and individual expression. However, contemporary archaeological and anthropological discourse challenges this gender-specific narrative, sparking lively debates [Conkey, Gero 1997].
Examining cave art without gendered biases and emphasizing exaptation –a concept that highlights the unpredictability and diversity of cognitive processes– opens doors to fresh theories on gender diversity in primitive artistry. Through this lens, art emerges as an essential medium for exploration, especially in tumultuous eras [Melis, Pievani, Lara-Hernandez 2024].
Identifying the gender dynamics behind cave art is intricate, given the sparse evidence and challenges in deducing gender purely from artistic content.
Several researchers advocate for studying handprints to determine gender, focusing on attributes like size or finger proportions [Soffer, Adovasio, Hyland 2000]. However, this technique lacks certainty. A broader sociocultural understanding could offer more discernible insights. Current ethnographic research suggests that the act of artistry transcends gender boundaries [Conkey, Gero 1997], insinuating that prehistoric communities might have held similar artistic values.
Novel archaeological methodologies, including DNA analysis, might cast light on gender dynamics during prehistoric times [Vanhaeren et al. 2006]. Nonetheless, current investigations yield inconclusive results [Lewis-Williams 2002; White 2012].
Exaptation delineates the phenomenon where previously non-functional attributes acquire novel functions, differentiating them from features formed purely by their original evolutionary intentions. In subsequent sections, we will delve into scenarios where artists chiefly harnessed visuals to convey their creative spirit.
Genetic specialist Ewin Birney theorizes that nature's marvels often integrate a mixture of elements –some repetitive, others ostensibly lacking purpose. Yet, such components can culminate in the genesis of even more elaborate constructs. Birney equates the genome to "a jungle inhabited by strange creatures," emphasizing its repetitive motifs, particularly prominent in neural configurations. Such multifaceted patterns, as previously discussed, give rise to avant-garde thought structures that deviate from conventional paradigms.
In this context, the domain of art and drawing exemplifies such progressive thinking. Traditionally perceived as evolutionary residuals or 'spandrels,' the continuous relevance and significance of such art forms have bemused academics for centuries [Melis 2021].

Conclusion

At the nexus of architecture and creativity lies the potent principle of exaptation, an emblem of evolution's unexpected twists and human capacity for innovative repurposing. In agreement with this notion, architectural drawings, when imbued with environmental consciousness, become more than mere representations. They are catalysts, urging us to reimagine the surrounding realities and, more pragmatically, urban spaces and their potential. Our journey across various cultural and temporal drawing landscapes accentuates the transformative might of human ingenuity, beckoning us to reevaluate architectural drawings as instruments to tackle global quandaries.
This evolutionary drive in design mirrors the fluidity of associative thinking –a decentralized, non-fixed mode of cognition– that naturally resonates with the essence of exaptation. This correlation of ideas is evident when we perceive avant-garde architectural forms as spandrels: spaces imbued with potential yet unencumbered by established norms. These conceptual spaces, rich in latent versatility, become pivotal

Fig. 7. Alessandro Melis, GF5, 2013.

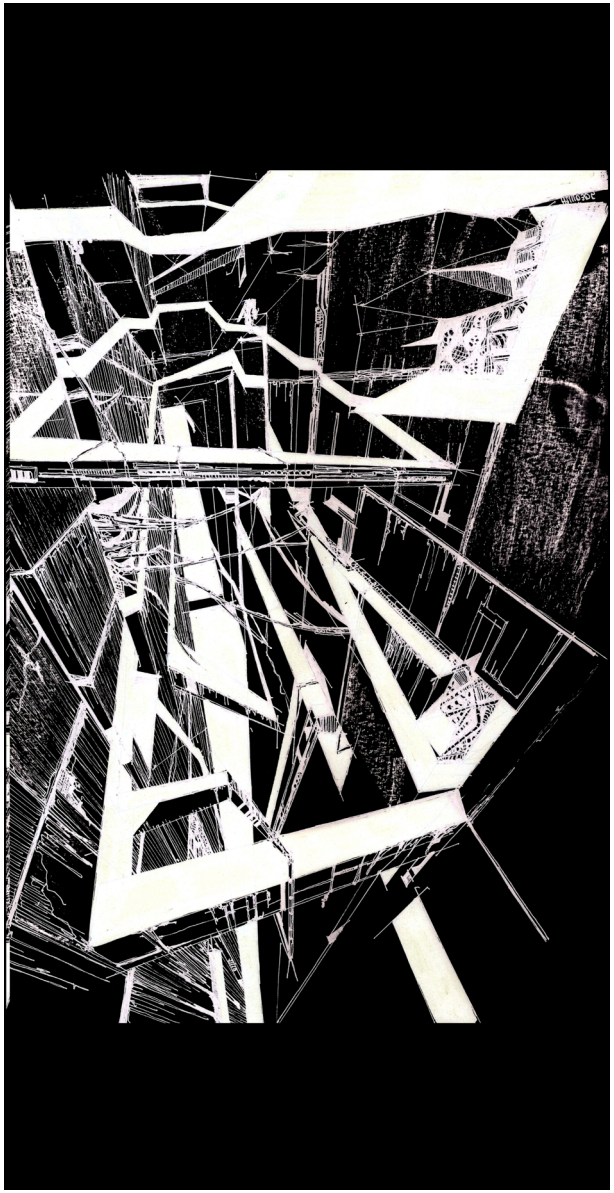


Fig. 8. Alessandro Melis, Rocce, 2010.

when faced with unforeseen challenges, embodying a heterarchical dynamism [Melis, Pievani, Medas 2021].
Venturing into the realms of sociology and urbanism, echoes of associative thinking resonate in Elias Canetti's reflections on the duality of structured chaos [Canetti 2018] and in Richard Sennett's discourse on organic urbanism [Sennett, Sendra 2020]. Canetti's musings serve as a reminder that while order is alluring, it's the structured chaos that provides the freedom to experiment and innovate. Similarly, Sennett's exploration of urban entropy champions the idea that amidst apparent disorder lies a nuanced order, a sentiment echoing the spirit of our times. Modern tools, products of deep insight, equip us to discern and articulate this embedded harmony amidst perceived chaos [Melis, Pievani, Lara-Hernandez 2024].
In essence, our age is defined by its acceptance and celebration of complexity –a world where fluidity, diversity, and boundless possibilities reign supreme. Through the combined lens of exaptation and associative thinking, we stand poised to harness this complexity, reshaping our built environment in consonance with the evolving taxonomies of human experience.

Author

Alessandro Melis, IDC Foundation Chair, New York Tech, amelis@nyit.edu

Reference List

Boden, M. A. (2003). *The Creative Mind: Myths and Mechanisms*. New York: Routledge.

Canetti, E. (2018). *La provincia dell'uomo: Quaderni di appunti 1942-1972*. Milano: Adelphi Edizioni.

Chauvet, J.-M., Brunel Deschamps, E., & Hillaire, C. (1996). *Dawn of art: the Chauvet Cave: the oldest known paintings in the world*. New York: Harry N. Abrams.

Clottes, J., Lewis-Williams, D. (2017). *Cave Art*. London: Thames & Hudson.

Conkey, M., & Gero, J. (1997). Programme to Practice: Gender and Feminism in Archaeology. In *Annual Review of Anthropology*, 26, pp. 411-437.

Gould, S.J., Vrba, E.S. (1982). Exaptation – a missing term in the science of form. In *Paleobiology,* 8.1, pp. 4-15.

Lewis-Williams, D. (2002). *The Mind in the Cave: Consciousness and the Origins of Art*. London: Thames & Hudson.

Melis, A. (2021). Manierismo e decolonizzazione dell'ordine in architettura. In L. Malfona, A. Crudeli (a cura di), *Indagine sul manierismo*. Pisa: Pisa University Press. pp. 129-136.

Melis, A., Pievani, T. (2022). Exaptation as a design strategy for resilient communities. In *Transdisciplinarity*. Cham: Springer International Publishing, pp. 307-327.

Melis, A., Pievani, T., Lara-Hernandez, J.A. (2024). *Architectural Exaptation. When Function Follows Form*. London: Routledge.

Melis, A., Pievani, T., Medas, B. (2021). *Architectural Exaptation. Catalogo del Padiglione Italia "Comunità Resilienti" alla Biennale Architettura 2021*, Vol.1a. Roma: D Editore.

Mithen, S. (1996). *The Prehistory of the Mind: The Cognitive Origins of Art, Religion, and Science*. London: Thames & Hudson.

Pringle, H. (2013). The origins of creativity. In *Scientific American*, 308(3), pp. 36-43.

Sennett, R., Sendra, P. (2020). *Designing disorder: Experiments and disruptions in the city*. London-New York: Verso Books.

Soffer, O., Adovasio, J. M., & Hyland, D. C. (2000). The "Venus" Figurines: Textiles, Basketry, Gender, and Status in the Upper Paleolithic. In *Current Anthropology*, 41(4), pp. 511-537.

Vanhaeren, M. et al. (2006). Middle Paleolithic Shell Beads in Israel and Algeria. In *Science*, 312(5781), pp. 1785-1788.

White, R. (2012). The Women of Chauvet: Comparing Female Figurines from the Paleolithic. In *Current Anthropology*, 53(2), pp. 118-128.

Wilson, E. O. (2017). *The Origins of Creativity*. New York: Liveright Publishing Corporation.