Summary

The living tract and the adjoining rooms A comparative study of various homes

(Pages 207–209)

Is an individual style of living possible in each modern home or apartment, or do we find merely a limited number of stereotyped plans? We generally expect to find more individualized plans for private homes than for apartment houses.
Our 15 examples A–P have been taken from Germany, Switzerland, the Netherlands, the USA and Australia. Nevertheless, the picture remains imperfect because our choice was made at random and not in accordance with a specific intention.
The majority of these examples are subject to detailed study in the following pages. The analysis bears solely on the functional relations obtaining between the living tract and the rooms adjoining it, in so far as these relations can be read on the plans.

Number and situation of the floors of the dwelling-house
8 examples have one single floor (A–H), 3 examples have 2 floors and the living room is on the ground floor (I–L), 3 examples have 2 floors and their living room is situated on the 1st floor (M–O),
1 example has 5 floors, its living room is on the 3rd floor (P).

Dining room and living room
In the 2 examples G and H by Dailey and England, the living room is totally separated from the dining room. Dailey instals the kitchen in the dining room. Archer, Morlock + Murray, Neutra and van den Broek + Bakema combine the living and the dining tracts in one single room (C, E, K), without any spatial differentiation. The Dutch architects, in addition to the dining room and the living room, provided for a "family room" on the upper floor. By means of corners or other spatial displacements Archer, Mortlock + Murray, Marquis + Stoller, Neutra, Beyeler and Konstantinidis (B, D, F, I, P) indicate what distinguishes the parts of the two tracts. In the case of Franzen, McNulty, Wong, Sudgen and Zeilhofer (A, L, M, N, O), the areas of the 2 rooms are clearly indicated but interconnected in "sliding" fashion. When the living room is a different room from the dining area, there are four types of access from the entrance:

1. To reach the living room, it is necessary to cross the dining nook: Beyeler (I), van den Broek + Bakema (K), Sudgen (N).

2. The dining room is situated behind the living room: Neutra (E).

3. The access axis separates the 2 rooms: Franzen (A), Marquis + Stoller (D) and Neutra (F).

4. McNulty (L), Wong (M) and Zeilhofer (0) have elaborated ideal solutions: Each of the two rooms is entered directly from the outside without its being necessary to pass through the other room.

Access to the kitchen and to the outdoor areas
The kitchen and the terraces are treated together, because the outdoor areas are not only an extension of the living room but also of the dining room.
Franzen (A) sites the terrace in front of the living room. He has probably not envisaged the possibility of anyone's eating there.
Archer, Mortlock + Murray (C), Beyeler (I) and Neutra (E) locate the kitchen, like Franzen, where it is accessible to the entryway, but in their plans a special door leads from the kitchen to the living room or to the dining room. In these examples, the living room has to be crossed to go from the kitchen on to the terrace.
In the example (B) Archer, Mortlock + Murray have sited the kitchen in such a way that the dining room and the terrace can be reached without its being necessary to go through any other room.
Neutra (F), van den Broek + Bakema (K) and Konstantinidis (P) move the kitchen away from the terrace.
In the majority of these examples, the terraces are accessible via the living room as well as via the dining room. In principle, the terrace is oriented towards one side only. In the case of Archer, Mortlock + Murray (B), it faces north (Australia!) and east. Marquis + Stoller have made it face south and west) (D).

Cloakrooms and WC
Franzen locates the toilets in the bedroom tract and the cloakroom beside the entryway. In the case of Archer, Mortlock + Murray (B), we find a little passageway with WC and cupboard beside the laundry. We get the ideal solution in the plans of Marquis + Stoller, Neutra and Beyeler: the entryway is pleasantly large. It contains a cloakroom which can be reached without passing through the private part of the house.
The plans of Dailey, van den Broek + Bakema, Sudgen and Wong are identical, but, in these examples, there are no toilets beside the living tracts. It is rather surprising to note that only Marquis + Stoller (D) as well as Neutra (F) site the toilet belonging to the living tract outside the private area and at living tract level.

Separation between the living room and the **private tract.**
It is above all in the small plans that the separation between the living room and the bedrooms gives rise to a number of problems.
In the case of Franzen (A), a partition resolves this problem; Archer, Mortlock + Murray (B), on the other hand, make use of damp rooms and an interior courtyard; Marquis + Stoller (D) and Zeilhofer (O) effect this separation by means of damp rooms, Wong (M) by means of the bath; Dailey (G) and England (H) resort to long distances. In the example C, Archer, Mortlock + Murray mingle the tracts. Finally, in the multi-storey buildings, it is a ceiling which serves as the separation element.
In conclusion, our comparison reveals the multiplicity of the solutions permitting an individualized home, from the standpoint of the plan. This is what distinguished small and medium-sized houses from apartment buildings.

John W. Sudgen, Los Angeles

Siegel house at Zarahemla, Utah

(Pages 210–212)

The house is situated at the foot of Mt. Olympus, on the north slope, from where there is a panorama of the entire Salt Lake Valley.
The site is covered with a stand of trees. It is restricted in extent, stony and crossed by the dry bed of a stream.
The house is supported by steel frame structures, the supports of which measure 3×18 ft. and extend in each direction.
As protection against the sun there have been suspended heat-insulating glass panels, which are also non-reflecting, 1.35 meters in front of the elevation. This distance, 1.35 meters, is taken up by the canopy structure. Aluminium-strand curtains also serve as anti-solar protection in this totally glazed house. The partitions can be easily exchanged, except for those that separate the bedrooms from the core of the house.

Willi Zeilhofer, Munich/Landshut

Architect's home on slope in Landshut

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This small house was built on the slope of a hill forming part of a huge orchard. This slope is bounded on the northwest by a wooded strip which reappears on the southeast and which descends abruptly towards the southwest. This hillside location commanding a mangnificent panorama as well as the conception of a single-tract house were crucial factors bearing on the design of this house. Extremey limited dimensions have been chosen, which, even so, ensure an optimum living area and keep costs down to a minimum.
The upper level projects nearly 3 meters above the ground floor. Thus, in its setting of trees and meadows, this storey seems to be freely suspended in the air.
On the inside, a continuous glazed bay creates the same impression of freedom and harmony with the outdoors. Only a small core, comprising the bath and WC and the kitchen installations, is entirely closed in and thus divides up the residence area into different tracts. The bedrooms are separated one from the other by means of double-locker elements. They are all connected with the living room tract by way of sliding partitions of ash.
It is also possible to seal off, in the same way, the kitchen from the living-room, it representing $^{2}/_{3}$ of the living area. A hemispherical dome of glass then allows for the illumination and the ventilation of the kitchen and the bathroom.

Ancher, Mortlock, Murray+Woolley, Sydney

House of a single lady in Collaroy near Sydney

(Pages 216–217)

The owner lives alone. Being a grandmother, she is often visited by her grandchildren, who frequently spend the night. That is why a large playroom adjoins the children's bedroom. All the rooms are disposed around a patio.
In Australia, the north side gets the sun, which is why the living room has a terrace facing north and serving also as a bedroom for the owner.
The supporting structure is a timber skeleton. Most of the wall elements are of untreated brick.

Ancher, Mortlock, Murray+Woolley, Sydney

Badham house at Cronulla, Australia

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The very large site is bounded by the harbour of Hacking. The actual building surface is restricted by the presence of cliffs and by the necessity of preserving a number of valuable trees.
There have been provided guest rooms, large public rooms, 4 bedrooms, 2 baths, a billiard room, a study, terraces, a hobby room in the basement, a two-car garage and a swimming pool in front of the living tract. It was absolutely necessary for the main rooms to have sunlight, which comes from the north, and at the same time to command a south view. To resolve this problem, there was constructed a patio which augments the transparency of the house, which, moreover, constitutes its primordial character.
The master bedroom with bath and the study constitute the independant "master tract". The other rooms form one single tract which is subdivided by sliding partitions, supporting walls and screens.
The supporting structure consists of a timber skeleton framework. The living rooms and the terraces have floors of cement panels. The screen-walls are faced on the outside with asbestos panels left their natural colour and on the inside with wood-fibre panels or laminated boarding. As for the walls, they are, outside and inside, of grey bricks cemented with black mortar. All the ceilings are of laminated pine. The doors are painted white.

Alfred Newman Beadle, Phoenix, Arizona

Steel skeleton structure house in Phoenix, Arizona

(Pages 221–223)

The architect in this case is also the contractor. The house intended for a family of 5 children was to be erected on a rectangular site crossed by the bed of a stream which is only intermittent, flowing only after downpours. For this reason the architect has built the house 1.50 to 2 meters above grade level.
One half of the constructed volume is made up of interior rooms and covered exterior tracts. The tubular steel skeleton is faced with sandwich panels and glass.

Yau Chun Wong, Chicago

House above Lake Michigan

(Pages 224–225)

The supporting system of the house is made up of 8 concrete supports measuring 1×5 ft. in cross section, of peripheral beams 30, 40 and 80 ft. long and prefab concrete slabs for the floor and ceiling.
The 1×5 ft. cross section of the supports makes it possible to place the peripheral beams above the level of the floors, on a single pillar.

Aris Konstantinidis, Athen

Vacation House at Anavyssos

(Pages (226-227)

The house is situated on the Athens - Sunion road. In Greece construction with natural building stone is financially advantageous. Therefore I looked for a "system" in which the cut-stone walls would form a building which would be equally typical of a supporting-frame structure. As I see it, this is how a rhythmic order was created.
The plan is based on a dimension unit of 2 meters, i. e., the length of a supporting wall. On the inside, the brick walls, the lockers, etc., also follow this 2-meter rhythm.

David Haid, Chicago

Weekend House above Lake Michigan

(Pages 228-230)

The house has an area, in plan, of 21.6×7.2 meters, of which 4.8×7.2 meters consist of covered terrace situated on the south side.
The supporting structure, the partitions and the interior facing of the roof are of wood. Beneath the roof, the finishing of which is 4 cm. thick, there is 5 cm. of heat-insulation panelling. The concrete floor base is covered with greyish-yellow terra cotta. The glass elevation is combined with a mobile "partition" of white linen screens. The house has pleasing lines and proportions, and its construction materials and the simplicity of its design create a harmonious effect.

Fritz Beyeler, Bern

Beyeler house

(Pages 231-233)

The architect had at his disposal a relatively small site, bounded on the west by the edge of a forest. The steep slope and the constriction of the site in the longitudinal direction made a one-storey solution impracticable. That is why an upper floor was added accommodating the bedrooms. This upper floor is square and placed over the west tract of the ground floor.
The ground floor itself, whose main entrance door is located on the east side, is also square in plan, with a kitchen annex. The square of this level is shifted towards the east. Thus there are created a lounging tract towards the west and, on the upper floor, a terrace above the east part of the ground floor.
As the house is built on a slope commanding a magnificent view, the living room is covered along its entire length on the south side, the side with the view. Small annexes serve as study and dining nook, which are connected with the kitchen and the vestibule.
The site on the slope has been brilliantly exploited to accommodate 3 terraces situated one above the other. Each of these terraces is located in front of one of the 3 floors of the house, including the lower floor.
There is access to the swimming pool via a garden stairs running from the living tract on ground floor level. Marble is used as the construction material of the ground-floor living tract and wall-to-wall carpeting in the bedrooms. The wall of the lower floor and of the gardens is of concrete. The house has solid decks on steel supports measuring 60/60/7 mm.

J. H. van den Broek and J. B. Bakema, Rotterdam

House in Rotterdam-Hillegersberg

(Pages 234-235)

The construction program comprises 2 flats. On the ground floor is the residence of the owner of the house. The 1st floor is reserved for the son of the family.
The living rooms are sited in the south angle of the house. Their south walls are entirely glazed and connected by terraces. The bedrooms are separated from the living rooms by lockers which stop short of ceiling level.
The walls are of white freestone. The concrete supporting parts are in sections left untreated. On the other hand, at the entrance to the garage, they are faced with mosaics.

Raphael Soriano, Tiburon, Calif.

Apartment House in Los Angeles

(Pages 236-238)

In principle this building is a single-family house to which there have been attached 9 1-room apartments in such a way that the family character of the house is but little jeopardized. Each apartment has a garden or a patio.
Despite the difficulty of the assignment, the building reveals the same simplicity in its structural conception, the same harmony between the internal tracts and the exotic Californian flora on the outside as Soriano's other houses.
Apart from the severe skeleton construction of steel and the simple design, the size and the disposition of the rooms is different in each of the 9 apartments. That is why in this rigorous simplicity one soon discovers an extraordinary multiplicity.

Gernot Minke, Stuttgart

German Pavilion at the Montreal Expo
Example of the realization of the architectural idea of traction supporting apparatuses

(Pages 239-250)

The great variety of types of supporting apparatus subject to traction is constantly growing. We are, nevertheless, always confronted by the same phenomenon: as soon as a certain architectural system has been selected, the shaping possibilities become relatively limited. A system of supporting apparatuses allows for numerous variants, but the shape is subject to architectural norms and the laws of traction. The traction support procedure ought therefore to take into account these laws, and it cannot be carried out without a permanent check on the interior vectors. This realization ends, in practice, in new ways of conceiving shapes.

Description of the project

The pavilion is situated on the regatta lagoon on the St. Lawrence River. It is bounded by water on two sides. The small island constituting the site has been planned as a totality (Fig. 1). The pavilion has been planned as a large envelope above an exhibition area which, at the same time, serves as a recreation ground, a relaxation area. The exhibition area is divided up into synclinal shapes and terraces situated at different levels. The large envelope accentuates still more the contours of the site. Towards the top, it is attached at 8 places and drawn tight towards 3 points below. The site extends spirally upwards owing to the multi-level terrace structure. It measures approximately one hectare. The covered surface corresponds to around 8,000 sq. meters. In the north-south direction, it extends for 130 meters, and east-west 100 meters. The highest mast rises to a height of 38 meters.
The large envelope is made up of a net structure composed of cables. This net is suspended from eight masts and three tension points. Around the periphery, it is held taut by 30 cables. The steel-cable net (the cables have a diameter of 12 mm.) forms rhombic meshes measuring 50 cm. per side. At each extremity, the cables have keepers which direct the forces coming from the surface towards the support points. Below this primary structure, there has been suspended, at a distance of 50 cm., a pre-stressed membrane, this constituting the secondary structure. This membrane consists of a polyester sheet covered with PVC. Every 3 to 5 sq. meters, it is connected to the large cable net. This tension guarantees a supplementary stabilization of the membrane and directs the stresses produced by the wind or by the weight of the snow on the skin into the cable net (Fig. 29 to 31).

Problems and methods of shape designing

6 main criteria were at the basis of the idea underlying the design of the shapes employed on the pavilion:

1. Every point of the net ought to rest on a surface having the shape of a saddle, i. e., it ought to rest simultaneously on a negative and on a positive curve in order to be stabilized in all four directions.

2. The direction of the net ought to be such that each cable is curved to the maximum extent.

3. The curve of the net ought to be constant over the entire surface. It is necessary to avoid flat areas, for the weight of the snow can cause great modifications of shape.

4. The direction of the meshes which are square on a plane undergo the slightest rhombic deformation possible, a deformation caused by the curve of the net having the shape of a saddle.

5. The nodes of the cables ought to rest, in both directions, on harmonic curves if there is to be a regular distribution of tension.

6. The tensions ought to be equal, if possible in all areas.
To meet the latter requirement, it would be necessary to investigate the minimum membrane surface (skin subject to traction). This minimum surface also appeared in the original designing of the different shapes.
The first working model was realized in fishnet (Fig. 2). From the outset, 8 masts had been planned. The height and the location of the masts were adapted to the shape of the net and to the surrounding grounds. The conception of the curve of the peripheral cables and of the keepers at the interior extremities presented a difficult problem. This was the first time that there was employed, in a project, interior strut cables to stabilize and stretch a cable net. This new system of support apparatuses demanded a whole series of tests.
After the original planning of the project, there was constructed a scale model in cloth (scale: 1:100 - Fig. 12). In order to be able to evaluate the stability of the shape when subject to wind, there was constructed a wind-tunnel model on a scale of 1:150 (Fig. 15).
Fig. 16 shows the cable net constructed of stainless steel on a scale of 1:75 in order to get the fundamental shape under tension. In order to compare the tensions on the cables, there were developed voltmeters (mechanical) occupying exactly the width of a mesh (Fig. 17). Certain cables were doubled to reinforce the net and to avoid in this way too great a deformation resulting from the exterior forces. Fig. 18 shows the result: a more pronounced curve in the shape of a saddle in the areas subject to the deformation.
All the preceding stages were for the purpose of determining the shape of this system of supporting apparatuses. The next step was to realize this shape in order to be able to draw up the precise plans of the foundations and the ground plans and to prefabricate the masts, the peripheral cables and the net cables. The technical tests run off in preparation for the design of the final shape and for the determination of this shape by means of models were effected at the Institute for Light Supporting Structures in Stuttgart under the direction of Otto Frei. These tests demanded 20,000 hours of work.

Assembly procedure

- Erection of the masts and provisional stressing (Fig. 26).
- Assembly on the ground of the pre-assembled parts of the net.
- Raising of the net on rods (Fig. 27).
- Stressing of the net and checking of tension (Fig. 28).
- Installation of the transverse elements for suspending the skin.
- Assembly of the large pre-fab skin sections.
- Raising of the skin, attachment to the transverse elements on spring plates (Fig. 29).
- Connection of the large elements in the air.
- Stressing of the skin (Fig. 30).

David Haid, Chicago

Restaurant with service station on an express highway

(Pages 251-254)

This restaurant with service station is now under construction on one of the Illinois State Highways. On both sides of the highway parking lots have been laid out, with trucks separated from the other vehicles.
The service station buildings measure 29.7×13.5 meters. Divided into 3 parts, they accommodate, at one end, the repair shop, in the centre, the supply room and car laundry along with the toilets, and, at the other end, the shop and the information office. The pumps are covered with a roof measuring 7.8×76.5 meters.
The restaurant is suspended above the highway by means of a support-free stainless steel construction. It is entirely glazed. The walls of the utility tracts are of greyish-yellow brick. The parking lots located above highway level are connected with the restaurant by means of concrete bridges. The weight of the restaurant, which measures 27×77.5 meters, does not rest on the wall of the lower level but mainly on the 4 steel columns. These carry the trusses in the longitudinal elevations. Above the highway, the trusses extend freely over spans of 40.5 meters and, at the two ends, they project 13.5 meters. Every 2.7 meters there have been installed lattice trusses 27 meters long, running across, at the level of which there are placed the ventilation and power ducts. Also, every 2.7 meters there are the girders, with full webbing, located one above the other, furnished with double T-irons which hold the window frames. The floor and the ceiling are of steel profiled plates 2.7 meters long. The restaurant has an acoustic ceiling attached beneath the lattice girders.