TRANSITIONAL HOUSING FOR EMERGENCIES: TEMPORARINESS AND REVERSIBILITY OF THE BUILDING PROCESS

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Abstract

The problem of post-disaster reconstruction goes unavoidably through the phase of "transitional living". To build for temporariness is first of all a cultural issue and today can be interpreted according to two prevailing needs: (i) to comply with the requirements of minimizing the impact on the land, protecting the resources and maintaining environmental balance; (ii) to stress the temporariness of the building itself, in order to realize the highest degree of reversibility once its use has been fulfilled. The concept of reversibility of the construction needs to be operated as a process innovation rather than as a product innovation, through systematic actions of planning, design, construction and de-construction, and re-introduction of the technical resources in a further productive cycle that adheres as much as possible to the realities of industry and to the rules of the productive system. The transitional house becomes a built object which is "dis-integrable" in two senses: (i) as a system of components which can be easily disassembled and (ii) using a biological metaphor, as a construction that is dissolved without leaving "waste", since the material resources from which it is made can be reused.

This paper illustrates the results of research aiming at defining the design requirements of the transitional living phase after an emergency and to show the technical feasibility of the reversibility of the building process.

Keywords: Temporariness; housing emergency; transitional living; reversibility; technical feasibility; innovation of the building process.

INTRODUCTION

In recent years the theme of the housing emergency has strongly attracted the general interest, not so much because of the intensification of the phenomena that cause it but rather due to a growing awareness of the need to tackle the problem more systematically and above all of the possibility of using appropriate instruments.

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There is agreement about the concrete cultural and scientific conditions needed in order to develop a new way of facing the problem of transitional living, of which particular cases in point are those caused by emergencies.

The following remarks derive from the knowledge that:

- even in our society the culture of transitional living is taking root and is becoming more widespread. Now, more than in the past, it has many fields of application (including intervention in the case of emergencies), but this makes it indispensable to re-examine the traditional methodological references of the architectural project;
- transitional housing, and therefore also emergency housing, must be included in the sphere of influence of "architectural activity" i.e. in the sphere of action of formal, functional and technological quality. Therefore, the answers must not be dictated only by the logic of production. Active players must be involved and a decisive role must be played by the world of academic and professional project research, local government authorities and civil defence organisations;
- the environmental impact caused by the spread of transitional living is no longer a negligible phenomenon – nor will it be in the near future – from both a quantitative and a qualitative point of view, with the result that it will be necessary to measure the aims of the project in relation with the material resources available;
- the events that lead to a housing emergency are of various kinds and no single answer to the need for an adequate remedy exists. There are several solutions according to the circumstances caused by the specific events (type and importance of the event, number of homeless, location, social and economic context, available infrastructures, etc.); this means that new proposals have the aim of enlarging the field of action, by adding to already available and adopted solutions;
- the only solutions for the housing emergency adopted to date (containers, wooden houses) are still among the few (and too often inadequate) solutions that the temporary housing market provides;
- this is also happening in the face of a demand that is not systematically nor adequately formulated so as to guarantee not only respect for the rules of the productive system – and therefore the concrete feasibility of the intervention – but also the needs and aims of the community;
- there is, at least in Italy, according to reports from the central Civil Defence authority, a difficulty on the part of those in charge of managing the housing emergency interventions, to “govern” the market supply, in the absence of an effective way of directing and at the same time evaluating the solutions provided by current production.

Transitional living

Time and space constraints today pervade every aspect of social life, bringing deep changes from an anthropological point of view. The arrival of new dynamics in social and working life contributes to the growing phenomenon of transitional living and the temporariness of architecture. Living is fragmented, atomised, parcelled out in time and space; the places and moments in which one lives become transitional states in which the time-space horizons are no longer static but dynamic.

Today transitional living provides an answer to the increasingly frequent contingent needs that contemporary society expresses: from the “houses in which to park people” to accommodation for temporary workers, “reserve” buildings, housing for nomads, refugees, immigrants, seasonal residences and emergency housing; perhaps the last of these is the most emblematic of the need to overcome a time-space condition that is “temporary” if not “precarious”.

The establishment of new perceptions of the time-space dimension makes the experience of “temporariness no less important than what is durable” and makes it necessary to redefine the “time and space horizons of the memory and the project” (Paolucci, 2003).

Strictly from the point of view of architectural discipline there are practically two consequences of these changes: the search for a balanced coexistence between architecture for permanent use and architecture for temporary use and the introduction of the chromosome of temporariness into the project’s genetic code.

Regarding the first aspect I have already had the opportunity to illustrate (Bologna, 1998) that the traditional concept of architecture sees an essential connotation in the durability and transmissibility in time of a whole series of values (cultural, social, aesthetic, technical, functional etc.) generally associated with architectural activity. A type of architecture programmed to fulfil contingent needs and for a fixed temporal use is being added to this, and is at the same time gaining a respectable position.

With regard to the second aspect we need to establish clearly that by looking at the project as a transitional time-space programme we shift our attention onto the temporary nature of the building itself as a material fact rather than onto the temporariness of its use and/or location. This consideration introduces us more directly to the theme of transitional living in cases of emergencies.

The time-space rhythms that are typical of man in his own environment can be compared with the tension between the two temporal dimensions that contemporary philosophical thought identifies as “natural time” and “technological time” or earlier in the Middle Ages as “ecclesiastical time” and “merchants’ time”. The former is defined by a cyclical sequence of events and is regulated by the rhythms of the sun. The latter derives from the measurement of man’s sequence of activities, from standardisation and from an examination of the productive and industrial systems.

The project moves between these two extremes, alternately preferring one and then the other.

Conferring on the artefact a “transitive property” between a state prior to and a state subsequent to its use means working in terms of the reversibility of the building process. It is hard to imagine that the reversal of the construction process can enable the sequence of operations as originally accomplished to be followed backwards until the starting point is reached. This is due not only to the trajectory of time that goes in one direction and is unavoidable, but also to the energy consuming nature of the production processes, making it actually impossible to return to the initial state.

Etymologically speaking the rule of reversibility as a physical phenomenon is not feasible in the case of the building process. What counts in our case is the possibility of identifying a criterion for reconstructing the actions of the building process, where the reversibility of building is represented by the cyclical nature of the process, on the model of a spiral rather than a circle: a reversibility that belongs to the irreversible motion of nature. In the reversibility project, technical time meets natural time to answer the needs of the sustainability of development and environmental compatibility. The reversibility of technical time, in relation to which man develops the activity of transformation and production, is confronted with the irreversibility of natural time, on which the environmental resources that he uses depend.

The reversibility of the construction process

By reversibility of building one should thus understand the concrete possibility of starting – once the temporary function of the artefact has been exhausted – a reverse process of de-construction through which the material and spatial resources involved can be “freed” to allow them to be re-integrated in the environment from which they were taken or re-introduced into another production cycle. This means that the space occupied (the ground), the materials and all the technical factors must always be considered as “resources” with their own useful life cycle that goes beyond a temporary use. This means foreseeing (programming, planning) the destination of the products deriving from the process of de-construction that have been temporarily used to satisfy a contingent requirement. I wish to make it clear that we are not talking about “demolition”. Incorporating in the project the expected transitoriness of the artefact means thinking of a non-destructive action from which one does not obtain “waste” or “residue” but “assets” that maintain intact as far as possible the potential to be re-introduced into another production cycle or to be reintegrated into the natural environment.

A heated debate has begun in recent years over the themes connected with the future forms of global development, capable of not damaging the quality of our planet’s ecosystem, and consistent with this evolution in public opinion, also the

economic (and productive) model which was dominant in the last century – based predominantly on waste, on disposable goods and on an indiscriminate use of resources - has tackled this momentous transition, always concentrating on the productivity of resources (Hawken, Lovins, Lovins, 2001). By now there is a reference standard, a compulsory method which is becoming increasingly popular, upon which the "next industrial revolution" is based, and which is pushing civil society towards a more sustainable economy.

The model of understanding that we adopt and that we consider as the foundation of our scenario is based on optimising the metabolisation of the flow of resources and above all on reducing it. This systemic approach implies bearing in mind the integration of all the expected costs and benefits; this must be inferred from the "de-materialisation" of the "production and consumption" system (Manzini, Vezzosi, 1998) in order to build a cyclical view of the process.

Process innovation

Apart from the matter of economic and technical feasibility, the wide range of approaches adopted in recent years to solve the problem of transitional living and in particular in cases of emergencies, unfortunately still have the same discriminating feature: they tackle the problem according to a univocal logic of "product" innovation, which is strongly anchored to the definition of an intelligent and fully accessoried "machine for living".

In other words: an infinite number of solutions supported by one concept of the construction process, i.e. the transitional living module conceived as a finished industrial product, an object to be purchased like any goods produced for sale on a shelf and ready for use. This is an approach that does not allow any other viewpoints; on the contrary, accentuating the sophistication and analytical complexity of the phenomenon from the same viewpoint makes any other proposal useless.

The validity of the products that derive from this attitude is not questioned, but as stated in the introduction, this cannot be the only logic suited to facing the many cases that arise.

In the light of these problems, it is evidently necessary to concentrate on process innovation before starting on product innovation in order to fulfil the reversibility criteria; one must rely on the wealth of technological resources available, identifying the process method according to which they can be temporarily organised; it is necessary to make use of the potential of the productive system and of the new formulas regulating the exchange of goods and services in the economic system.

This means concentrating our attention on the need to set in motion a systematic series of actions involving programming, planning, building, de-construction and re-

introduction of the resources into the production cycle, following the industrial process and the rules of the production system as closely as possible.

Historical continuity must be given to the cultural thought that came into being in the first half of the 20th century. We recall in this regard the Case Study House Programme launched in California that lasted from 1945 to 1966, originating from the experience of the Balloon Frame systematically spread by Snow and of Paxton's Crystal Palace during the Industrial Revolution and passing through research and experimentation, from the 1920s, initially with Fuller and Wachsmann, then with Gropius and Breuer. There was also the work of Jean Prouvé (1901-1984): components industrially manufactured with light materials and sophisticated assembly techniques were used in order to enable the building, for which its creator preached the principal of temporariness, to be dismantled and demolished. He claimed that building using heavy technology with the prospect of a long life cycle would be too great a burden for future generations.

We find this mark of continuity again today in some of the most interesting experiences completed for the Hannover Expo 2000. Exhibition pavilions – starting with the Crystal Palace – were originally intended as transitional buildings, as a stage to present modernity, and as such they are presented again one and a half centuries later. The central theme around which the planners representing the various countries worked was the relationship between progress and sustainability and the desired result is buildings conceived with the idea that they should be dismantled and recycled.

Indicators of technical and operational feasibility

Among the first "technical" project indicators for measuring reversibility is the requirement of the dis-integrability of the building, which must be understood both as the system's capacity to be dis-assembled, easily dismantled and as the building's capacity, according to the biological metaphor, to dissolve without leaving any "trace".

On the basis of this logic the dis-integrability of a construction system can take place along three development lines.

Technological dis-integrability is what is achieved by a system composed of elements that can easily be dis-aggregated or dis-connected or dis-assembled, in other words a system that can be deconstructed. It is the type of dis-integration mostly widely and commonly applied, that takes place in an exclusively technological context since it concerns the interfaces of the elements that compose the construction system.

Physical dis-integrability is obtained when a system is made with materials in which a change in their physical state causes the construction to dissolve. This is

the more concrete case of earth buildings according to the various techniques (adobe, pisé), where the raw material is worked, mixed, compacted to make the construction elements (walls) but which can be crumbled and reduced to its original physical state. There is also the case of constructions made with dry stone walling, even in its modern reinterpretation, or constructions made of ice – yesterday the *igloos*, and today the various *icehotels* built for tourism in the Scandinavian countries and Canada – that are based on the reconversion cycle of water from a liquid to a solid state and vice versa. They are perfect examples of reversible constructions in which the residue of the de-construction process can be re-integrated in the environment just as it had been removed.

Organic or biological dis-integrability is obtained with a system built of organically or biologically degradable materials. Today this is certainly a rather unrealistic hypothesis, but can be imagined for the future, with the encouragement of certain fantastic similitudes, such as the edible witch's house in the Grimm brothers' fable of Hansel and Gretel (1812). Or by certain experiments made as a provocation, like the living capsule proposed by Doriana and Massimiliano Fuksas on the occasion of the Mostra Interni d'autore in piazza (Exhibition of Interiors) in Milan (2002), with its "walls" filled with freeze-dried food. Nonetheless one should not rule out the possibility that this type of dis-integrability for buildings will sooner or later be accomplished: today there are already materials that are easily bio-degradable, such as for example "mater-bi", the material based on corn starch which is used to make biodegradable paper wrappings, insulating panels, disposable objects (cutlery, plates).

The requirements of dis-integrability in building lead to techniques for connecting and separating the elements and materials that can be referred to the standards of *assembly and dry stratification* where all the elements are integrated in the building through addition and are connected to each other not through cohesion but simply by being placed next to each other so as to make the joints reversible.

Foreseeing in the planning stage the destination of the residues deriving from de-construction, or better still, of the re-introduction of the material and technical resources recovered from the de-construction phase into another production cycle – whether or not they belong to the same construction sector – is linked to two important concepts: recyclability and re-usability.

The construction system will therefore need to be considered in such a way that every single component of the building, once it has been dis-aggregated, can be transferred for a new use or for the applications for which it was originally used. This is naturally achievable if the technological and construction choices (after planning a selective dismantlement of the building) enable materials with different characteristics to be separated; that is materials which are not susceptible to subsequent transformation processes in order to gain further performance characteristics in a new field of application.

The possibility of recycling or reusing technological resources is enhanced by the construction system's capacity to use existing products, transferring them for appropriate new uses. It is easy to think of transferring many economic industrial products, semi-finished or made from a few components, large stocks of which are readily available and commercially widespread, to other functions that are different from the original ones, nonetheless retaining their own connotations in terms of performance. Many building products available on the market may not be assembled exclusively for residential purposes, but their application and transfer to that function cannot be ruled out, since the choice of process can be changed without necessarily changing the product.

They are materials in everyday use, at a low level of specialisation that can easily be integrated within construction processes for various purposes, all with the advantage of low costs and fast installation.

The possibility for the construction system to reduce or eliminate the use of "special" components conceived especially for the project to which they must be adapted, would make it possible to find every single component "by catalogue", obtaining it directly from the production system.

The aim of de-construction is to increase the level of recylability of the resources used whatever the original configuration of the building, according to an approach that concentrates on the quality of the material obtainable from recycling.

This is achieved by guaranteeing the maximum "*invariability of product standards*", i.e. maintaining as far as possible unaltered the morphology, dimensions and performance that the product on the market has at the moment at which it is first put into use, consistent with the logic of using technological resources that already exist rather than creating new ones. This is made possible by *minimising the planning activity involving the element itself,* which frequently means that it is modified or that its morphology and dimensions will be adapted from the original state of the product, and instead optimising the rules for assembling it according to the production criteria "according to the catalogue".

The adoption of a **modular dimensioning system** speeds up the process and avoids placing excessive constraints on the placing of the components that, being interchangeable, may allow a partial personalisation of the living unit. The modularity of the components also provides greater *typological and technological flexibility* in time, since the components can be changed and the space modified (enlargement, change in the distribution etc.).

The desired simplification of construction makes it possible to limit the need for skilled labour to a few operations and with a supervisory role (this task could be performed by Civil Defence technicians or by volunteers), with the possibility of directly involving the user. The principle of *"assisted self-constructibility"* has the aim not so much of recruiting more labour in order to complete the buildings, but above all of succeeding in giving an active role to the person who will occupy the living

unit, being encouraged to participate in a “reconstruction” process already in the initial transitional phase, with the possibility of having a say in the decision-making process in relation to personalising the transitional house intended for him or her. The sense of contributing to building a house for oneself and personalising it, not accepting it passively almost like an act of charity on the part of the community, may also make the user more aware and responsible towards the management of the property itself. Thus the principle of self-constructibility also has important consequences for the psychological “rehabilitation” of people already suffering as a result of the loss of their own property or of their family affections.

Another fundamental indicator in favour of the effectiveness of the proposal that incidentally is already contemplated under the current legislation is the choice and planning of the site on which the emergency housing will be erected. As previously pointed out, precise indications are given in relation to the topography, drainage, soil conditions, accessibility, … and above all to the specific primary urbanisation works. A frequent problem is the lack of an updated picture of the availability of areas to accommodate the evacuated population; thus we stress the need for the authorities with specific responsibilities regarding the planning and management of the territory to provide multifunctional areas with facilities, for the use of several municipalities, in a central position with regard to the risks to which certain territories are exposed.

Of fundamental importance for the process feasibility of our proposal will be the preliminary *infrastructuring* and *mulfunctionality* of these areas, extending the possibility of an alternative use of the area already equipped with infrastructures (fairs and markets, sports or musical exhibitions etc.) thus making the initial investment costs easier to bear.

An indicator of the fundamental process that could establish new “rules of the game” consists in reformulating the production system with the aim of reducing the flow of resources, while retaining the possibility of generating new conditions of welfare, through the constant re-use of resources in continuous closed cycles.

The adoption of the key-concept of the life cycle in the sense of considering the set of phases and impacts that determine and accompany a product, from *birth* (pre-production) to the *grave* (decommissioning), would imply a transition scenario from the univocal “product design” to the circular “product-system design”. From a procedural point of view, this shows the importance of being in touch with the series of relations that the product will have in the environment during its entire life cycle.

With this in mind, a first step towards the construction of a potentially feasible scenario would consist in deciding, from a procedural point of view, at what level to stop the LCA (Life Cycle Analysis) and consequently fix the functional, territorial and temporal frontiers. For example emergency housing can no longer be considered as a product with an *extended* life, but as a product with a *short* life, thus avoiding many impacts (and costs) in the planning, distribution, use and decommissioning phases. But unlike current practice, it is also important to define the functional limits and in particular the *scope* of the analytical process: the enlargement or restriction

of the analytical horizons have a considerable influence on the types of impacts observed, on the accuracy of the observation and on how these impacts are assessed.

Only by planning according to this logic which considers an entire life cycle, with an appropriate duration, will it be possible to remove many of the intrinsic shortcomings of the present *product-model* and to ensure that the resources committed are far more productive (and socially accepted).

To properly understand this indicator's effects, we should remember the industrial model introduced towards the middle of the 1980s by the two visionaries, W. Stahel (a Swiss industrial analyst) and M. Braungart (a German chemist), that is nowadays taking shape more firmly: they imagined an economy in which instead of producing and selling goods, services were supplied to customers through various forms of rental or leasing (not to be confused with the traditional definition of a service economy).

In this perspective, producers cease to consider themselves as sellers of products and become suppliers of services, obtained using durable goods that are gradually improved with *upgrading* systems. The producers' aim becomes to sell "results", "satisfaction", and "performance" rather than just plastic objects, cars etc. To take a simple example: instead of buying a washing machine, the consumer can pay a tariff for a service that enables him not only to have clean clothes, but also, if the washing machine stops working or develops a fault, an immediate replacement or repair by the manufacturer, because it remains the latter's property.

The typical characteristic of this process, the continuous return of the product to the manufacturer for repairs, re-use, reprocessing, led Stadhel to define it *"from the cradle to the cradle"*. Similarly Braungart sees the world as a series of metabolisms within which what man creates becomes *"nourishment"* for interdependent systems and at the end of its useful life returns to a new industrial or biological cycle. Continuing his analysis, he claims that if a product could not be returned to the natural cycles of nutrients, it should be re-designed so that it can be dismantled and completely re-incorporated in an industrial cycle as a *technical nutrient*.

In such a *service economy*, as in that in which our technical proposal should be placed and towards which the market is increasingly striving, the product is a means and not the end. Renting and returning a product means that the product remains the property of the manufacturer/supplier. Minimising the use of materials and maximising the duration of the product is not only advantageous for the consumer, but it protects the producer's investments and profits. Both the "holder of resources" and the consumer have an incentive to continually improve the productivity of resources, at the same time protecting the ecosystems.

Coming back to our field of application, emergency housing today follows a single path after the use phase: it is transferred from the emergency site to a storage place. In a service economy as illustrated above, our "product-system" would enable

the resources used to become fully productive, eliminating for example the *dead* phase of warehouse storage.

Moreover, assuming the potential limit of the duration of a product, the so-called break-end point, in which replacement with a *new* or *re-processed* product has a lesser global impact, the *infinite duration* approach will have to be abandoned to make way for the concept of optimisation, extension of useful life, of *appropriate duration.* Then, considering a living model with a long-term life cycle, it becomes difficult to identify the life cycle of materials, since every element is intrinsically connected with the life cycle of the whole building. It would be a pointless venture to commit resources permanently for temporary functions, with the prospect of drawing up a global eco-budget.

Proceeding along this line of logic, to establish an active flow of resources, it is necessary to create a product more in keeping with local resources, with the industrial requirements and with local rules of production and therefore more able to respond efficiently, rapidly and flexibly to the current request. Today an *emergency product* is used in the same way at all latitudes (with problems of adjusting to local climate conditions), without considering the possible local resources (presence of specific industrial sectors), and is often after its use transported and deposited hundreds of kilometres away from the place where the request, or rather the emergency originated.

By introducing these criteria of local availability, or geo-referentiation of resources, aimed at “local action”, not only will they result for example in a reduction in transport time and costs, but the specific environmental, economic and productive factors of the sites will be taken into consideration in the budget (local availability of resources, reduction of the environmental impact, local potential for reconversion of components and materials…), also triggering a mechanism of recognition of ones’ cultural identity, essential for the individual in order to regain mental and social well-being in the case of an emergency.

Connected with the aforementioned remarks is the indicator intended for the preparation of a “territorial resource network”, able to perceive the resource availability in a particular area (including disposal, re-introduction, re-processing). This undoubtedly involves coming to terms with strongly innovative elements and it cannot be the sole responsibility of those working with the Civil Defence authorities, but depends on the stipulation of conventions and protocols of intent with producers of resources, who have provided interesting services in other sectors.

Some of the advantages of such an innovative approach are speed, flexibility and the certainty of receiving resources that are always fully efficient and productive (no problems of low performance levels nor of obsolescence of the supplies,).

Defining a territorial resource network obviously means defining a list of producers/”holders” from whom the customer can request a service. There will be many advantages, such as those mentioned above and, for example, the cost of

transport to the place of the emergency will be lower (given the shorter distance) and “storage” and maintenance costs will be cancelled. In this way, the concept of possession will be transformed into a concept of access to resources.

The reduction or elimination of stocks produces an important series of economic and management type effects. First of all it limits the need for a large *initial investment* for supplying building systems that not all the organisations today (public administrations and Civil Defence mainly in the case of a housing emergency) are ready to support except for the barest minimum. Moreover it avoids the need to pay *rental fees* for storing the products purchased and reduces *transport costs* that, in the case of storage, increase because of the distance from the place where they will possibly be used. This can easily happen when there is a maximum concentration of warehouses. It also avoids the *immobilisation of capital,* which would happen in the case of stocks that produce absolutely no income and are moreover subject to devaluation, also avoiding the often rapid *obsolescence and deterioration* of materials in storage, which almost always require *maintenance* to recover their performance characteristics in order to re-use them.

The next step towards the achievement of a “territorial resource network” is the creation of a database by means of a virtual “market place” accessible via the Internet, where it will be possible to locate the stock of useful resources at that moment and in a specific place.

This contextual information system will make it possible to provide and gather information on the supply conditions (flows of materials and components) that the group of private producers/”holders”, previously engaged through conventions or protocols, will be willing to provide, upon short notice.

As well as the advantages connected with the possible optimisation of the life of the products in the “virtual resource warehouse” scenario as previously described; important foundations are laid for the decommissioning phase.

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