Chapter 10
Cases

Contents

This chapter is devoted to discussing situations in which the properties of certain systems are of, or may be considered as belonging to, a post-GOFS type. We refer to systems which can be represented and considered as acquiring properties, pre-properties, meta-properties and quasi-properties through explicit or non-explicit processes such as dynamical coherence(s) and multiple emergence(s).

In particular, we consider the case of architecture where, as introduced and discussed below, there is evidence both of acquired emergent social properties *materialized* in architectural artefacts and of structures of architectural artefacts *inducing*, in their turn, the acquisition of social properties. Architecture was chosen to be studied in detail, among other possible disciplines, since this two-way and superimposed process has more and less questionable evidence than, for instance, in other disciplines or artistic expression affecting social systems as mentioned in Sect. 9.4.4.

On this point, we also mention below how the possibility of *inducing* the acquisition of emergent properties within social systems *fits* with aspects of post-GOFS. This occurs when properties of complex systems, as discussed in Chaps. 2–5, cannot be explicitly and symbolically *prescribed* because their *nature* is different from those possessing GOFS properties.

As already discussed, suitable strategies have to be adopted in order to induce complex systems to acquire properties and possibly related and desired changes. Some characteristics of such strategies consist of using low-energy and

G. Minati, E. Pessa, *From Collective Beings to Quasi-Systems*, Contemporary Systems Thinking, https://doi.org/10.1007/978-1-4939-7581-5_10

non-invasive interventions, taking into account multiplicity, non-explicitness and the impossibility of symbolic prescribing, i.e. giving explicit *orders*.

In a metaphorical sense, we could say that suitable post-GOFS strategies are equivalent to '*whisper' to the system* the changes we have in mind, by resorting to orienting processes so as to *induce* autonomous *structural rearrangements*. In other words, we need to *convince* the system to acquire new properties, pre-properties, meta-properties and quasi-properties by *allowing the system to work* under the influence of dynamical coherence(s), multiple emergence(s) and *usage* of contradictions (Stokes, Dunning, Nazareno, & Brusco 2013).

The approaches suitable for *acting* upon complex systems constitute examples of effective strategies. The dynamic correspondences and coherences between the properties of social systems and their related architectural structures suggest a possible strategy based on acting upon architectural structures to *accordingly* act upon the properties of the social system inhabiting that architecture.

This is the main topic of this chapter which will also mention other cases such as multimedia, education and medicine.

As often remarked in this book, the new post-GOFS approaches should be grounded on principles and concepts used, for instance, in the *science of networks* (Barabási, 2002; Carley, 1999; Lewis, 2009; Valente, 2012) and in the study of meta-structures where actions upon emergent properties occur through actions upon properties of suitable features such as those relating to topology, scale invariance or meta-structural regimes.

The following cases consider the point at which complex properties are assumed as being *materialized* and not only *represented*, thus allowing the introduction of modifying interventions on *material representations*.

Ignoring such aspects, as in cases related to social systems, may produce, as stated in the previous chapters, a kind of ***second-order reductionism*** *which occurs when complex properties are misunderstood and treated as if they were GOFS properties.*

10.1 Architecture, City Planning, and Design

> To imagine a language means to imagine a form of life.
> (Wittgenstein, 1953, Part 1,§19).
> *Does imagining an architecture mean imagining a form of life?*

Within the conceptual framework of the theory of emergence and second-order cybernetics, focusing on the theoretical role of the observer as generator of *cognitive existence* rather than of relativity, architecture may be intended as the *self-design*, by a social system, of boundary and structural conditions suitable for making *structurally* emergent suitable social ontological properties (Della Torre & Canziani 2009; Fontana, 2012; Minati & Collen 2009).

Self-design is related to the processes of *transformation* of emergent social properties, e.g. lifestyles and customs, into structural constraints, aiming to provide

a structural status to those properties, so as to avoid considering only the properties themselves as emergent.

Clearly, human settlements are the product of human societies, generally built and developed by a vast number of unconsciously interacting acts, performed over a long time, rather than by *purposely designed single acts*. Such a vision generates the idea of an *implicit* (or sub-symbolic) *project* which relies upon the systemic approach (Di Battista, 2009). As will be seen below, *the implicit project* is considered as *the sub-symbolic transformer of emergent social properties in architectural structures*.

The project is implicit because it is self-generated by the random combinations of many different and distinct needs and intentions, continuously carried out by undefined and changing subjects. It develops in a totally unpredictable manner. It is, moreover, a project produced by random combinations which are nevertheless continuous over time and transform and/or preserve all built environments.

The project is also implicit since "Architects are responsible for no more than perhaps 5 percent of all the buildings in the world. Most buildings (...) which give the world its form (...) come from the work of thousands of housewives, the officials in the building department, local bankers, carpenters, public works departments, gardeners, painters, city councils, families..." (Alexander, 1979).

Here, we recall that the identification of architecture with the self-design of boundary conditions forces us to introduce a concept originally considered in mathematics. Namely, when dealing with differential equations, a *boundary value problem* is given by at least one differential equation *and* a set of additional constraints called the boundary conditions. The concept of boundary condition can be generalized to include the degrees of freedom or constraints given by structures, e.g. the geometrical and topological properties of *living space* as shaped by architectural design, inhabited by interacting agents establishing a collective behaviour (Minati & Collen, 2009).

Examples of boundary conditions affecting single and collective behaviours adopted by inhabitants and inducing emergence of social behavioural properties are:

1. The availability of sidewalks inducing or preventing pedestrian traffic.
2. The availability of living surfaces inducing residence for singles or families, e.g. collective housing.
3. The central role of some functional areas in flats, such as the kitchen, traditionally the warmest place, and the availability of several bathrooms.
4. *Internal* or *external* facilities, inducing suitable usages such as a laundry or places for food storage.
5. The shapes of walls and their topology, according to their specific roles in houses, hospitals or schools.
6. Lighting, which makes possible particular living styles and inducing them (e.g. street lighting and artificial dynamics of lights, such as traffic/pedestrian lights).
7. The number of entrances and exits in a block of flats.

8. The shapes of roads, inducing particular properties of traffic.
9. The various types of stairs, e.g. stairs with one handrail or two handrails, and the availability of a slide for baby carriages and wheelchairs.

The structural aspects of architecture, specifically the materials used to build, behavioural facilities, shapes, dimensions, illumination, acoustic properties and energy usage for illumination and heating have functional and inductive behavioural effects on those who live and spend their time in such a structured space (see, for instance, results of research presented on the web (Space Syntax Laboratory, http://www.spacesyntax.com/; University College London (UCL), http://www.casa.ucl.ac.uk/; The behavioral design lab, http://www.designcouncil.org.uk/).

Individuals, as well as their established social systems, introduce multiple, sometimes shared, cognitive representations of the space in which they live and, because of this, they become *inhabitants*. As a result, they not only respect the boundary conditions from a functional point of view, but also cognitively process and use the representations they have of the space structured by those boundary conditions adapting their behaviour. This is why there are different architectures from different era and social systems.

A related subject is *Landscape Architecture* and its emergence (see Sect. 10.1.4), where "Architecture materializes our lives in the network of signs and meanings that all our landscapes are, such as our rooms, houses, roads, villages, cities, and territories" (Di Battista, 2012, p. 523).

Architects have the power and responsibility to set the boundary conditions, because they draw up the plans and models which organize the spaces for the inhabitants. We may say that architects cognitively synthesize in a temporary way, by representing them, the coherences and incoherencies of the social system.

10.1.1 The Implicit *Project*

The concept of implicit project is introduced by the following quotations and anticipates self-architecture as emergent and corresponding to processes of emergence occurring within social systems as introduced in Sect. 10.1.2:

> Architecture organizes and represents the settlement system; it interprets, materializes, interacts with and confirms the references of cognitive systems, and projects (foresees) and builds *coherent occurrences* (steadiness, confirmation) and *incoherent occurrences* (emergence) in the settlement itself. Architecture operates in the interactions between mankind and natural environment with *coherent actions* (communication; consistent changes; confirmation of symbols and meaning) and *incoherent actions* (casual changes, inconsistent changes, new symbols and meanings).
>
> Coherent actions are usually controlled by rules and laws that guarantee stability to the system (conditions of identity and acknowledged values); incoherent actions generally derive from a break in the cognitive references (breaking the paradigm) or from the action of *implicit projects*.
>
> These are the result of multiple actions by different subjects who operate all together without any or with very weak connections and have different – sometimes conflicting – interests, knowledge, codes, objectives. Implicit projects always act in the crack and gaps of

> a rule system; they often succeed, according to the freedom allowed by the settlement system.
>
> Perhaps, the possible virtuous connections of this project, in its probable ways of organization and representation, could identify, today, the boundaries of architecture that, with or without architects, encompass 'the whole of artifacts and signs that establish and define the human settlement'. (Di Battista, 2006, p. 398)

> In the open system of the built environment and in the continuous flow of human settlements that inhabit places, there are many reasons, emotions, needs, all of which are constantly operating everywhere in order to transform, preserve, infill, promote or remove things.
>
> These intentional actions, every day, change and/or confirm the different levels of our landscape and built environment. This flow records the continuous variation of the complex connections between people and places.
>
> This flow records the continuous variation of the complex connections between people and places.
>
> This flow represents and produces the *implicit project* assuming that all built environments carry out to update uses, values, conditions and meaning of their places.
>
> ....
>
> No single project, either modern or contemporary, has ever been and will ever be so powerful as to direct the physical effects and the meanings brought about by the *implicit project*. (Di Battista, 2009, pp. 45-46)

We deal here with the passage from ***acquired*** *to* ***structural*** *properties where architecture is intended as a* ***structural synthesis***. Examples of this are given by the architectures of dwellings, intended first as a materialization of ways of housing and then inducing them. The same holds for the architecture of hospitals (Nickl-Weller & Nickl 2012), intended first as a materialization of conceptual *repair-like* therapeutic and medical approaches and then inducing them, and for the architecture of schools (Gelfand & Freed 2010) intended first as a materialization of ways of considering knowledge, i.e. based on a disciplinary fragmentation, and later inducing it.

These examples illustrate the passage from ***implicit, unexpressed*** *properties to* ***structural*** *properties, where architecture is considered as the design of new structures, in turn intended as* ***representations, translations*** *of the properties of social phenomena.*

Moreover, architecture does not only materialize and transform acquired emergent properties of social systems into structural constraints, but it also induces new emergent properties when introducing innovative ways of structuring space. Examples are given by vertical constructions, such as skyscrapers, or underground constructions. Their usage leads to the emergence of new properties.

10.1.2 The Concept of Self-Architecture

The concept of self-architecture is related to the transformation of acquired emergent social properties into structures playing the role of constraints, leading to the *functional* establishment of those properties themselves. *It may be intended as* ***self-***

design *occurring through implicit projects, and cognitive materializations, as* ***translations*** *made by architects or anyone carrying out design and structural changes*. As discussed below this translation is not only one-way and limited to replicating the same ontology in various ways but a two-way process inducing and also reporting inconsistencies and contradictions. Self-architecture relates to the transformation of implicit, still unexpressed, cultural properties of social systems into structures, structures of structures whose properties are able to confirm and induce the emergence of coherent behavioural properties. Therefore, self-architecture is related to the global *interdisciplinary coherence* between various simultaneous aspects of social systems such as those relating to language, music, literature, religion and science. Self-architecture also represents the evolutionary processes occurring when a temporary incoherence allows social systems to restructure and reach a new equilibrium and coherence. Namely, architectural design often shows temporary syntheses representing coherences and incoherencies of the social system. *This allows one to recognize a sort of* ***continuity*** *between architecture, the practice of dwelling, fashion, music, literature, practicing religions, etc., occurring in different periods such as baroque, rococo, neoclassical right up to post-modernism.*

Of course, by adopting a trans-disciplinary view, this continuity may be considered as characterizing the disciplines in general. However, while some disciplines, such as engineering and architecture, design *concrete* constraints, other disciplines mainly design *cognitive* constraints.

Another important topic is that of the relationships between architecture and law. Namely, analogously to what happens in architecture, laws prescribe individual as well as collective constraints related, for instance, to security, land use and roads which operate as boundary conditions. This limits social behaviour in the design, construction and use of living spaces, and as such, these constraints also are able to induce, at another level of description, processes of emergence in social systems.

One crucial aspect, among others, was introduced by the practice of Post-occupancy Evaluation (POE), allowing reciprocal feedback between designers and *users*, as well as the *effects of usage*, of the designed architectural structures, necessary for triggering a learning process regarding both the design activity and user habits (Blyth, Gilby, & Barlex 2006; Federal Facilities Council 2002; Preiser & Nasar 2008; Preiser, Rabinowitz, & White 1988; Preiser & Vischer 2005).

An elementary and related ethical aspect, before and during the planning and construction of a building, is the *consulting* of stakeholders who are impacted by decisions concerning aspects of using, altering, maintaining and improving living spaces occupied by human social systems. It should be recalled that the subject of ethics and architecture (Taylor & Levine 2011) is very difficult and often debated from an interdisciplinary perspective.

The practice of POE highlights the *second-order cybernetic double loop* of *self-architecture*, i.e. how one influences the other not only through normal regulatory feedback but through *redesigning* processes (Minati & Collen 2009) going, for instance, from the materialization of lifestyles to its opposite, converting structural materializations into lifestyles (Minati 2015).

The most important point is to be aware of the problem, make explicit and publicly available possible choices and include systemic effects such as considering cities not only as ***places*** *within spaces* (Mostafavi 2014) *but as systems of networks and flows to better comprehend how cities both emerge* ***and*** *function* (Batty 2013).

10.1.3 Environment and Architecture

A number of different aspects must be taken into consideration when trying to ***distinguish*** *between the concepts of environment and architecture and even when trying to define them. A brief overview* (*Di Battista,* 2006*, p. 395) also introduces the following tentative definition of architecture intended as a* ***whole of artefacts and signs that establish and define the human settlement****, based on William Morris's definition of architecture as '...the moulding and altering to human needs of the very face of the earth itself, except in the outermost desert'* (Morris 1878)*, while the concept of* ***human settlement*** *was discussed in* Sect. 10.1.1.

On the basis of such a definition, this section presents some cases which highlight the conceptual interaction between the environment and architectural structures, as well as the dynamics of their coherences and incoherencies, as discussed above.

Here, architecture, intended as a discipline dealing with multiple systems of architectural structures, town planning and land usage, is understood to *represent* the settlement which generates it. In turn the settlement influences the architecture, for instance, by usage and re-usage when places are multiple systems of *sediments* (Di Battista, 2009). In this regard, approaches such as those based on the concept of *social field*, as introduced by the social sciences, and on the conceptual structure of *environmental psychology* will be mentioned.

We begin by remarking that the effectiveness of architectural structures and *design* (Zeisel & Eberhard 2006), when assessing up to what point *usage* is able to *induce behaviour*, is crucial when dealing with problems such as those related, for instance, to evacuations, line management, crossing, decision-making in emergencies and stair usage (Cucurnia & Giallocosta 2016). However, it should be stressed that, besides the critical issues quoted above, architectural structures are always able to induce *behaviour*, as in the architecture of housing, which is often designed with local current *ways of dwelling* in mind and then inducing and replicating the same approach (Mosha, 2012). Here the expression *architectural structures* relates to a wide range of structures establishing architectural systems such as cities, neighbourhoods, houses, apartments and the landscape itself. The reference is, for instance, to urban design, town planning, civil and industrial architecture, the design of outdoor and public spaces, i.e. landscape, and the design of tools for inducing usages.

Within this context one might consider the combination of aspects due to the interdisciplinary actions and reactions of inhabitant agents possessing complex cognitive systems such as human beings. These aspects are related, for instance,

to shapes, colours, details, dimensions, functional properties, interconnections, visibility and availability of natural resources, e.g. lakes or rivers, trees and green meadows. In this way architectural structural properties are coupled with cognitive properties induced in inhabitants by usage and re-usage (Minati & Collen 2009). Accordingly, architectural structures should be designed bearing in mind both their power in influencing social systems behaviour and their emergent role (Keith, 2005) in materializing social properties.

Research in this area is crucial to reveal such interconnections allowing architects, on the one hand, to consciously and ethically design and plan the built environment as well as, on the other, inhabitants to develop social behaviours deriving from the built environments. This research should be interdisciplinary (Di Battista, 2009) by taking into account, for instance, psychological, functional and anthropological aspects, being based upon a systemic view allowing models and simulations of processes of emergence, i.e. the acquisition of social properties, by using suitable tools (Fontana, 2016). In addition to research on Post-occupancy Evaluation, when dealing with the design and emergence of social fields, it should be then possible to obtain a *pre-occupancy* evaluation of social emergent properties (Sawyer, 2005). By setting crucial properties of inhabitant agents, together with those of the architectural field, in a suitable usage simulator, one could outline possible acquired emergent properties.

Thus, we believe that the concept of social field, as well as the concepts used by environmental psychology, could be suitable for describing and understanding the effects of architectural structures on the inhabitants and on human settlement in general.

We recall that in the social sciences and in psychology, the concept of field was introduced by the psychologist *Kurt Lewin (1890–1947)* (Lewin, 1935, 1936, 1951). Lewin proposed this concept within the framework of Gestalt Psychology founded by Max Wertheimer, Wolfgang Köhler and Kurt Koffka (Koffka, 1935). The *force field* or life space was assumed to be present in any individual or social group, changing on the basis of experience and intended as a representation of the environment with personal values, emotions and goals. We may identify life space with the cognitive system combined with representations and stimuli related to the environment. Lewin also referred to *social space* or *social field*, intended as the joint life space of more than one person. The latter concept was however criticized as it fails to clarify how the life spaces of two people would have anything to do with one another (Mey, 1972). The usefulness of an approach based on the concept of field is still under discussion, for instance, in sociology when considering *Field Theory* (Martin, 2003).

We recall that the concept of field is borrowed from classical physics, where it considers the association of physical properties to points in space-time. Examples are given by electric or gravitational *vector fields* where at each point we have specific components of the electrical or gravitational field vectors. Other examples are given by *scalar fields* where at each point we have a specific value of a scalar variable, such as temperature or pressure. In the social sciences, on the other hand, the concept of field refers to the association between a position (not necessarily of a

geometrical nature) and the action of a *force* exerted on the person occupying that position. Usually such a force comes *from the inside*, having a cognitive nature as opposed to forces generated by external sources such as those considered in physics.

Within this conceptual framework, the concern with economical *optimization* is often of secondary importance with respect to social and cognitive aspects such as those brought into play by architectural attention to other kinds of details (Salingaros, 1997). Among these one can cite the search for beauty, the desire to meet others, a sense of hierarchies, a preference for multiplicity vs. standardisation, a sense of openness derived from opening doors rather than from a lack of boundaries, inducing topologies by labelling areas according to specific values, the use of building material which indicate the social status of the inhabitants, the use of land in a *non-optimised* way, e.g., for parks, playgrounds and artistic exhibitions, the use of street lighting, traffic lights and shop opening hours designed to set social rhythms, the colour of house fronts and their state of maintenance, the attention to harmony with neighbours, etc. Such aspects have been examined previously including works by Collen (2009), Di Battista (2009), Fontana (2012, 2016) and Giallocosta (2010). The subject is referred to as *Environmental Psychology*. There are also important texts on the subject (Carley, 2013; Clayton & Myers 2009), dealing with the interrelationship between environment, cognition, behaviour and human emotions by considering both built and natural environments. Typical case studies within this context include those related to the relationships between well-being and the environment (Cooper, Burton, & Cooper 2014), to the effects induced by the *broken windows* theory (Kelling & Coles 1998) and to the study of crime prevention through environmental design, within the conceptual framework of so-called Space Syntax, such as dealt with by the Space Syntax Laboratory, http://www.spacesyntax.com/ and others (Clayton & Myers 2009; Cozens, Saville, & Hillier 2005).

Environmental psychology, briefly, among other issues, studies how architectural structures can induce a social behavioural *field* for inhabitant agents, in this case inducing rather than prescribing behavioural properties acquired by agents located at a point within that field. More in general, environmental psychology is an interdisciplinary field, collecting the different competences of psychologists, architects, economists, geographers, cognitive scientists, sociologists, policy-makers, educators and entrepreneurs. Its general interest is devoted to the interplay between humans and their surroundings. Despite the current decline in the initial enthusiasm for collaboration between architects and psychologists, the domain is vital and growing at a high rate, the main problem still being the absence of a sound and commonly shared methodology (for useful reviews of the field, see Gifford, 2007; De Young, 2013).

10.1.4 The Cognitive Construction of Landscape

Among the many contributions introduced in the literature, a possible novel approach to and understanding of the subject is related to our discussion on post-GOFS.

On the basis of the emergent nature of the landscape (Barnett, 2013; Di Battista, 2016; Starke & Simonds 2013; European Landscape Convention 2000, http://www.coe.int/europeanlandscapeconvention), and of the central role of the observer, as a generator of its cognitive reality through cognitive models able to detect coherences or not, we propose here to consider conceptually the landscape as a Multiple System. That is, the landscape as a cognitive *representation* of the synthesis and its *constructivist coherence* between environmental Multiple Systems, such as houses, roads, factories, cars, airplanes, street lights, traffic lights, trees, lakes, mountains, etc. The same approach can be used when considering Multiple Systems within a room, identified by the furniture, windows, doors, chandeliers, paintings, carpets, etc.

Two possible, and somewhat interesting, understandings follow from such a conceptual approach:

1. The detected coherences and incoherencies represent processes occurring both in the Multiple System Landscape (MSL) and cognitive discontinuities between the coherence conceivable by the observer's cognitive system and those used to detect the landscape as an emergent property. A large-scale example is offered by the shapes of industrial plant or energy-producing wind turbines strongly contrasting with mountain landscapes. Of course, learning and adaptation processes can completely change initial evaluations of a MSL as with the Tour Eiffel in Paris, initially severely criticized, or with streets populated with cars.
2. A conceptual framework is established where an *inhabiting* component contributing to the emergence of a MSL also becomes an observer of its emergence. *It is as if a bird of a flock could also see the flock as an observer*. Can the component see the flock in an objective way? We know that the component will see it through the *eyes* of a component. It will henceforth play multiple roles, as component and as observer. She/he will need multiple models, using different logics, and will have to invent them. This circumstance metaphorically recalls the process of knowing the knowing itself as considered in cognitive science.

An MSL should be considered as a representation of the constructivist coherence generated by the observer. Such coherence concerns the relationships between the Multiple Systems establishing the environment, such as houses, roads, factories, automobiles, airplanes, street lights, traffic lights, trees, lakes, mountains, etc. This requires the study of multiple interdisciplinary (psychology, sociology, cognitive science, vision and memory, architecture, etc.) and trans-disciplinary models allowing one to deal with systemic properties in an abstract way as collection, representation, variation, induction and combination of coherences.

As implied in the concepts of implicit project and self-architecture, we should study not only the *local* but also the overall coherence between the various aspects

of social systems, such as cultural, technological and sociological. Thus a MSL could be viewed as representing the evolutionary processes of coherence and, possibly, incoherence occurring within social systems. Thus Systemics, in its post-GOFS form, could be a cross-disciplinary and unifying approach for representing and modelling landscapes. It sets the theoretical *non-decidability* – i.e. *non-symbolic decidability – of the landscape given its emergent nature*. Finally we mention the correspondences between the MSL and the *image understanding* as the artificial process of interpreting what is actually happening in an image or frame.

10.1.5 Completing Architecture

In the same way as statements can be considered as *flocks of words* from which a meaning emerges, the correspondences within the complexity of architecture lead to the emergence of environmental properties as well as inducing behavioural properties among the inhabitants of that architecture. Architecture is intended here, according to current research approaches and results presented in the literature (Batty, 2005; Portugali, Meyer, Stolk, & Ekim 2012; Complexity, Cognition, Urban Planning and Design, https://www.tudelft.nl/en/2013/tu-delft/complexity-cognition-urban-planning-anddesign/), as establishing structural and cognitive regularities of correspondences, intended as *syntaxes* of shapes, spaces and building material, with which social systems *pronounce statements of inhabiting*. *Buildings and houses cannot be suitably considered* only *as 'machine à habiter'* as metaphorically stated in the age of *functionalism* by Le Corbusier, pseudonym of Charles-Edouard Jeanneret-Gris, in his fundamental work *Vers Une Architecture*, published in 1924 and whose translation is now available (Le Corbusier, 2008).

Such *statements*, made in different places, on different scales and in different periods, are then composed and become *stories* linked to social and historical events. *Social memory* synthesizes and sediments, as for the issue of *reuse* in architecture (Van Uffelen, 2010) such *architectural statements*.

Within this conceptual framework, we focus our attention on the multiplicity of corresponding, entangled dynamic components of coherence to be induced, recognized and maintained in architectural systems. The list of aspects with possibly various degrees of coherence could be very long and will depend upon the general culture and approaches within the simultaneous generation of and inhabiting within a social system.

Examples of such aspects include acoustic properties, building materials, details, dimensions, energy usage, functionalities, harmonicity, illumination, morphology, openness, colours, reuse, shapes and topology.

> Research has established the concept of the built environment as the peculiar eco-system of the human species, underlining... the need to resort to the scientific approach of biology in order to better understand such complex physical phenomena as cities.. (Fontana, 2012, p. 543; see also Batty, 2005; Giacomini, 1989; Hensel, Menges, & Weinstock 2004; Marshall, 2008; Minati, 2008; Science, 2008; Weinstock, 2010)

Within the framework of the huge variety of well-established modelling and simulation approaches used in architecture, including *EnergyPlus*, for energy simulation programs for buildings (EnergyPlus, https://energyplus.net/), and *Urbanism*, supporting planning and analysis of urban developments (Urbanism, http://www.urbansim.org), later reviewed (Chenn, 2012), agent-based models (ABM) may simulate pre-occupancy issues by considering constraints, i.e. boundary conditions, and interacting agents with specific characteristics.

Meta-structural analysis in architecture is also a possible approach using the values adopted by mesoscopic variables for *pre-occupancy assessment* and for performing simulations. The purpose is not only that of certifying functionalities but also of outlining aspects of possible processes of emergence of acquired properties, which could then be avoided or embraced, within the inhabitant social system.

The post-GOFS approach should be the general culture of this new understanding and promote the *systemic completion* of architecture which takes into consideration multiplicities of effects and roles often invisible when considered from within specific disciplinary professions.

10.2 The Complexity of Social Systems

Here, complexity of social systems is intended as deriving from the acquisition of properties and problems arising, for instance, relating to coherence(s), development, emergence, entanglement, irreversibility, multiplicity such as multiple non-equivalences, multiple non-homogeneity, multiple structures, network properties, non-linearity, non-symbolic aspects, quasiness, scenarios, self-organization, simultaneity, uniqueness, uncertainty and incompleteness.

The nature of such properties and problems are different from those dealt with using GOFS related to anticipation, automation, completeness, context independence, control, decision, forecast, growth, non-connectedness, optimization, organization, planning, precision, regulation, reversibility, separation, solution and standardization. Extensions or updates of GOFS concepts are not effective because of the different nature of the new properties and problems but could be eventually and adequately *combined* with post-GOFS concepts.

Different strategies should be implemented to act on post-GOFS properties in social systems such as acting upon coherence(s), communication, constraints, possibility of interactions, management of inconsistencies, memory, representations, available resources, robustness and time management.

The complexity of social systems can take on a vast range of properties of different natures. Sources of the complexity of social systems include the aspects listed in Table 10.1.

As is well known, within traditional economic theories, corporations and institutions are still conceptually considered as *social devices* which can be dealt with by using GOFS. The change occurring in post-industrial societies, as discussed in

Table 10.1 Examples of sources of complexity of social systems

Their being *knowledge-intensive*
Delocalisation and globalisation
Easy replicability
Highly general networked interconnections
High manipulability
High virtuality
Being endowed with hyper-connections
Importance of individuality
The occurrence of Instabilities to be recovered by coherences
Interchangeability
The possibility of on-line actions
Shorter time between design, implementation, and marketing
A generally short life span of products, ideas, projects
The presence of technological innovations and solutions, such as augmented reality, 3D printers, and huge data availability, creating new problems of a *different nature* (Minati, 2012b; Minati 2012c) where a *new theory of work* and *value* should be introduced
The arising of epiphenomena, i.e., secondary phenomena occurring alongside or in parallel to primary ones
Multiplicity
Non-linearity and non-sustainability
Networked availability of knowledge
The fact that products and services come with *induction for use* more than *directions for use*
The rapid transformation of solutions into new problems

Chap. 9, relates to the ways of understanding processes such as to manage, decide, develop, optimize, make profitable, obtain revenue and investments, take advantage, compete, produce, design and develop finance and marketing policies.

The usage of the GOFS approach for understanding such concepts will lead to iterative usage of technologies and innovation where consumerism is intended as the principle source of social and economic dynamics.

Conservation of such understanding is supported by a wide variety of reasons such as the ways of *writing financial statements*, budgeting, assessing the value of stock, and funding on the basis of guarantees, still reproducing assumptions valid in the old industrial society, reasons for lending, education, and coherence(s) with the general culture and way of thinking. A good example is given by *stability* assumed to be kept and defended, while its negation, that is the end of stability, is in reality the necessary passage to reach new phases of economics, i.e. development.

The conservative understanding is, for instance, given by the *sequences of consumer cycles*, designed and decided by producers. Innovation occurs *within* such cycles still considered as GOFS processes. The crisis of systems of such cycles is not reducible any of them. We face properties of systems of cycles having post-GOFS properties and affecting their unsustainable nature of consumerist cycles (Minati and Pessa, 2006, pp. 321–334).

Such processes and their properties will be dynamically represented in the architectures of corresponding systems. Eventual correspondences between complexities of social systems on their architectures should become a research issue.

10.3 Other Cases

We list in the following some examples of other application areas where it is possible to detect post-GOFS properties eventually combined with GOFS properties and use post-GOFS approaches to 'manage' coherence(s) and phenomena of multiple emergence(s) represented at different levels of description.

For instance, consider *multimedia*, i.e. television, mobile phones, Internet, CD and DVD, where services, methods of use and marketing *correspond* to the general properties of social systems such as the *reasons* for which people interact. For instance, multimedia make easier communication, reproduction and availability of text, voice and visual information. This implicitly confirms the *reasons* for use within a technologically up-to-date social system and eventually *induces* them within social systems where such products and services implicitly *export ontologies* facilitating the 'hosting social system' to adopt them (Strate, 2014). The *social syntax* of multimedia apparently adapts to any content and is semantically independent, but in reality using this syntax will affect their content in the long term. First of all, they are based on *virtuality* (Minati and Pessa, 2006, pp. 359–379). The process activated relates to the *dynamics of coherences* between text, images, data and music. The possibility of introducing *standards*, for instance, in music, movies and language establishes *cultural invariants*, and the dynamics of their usage, in turn, represents and can induce or *force* the corresponding *real* dynamics occurring within social systems *just as office software first supports and facilitates office work and then leads people to work in a given way*.

Post-GOFS properties may be indirectly represented and used to *prescribe* correspondences to social systems. It corresponds to the statement *let people listen to our music, watch our movies, eat our food, dress like us, use our products, use our language, etc. and they will become similar to us*. In the past, the same approach was used by exporting religions or ideologies.

The point is that the *extensions* of the usual ways of representing or processing information should not avoid the possibility of conceiving or designing *new logistic curves*, i.e. do different things by introducing radical innovations (Christensen, 2013). The general problem is to take advantage of *standardization*, but at the same time, the latter operates within a conceptual framework where *deviations* are possible, distinguishing between inefficiency and creativity.

Current ways, for instance, of communicating, writing and making office work prescribe methods of working in offices and indirectly ways of conceiving working itself and professional roles deriving from commercial software and procedures. *There is the adoption of the ontological view that optimization is unique* and we have reached it.

Which will change first? The software for marketing motives and procedures or the ways of doing things themselves asking for different software and procedures?

Another subject is that of *education*. Section 10.1 mentioned how *explicit architecture* is responsible for no more than perhaps 5 percent of all the buildings in the world. We might well ask ourselves the percentage of professional educators working in schools or *explicit educational systems* who are responsible for *education* (Robinson & Gerver 2010) and how crucial is the education of educators for the *science of education* (Keating, 2012; Oecd, 2013).

This is also an important issue when related to *learning organizations* (Minati, 2012a, 2012b; Minati and Pessa, 2006, pp. 375–381) where their learning cannot be considered as being linearly coincident with the sum of the learning processes involving the individual agents belonging to them (Biggiero, 2006, 2009) and is related to the issue of *knowledge management* (see, for instance, Hislop, 2013). The process can even be generalized by the concept of collective or swarm intelligence discussed in the previous chapters. A learning organization is not supposed to learn what individuals are used to learning, such as information and knowledge. Rather it learns how collectively, i.e. coherently, to use and process various individual learning processes. It is a matter of non-explicit learning as considered in *machine learning* (Flach, 2012) as, for example, in the case of neural networks where learning is not due to symbolic processing.

The post-GOFS understanding of social processes helps to realize that education should be reconsidered and understood mainly *as transversal, multidimensional and non-separable, i.e. embedded within a large variety of context-sensitive processes* including cognitive, psychological, emotional, social, physical and linguistic processes.

Knowledge societies paradoxically require and provide different levels of learning, the basic one being *induction to usages* of products and services. However, within this context, education has the main purpose of generating an average, shared social level of usage and understanding of products and services without the need to possess appropriated knowledge in order to understand technological or scientific content, as mentioned in Chap. 9. This *reduction* is required by the consumerist approach to expand markets even at the cost of their using such content unknowingly. Usage is predefined, and the consumer's lack of knowledge prevents awareness, necessary for sustainability and the *inventions* of novel usages for opening new markets.

The focus of education in post-industrial, knowledge societies is on the level of coherence(s) between various kinds of knowledge at different levels.

Post-GOFS will eventually be able to represent such dynamical coherences by using networks, meta-structural properties and regimes of validities. Such representations may be used to design and put into practice the post-GOFS systemic level of education and induce other suitable ones.

Such *non-symbolic* education should be simultaneously multilevel and multidimensional. This is the case where any information is provided *to* and learning process occurs *in* one of the several systems of a Multiple System or Collective Being. *It is then the dynamics of the MS or CB which process the*

knowledge made available to ***composing*** *systems within a context of continuous emergence*. There is a huge variety of professional, scientific, practical knowledge and know-how which *merge* in usages and lead to social, dynamic, temporary and local coherences.

Another area where expected evolutions are assumed to be based on post-GOFS properties is the so-called predictive, preventive, personalized and participatory or P4 *medicine* (Hood & Flores, 2012; Hood, Balling, & Auffray 2012). P4 or proactive medicine has the theoretical purpose of supporting health in different forms, i.e. age, place, etc., and well-being as emergent properties rather than merely by the treatment of diseases. P4 combines hypotheses-driven (*top-down*) and data-driven (*bottom-up*) approaches and models (Cesario et al. 2014). The conceptual shift is from considering *systems of parts* to consider contexts or fields having *generative properties* (pathologic properties) different form environments intended *hosting* or influencing (see also the Sect. 4.6 System propagation).

10.4 Further Remarks

The cognitive shift discussed in this chapter with special regard to architecture and of a post-GOFS nature consists of *abandoning* the usual interventional, intrusive, dirigiste, decisional, symbolic and forcing approach because such a strategy is ineffective when dealing with complexity.

This does not mean that another, alternative strategy can be uniquely and precisely identified. The message is that an endless variety of possibilities are conceptually available. We now know their post-GOFS nature and that the focus is on properties such as coherence and emergence.

In this book we have mentioned some possible new methods including the network, meta-structural and 'QFT Systemics' approaches.

We consider this new understanding as being produced by the need to abandon approaches based on pursuing *objectives*, symbolic, measurable and objectivist goals *only*. It should be a matter of continuously looking for general, post-GOFS properties having a strategic nature and which can be locally materialized and quantified. Looking only for GOFS properties is partial and non-strategic, whereas post-GOFS focuses on properties typical of the dynamics of games. On this point, we recall that Peter Drucker used to say that the first thing to be decided in a strategy of development is what to abandon and not to identify new objectives (Drucker, 1970).

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