

CONCRETE AND ART

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Summary

Concrete, the most generalized structural material of modern architecture, lends itself to artistic surfacings. Regularities, aesthetic effects of autotelic architectural surfaces ranging from simple exposed concrete to concrete reliefs and glass-concrete with aesthetic values are analyzed.

Architecture has always been willing to avail of the inherent artistic expression of structural materials. Projected to modern architecture, it means a self-intended correlation between sincerity of design, endeavour to simple, economical forms and inherent aesthetic values of materials. Indeed, architects dispose over a wider range of materials than ever.

Concrete is one of the most current structural materials, to be shaped at will, and lending itself to a wide range of structures thanks to its reinforcement. It is applied both for non-load-bearing walls and for load-bearing structures; it is the material both of large-span halls without intermediate support, typical of modern architecture, and of mass housing with concrete units. It is a mix of binder, water and aggregates hardening to a kind of artificial stone. Its application possibilities derive from the way of processing: in freshly mixed, plastic condition it is cast into moulds of which it retains the shape after hardening. In addition, in-situ monolithic construction or plant precasting are determinant for the final appearance.

Sincereness of modern architecture, and its emphasis on the material obtained its natural way of expression by applying exposed concrete surfaces pointing both to the material and the technology. Structure and aspect are homologous, materially identical.

Already at the beginning of modern architecture, reinforced concrete structure had the prevalence. The structure of *Perret's* living house in Rue Franklin, Paris, is concealed by a wall cladding that gives only a hint of its system, but for his garage, Rue Ponthieu, and mainly for his church in Le Raincy, the exposed reinforced concrete structure is an essential means of architectural design, a conscious exploitation of its effects.

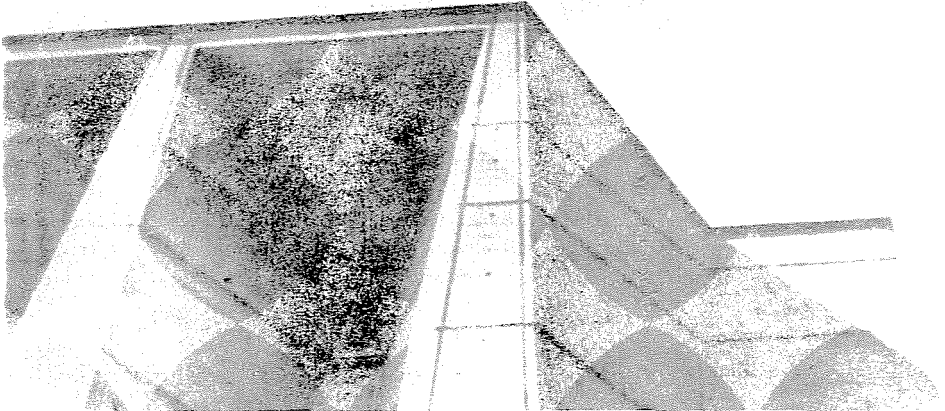


Fig. 1. UNESCO-Building in Paris. Folded-plate end wall of the board room

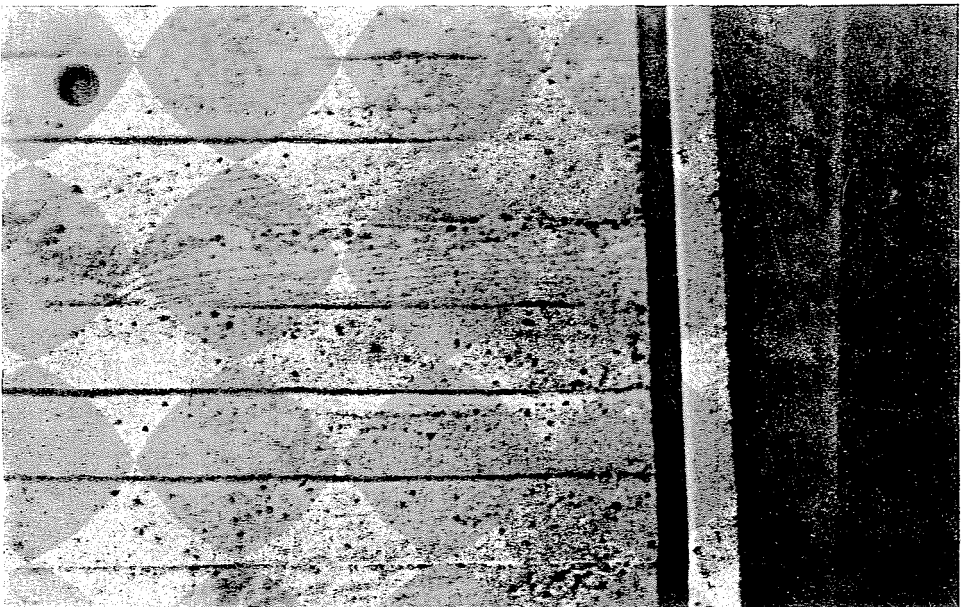


Fig. 2. UNESCO-Building, Paris. Detail of the folded-plate r.c. wall



Fig. 3. Unité d'Habitation, Marseilles. Le Corbusier's concrete relief on the r.c. wall of the elevator tower, with the Modulor figures

At an early date, reinforced concrete predominated in engineering structures, e.g. bridges and the like. The strive to simple, convenient forms had simple surfacings peculiar to the technology of construction, as concomitant. Economical construction of e.g. bridges by *Maillart* entrained surfacing economy, exposed concrete surfaces. Structural principle, form and appearance are counterparts.

Suitability of reinforced concrete to shaping facilitated the development of surfacing solutions. Among the greatest modern architects, *Le Corbusier* made the most of use from visual features of concrete just as of other structural materials.

Rather than to give a historical survey of development, methods of application for a visual effect, and their impact on the architectural composition will be considered.

The concrete surface depends on material features and on treatment. Freshly mixed concrete is plastic, freely formable. Its mould — producible from a wide range of materials from rough boards to metal or glass, and even of their combinations — defines the surface of the building unit. Timber is the most generally applied shuttering material. Graining, joints, surface roughness lend vigorous, somewhat rough aspect to hardened concrete.

The final appearance of exposed concrete surfaces depends on technology, on production process, but also on random events. Eventual shortcomings induced to experiment with two procedures: either to define the surface texture by purposefully selecting the mould material; or to obtain variegated effects by overemphasizing the flaws of the shuttering to produce plastic and light-shadow effects in irregularly joined surface parts. This second method little suits structural members, namely random cross-sectional dimensions may oppose the strict constructional principle. It rather suits secondary structural members such as partitions in outer spaces, and accessory structures e.g. rainwater basins.

Geometric pattern of regular, parallel or radial boards of a purposefully arranged shuttering directly displays material and structure. Divisions, alterations of surface elements are determinant for the relation of man to building, especially in large-scale constructions, as elements of transition from the usual scale of the direct surroundings. Enormous wall surfaces are enlivened by the familiar dimensions and texture of boards, the visible graining of timber. Purposeful, rhythmic texture helps large-scale exposed concrete surfaces to become active factors of architectural design rather than neutral, grey sheets. Thereby architecture deliberately creates a surface and mass effect.

Since in final account, exposed concrete surfaces bear imprints of wood graining and texture, one may wonder if this is the much evoked sincerity of modern architecture? May concrete “simulating” timber surface be true to material?

Indivisibility of material and texture in modern architecture means non-concealment of how, and of what a material the given structure arose. Imprint of the shuttering material on the concrete surface is by no means simulation of wood to the detriment of material-likeness, namely the surface is not expected to look like wood. Graining and gnarls hinting to the shuttering material clearly exhibit concrete material, unmistakable because of colour and surface texture. What is more, no element of architectural creation must be examined apart from the conception of the entire work. Examining the integer structure with appearance, surfacing, the effect is unambiguous: material and technology are coherent.

Metal, and in particular, glass shutterings produce smooth surfaces where hardened binder prevails while aggregates are about concealed inside the concrete mass. In general, however, the expected smooth surface is impaired

by working of the material after placing, minor air occlusions animate the concrete at close look: the surface is patterned by working phases of concreting. A mesh of lines along shuttering joints divides and rhythmizes surfaces of structural members, walls and partitions. Especially in the early period of modern architecture, a mechanically smooth, "pure form" was attempted by removing flaws hinting to the mode of manufacturing, to emphasize simplified, geometric forms by means of perfectly smooth surfaces. Sincereness in the matter of shuttering replaces, however, geometric configurations by the perception of material and structure made therefrom. Purposeful, systematic divisions create plastic effects of inevitable, recessed or embossed joints on smooth surfaces. Exposed concrete surfaces even slightly meshed possess scale qualities proper to those shuttered in timber. The unsophisticated appearance of concrete shuttered to smooth surface rises, however, problems: if concrete is an artificial stone, its aggregates, e.g. crushed stone or gravel, are expected to emerge to point out material properties. The excessively smooth surface consisting of binder conceals aggregates making up most of the concrete mass, disturbing the definite idea of materialness.

The observation that the shuttering as a negative form leaves its permanent imprint on the contained concrete mass induced designers to improve surfacing residing in the technological process by properly shaping the shuttering, ranging from unit-wise repeated, embossed ornaments to self-contained artistic concrete reliefs, to improve the appearance of the construction by applying a wide range of means and forms, in particular, on precast units. Moulds being usually made of embossed metal or plastic sheets, the desired shape does not exclusively depend on the concrete material, but also on the mould features, on the way of embossing. Trueness to material, imperative in modern architecture, emerges both indirectly and directly: the final effect of the surface should reflect both its material, the concrete, and be in no contradiction to technology processes of casting and mould making.

The demand for more animated concrete surfaces, especially in case of repetitive ornaments, induced to apply precast concrete tiles. (Cladding tiles applied on concrete or e.g. brick masonry, plainly exhibiting the surfacing, are in no contradiction to the prevalence of structural principle.) Decorative texture of identical, repetitive cladding units gets soon utilized in modern architecture. Effect of the façade of the Millard house in Pasadena by *F. L. Wright* is elicited by the harmony between simple masses and richly embossed façade surfacings.

The complex realm of architecture may, however, need other than decorative effects. Transfer of information inaccessible to architectural means is incumbent on attendant arts. Structural concrete lends itself to artistic shaping by its mouldability. Superimposed layers inside the shuttering produce special, recessed reliefs. Plane elements slightly out of level of the structural

plane define the means of composition: shadow outlines and plane ornaments outlined by edges, which are the media of artistic expression. Obviously, structure and material induce to abstract ornamentation: simple elements are unfit to naturalist details. Treated parts may be either all the façade surface, a major architectural part — parapet — or a point of accent of the surface. Also structural elements with this kind of ornamentation are encountered: modest decoration on cornices, edge beams or stout pillars is in no contradiction to structural straightforwardness. Experiments have also been made by pouring coloured thermoplastics or synthetic material solutions into recesses for variegatedness in colour and in texture, as revival of the ancestral technique of cloisonné enamel by recent means, of recent materials.

Moulds lend themselves to richer, essentially freely formed ornamentation, particularly for precast concrete cladding units. Concrete is cast in a plastic or gypsum mould made of the pattern relief. The surface is enmeshed by the light and shadow effect of the web of cladding unit joints. This relief development method has already been encountered in the history of arts.

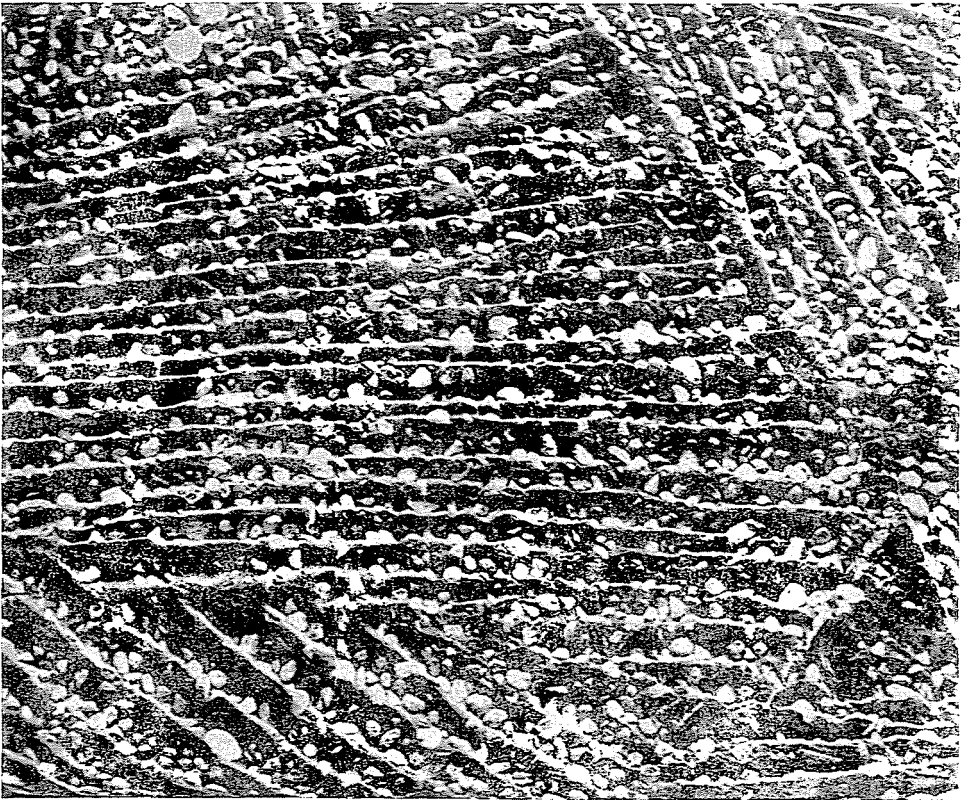


Fig. 4. Detail of a natural exposed concrete surface

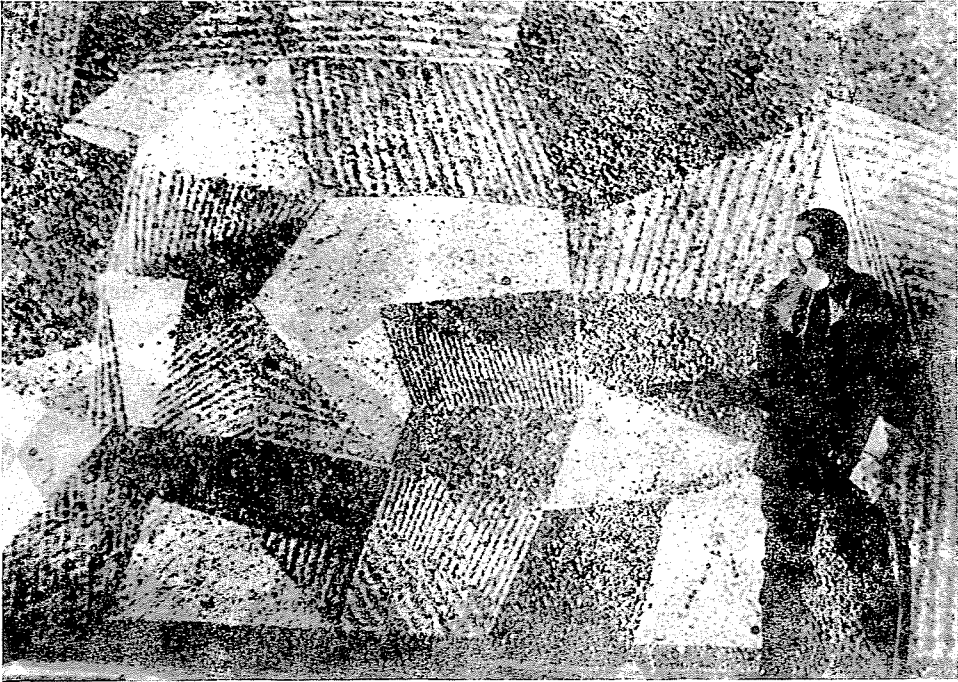


Fig. 5. Office building, Oslo. Exposed concrete surface treated by sand blasting, after designs by Carl Nesjar

Roman sculpture had recourse to pottery, and shaped from inside, the rear plane, outwards. Picturesque effects of Roman prototypes can also be achieved in modern sculpture. Though, behold: trueness to material may be at loss, excessive plastic effects may oppose materialness of concrete, an artificial stone.

Modest bas-relief lets base plane prevail, so that materialness, tectonic character of the building unit subsists. As another example from arts history: surfacings of huge masses in Egyptian architecture are reminded of by fine plastic reliefs over entire façade surfaces. The architecturally conceived concrete surface becomes an autotelic work of art.

While the discussed methods aim at certain plastic effects — either as unavoidable marks of making or as artistic reliefs — also further surfacing possibilities emerge. To display the real concrete material, i.e. the aggregate, hardened surface binder has to be removed, as another way toward trueness to material. Removal of the surface cement to display crushed stone making up most of the concrete is again conform to the principle of material sincerity, even if in a way differing from that for shuttered surfaces. The most of difficulty arises from the removal: hardened concrete resists dressing like an artificial stone. Usual surfacings, boastings, e.g. bush hammering are awkward

to apply. Nevertheless, the first attempts applied this technique, producing surface effects varying with size and kind of hammer. Texture and colour depend on aggregate and binder. Sand and gravel, usual aggregates of structural concretes, embedded in greyish cement, are little pleasant after dressing, so aggregates have been carefully selected for more demanding surfaces. Using higher quality aggregates of variable colour, particle size and grading produced rich effects. Translucent, white quartz embedded in dark grey cement, or its opposite, dense, dark slate with white cement, and the infinity of intermediates offer a wide range of surfacings. Angularity or roundedness of particles present different texture possibilities. Fine aggregates raise the dilemma of economy: generalization of concrete is partly due to its inexpensiveness. Use of expensive minerals and rocks would counteract this advantage, therefore such aggregates are attempted to keep on the surface of the concrete mass. Thereby concrete is divided into structural and surfacing materials, parting with harmony between material, structure and form. The fine surface material is not identical to, only concealing, the structural concrete. Several solutions were tried out to lift this contradiction. In case of increased quality requirements, high-grade aggregates are applied throughout the concrete but then technological difficulties arise. Moist concrete cast in the shuttering segregates according to grading, and the hardened concrete deprived from the cement layer exhibits phases of construction. To avoid it, dry aggregate is placed in the shuttering, and cement grout pressed in through proper holes. The resulting surfac is satisfactory but complexity and expensiveness of this method restrict its field of applications. Aggregate exposure and roughening are facilitated partly by applying chemical retarders, and partly, by recent handling methods: wire brushing, sand blasting. This latter requires a complex equipment but it also lends itself to produce decorative textures. Several examples of this artistic surfacing of natural concrete, "Naturbetong", are encountered in Norwegian architecture.

Difficulties in in-situ making and dressing of concrete with high-grade aggregates argue for its use in precast units, panels. Ordinary concrete can be superposed on the high-grade bottom layer in the mould for a cladding tile or non-load-bearing unit (e.g. curtain wall). Cladding units are not subject to the same requirements as structural members. Neither the plate-like appearance of crushed stone defies its material and structural qualities.

In this system, the aggregate can be exposed all over the surface but also variegatedness is possible by saving part of the binder and varying the mode of dressing. Again, a historical analogy: just as sgraffiti were made by cutting away parts of a surface layer to expose a different coloured ground, the modern artist varies the degree of dressing to produce surface elements of different textures as a mode of expression. Rather than purely decorative, "Naturbetong", the sgraffito of modern architecture, is born in hands of the artist,

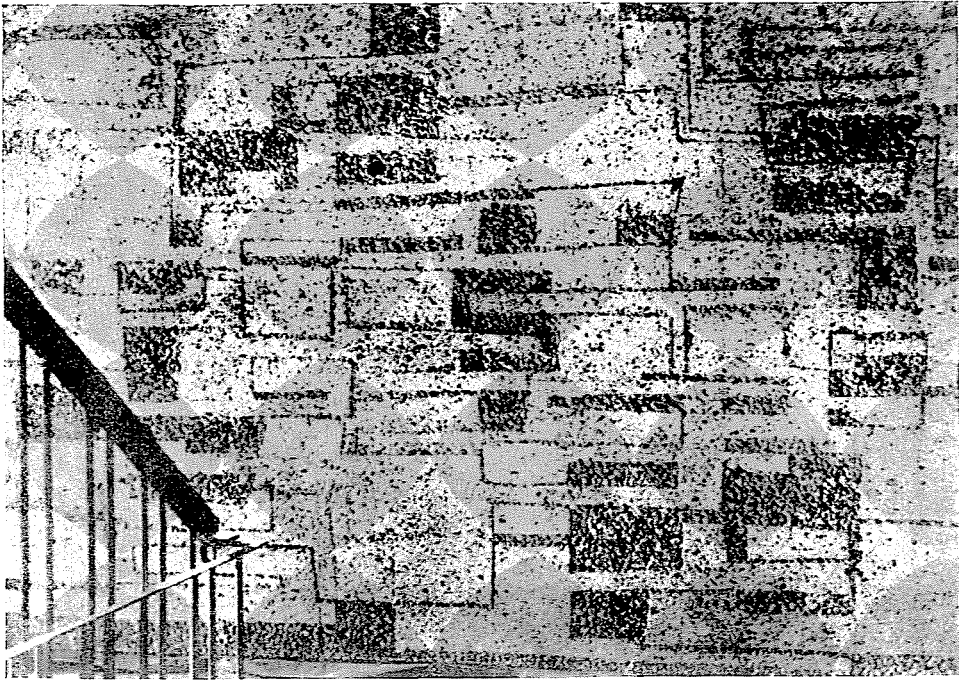


Fig. 6. Office building, Oslo. Decorative concrete panel by Odd Tandberg

of a new material, by a new technique, either as texture of an architectural surface, or as an independent artistic means of expression.

Partitions, external walls have often functions that require them to be perforated, so-called screen walls combining solid and hollow, positive and negative forms, eventually outside the scope of this study. Pierced concrete walls, however, may have other functions than screen walls. Recent forms of glass, this historical building material, are combined with concrete, from simply translucent, regular, factory-made glass bricks to individually shaped glass blocks. Glass-concrete walls made from a mesh of identical units often conceal structural concrete when edges overlapping deeply set joints hide the small r.c. ribs by the effect of light refraction. By carefully selecting simple factory-made units according to colour and pattern, inherent decorative artistic effects of the material can be made use of even in this undemanding case. Composition has its restrictions due to proportions and dimensions of units but colour and spot effects enhance decorative appearance.

In mediaeval architecture, structural members reduced almost to linear were added stained glass windows for confining the space. Stained glass plates framed in lead eliminate excess light from the inner space, separate abstract interior from nature. In modern, especially ecclesiastic architecture, this

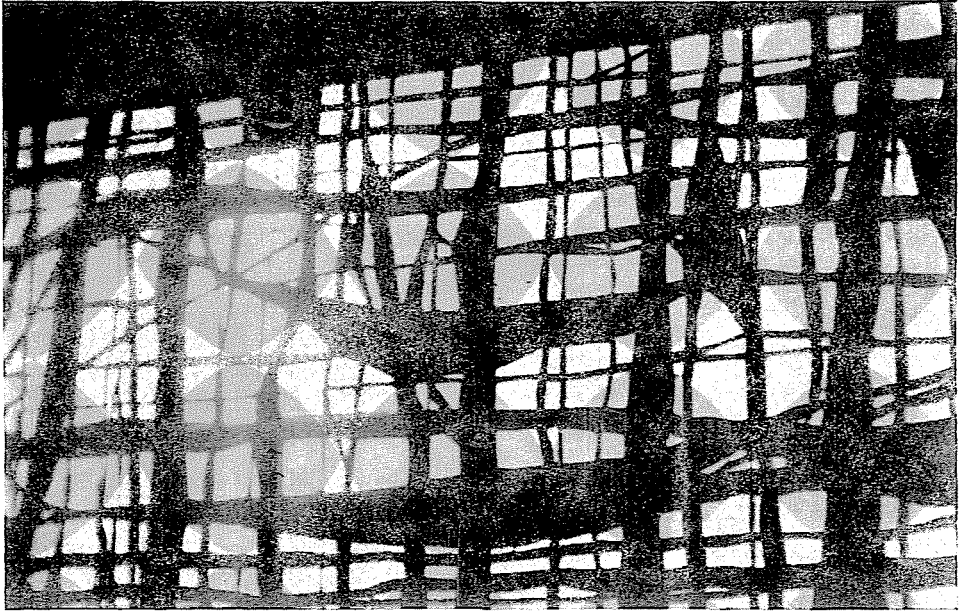


Fig. 7. Church of Bagatelle-Neuilly residential district, Paris. Glass-concrete windows by Pierre Chevalley

centuries old technique subsists. Lead is often replaced by reinforced concrete cast according to a newly developed method, framing glass new of colour and texture. Both components keep particularities but their union is transubstantiated in appearance. Irregular glass blocks are united by tapering or wider concrete strips. Although windows and glass walls are not primary structures, they are subject to some constructional restrictions. Certain ribs within the arbitrary concrete web are not only joints but also supports for the secondary construction by being reinforced. This more or less regular grid is a compositional restriction, similar to iron grids bracing Gothic stained glass windows. While, however, the mesh of lead frames connecting glass plates was subordinated to the bracing system, the arbitrary tracing of concrete ribs conceals secondary function, bracing and connecting elements intermingle.

In the internal space, the organic or strictly geometric web of dark concrete strips between glass blocks translucent in the incident light becomes determinant. Colour and light effects varying with direction and intensity of outer light reanimate the inner space, finely coloured glass blocks modulate the light. While inside the alternation of light and dark surface elements acts, and the effect of concrete materials is blurred, outside the web of marked clear concrete surfaces prevails over the gloomy shine of glass blocks. Between dark, glossy glass blocks, the "structure", the concrete of connection sharply comes to sight as a forceful, here and there refined fabric. Dualism, blurred

inside, becomes definite from the sight of sunlit concrete. Concrete animates the dull façade plane of glass-concrete windows and shares the overall architectural effect. In addition to be decorative, it may be the bearer of the artist's message. Composition is restricted by secondary structuralness, — concrete suits geometric, abstract patterns.

A further development of glass-concrete panels consists in moulding concrete connecting the glass elements to concrete reliefs or concrete sculptures. Its effect prevails mainly seen from outside, while inside, it is still the pattern from light and shadow, glass and concrete, that acts.

Concrete suits to create grandiose constructions. Beyond its primary, structural function, it offers possibilities from ornamentation to self-contained



Fig. 8. Detail seen from outside of the glass-concrete window of the Bagatelle church

work of art. Unity between attendant arts and architectural creations exists materially and by genre, to be realized by the creative mind.

Concrete as a means of artistic expression does not look far back, but there are examples to show this simple, modest structural material to cope with demanding artistic claims.

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* In Hungarian.