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Victor Horta: The Maison Tassel, The Sources of its Development

In architecture, Art Nouveau initiated a major change in structural thinking, despite its relatively brief and uncertain life. It lasted for some 20 years, or even less in some Western European countries. Once all the rage, it came to be abandoned by its enthusiastic adherents as the wild oats of youth. Its numerous architectural exponents sought to express the same inspiring motivation which characterized the applied arts. The correspondingly sinuous linearity; the biomorphic qualities; the semi-naturalistic, semi-abstract elements — both structural and decorative; all were present in its varied examples. Moreover, one had the floral reference to the total forms of plants. The leaves; the stalks; the roots; the blossoms; these formed the epitome of the constant organic expression which was the order of the day.

The strong desire to break with the past was, perhaps, the most common bond linking the craftsmen, artists, and architects who sought their creative expression in Art Nouveau. This was the case in all countries where the style appeared. To the avant-garde mind, it provided a captivating contrast to the traditional, static, 19th century art forms. Both in its content and form, Art Nouveau was insistent on an art of growth. The subsequent architectural focus seeks to illuminate the work of one of its most significant innovators, Victor Horta. In almost any comprehensive study of the Fin de Siècle phenomenon known as Art Nouveau, the appearance of this name is inevitable. Nearly all accounts hold some mention of the man whose creative efforts were to culminate in the first definitive manifestation of a significant episode in modern architectural development. Invariably, descriptions of the *Maison Tassel* figure prominently among their contents. The product of a more personalized form of expression, the house represents the first time Horta came into his own as an architect. It evoked the spirit of a generation obsessed with change, novelty and progress. At the same time, it designated the beginning of a period which would lead to world fame for the Belgian architect who engendered it. Upon completion, the project was heralded as the first declaration of a victorious modern movement; the first truly modernist work. It was revered as if it were some shrine or holy relic. Subsequently, architects and designers from all corners of Europe came to Brussels so as to understand the scope of what this house represented.

The *Maison Tassel* stood in a row of rather conventional city residences. It would have appeared, and still does, as a somewhat modest structure, conforming to the same conditions which characterized most Flemish urban dwellings. It was similar to its neighbours in that it too was long and very narrow, the facade stretching a mere 23 feet across. Yet, despite these restrictions, the house was recognized to embody the first daring departure from the norms of European

architecture of the day. Well before any sign of a new direction in architectural design, Horta's building programme punctuated the turning point for treatment of the private home. "This house roused Continental architecture from its lethargy at one blow."[1] Consequently, from the day of its completion until the present, it has given rise to a variety of glowing reports delineating the extent of its innovations, and its impact.

The essence of Horta's entire Art Nouveau oeuvre is embodied within this dwelling. The choice and "marriage" of materials; the floorplan; the facade; all serve as an introduction to the fundamental tenets of his conception. Thus, in examining the building, one also comes to appreciate the numerous factors which shaped both the man's evolution and his subsequent attempts to instigate a distinctive architectural approach to the exigencies of his time.

The plans were conceived in 1892-93, and construction began in September, 1893. Completion was in 1894. It is unknown how long before these dates Horta could have been designing as such on paper. The site: 12 rue de Turin. Presently, it is identified as number 6, rue Paul-Emile Janson. With this work, the "ligne Horta", the whiplash line, was introduced into architecture. It was born to decorate the home of Monsieur Tassel,[2] — engineer, bachelor, freemason, professor of descriptive geometry at the University of Brussels, attaché to the Bureau of Studies at the Société Solvay.

The most often noticed feature of the house, the frank exposure of metal structure, is especially noticeable in the staircase (fig. 1), which rises to the right of an octagonal vestibule (fig. 2). At its foot stands a cast iron column, creating a penetrating first impression. As its gracefully slender form climbs toward the ceiling, it grows into a vase-shaped capital. Out of this, curved iron tendrils spring forth to form brackets under the curved open work beams of iron above. Their forms are partly plant-like, partly arbitrary. With this, the classical scheme of the column is dissolved, replaced by a multiplicity of free moving supports in space. Subsequently, the floral conception of form which permeates the building is conclusively established. What ensues is seduction. Passionate and yet gentle, an organic swaying and interweaving entices the senses into a delicately intoxicating structural metaphor. Lighter, non-structural bands of metal interlace to form the stair rail. Sinuous painted vines caress the walls and ceiling. Swirling curvilinear mosaics rouse the floor. One yields to the linear embrace of complex organic motifs.[3] Horta created an exemplary hall, unsurpassed by imitators, and to an extent, even by the architect himself. He transcended the mere decorative, going on to produce an extraordinary work of interior architecture.

The description of the staircase underscores the excitingly novel exposure of metal structural supports both inside and out. In the interior, an equally unexpected introduction of iron occurs in the drawing room. Here, Horta outrightly challenged the long standing tradition which maintains a notion of this room as the most formal and therefore conservative area of the house. One can only imagine the impact, both positive and negative, which the appearance of an I-section support would have caused. It is carried across the ceiling without any attempt at disguise. At the same time, the use of iron in the facade is just as distinctive. With its appearance, Horta adapted to an elegant townhouse features

which otherwise would readily bring to mind industrial associations. Found in grilles, slender window ledges, and horizontal support beams, the iron embodies an interesting play on the accepted assumptions which governed residential construction.

It has been said that the facade of the *Maison Tassel* is less striking than the interiors. In fact, if it were not for its ornamental detail, it would not be particularly unusual. Nonetheless, the same linear curves of such internal/decorative elements as the stair ensemble are plastically reflected in its contours. The building's stone facing seems to be imbued with an unprecedented flexibility, as it is impress-ively adorned with a subtle fashioning of profile. An alternation of concave and convex is the result. With the interplay of light and shadow inherent in this, the architect shows complete mastery of the work's plastic physiognomy. Flanking the centrally located door,[4] two large, organically inspired volutes appear to spring forth from the body of the wall. Although non-structural, the quiet strength of their elegant curve seems to carry the weight of the gently bowing window loggia, perfectly inscribed within the structure of the building. It is the first time the loggia forms an integral part of the edifice. No longer a mere projection, an appendage grafted onto the surface of the building, it contrasts engagingly with the customary Brussels bay windows, seen in profusion among the neighbouring homes. The loggia rises 1½ stories within the elevation of the facade. On either side, a line of thin windows is placed. They continue to the top floor where they are reduced to mere slits within the preponderance of stonework, thus bringing to mind the narrow medieval openings of Gothic castles. The first storey of the bay is given over to the lighting of the mezzanine. Stocky stone pillars sculpted with a vaguely Gothic, vaguely neo-Rococo flavour, rhythmically punctuate the area to form six windows. On top, one has the main floor, where slender metal columnettes correspond to the supportive pillars below. These too act to divide the window space, this time into a series of long, seemingly upward moving compartments. A flowing display of Art Nouveau grille work around their bases, acts to alleviate the general tone of austerity in the facade. Proceeding to the uppermost storey, one finds that the architect has made use of the projection of the bay so as to create a curving balcony. The verticals of its railing terminate the ascendant spring of the iron columnettes below. In between, volutes of forged iron provide further hints of soft ornamentation for the edifice. With the suppleness of their modelling, Horta creates another paradox to challenge the accepted ideas concerning materials, their forms, and their uses. A similar concept is embodied in the pair of gliding stone volutes animating the facade on either side of the railing's end. Finally, one reaches the cornice, visually carried there by the gracile stone uprights which flank the french doors to the centre of the balcony. As its silhouette angles down over the windows, one notes the low key sobriety of the decorative mouldings. A studied harmony is created between the relative asceticism of the stone and the exuberance of the iron. Consequently, the understated character of the stone speaks of logic and simplicity, while the plasticity of the iron celebrates life and growth.

It is impossible to overlook the obvious references to Classical architectural vocabulary which the architect chose to employ. One turns to the large volutes framing the door. Seemingly the source of support for

the projection above, they are in fact not at all weight-bearing. The entire organization of the window loggia is conceived as an integral part of an iron infrastructure which underscores the totality of the facade. In the case of the window complex, certain parts of this infrastructure are accordingly allowed to show through and be treated ornamentally. It would appear that the volutes were a conscious and perhaps necessary concession to traditional Western mentality. Even today one finds it difficult to acknowledge an apparent notion of weight without adequate visible support. Another concession along these lines is a series of small corbels directly underneath the loggia. They too seem to denote a similarly supportive allusion. Moreover, despite their organic inspiration, it seems Horta was unwilling to wholly abandon the security of the classical references they hold. Such is also the case with the columnettes leading to the cornice. As they are topped by a vegetatively conceived capital, one recognizes the elements of invention entirely distinctive to Horta's oeuvre. However, one questions how much of a change in thought was really entailed in producing what can be seen as an organic variation in classical format. Even so, if one were to eliminate the classical point of reference, one would still perceive suggestions of the Flamboyant Gothic and Rococo styles. All this goes to emphasize the fact that for all the innovative features within the facade, Horta toed a fine line between tradition and conceptual novelty. Whether this was by choice or out of necessity for public acceptance, may perhaps never be sufficiently answered. However, the mention of these details is not to undermine the impact of the *Maison Tassel*. Indeed, the acclaim to which it gave rise was immense.

As one turns back to the interior, one begins to perceive the "music" of the decor as a deliberate response to the sobriety of the facade. Throughout, there is ample expression of a new style as the "ligne Horta" is deployed with a mad ebullience. Our description of the stairhall has given only a hint of how its frenzied, whipping forms dominate over floors, walls, ceilings, and chandeliers. It lashes everywhere, coiling, intertwining, loosening. It is as flexible as a creeping plant, yet a plant kept in check by the mastery of the architect. This was the line which embodied the ambiance of an era. Horta subordinated all materials to the ornamental presentation which it embraced. Iron, stone, glass, wood, mosaics, all conform to the interlaced linear rhythm which takes possession of the house. It is a linear fantasy. By its very profusion and the generous dimension and scale of its exponents, the architect's use of line immediately raised interior decoration to a more significant level.

The first to initiate what later became *de rigueur* among the great Art Nouveau architects, Horta designed all elements of the interior down to the slightest detail. Tables, chairs, sofas, linen, cutlery, lights, door fixtures, etc., became a total masterpiece. A perfectly articulated conception, entirely yielding to the overriding influence of the *ligne Horta*, was created.[5] In retrospect, it may be said that Horta incarnated an architectural parallel to Richard Wagner's postulate of the *Gesamtkunstwerk*.[6]

Horta's curves and arabesques represented a novel motivation to the turn of the century architectural idiom. Important to the creation of its remarkable style, they comprised its fundamental theme and thus its most clearly visible expression. Perhaps, within the *Maison Tassel* or elsewhere, one could at times say

that the result of their use submerged the organs which were meant to contain them. Surpassing structural considerations, they nearly became ends in themselves. If so, it would therefore appear that they ascribed to another late 19th century aphorism, "l'art pour l'art". However, first and foremost they represented the feelings of their author. Perhaps, then, their occasional excesses can be illuminated with the following quotation. Said Horta:

> If it is correct that logic is the basis of a creator's slightest reasoning, I believe that it must not be allowed to interfere with one's "charm", that delicate, superfluous entity which often adds to harsh necessity.[7]

It was precisely so as to overshadow that rude necessity which seemed to be so persistently encroaching in a world constantly preoccupied with a quest for logic, that Horta created a refuge in that "delicate superfluity" which characterized his Art Nouveau creations.

Yet the varied manifestations of the "ligne Horta" could not have been the only elements to constitute the architectural revolution which transpired. Beyond this factor, and the previously discussed exposure of, and therefore truth to, modern materials, what is an especially important legacy of the *Maison Tassel* is the flexibility of its groundplan. As mentioned, the house, like its neighbours, was bound by conditions which imposed a long and very narrow construction, only 23 feet (7.20m) in width. Nonetheless, the groundplan developed within these predetermined restraints was entirely original. It represented an audacious break from the conventional organizational layout of a house. According to habit and tradition, a Brussels townhome focused on a main floor consisting of three small rooms in a row, opening off a long corridor. To the other side, a staircase would lead up to the next level. (see diagrams 1 and 2) At the planning level of Horta's house, one notes the beginning of what Le Corbusier was later to call "le plan libre". Instead of the long corridor running down one side of the house, he substituted the aforementioned octagonal vestibule. Continuing from it is the ample and pre-eminent staircase. As one ascends its different levels, one finds a corresponding disposition of rooms, which consequently create a multilevel space. The resulting variations in floor heights are coupled with a free use of penetrations through walls, which maintain an independence from traditional methods of room partition. Together, these elements succeed in creating an impression of great spaciousness and openness. The impression is further extended by way of the integral contrast between the relatively narrow facade and the unexpected, surprising feeling of space upon entering through the front door. Ultimately, the flowing interrelation of spaces for which Horta has become famous is evoked. Thus, it is interesting to note that the subsequent quality of spatial "movement" within the house is very strongly underscored with the Art Nouveau decoration to which the "ligne Horta" has lent its form.

What is particularly important with regard to this view toward space, is that it too was part of the continuous protest against the prevailing architectural traditions of the time. In its implementation, Horta presented a salient response to the accepted Euclidian attitude governing space. He conclusively rejected a belief widely expounded during his own period, and one which even today remains predominant, namely the classical idea of space based on the pure three-dimensional mathematics of Euclid. Generally, this reasoning leads to the

construction of closed, symmetrically oriented spaces which have to be experienced from the single central perspective. This, by its very nature, can only be noticed and observed by a single individual. Horta sought to move away from this exclusivity. He pushed aside the entire notion of space geared to a specific personage; did away with the ego-centric observer of central perspective. To illustrate, one may take the Renaissance architecture of Brunelleschi as an example. In his well documented *Church of San Lorenzo*, in Florence, the key concept to appreciation is that of one-point perspective. One stands at one particular spot in relation to the architecture, in this case, perhaps, at the beginning of the nave, so as to perceive the exact issue of the building. At any one time, only one person can stand at that certain spot. Therefore, the full effect of the architecture can only be dependent on a single individual. In essence, one is presented with the major problem of the Renaissance itself. The emphasis falls on the response of one individual in view of a given situation, architectural or otherwise. Largely, this attitude has been maintained ever since. By contrast, a brief look at the concept embodied in Gothic architecture. Most often, the structure was built so that one is drawn to wander through it. Basically, this architecture was geared to evoking a response from groups of people, collective society, as opposed to a single person. With the introduction of the "plan libre" into domestic architecture, Horta moved to a more pre-Renaissance attitude in his treatment of space. The architect once said that the whole extent of the ground floor is visible from the entry of the typical Brussels house.[8] With the reaction presented in the *Maison Tassel*, this was no longer possible. Horta instituted a dynamic, plastic treatment of internal structure. The subsequent asymmetry in the distribution of spatial masses, as well as in minor details such as window and door settings, created a gliding, rhythmical experience of the various parts of the structure linked organically together. Undoubtedly, this phenomenon was closely associated with the contemporary passion for the Middle Ages.

The difference in levels was not the only device employed to give new flexibility to the groundplan. The introduction of light wells provided new and unusual sources of illumination. By their very magnitude and profusion, they could only increase the effect of size and airiness among the surprising interrelations of rooms at different levels.[9] Moreover, the choice to give half the floorspace over to the Jardin d'Hiver was especially intriguing. Its construction of glass and exposed metal framework continued the analogy of unencompassing space, and at the same time acted to give a definitive evocation of the floral conception which distinguishes the house.

It is especially amazing that Horta could achieve such impressions, and make them work successfully, within an area so confined. Soon after its completion the *Maison Tassel* became famous in all European avant garde circles. Contemporary opinion admired it for two things: its perfect adjustment to the living and entertainment needs of its bachelor owner, and its freedom from any trace of historical styles. Yet it was this last point which initially caused an uproar among the conservative bourgeoisie in Brussels.

> A Bruxelles, on cria au scandale, et à la vue de l'Hôtel Tassel on prétend que Balat, le vieux maître, éclata en sanglots. Un an plus tard, décorateurs et architectes accouraient de tous les coins de l'Europe, attirés par les

réalisations de Horta.[10]

The Balat mentioned in the preceeding quotation was Alphonse Balat (1818-1895), official architect to Belgian King Leopold II, and the most important teacher of Horta. The influence he exerted on his pupil was immense. Whether or not the fact that he burst into tears upon sight of the *Maison Tassel* is actually true, it has since become a popular anecdote. The house represented a definitive break with the romantic, psychological comfort of eclectic 19th century nostalgia. That Horta would apparently swallow up and suppress all the architectural grammar of so many past centuries, only to invent his own, was an unbearable affront. Even in his own day, Balat was recognized as the master and champion of historicism. Thus, his reaction in such a way to the shock posed by this house must have been a source of smug satisfaction for the opponents of this late 19th century architectural practice.

The second part of the quotation speaks of the interest the house drew one year later. Of course, this is quite true. But even so, hardly completed, the brilliant edifice found immediate vogue as a novelty in Brussels. While it raised the scorn of the old, it also brought to life an infatuation in all young people, just as the *Maison Autrique* did in 1893, the *Hôtel Wissinger* in 1894, and the exquisitely opulent *Hôtel Solvay* in 1895. All were conceived, and construction had begun, before Henri van de Velde had even erected his first house,[11] and before Samuel Bing had opened his famous boutique in Paris under the sign of "l'Art Nouveau".[12] Architects from France (Hector Guimard being one of the first), Germany and England, critics and connoisseurs, expressly travelled to Brussels to note and absorb the lessons found in Horta's *Maison Tassel* and his other subsequent examples. Thus, it is interesting to note such contemporary accounts as that of Guimard. While preparing an exhibition which was to have been held at the Champ de Mars in Paris, in March in 1896, the architect wrote to Horta:

> ... Plus je vois se multiplier tant chez nous les expositions des tentatives nouvelles des arts de l'architecte, plus je tiens à montrer vos oeuvres qui sont les plus intéressantes et les plus dignes d'être encouragées. Ce ne sont pas des compliments que je veux faire mais vous rendre justice.[13]

This was from a letter dated January 28, 1896. Later, on May 8, 1896, Guimard writes once again to Horta:

> ... J'ai exposé cette année au salon le résultat de mes recherches à l'étranger et comme j'ai été si heureux de vous le dire c'est en vous que j'ai rencontré l'architecte véritable digne de ce nom et j'ai tenu à faire d'après les gravures que vous m'avez adressées la représentation de votre maison de la rue de Turin, la façade et les deux intérieurs vus de l'escalier...
>
> A côté des architectures voisines votre place au centre de mon panneau est l'expression de la supériorité de votre talent sur celui des autres; tous les architectes auxquels j'ai pu montrer votre oeuvre (ce qui m'a procuré le plaisir de leur dire que vous étiez le seul ARCHITECTE que je connaisse) rendent hommage à votre talent. Je ne vous fais pas des compliments (pour) que vous jouissiez des résultats acquis, mais pour que vous y puisiez dans les moments pénibles un encouragement et que vous sachiez que le temps vous rendra la justice qu'il m'est si agréable de vous rendre de suite.[14]

The infatuation spread quickly. In very little time, its effects came to be felt throughout Europe — from Paris to Moscow, from *Castel Beranger* to *Haus der Woks*. Such was the power of the economy of the Bourgeois

Golden Age, to which it was a response.

As the style engendered with the *Maison Tassel* won more and more adherents, it became the last word in modernity. To have it was to have status. The subsequent patronage of the wealthy middle classes permitted its rapid diffusion throughout the continent, and nourished the strong undercurrent of luxury which characterized its principal residences. Thus, it followed a pattern which was very similar to the phenomenon experienced in the Renaissance construction and beautification of urban palaces. One final excerpt attesting to the esteem in which Horta and his work came to be held is taken from *Wiener Tageblatt*, November 11, 1898. The Austrian critic Ludwig Hevesi writes:

> There lives in Brussels now, in 1898, the most inspired of the modern architects, Victor Horta ... His fame is exactly six years old and dates from the residence of M. Tassel in the rue de Turin. This is the first of these famous dwellings which fit their owners like faultlessly cut coats. It houses the man for whom it was built in the most perfect manner conceivable — as perfectly as the mussel shell houses the mussel. It is most simple and logical ... altogether new and just as delightful. But — and note this — there is not the faintest echo of any historical styles ... No detail derives from anything at all in existence. It has the pure charm of lines, curves, and surfaces — and it is quite personal, as personal as if Horta, instead of simply drawing the parts, handed them to the workmen all modelled in advance.[15]

Let us turn to the immediate cultural and historical background in which this first Art Nouveau edifice was conceived. A variety of prominent forces appear to have been influential in both shaping the phenomenon and propagating its achievements. Among these, the general atmosphere within the Belgian capital itself must be considered important, since it established the first Continental acceptance of a new movement. One thus comes to speak of Fin de Siècle Brussels: a mecca of interchanging ideas; a centre for social emancipation; the threshold of a living modern art. A city of luxury, it was reorganized in terms of civic planning and urban symbols by Leopold II.[16] A financial centre, it was supported by a shrewd political policy of colonialism. An Anarchist stronghold, it spearheaded the movement which gave a political voice to the blue-collar work force (1886), and which culminated in universal suffrage in 1893. The city was open to the most advanced forms of art, action, and thought. Bolstered by a vast national manufacturing and commercial enterprise, Leopold could loftily affirm:

> We must endeavour to assure outlets to all workers: those of the mind, those of capital, those of the hand.[17]

In the arts, lawyer Octave Maus was the leader of a vigorous avant-garde movement. Opposite *Jeune Belgique* of Max Waller, in 1881, he founded the revue titled *l'Art Moderne*, an event which underscored a pan-European experience at the time. Throughout the continent, there was an incredible upsurge in the publishing of periodicals. Ultimately they came to voice the opinions of youth and progress, becoming essential to the diffusion of the "Modern Style". Meanwhile, Maus also successively brought to life the *Groupe des XX* (1883-1893), and *La Libre Esthétique* (1894-1914), whose exhibitions, concerts, and conferences nourished a movement which was respons-ible for the initiation of old Europe into the latest tendencies of the modern arts. A multiformity of artists grouped together under its banners.

Thus, welcomed and often discovered before being known in their own countries were the likes of Rodin, Whistler and Max Liebermann

(1884); Renoir, Monet and Odilon Redon (1886); Seurat, Pissarro and Berthe Morisot (1887); Toulouse-Lautrec and Signac (1888); Gauguin (1889); Cézanne and van Gogh (1890); Walter Crane and Larsson, Filiger and Chéret (1891). Imported from France, the doctrines of Symbolism impregnated literature, painting and sculpture before continuing on to architecture and the applied arts. Meanwhile, carried by Odilon Redon, Gauguin and the Nabis, nurtured by Toulouse-Lautrec, and sustained by an undercurrent of Japanese orientalism, the *arabesque* came to frame a light discourse of forms, which sought to transpose "nature into the realm of intelligence and imagination."[18] Its swaying movement broke all notion of classical art. Its consequences were to touch such painters as Fernand Khnopff (1881), Jan Toorop (toward 1890), Xavier Mellery, and Félicien Rops. Sculptor Georges Minne was also affected (1886). In 1890 the *Salon des XX* saw the juxtaposition of two tendencies: one directly inspired by nature as in the work of Sisley, Toulouse-Lautrec, Finch and van Rysselberghe; the other illustrated by Odilon Redon, Toorop and Khnopff, which, notes Madeleine Octave-Maus, aimed at a translation of emotions, dreams and literary reminiscences into the language of the plastic arts.[19]

A number of other significant phenomena also serve to characterize this scene. Among these, the participation of Walter Crane, the most popular disciple of William Morris, in the eighth exhibition of *Les XX* had profound repercussions. In *L'Art Moderne*, the painter Georges Lemmen devotes an important study to him (1891), praising that "(revolutionary) labourer of the art world" concerned with the expressive value of forms, lines, and arabesques.[20] Notes Madeleine Octave-Maus once again:

> Meanwhile, the display window of Maison Dietrich — perhaps the first art bookshop to have opened in Brussels — captures the attention of strollers in the fashionable Montagne de la Cour district with a series of photographs of uncommon quality and dimension, reproducing the works of Burne-Jones and Rossetti.[21]

These allusions underscore the fact that in Belgium, as in France, England, Germany and Italy, painters were to show an increasingly powerful interest in the decorative arts. Ultimately it was the efforts of the English Arts and Crafts movement and its Pre-Raphaelite forerunners which formed the basis of the development. "There are no paintings, there are only decorations" wrote Verkade, mouthpiece of the Nabis. "Down with useless furniture. Painting must not be permitted to usurp the freedom denied to the other arts (the art of furniture making and design being implicit)".[22] These remarks bring forth one of the key ideas of an era visibly haunted by the overriding concern "to embellish" the individual environment — the bourgeois surroundings of everyday life. *La Libre Esthétique*, which patronized all manifestations of the new art, expressed this idea with conviction. Its first Salon (1894) included a large exhibit of applied arts where, along with silver-work by Ashbee, one saw ornaments by William Morris, posters by Chéret and Toulouse-Lautrec, ceramics by Delaherche, and drawings by Beardsley. Gustave Serrurier-Bovy presented a completely furnished study whose style was inspired by the prevailing *goût anglais.* Serrurier-Bovy was the first in Belgium to use the wallpapers and fabrics of William Morris, whose Japanese-like motifs and floral inspiration exploited all potentialities of the arabesque. In addition to these works, the following year *La Libre Esthétique* brought fame to the architecture of Voysey, the first glassware from the French city of Nancy by

Daum, and a collection of chairs conceived by architect Georges Hobé. Meanwhile, independent of that year's exhibition, the painter Adolphe Crespin created for the architect Paul Hankar a variety of architectural decorative patterns, plans for furniture, sketches for wallpaper. It is against this highly vital and creative setting that the appearance of Horta's *Maison Tassel* must be viewed.

Several factors fundamental to the architect's accomplishments are brought to the fore. Most obviously in evidence was the search for unity in the arts. This was proclaimed by the widely diverse fields of creative activity assembled under the auspices of the *Groupe des XX* and *La Libre Esthétique*. An essential art theory of the time, it was one of the most dominant ideas in aesthetic circles, and has already been mentioned in regard to Horta's response to the Wagnerian concept of the *Gesamtkunstwerk.* Integral to the theme was the aim of renewing art by promoting closer cooperation between the artist and artisan. Horta personally achieved this through his own attention to the design of all decorative and utilitarian elements of the house. First and foremost, he was an architect. Yet he recognized and believed in the contemporary need for a creator to be able to lend himself to all aspects of the creative process, toward a total result. To a great extent the roots of this lie in what was initially an English development. The teachings of the likes of John Ruskin (1819-1900) and William Morris (1834-1896) were founded on such an idea — the rebirth of art through the renewal of handicraft. As it crossed the Channel to the Continent, the appearance of Walter Crane only served to strengthen it for those who had already adopted it.

Ultimately, the subsequent direction toward union of the arts was a result of the socio-moralistic preoccupation which characterized 19th century artistic thought in England. The prevalent feeling centred on the belief that all artists have an ethical obligation to reconcile art and society, with objects of more honest design and production. By turning artists into craftsmen and craftsmen into artists (to use a key dictum of William Morris), man could consequently succeed in creating a better environment for both types of creators, as well as for the all-important working classes.

The machine and industry were the primary dangers threatening the achievement of this utopic vision. In this regard, the English preached a rejection of that which was but another form of enslavement. Yet despite this, the upcoming century to which they looked was not to be the golden age of handicrafts. Rather, it was the commencement of a great era of industry and industrial design. Within his architecture, Victor Horta recognized this, and therefore attempted to reconcile the two. Art (decorative design) and industry (structural exposure) were joined to form the fundamental dualism inherent in Art Nouveau theory. However, on the one hand there was also his desire to renew art and handicraft, and on the other, through the subsequent process of renewal, the creation of handicraft which, by its very nature, its special approach to decoration, and its individuality, was hostile to the machine. Horta succeeded in maintaining a truce between the two, but at a price. The Art Nouveau forms and language which ensued could only appeal to a small exclusive group. Their expensive design and reliance on the handmade product rendered them incapable of satisfying the social needs of a new age, increasingly geared to the demands of mass production. This, then, was to form

one of the elements which brought about the downfall of the style.

In addition to the relatively intellectual deliberations of the Arts and Crafts Movement, a number of more directly related links with England are widely recognized to have a bearing on the formation of Horta's *tour de force* on the Rue de Turin. According to the writings of Henri van de Velde, there was a close relationship between English and Belgian artists. The artist A.W. Finch, a Belgian painter of English descent who later became a ceramist, acted as the first to introduce an awareness of the English revival in the applied arts and crafts. Around 1890, he began to collect a few objects, which were seen as quite impressive. They subsequently proved to be of great influence. Soon afterward, Gustave Serrurier-Bovy of Liège began to design the aforementioned ensembles. Ultimately, they were inspired by English design. Within a short while, the English style became transformed into something entirely Belgian.[23] Meanwhile, Walter Crane wrote:

> The revival in England of decorative art of all kinds culminating, as it appears to be doing, in book design, has not escaped the eyes of observant and sympathetic artists on the continent. The work of English artists of this kind has been exhibited in Germany, in Holland, in Belgium, and France, and has met with remarkable appreciation and sympathy. In Belgium particularly ... the work of the newer school of English designers has awakened much interest.[24]

Regarding Horta, it is believed that the vocabulary of his ornamental style immediately originated from the English innovations in decorative art during the 1880s and '90s. These in turn had developed from similar manifestations found in the graphic art and book page design of William Blake (1757-1827) and the Pre-Raphaelites. In view of the ornaments and the homogeneity of their presentation within the *Maison Tassel*, H.R. Hitchcock thinks it is very likely that the architect knew of these exponents.[25] Moreover, there appears to exist an acquaintance with the textiles and wallpaper patterns of Macmurdo, Heywood Sumner, and others. Created for the *Century Guild*, established in 1883, they too show the semi-naturalistic forms, swaying lines, and asymmetrical organization of Horta's mature decorative work of the 1890s.

We can also see in the previous description of the Brussels cultural milieu the growing desire to liberate art from the academism which was so firmly entrenched everywhere at the close of the 19th century. The 1890s were a time of bold experimentation characterized by a tolerance for new ideas and an eagerness for novelty. In general, there was a disgust with the old naturalistic formulas which prevailed, whether in imitation of nature on canvas, or in imitation of craftsmanship through cheap machine-made goods. The knowledge that a new century was approaching gave a feeling that a new era was at hand. Consequently, the hope for a new art was strongly encouraged; it was seen as a chance to shake off the staid traditions of the past. Needless to say, the same held true with regard to architecture. Indeed, everywhere there was an insatiable yearning for the new. To quote author S. Tschudi Madsen, this was reflected in movements such as the

> New Paganism or New Hedonism, while *The Picture of Dorian Gray* was characterized as the New Voluptuousness. Oscar Wilde himself wrote about the New Remorse in *The Spirit of the Lamp*. Turning the pages of *Punch* and other contemporary magazines, one constantly comes across allusions to new movements and ideas — New Humour, New Women, New Realism, New Drama — and

> we find periodicals such as *The New Age* and *The New Review*. In common with all these names and expressing the same spirit and tendency of the age, the New Art — l'Art Nouveau — comes into being.[26]

The art of the Decadence was another manifestation of this quest for novelty. As it revelled in an illusion of a strange mood of decline, it was intimately bound with the Symbolist trend in the art and literature of France and Belgium, and that of the Aesthetic Movement in England. An aura of artifice and affection, perversity and egoism distinguished its exponents.[27] The tendency was toward sophistication and remoteness from popular culture, or, as author Peter Selz writes, "toward the creation of an esoteric work in which art was to become *the* way of life."[28/29]

All this is reflected in the work of Victor Horta. The individual yields to the all encompassing manipulations of his architecture's flowing rhythms. In effect, it is the art which governs lifestyle, no longer the lifestyle which governs art. The analogy is extended by comparison with the contemporary literary currents. The development inclined toward a neo-romantic, irrational, mystical undertone, in conscious opposition to the philosophically rooted Naturalism and Positivism, which continued to enjoy official acceptance. The aim was no longer to depict or describe nature, but to evoke and convey its sensual impressions in a subtle, sometimes obscure manner.[30/31] There was no attempt to make an appeal to reason. Ideally, the response sought was purely emotional, to be achieved through such effects as visual or musical rhythm, sounds, and suggestive associations. One therefore perceives further affinities with Horta's creative output. The romanticizing irrationality of the architect's floralineal ornamentation engendered the ultimate rejection of the positivist-inspired classicism of the day.

Meanwhile, the contemporary interest in Japanese Orientalism underlines several other factors which influenced Horta's Art Nouveau. This attitude in art was already some 25 years old when the architect began to make allusions to its concepts in his own work. It had begun suddenly in the 1860s. Fostered by a steady fascination with exoticism (the Decadents were some of its most avid disseminators), the movement eventually influenced most genres in Western art. It represented a completely new aesthetic approach to Western creators, one from which each could draw his own personal inspiration. Among the most significant factors for Horta was the two-dimensional, planar aspect of Japanese woodblock prints. Characterized by their expressive contour and an insistence on a refined use of line, they gave rise to a distinctive architectural translation. The absence of central perspective formed another key element. The idea of compositional asymmetry was brought in to counter the seemingly inescapable principle of symmetry. This was also found within Japanese prints. Finally, there was the general simplification of "natural" forms for the sake of art. This becomes important with regard to the similar underlying vision of interior design as a refined creation. Japanese furniture and decor had a simple, almost fragile construction. This attracted new interest on the part of Horta, who, within his interiors, instituted what would have appeared as relatively bare, unadorned surfaces. His interpretation formed a striking opposition to the *horror vacui* of contemporary European interiors, under the influence of Historicism. Thus, the architect discovered that a comparatively sparing use and placing of ornament could actually act to increase its value and effect.

Whether it be the examination of oriental art, the desire for artistic unity, the preoccupation

with the New, or the immersion in the Decadent, all were aspects of a widespread reaction to Historicism. All must be seen as the product of one great contemporary anti-movement. Through his architecture, Horta made a revolutionary response to the prevailing Fin de Siècle reality. However superficial it may appear today, his ornamental vocabulary transcended the blind reproduction of the archaeologically rooted decoration still popular with the public. With this, he was highly instrumental in establishing the general belief among Art Nouveau artists that they were evolving a new and contemporary style in which the rejection of convention — the initial attitude of *épater le bourgeois*[32] — was "advanced" and desirable.[33] However, there was more to the architect's protest against the traditional and the commonplace. Part of the overall break with Historicism was the acceptance of modern technology. In obvious opposition to the Arts and Crafts trend, Horta made use of iron in his buildings. He displayed the structural qualities of the material within the *Maison Tassel*, and emphasized them through his ornamentation. Though the use of metal did not dictate the fluidity of his organic forms, iron was fitting material for his purpose. Its architectural deployment underlines Art Nouveau's essential acceptance of technology and the machine as a means to creating its representations. Yet this was clearly without elevating its inherent functionalism to the status of an aesthetic principle.

Horta's use of iron was the outcome of a long development marked by the quickening advance of industry in the mid-19th century. Faced with this acceleration, architects began to acknowledge that the traditions of their art were outmoded. They had to keep up with the derivatives that industry was putting at their disposal. With the Industrial Revolution in England around 1750, it was discovered how iron could be produced industrially. Attempts were soon made to replace timber or stone by iron, but only in structural uses. The material was used for purely practical reasons, rarely being regarded as an aesthetic asset. As a variety of historical styles came to be maintained (classical, italianate, gothic), one could, for example, have a classical facade made entirely of iron: a cast iron facade made to imitate marble, cast iron piers, cast iron lintels. The iron would be disguised to outwardly correspond with the age old stylistic formulae governing architecture. It was a blind requisite that all buildings from which the spectator imagined himself to gain a serious aesthetic impression, had to appear in elaborate historical dress. It was only in buildings of a temporary or functional nature, such as London's *Crystal Palace* (1851), or the *Galerie des Machines* and *Tour Eiffel* of the 1889 Paris Exposition, that the exposure of purely structural, unornamented iron found some degree of acceptance. Horta's *Maison Tassel* embodied the first positive aesthetic toward iron beyond this limited perspective.

From the very beginnings of architecture, a visible relationship between load and support had been one of the outstanding facts. With the introduction of iron, and subsequently glass, this relationship conclusively changed. The interplay of vertical and horizontal elements ceased to be immediately obvious. It was this very point which marked the beginning of an entirely different kind of aesthetic feeling. Victor Horta, in particular, played an essential role in its development. One of the few turn of the century architects who best understood the nature of iron as a building material, he focused his realizations on the fact that it could transmit great stresses through members of very small cross-section. Horta chose to shape those members. While he did so according to the nature of the material which he had so clearly grasped, he also made the members of his metal structures look as if they were produced by Nature itself.

Thus he gave rise to the creation of a multiplicity of moulded forms, fertile in their suggestions of the very slender plant stalk or bone. In view of the astonishingly prolonged lack of acceptance for new architectural forms, the consequent analogy to Nature which the architect began to evoke can be seen as a conscious attempt to reconcile his use of exposed slender iron supports with our inborn sense of what is solid.

Horta rightly perceived that this sense of solidity was something rooted in our very own human "nature." Being a permanent thing, it was epitomized in the classical architecture with which contemporary society was so enthralled. In that context, even today, the visible relation between load and support, solid and void, is essential in surrounding the viewer in such a way that he has a sense of solidity and visual security. Horta's new architecture, with its unabashed use of new material, destroyed this. The traditional associations one made through the relations of such elements as marble and wood, were removed. Moreover, it undermined the visual security of proportion. Faced with the slender cast iron columns which were employed, one came to ask: is it realy possible that these seemingly light components could carry a structure? The result was the creation of a basic feeling of uneasiness for the turn of the century viewer, particularly upon having just come out of the Classical architecture of the Beaux-Arts style. Yet, while Horta's buildings expressed their creator's understanding that iron has physical laws of its own, they also expressed the existence of another type of knowledge — that of how structure functions within Nature. In looking at their interplay of structural vegetative forms, the architect invited the viewer to look at Nature itself, so as to transcend the fear caused by seemingly inadequate connection between load and support. Taking the example of a huge, heavy branch extending from a tree, one could ask, how is it possible that it does not break off? Of course, one gains security in the awareness that the tree has its own internal organic structure, which ultimately supports the branch. With the analogy Horta created by imbuing his architecture with natural forms, he sought to somewhat satisfy the individual's problem as to the conception of solidity in structure. It was almost as if to say that, if such physical feats are possible in Nature, they are possible in architecture too by virtue of the use of iron.

It is very interesting to note that the influence of Alphonse Balat, a Classical architect, was significantly responsible for shaping this attitude in Horta's work. While Horta fulfilled his architectural apprenticeship under Balat's direction, the instruction he gained comprised an important episode in his evolution. In addition to offering a major source for iron construction in his oeuvre, the connection affords us further insight into the sources for his spatial planning and his nature-based ornamentation. Within this context, the work of master and pupil on construction of the *Royal Green-houses* at Laeken figures prominently. Here, the combination of stone, iron, and glass, subsequently to become one of Horta's hallmarks, was given its most successful expression. As a result, the complex is famous as one of the highlights of pre-modernism. The very first example of an actual greenhouse was built in *Chatsworth*, England, by Sir Joseph Paxton around 1840. Nearly 40 years later, Paxton's freestanding conservatory was surpassed. In 1876, Balat was commissioned to erect for King Leopold II the glass landscape of interrelated greenhouses found at Laeken.[34] Consisting of a theatre, an orangerie, a winter garden, dining rooms, reception rooms, and even a church, it became the centre of courtly life. This was so to the extent that the court was almost transferred there, to the "fantasy" world of the greenhouses. A veritable city of glass and

iron, it held an extensive array of glass protected environments.

The largest greenhouse, the *Winter Garden*, forms the main structure of the project. One of the finest bell-shaped glass structures ever built, it is nearly 30 meters high at the top of the lantern which crowns it. Its diameter of 56 meters makes it one of the most grandiose greenhouses in Europe. Within, 36 doric columns of white marble, each 18 meters high, support an exo-skeleton of 36 ornamental curved iron ribs. Functioning almost like flying buttresses, they pierce the glass skin and structure of the upper dome so as to eventually carry the roof. In the centre of the building, tall palm trees were placed. The central room formed by the circle of columns was fitted with a handsomely tiled floor, allowing the building to be used as a ballroom. Fountains are on each side, and great plants all around. Beyond, there is an 8 meter wide ambulatory, leading to two barrel vault shaped corridors on either side of the structure. While one led to the *Serre du Congo*, the other went toward the palace by way of the older *Orangerie*. Functioning as a hall of festivities and a dining room, this structure had an addition branching off which was a theatre of glass. But the *Winter Garden* was the centre of all this: the courtly life; the festivities; the receptions. Already by 1907, it had been described and discussed in terms of spatial planning and constructive aspects. Points of particular interest were its glass and iron construction, and its bell shaped dome. Before the introduction of iron into architecture, nobody had ever used the shape of a bell dome placed directly on the ground, to create a central building. Moreover, the bell itself embodied the implementation of a completely new concept. While the idea did in fact date from Paxton, Balat became the first architect to have instituted it. What is interesting, is that it was Leopold who actually told him to use it. In regard to its iron construction, there was an enormous amount of experimentation which had to take place for the building of this conservatory and the others which were to follow. This is a key element to their importance, since it was this experimentation which ultimately formed the real basis for modern architecture. As a result, Balat was forced to deal with new materials, in the ways to which they were best suited. So, in this respect, one had moved totally away from the Classical tradition. Prefabricated building materials incarnated another relatively new concept, while the building in serials, whereby duplicate parts of the structure would be built simultaneously, entailed an equal significance. In addition, as one found that iron could be moulded into any shape, one was permitted a facility which was very new in this field of architecture. For Balat, a rather surprising imagery came out of this. He created a tendency toward an organically inspired vocabulary. The iron constructions employed in the *Winter Garden* leaned toward a plant shape. Examples of this are found either in the very shape of the cupola, the spring and curve of its ribs bundled together to form a 12-sided lantern, or, most obviously, the ribs' innate ornamentation. The flexibility of iron enabled the architect to achieve these effects. Needless to say, the roots of their appearance can be found in the function of the building itself, as of course, it was intended to contain a botanical collection.

When Horta joined Balat's studio in 1880, these considerations in connection with the Laeken complex figured prominently in the instruction he received. Work on the project continued until 1886, and so was a constant source of stimulus to his formation. Within his work there is ample expression of homage to prefabricated materials. Moreover, the elegant curves and contours which animated his metal work, point to a highly interesting additional source of inspiration for his ornamental

vocabulary. It is particularly important that this was drawn from the pure iron and glass structure built by his master. There, all ornaments were first created from iron, and then, carefully integrated into the totality of the structure. Although the tremendous amount of this ornamentation hinted at some rather gothicizing features, the general vegetative quality lead one more and more to believe that Horta's work would have been unthinkable without this as one basis for his art. Meanwhile, on turning to the attractions of the conservatory's space, one notes that its clarity of conception and its flowing quality hold further analogies to Horta's subsequent accomplishments. Connected to the other greenhouses by glazed galleries, one ultimately perceives an interplay of views, which drift from one space to another, and from interior to exterior. Coupled with the ever-present array of exotic plants, the creation of such an unusual spatial relationship makes for a fascinating inference in the direction of Horta's Art Nouveau, as witnessed in the *Maison Tassel.*

Balat's greenhouses should surely be seen as a kind of utopia. In his creation of an ambiance for ideal society, he gave form to a concept which ultimately derives from literary sources. This is another point of significance with regard to Horta, especially when one takes into account his interest in socialism. The situation must be viewed in conjunction with the social crises in contemporary cities. As a result of overpopulation due to phenomenal industrialization, there was a great need for recreational possibilities to relieve tensions which had become entrenched. The creation of an ideal ambiance with obvious Garden of Paradise connotations, was seen as a refuge and outlet for these tensions. Just as Balat's greenhouses were geared to this factor, Horta's Art Nouveau expression must also be read as an interpretation of its intent within the context of residential architecture.[35]

Today, the *Maison Tassel* is renowned as a milestone in the history of architecture. As Victor Horta continued to expand upon the themes which it combined in an assortment of subsequent evocations, he set the standards of excellence, elegance, and originality toward which every serious Art Nouveau architect strived. In our present day Post-Modernist reaction to the carbon-copy minimalism which abounds, the lessons of these standards take on a viable new dimension. As we begin to show renewed interest in the beauty of architectural ornamentation, the "delicate superfluities" of Horta's Art Nouveau are in a position to once again capture our appreciation and imagination.

NOTES

[1] Giedion, S. *Space, Time and Architecture*, Harvard University Press, Cambridge, 1959, page 298.

[2] It was very difficult to find a first name for this man! Nonetheless, it is Emile.

[3] The building, including the stairhall, stayed intact up until its second last occupants, Belgian fashion designer Norrine, and critic P.G. van Hecke. Around the early 1960s, it was degraded into 6 or 7 flats which ultimately ruined the quality of the original spaces, covered the mural decorations with green paint, painted the metal work and door fixtures, replaced the front door, etc. Needless to say, one needs a good imagination to revive the intended effect.

[4] The centrally located door is another innovation on Horta's part, with regard to residential construction. Habitually, the doors of such townhouses would have been to one side of the structure, in the interest of space. However, as a result of his experiments in spatial planning, the architect is not bound by such traditions.

[5] One notable exception to this is the wall paper used in the dining room which showed an English pattern called "Tulip". It was designed by Arts and Crafts artist

Heywood Sumner, and underscores Horta's familiarity with English artistic trends as a prelude to the development of his expression.

[6] Aside from one picture depicting an exquisite door with stained glass panels in the octagonal vestibule, and several pictures of the staircase, (in both cases, as found in Borsi/Portoghesi, *Victor Horta*, Marc Vokaer, Bruxelles, 1970), there were no other interior pictures at my disposal. One can only surmise that the furniture design was much the same as that found in Horta's other homes. As for the exact interior decoration as far as wall elevations and furniture placement, one can only imagine.

[7] As translated from: R.L. Delevoy, *Pionniers du XXe siècle: Guimard, Horta, van de Velde*, Musée des Arts Decoratifs, Paris, 1971, page 20.

[8] Giedion, page 298.

[9] The increased size and number of windows lighting the house was an important consequence of the introduction of the comparatively light iron infrastructure into domestic architecture.

[10] Delevoy, page 29. — An excerpt from the writings of author Maurice Rheims.

[11] One mentions this since Henri van de Velde has claimed to be the true father of Art Nouveau Architecture on the Continent.

[12] Mention of the shop is important in that it gave its name to the phenomenon known as Art Nouveau. It is presented within the text so as to indicate the actual degree of novelty involved in the appearance of the *Maison Tassel*.

[13] Delevoy, page 22.

[14] Delevoy, page 23.

[15] Giedion, pages 299-300.

[16] In 1870, when the *grands boulevards* were being built around the centre of Brussels on the instigation of Mayor Anspach, a disciple of the great re-organizer of Paris, Haussmann, there were only 250,000 inhabitants in the city. In 1910, a year after the death of Leopold II, the population had risen to above 800,000. The city's phenomenal growth thus provided a wide scope of opportunity for architectural development, whether novel, or along more traditional lines.

[17] Delevoy, page 18.

[18] Delevoy, page 18.

[19] Madeleine Octave-Maus, *Trente années de la lutte pour l'art: 1884-1914.* Librairie L'Oiseau Bleu, Bruxelles, 1926, page 101.

[20] Delevoy, page 18.

[21] Maus, page 113.

[22] Delevoy, page 19.

[23] Schmutzler, Robert, *Art Nouveau*, Harry N. Abrams, Inc., Publisher, New York, 1978, page 69.

[24] Schmutzler, page 69.

[25] Hitchcock, H.R., *Nineteenth and Twentieth Century Architecture*, Penguin, 1958, pages 284-285.

[26] Tschudi-Madsen, S., *Art Nouveau*, Weidenfeld and Nicholson Ltd., London, 1967, page 41.

[27] This brings to mind the philosophy of Oscar Wilde, where the artful attitude becomes more desirable than the work of art.

[28] Selz, P. and Constantine, M., *Art Nouveau*, Museum of Modern Art, New York, 1957, page 8.

[29] Of course, this was by its very nature diametrically opposed to the social reform and utility of the earlier discussed Arts and Crafts movement. The only concept linking the two was that of artistic unity, as both groups admired the work and philosophy of Richard Wagner.

[30] The term is used in its abstract sense, thereby implying all the elements of existence.

[31] Even so, symbolism made no effort to convey its impressions through the medium of external or naturalistic means.

[32] Selz and Constantine, page 11.

[33] Of course, this initial attitude of "épater le bourgeois" eventually gave way, as what became a fashionable style gained popularity among the middle classes.

[34] Laeken, north of Brussels, is the site of the Royal Palace. In 1865 when Leopold II succeeded his father

to the throne, the arch-imperialist and lover of plants began to augment the original area of the palace park from 70 hectares, up to the 200 hectares which it occupied at the end of his reign in 1909. Therein he placed the most regal and extensive private conservatories to be found in Europe.

[35] It should be remembered that Balat's greenhouses were almost residential dwellings too, within the context of the wide adaptations of function they underwent for Leopold's court. One wonders to what degree this could have additionally influenced Horta's residential concept, and its ornamental modes of expression.

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ILLUSTRATIONS

Fig. 1: Maison Tassel, staircase. Lara-Vinca Masini : *Art Nouveau*, Secaucous, NJ: Chartwell Books, 1984 ed., p. 100, fig. 261.

Fig. 2: Maison Tassel, vestibule. *Ibid.*, p. 98, fig. 254.