Hand Drawing and Zoomorphic Design. Nature Explored by Representation: a Discontinuous Story

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Abstract

The relationship between hand drawing and zoomorphic design can be traced through a non-linear genealogy, which shows different enquiries of artists, artisans and designers into the natural world. It has been precisely the idea of nature that has led the eye and the hand to seek solutions and answers to design questions from different eras. The common thread that binds these experiences, however, is always dictated by the organic forms of plants and animals, which elude the geometric knowledge of architectural representation as consolidated by Albertian Humanism. Late Florentine Mannerism captured the unpredictability of natural forms, which were being collected by naturalists at the same time, and turned them into playful grand-ducal manufactures. After that, unfortunately, some isolated attempts, such as those by Lequeu, were unable to go beyond a superficial and sculptural evocation of animality. It was with Art Nouveau that Gallé and Guimard could read natural shapes as the most suited forms for the materials and decoration of an era that desired to escape from an exhausted historicism. Carlo Mollino was far more aware of the resources that the animal body can show in its anatomical structure, and he used hand drawing in a surprisingly wide range of manners. All these experiences can finally provide a conceptual background for the challenges of recycling and upcycling design in the face of artificial nature created by man in the Anthropocene era.

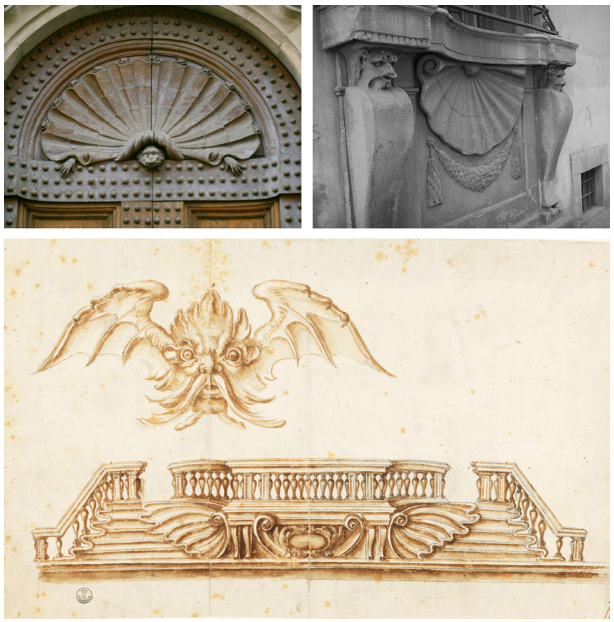
Keywords: Florentine Mannerism, Émile Gallé, Hector Guimard, Carlo Mollino, upcycling design.

Introduction: maker and nature

"I resolve on this, that certain principles, and perfections, and rules of any art or discipline shall be extracted from nature; and if we want to examine and use them, by paying attention, and taking care, we will undoubtedly make very well all what we will undertake" [Alberti in Bartoli 1804, p. 110].
From these words by Alberti, taken from *De Statua* in the famous sixteenth-century translation by Cosimo Bartoli, the confidence of the early Renaissance humanist in nature stands out as, explored with virtue and human intellect, it would not have denied teachings to sculptors and craftsmen to carry out any work. Although it has already been debunked that all the measurements made by Alberti rely on empirical observation [Aiken 1980], Panofsky's assertion [Panofsky 2010, 95] is still acceptable as he claims that Alberti and Leonardo were the first to dare to approach the living body with compass and square. Yet it must be remembered that, for Alberti, art 'does' not imitate nature from a figural point of view, but creates an analogy with the "*eidos*", after having grasped the phenomenology of its entire beauty and unveiled the causal links that regulate its harmonic development" [Panza 1994, p. 145].
Without entering into the philosophical debate on Albertian theories, it can however be stated that the idea of nature as a source of truth and beauty, supported by humanistic reflections, became part of the artists' imagination. This habit of mind ended up fuelling an almost inevitable *topos* in the mythography about the training of young painters,

who responded to an irresistible call of the innate genius through their early drawings of plants and animals [Kris, Kurz 1989]. In the above mentioned essay by Panofsky [Panofsky 2010] the author argues that the history of the representation of the human body is the mirror of the history of styles, but it can also be claimed that other living beings, such as plants and animals, have entered the repertoires of representation, although they have followed less structured paths through considerable temporal leaps.
An in-depth discussion about this issue would go beyond the purpose of the present essay; however, over the course of history, it is possible to touch upon some relevant moments that can shed some light on the complex intertwining of natural world, representation and phytomorphic or zoomorphic design. This kind of inspirations have often been deeply influenced by the configuration of cells and the development of organic tissues, these natural forms have naturally oriented representation towards alternative parameters, if compared to the established canons of architectural design. As it will be shown below, the manual sketch, traced on living bodies and on natural life, suggests different horizons of meaning with respect to the Euclidean control of the form and the perfection of Platonic solids.

Fig. 1. B. Buontalenti (1531-1608): a) Portal of the Casino Mediceo di San Marco (1570-1574), (photo by Sailko); b) Detail of the kneeling window of the Casino Mediceo di San Marco (1570-1574), (photo by Sailko); c) Drawing for the stairway of the church of Santa Trinita (1574), (Gabinetto dei Disegni e delle Stampe degli Uffizi n° 2324 A).



The drawing of mutant and amazing nature

Even at the time of Bartoli, Alberti's complex relationship with nature was replaced by anatomical investigation in artistic practice. If in the fifteenth century painters and architects debated with mathematicians and geometry scholars to study perspectives and representations of solids in space, in the sixteenth century the drawing of the human body rivalled physicists and doctors in investigating, *in corpore vili*, limbs, muscles, bones and viscera of the God's favourite creature, leaving us a corpus of extremely fascinating representations [Carlino, Ciardi, Petrioli Tofani 2009]. Since the second half of the century anatomical studies had been accompanied by the first extensive naturalistic inquiries such as those of Ulisse Aldrovandi, supported by large collections. In this way a knowledge was being formed, which would later be subject to publication in the form of books that were sometimes even unreliable from a scientific point of view, but, in any case, embellished by wonderful illustrations [Olmi, Tongiorgi Tomasi 1993], where the bizarre and the monstrous were not lacking [Aldrovandi 1642 and Caprotti 1980].
Still in the sixteenth century, almost as a consequence, artists began to experience a more fluid, reactive, hybrid relationship with a natural world pervaded not only by divine intelligence but also by magic. Hence, this new face of the universe seemed to be responsive not so much to mathematical investigation as to imagination and combinatorial curiosity. An intriguing clue already appeared in an ambiguous hint by Serlio in his Libro *Extraordinario* with a reference to a hypothetical 'bestial order' [Serlio 1551, porta XXIX]. But it is in the world of late Florentine Mannerism that perhaps the most fascinating forms of drawing can be found when goldsmiths, silversmiths, decorators, jewellers (who could be defined *ante litteram* designers) wanted to follow a completely different *mimesis* from that of Humanism.

Under Francesco I de 'Medici, a lover of alchemy, there was no longer a perfective *mimesis*, which Alberti also relied on, but rather a fluid and transformative emulation in the name of elegance, *sprezzatura* and whimsy. That new sensibility found expression above all in the work of Buontalenti who, in the Casino Mediceo di San Marco, inserted animalistic decorations in the usual sixteenth-century elements (fig. 1a) or reinvented Michelangelo's 'kneeling' window of Palazzo Medici-Riccardi, turning it into a monstrous ornament (fig. 1b). To approach a fascinating and terrifying natural world, compass and square, as Panofsky argued, were of little use; drawings had to be sketched by hand as it clearly emerges from the project for the stairway of S. Trinita (fig. 1c).

In this work, now moved to the church of Santo Stefano al Ponte, clearly Buontalenti also treasured the Laurentian vestibule but the deformation of the winding profiles declares a strong kinship with the rest of his production for the grand-ducal court. Somehow it is an experimentalism that seems even more deeply rooted in the theory of alchemical transmutation than Parmigianino's debated relationship with Hermeticism [Fagiolo Dell'Arco 1970].

In that declining Florentine world, which created his own figurative imagery [Berti 1967], Giambologna was called to make little bronze sculptures of birds with the precision of an ornithologist [Paolucci 1999] and Jacopo Ligozzi drew snakes, lizards, fishes and animals, just arrived from the New World, with almost Flemish details.

The artists, however, also tried their hand at fanciful zoo-phytomorphic experiments, so much so that Ligozzi himself invented disassembled drinking cups, in which the liquid seems to come out of a sort of cluster or perhaps a pumpkin, which, however, can also be assimilated to a tentacle with suckers (fig. 2a). Two jugs, where to mix wine, water and ice, are even more interesting (fig. 2b). Especially in the upper drawing, it seems to recognize almost a corallogenic concretions but also an allusion to the precious shells of exotic molluscs mounted in metal by silversmiths.

Despite the redundant shapes of Baroque, with all its opulence of architecture, furniture, and objects, such experimental interpretations of Mannerism would not be revived by seventeenth century artists, having to respond more to the celebratory needs of religious and state institutions than to potentially destabilizing provocations.

Although Buffon reasserts that "all the ideas that shine in the arts have their models in the productions of nature" [Buffon 1959, p. 25], even the eighteenth-century rationalist classicism confined the imaginative relationship with nature to an eccentric artist like Lequeu. In the case of the visionary French architect, the use of an *animalier* fashion was often limited to ornamentation (fig. 3a), while certain provocative and utopian buildings (fig. 3b) were more similar to inhabited sculptures (ideas already conceived by Giambologna in Pratolino or by Pirro Ligorio in Bomarzo) than to real reinterpretations of animal shapes, so much so that they could only exist in personal drawing sheets [Lequeu 1777-1825].

Fig. 2. J. Ligozzi (1547-1627): a) Drawing for glass (Gabinetto dei Disegni e delle Stampe degli Uffizi n° 97163); b) Design for two jugs to mix water, wine and ice (Gabinetto dei Disegni e delle Stampe degli Uffizi n° 97178).

Fig. 3. J.-J. Lequeu (1757-1826) : a) Porte de sortie du parc des plaisirs, de la chasse du prince [Leque 1777-1825, Figure 175]; b) Lequeu L'étable à vache tournée au midi est sur la fraîche prairie [Leque 1777-1825, Figure 174].

This can be confirmed by the traditional features of many others of his projects, but above all in the attempt to reduce even the representation of the human face to the traditional parameters of descriptive geometry [Lequeu post 1778-1779]. It is not possible to know how much Lequeu's drawings have been seen and disseminated but the fact is that his work has remained almost unknown, as much as that of Charles Ribart and his *éléphant triomphal*, until its rediscovery in the twentieth century [Kauffmann 1952].

Drawing from nature

To have a substantial change in the relationship between natural world and design, it was necessary to await *Art Nouveau*. The foundations of the new floral style were clearly stated by Émile Gallé when he argues that furniture "will have vital lines and specific details deriving from the physiological features of various species of flora and fauna, adapted to each material" [Gallé 2009, p. 84]. On the contrary, the furniture made up to then "are purely geometric laboratory combinations, and not living concepts resulting from the observation of natural organisms" [Gallé 2009, p. 93]. Implicitly, Gallé seems to counter the anthropocentrism of Humanism when he writes that Renaissance wanted to reproduce "the body of an animal that is well known to the public, the Man" also in furniture, claiming instead, for his part, that he would rather choose "in the large collection of living beings the curvature of the hippocampus or the tremors of a neuropteran's wings, as a support for a shelf" [Gallé 2009, p. 99].

Fig. 4. Atelier di Émile Gallé: a) Model for ashtray with snail, 1885; b) Model for a ceramic and glass vase, 1880; c) Model for decoration of a majolica writing desk with shells, 1889; d) Four-sided model for two vases, 1885; e) Model for a vase in the shape of a pitcher, 1882-1884; f) Wase with trout and fly, 1885-1900 (photo by Saiko). 4g. Project of a vase mounted in bronze, 1890 circa.

Furthermore, what is important to Gallé is not only the object of representation but also the connection between material and drawing. Glass and ceramics actually imply the ineffectiveness of the geometric line, which is difficult to reproduce on the object because of viscosity, processing and firing of such materials. But above all, it is the natural form that must be combined with the design of the object it should decorate. Therefore, the image of a snail, replicated along a spiral path, can adapt well to an ashtray (fig. 4a), a flight of butterflies embraces a ceramic and glass vase (fig. 4b) and an arabesque of shells lies on a majolica writing desk (fig. 4c). Furthermore, precisely in consideration of the final effect, Gallé needed to produce the atelier models in colour, which is often a hallmark in his drawings (fig. 4d).

Obviously, a good understanding of three-dimensional geometry was in any case necessary to deal with the unrolling on the plane of a decoration that needed to adhere to a jug (fig. 4e). However, his most fascinating results are those drawings that stand out as real works of art when they can render the final transparency through soft and delicate strokes (fig. 4f). On the other hand, for a different product such as a vase mounted in bronze, ordinary graphite on wove paper can immediately depict the crumpled shape of an orchid or an iris (fig. 4g).

The charm of those representations, however, must not lead us to forget that Gallé did not make personally his own pieces of art, apart from the works of his early years, but he just supervised the execution, leaving them to the hands of skilled craftsmen. Cartoons, sketches and finished drawings must therefore be attributed to an atelier of talented collaborators, designers, ceramists and glassmakers.

And Gallé always advises them: "multiply your sketches, but compare them to the living model" [Gallé 2009, p. 104].
The passion for colour and transparent materials also caught the interest of the greatest architect and interior designer of Art Nouveau France; Hector Guimard. For the decoration of Castel Béranger, Guimard drew a window carefully studied through the insertion of coloured glass pieces (fig. 5a). Thanks to the alternation of opaque and transparent surfaces, the effect suggests to the observer that he find himself inside an aquarium, a form of exhibition of the animal world that had become one of the *fin de siècle* aesthetic models [Harter 2002].
Nevertheless, Guimard achieved his most astonishing result with a study sketch for the lighting system of Paris metro stations (fig. 5b). Here his hand was truly led to follow the magmatic genesis of a living form in its natural development. It is a somewhat mysterious drawing, where biological forces seem to reflect the echoes of a dried stem, the remains of a chrysalis or even the incongruous assemblage of animal bones.
What is certain is that precisely his soft and fluid design, combined with a naturalistic colour of cast iron, was able to make the metal of the *métro* acceptable to a middle class not yet accustomed to the aesthetics of industry (Canac 2014, p. 39).
In the era of Positivism, a special attention was also paid to the scientific representation of natural organisms. *Kunstformen der Natur* (Haeckel 1904), a fairly successful book at time, shows colourful plates, especially featuring marine animals (fig. 6a), including the *Rhopilema Frida* (fig. 6b), captured by Haeckel in 1901. If Gallé, Lalique, Guimard, and Majorelle drew from nature, critically reinterpreting it, the sculptor Constant Roux created chandeliers for the new oceanographic museum of Monaco (fig. 6c) under the fascination of the jellyfish sketched by Haeckel, at the extreme limit of mimetic cast. This is perhaps a one of a kind example, but it marked a threshold beyond which it would be difficult to proceed.

Carlo Mollino, a new approach between dynamics and bodies

Among the Italian architects and designers, perhaps Carlo Mollino is one of the most difficult to label. It is possible, however, to highlight some rather evident formal references that can suggest how his work follows in the wake of those designers and draftsmen who have been shown so far. Some allusions are almost obvious such as in his text *Architettura Arte e Tecnica* [Mollino, Vadacchino 1947] where he compares the logarithmic spiral of the nautilus with the volute of the Ionic capital (fig. 7a). Although the reference to the golden ratio is no longer sustainable [Bartlett 2019], yet this simple pencil drawing testifies to his attraction towards the forms of nature, even at the cost of implicitly countering Gallé's assertion for whom "nature does not know […] the theory of the three architectural orders" [Gallé 2009, p. 112]. Mollino also pays homage to the dy-

Fig. 5. H. Guimard (1867-1942): a) Drawing of a window for Castel Béranger, 1898 (Guimard, H. (1898). Le Castel Béranger, oeuvre de Hector Guimard, planche n° 48. Paris: Librairi e Rouam) ; b) Pencil drawing for Paris metro lantern, 1901 circa (Musée d'Orsay, Inv. GP364, Parigi. Copyright: ©Musée d'Orsay, Parigi, Francia. Foto SCALA, Firenze).

Fig. 6. Discomedusae: a) Plate 8; b) Rhopilema Frida, Plate 88 (from Kunstformen der Natur, 1904); c) Constant Roux, Chandelier of the Oceanographic Museum of Monaco, Salon d'Honneur, 1908 (photo by M. Dagnino, Musée Océanographique; digital reworking M.G. Romanato).

namism of a heron's flight in a sequence almost extracted from Marey's chronophotographic gun, but drawn in pencil (fig. 7b) and, not by chance, he declares himself fascinated by the "flight path" of a bird of prey or by the "functional beauty" [Mollino, Vadacchino 1947, pp. 63, 64] of a feather. Therefore, not surprisingly, in Mollino's drawings it is possible to read a deep interest in space, explored through freehand sketching such as in some preliminary studies of dancers for the project of the Teatro Regio (fig. 7c).
It has long been known, however, that the living body is one of Mollino's sources of inspiration. On this issue, Fulvio and Napoleone Ferrari could show noteworthy comparisons with anthropomorphic and zoomorphic morphologies for many of his projects [Ferrari, Ferrari 2006, pp. 50, 51, 74, 106, 134, 162-165].
Mollino, for example, showed the features of his 1947 armchair for CADMA (fig. 8a) with a drawing in which

Fig. 7. C. Mollino (1905-1973): a) Drawing of shell and volutes of Ionic capital for Architettura. Arte e tecnica, 1947 (ACM Man2 p58 59 f123); b) Disegno per Architettura. Arte e tecnica, 1947 (ACM Man2 p66 67 f147); c) Detail of the Study sketches of dancers for the project of the Teatro Regio, 1965 (ACM P17B 402 023).

the lines seem to recall the shape of a gazelle on the run [Ferrari, Ferrari 2006, p. 126].
Among animal forms, Mollino could actually find stimuli for design with the same joyful vitality of Tuscan Mannerists. Up to now, no one seems to have recognized in the *dormeuse* for the furnishings of Minola house an intriguing resemblance with the profile of a tortoise (fig. 8b), which is clearer in the drawing than in photographs. But, above all, Mollino had a deeper interest in the anatomical and functional structure of animals. In many of his pieces of furniture a biomechanical pattern of combined forces and masses can be noticed and Mollino knew well that topic, having written on it about skiing [Mollino, 1950]. From this point of view, Mollino was profoundly different from his forerunners listed in the first part of this essay. In his eyes, those animals must have appeared as complex machines as his airplanes and cars, so much so that he claims; "Just think of how distant the fuselage of a glider is, in comparison with the heron's rib cage" [Mollino 1941, p. 4].
Thus, in the table for Minola house, it can be supposed that Mollino replicated the tense and punctiform structure of the leg of a locust, accompanying the technical drawing with a hand sketch representing the joints to support the glass tops (fig. 8c), as if they were wings. The designer's aim is therefore to appropriate balancing of masses, shapes, and frames, to be transform them into furnishings. In the 1948 office table for Reale Mutua Assicurazioni, for example, it seems to notice an analogy between the strut and trestle structural model and the anatomy of the opposing limbs of a deer. Therefore skeletal structure became a dominant theme such as in the top supports of his '*vertebrae*' table (fig. 8d), and it was replicated, not by chance, several times. The most fascinating version is perhaps the furnishings of the exhibition for the museums of the United States in 1950, where Mollino could compose almost a whale skeleton with the ribs supporting the crystal.
Yet Mollino also considered drawing a direct expression of his concepts. Having to create the movie scenography for *Femmes d'Escales* in 1945, he managed to synthesize the path of a flight of stairs with a single snake-like stroke of Indian ink on paper in an almost calligraphic style (fig. 9a). In the same way, the reconstruction of the Teatro Regio was outlined through few thick strokes to sketch out the idea of a shell-like roof supported by ribs, so much resembling a mollusc valve (fig. 9b).
His vibrant and personal mark appears almost like a signature even in small landscape sketches that try to enclose

the design idea between background and foreground. This is the case of the small drawing, almost an idyll, for the project of the Equestrian Center in Rome (fig. 9c). On the contrary, dirty strokes serve to reduce the artificial hardness that modernist architecture has always destined for banisters. Thus in the Lutrario ballroom the balustrade (fig. 9d) seems to support vine or wisteria shoots with a broken rhythm.

Yet, an essential fact in Mollino's biography should not be forgotten, and that is his clear awareness of Surrealism. Suffice to say that, in the 1930s, he was one of the few Italian architects who owned the entire collection of Minotaure [Ferrari, Ferrari 2006, p. 34].

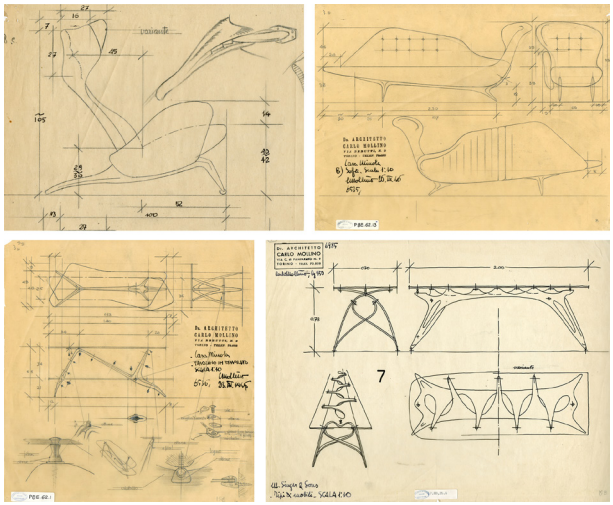
That allows us to explore, with more awareness, the relationship between photography, drawing and furniture of one of his most intriguing works; *Bedroom for a farmhouse in a paddy field*, designed for *Domus* magazine [1943]. Although it is a project from the 1940s, through a comparative analysis of images, it is possible to go back to a probable formal reference of 1935. That is the photograph *The enchanted room* (fig. 10a) staged by Mollino in the studio of Pietro Martina and rightly correlated by Federica Rovati with the cultural surrealist environment of Turin in the 1930s as well as with the previous interior arrangements of Miller and Devalle houses [Rovati 2006, pp. 66-74]. However, it is curious to note how some elements seem to be reinterpreted later in a preparatory sketch (fig. 10b) precisely for the 1943 publication. Certainly, about this project, ideal analogies with Albini's Room for a man at the VI Triennale of 1936 must be recognized [Irace 2006, p. 86], but the study sketch leads us to hypothesize a sort of morphogenesis of its composition and relate it to the 1935 shot.

Through the pencil drawing, it may be inferred that, in this sketch, the curtains reproduce the heavy curvature and consistency of the 1935 photograph and assume the angularity and thinness of mosquito nets only later in the project of 1943 (fig. 10c). Similarly, proceeding backwards, the mirror with the self-portrait of the final version can be traced back first to the picture of the sketch, in which a woman's gaze is reflected, and then to the framed canvas placed more in depth in the 1935 photograph. Starting again from this shot, it can be noticed how the oval mirror, which reflects a part of Mollino's body, leaves its function of evoking a wider space to the trapezoidal frame of the two following versions. It is also evident that the vertical black mark, strongly emphasized in the drawing as a central axis, mimes the table where a shell (not surprisingly a zoomorphic reference) and a vase are; and then disappears later in the final version. It can then be observed that the female legs in the sketch, placed more laterally than in the final solution, seem to be the evolution of the decorated sheet of paper in the photograph. Furthermore, the large unframed canvas on the left of the 1935 shot first leaves a thick pencil stroke in the intermediate phase and then is totally eliminated.

Therefore, focusing on the hand sketch, it can legitimately be argued that this is an intermediate stage between the final project and the photograph, even perhaps only at the level of an unconscious surrealism.

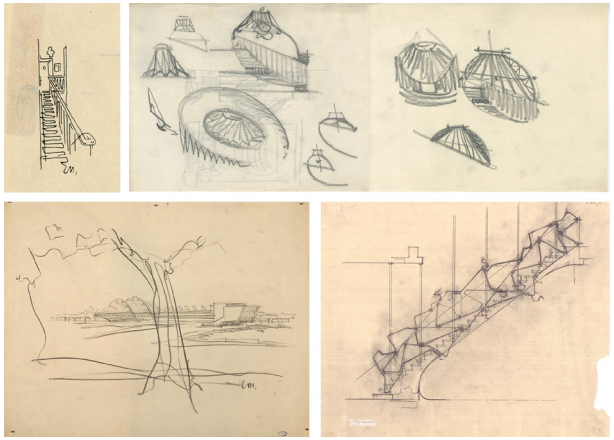
Again in the hand drawing, it is interesting to note, even more than in the final version [Forino 2001, p. 51] how an observer can feel the strange sensation of being in a cocoon, or still inside an aquarium, wrapped in falling soft drapes and no longer in the glass inlays of Guimard. And perhaps this claim is not so far from the truth when the colourful and fluid environment of Lutrario ballroom is taken into account, as it is in some way similar to the interiors of the Atelier Elvira by Endell, the so-called *Polypenrokoko* building.

Fig. 8. C. Mollino (1905-1973): a) Armchair for CADMA, 1947 (ACM P8F 69 17); b) Dormeuse for Minola house, 1944-1946 (ACM P8E 62 13); c) Small table for Minola house, 1944-1946 (ACM P8E 62 001); d) Vertebrae table for Lattes publishing houses, 1950 (ACM P8B 35 6).



Finally, in Mollino it is surprising how the strokes bundles in the sketches for the house of a sculptor in Aci Trezza of 1944 (fig. 10d) contrast with the extreme sharpness of his presentation drawings for other creations such as his *House on the hill*. For this project Mollino relied on an eclecticism that must be interpreted "in the sense of synthesis and original rethinking" [Mollino 1944, p. 8] and elaborated a building, composing a *domus* and a basilica. Yet in the highly controlled perspective view of the living room, regularly marked by vertical and horizontal grids (fig. 12e), the recovery of the seventeenth-century decoration stands out as well.
It is actually the image of an architectural *quadratura* which should have been projected in the evening onto a parabolic vault working as a Baroque 'light chamber' during the day. In this case the design of the physical space and the interchangeable image (we would call it light design today) have the same presence. After all, already in the letter accompanying his project of the *House on the hill* for *Domus* in 1942, Mollino writes that he feels at ease in an environment that is "as neutral as I could wish for: it does not disturb me, it does not rouse me to mistakes, but it leaves me free to be alone with my fantasy, let's call it my inner landscape" [Irace 2006, p. 82]. In other words, an environment that is natural, yet made of study, drawings, designs.

Fig. 9. C. Mollino (1905-1973): a) Scenography for Femmes d'Escales, 1945 (ACM P9B 86 027); b) Sketches for the roof of the Teatro Regio, 1965 (ACM PdV 42 3 (8), ACM PdV 42 3 (10)); c). Project sketch for the Equestrian Center in Rome, 1938 (ACM P1 1A 140 242); d) Drawing for the Lutrario ballroom, 1959 (ACM P9A 30 31).



Conclusions: towards a design without drawing

The fluctuating relationship between design-oriented drawing and zoomorphisms often shows results of great worth, but it assumes necessarily discontinuous outlines. However, it is possible to recognize a common thread linked to the manual drawing as the best way of grasping a universe of organic shapes which, by their nature, escape the geometric rules of exact quantitative measurement. But what can be the sense of nature that today's design must be able to find in all that? The current era is probably the most mature stage of the Anthropocene [Lewis, Maslin 2020] in which man has covered the earth with his own waste products. However, it would be defeatist to delegate the mere function of dating a future geological stratum to all that material. If the products of industry and design are today's landscape, it can be argued that this is the nature in which human beings live by now. It is a heritage created by the man himself but it is not seen as a resource yet. Since the 2000s, design has been oriented towards an approach that includes sustainability, reuse of products and low environmental footprint. The natural outcome of this trend is the need for 'recycling', but even better for 'upcycling', [Sacchi 2021, Pulvirenti 2009], which is a limited re-working of an object, at the end of its useful life, to be integrated into a new product.
A chapter on this issue and its contemporary evolution would require a further essay. However, some examples can be given to illustrate a concept that is still unfamiliar to the general public. An old suitcase with straps, for example, once placed vertically and attached to the wall, can easily become a small cabinet. After pedals and handlebars are locked, a bicycle can hold up a washbasin, towels or a laundry basket, making an equipped bathroom wall less anonymous. Old cutlery can be used to hang kitchen towels, if they are simply crooked and nailed to the wall.
In this sense it is also conceivable that design can be finally rescued from market forces and left to the imagination of individuals who can, therefore, experience a satisfactory emancipation from industrial technology and the logic of consumption.
Exhibitions have now brought to light how, in front of the challenge of global capitalism, an increasing number of people in developing countries have long since faced the problem of searching for basic resources and have been forced to make the transformation of discarded materials into a real necessity [Irace 2013].

That lesson can also be introduced into advanced countries only if design can manage to take a further conceptual step and assume the responsibility of the ecological approach. This means welcoming the suggestions from the plant or animal kingdom, so that the natural world is no longer dominated and exploited but only symbiotically lived. These phytomorphic and zoomorphic references, as it has been seen so far, have taken shape several times in the history of art and can still offer a wide range of possibilities to designers.
Trivial fragments of broken ceramics, for example, rearranged to create multicoloured paving like on a Mannerist shelly beach, would have delighted Buontalenti in his Boboli caves.
Old empty bottles, reused as luminescent bodies like jellyfishes and abyssal creatures, can easily respond to the ambitions of positivist sculpture, without replicating its banal mimetic matrix.
Damaged safety glass, with its cracks following the trajectories of internal forces, does not appear very different from insect wings with their nervures, which perhaps Gallé or even Mollino would have liked, and, once properly sealed, could be reused as a worktop.
From this point of view, the challenge to representation is perhaps equally hard. The message that can be suggested is that the rigorous norms of technical drawing based on descriptive geometry turn out to be redundant or can diminish their meaning in front of upcycling design. More precisely, the issue of upcycling design concerns the resemantization of objects, but working first of all with the disarticulation and recombination of bodies through the topological concepts of continuity, connection and convergence.
In this sense, an encouragement can come from a movement, often misunderstood in its deep reasons, that wanted to see nature no longer as a mere source of metaphors but as a fertile ground for avant-garde art experiments; and that is Arte Povera. Germano Celant, the critic who coined the term itself and was able to encompass various trends of the sixties within it, has recognized its tendency "to reduce the image to the pre-iconographic stage, a hymn to the banal and primary element" from which "a physicalisation of an idea, an idea translated into 'matter', derives" [Corbi 1969, p. 27].
It is undeniable therefore that, for upcycling design, the request to compose artefacts with recycled objects compels makers to consider these elements as ready-mades, which do not need specific projects, ruled by executive drawings, but rather a functional reformulation through hypotheses for assembly and reinvention still to be defined.

Acknowledgments and image credits

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Fig. 10. C. Mollino (1905-1973): a) The enchanted room, 1935 (ACM 4 19 003); b) Sketch for Bedroom for a farmhouse in a paddy field, 1943 (ACM P9C 92 023); c) Project for Bedroom for a farmhouse in a paddy field, 1943 (ACM P9C 92 35); d) Sketches for Mastrojanni house in Aci Trezza, 1944 (ACM P11C 149 004 e ACM P11C 149 014); e) Sketches for Mastrojanni house in Aci Trezza, 1944 (ACM P11C 148 2).

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