

# Human Sustainability

## Human Scientific Factors to Enhance Life Cycle Sustainability of Housings

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### Short Summary

The presented work is dealing with psychological and physiological contributions to enhance the performance of blue, green or smart housings and dwellings.

Based on scientific research results the main goal of the work is to define ways of enhancing the life cycle sustainability of housings by considering the human quality factors. Another task is to explain the thesis that sustainability without humanity is an insufficient goal and with regard to housing structures hardly realizable.

Within the paper a scientific methodology (Research Report Part I) will be presented which is able to analyse precisely the human quality of housing projects. It comprises all essential factors which are relevant for the performance and acceptance of buildings from a human perspective.

### (A) Introduction and Correlations

The **main thesis** of this work implies that humane building leads sustainable building. Concerning housings we can state, that without humanity there is of course no social, but also no economic, nor ecological sustainability possible at all.

This thesis can preliminary be explained (illustrated) by mentioning at least three correlations.

#### (1) Prolonging the duration of use and the life cycle endurance

There is one main causal connection to be considered: The higher the human quality of residential buildings the longer and more intensively they will be occupied on average.

Usually the by far biggest amount of resources and energy has to be spent during constructing buildings: It starts with the production of raw materials, the manufacturing of building materials, the fabrication of structural elements and components used for constructing houses. Next all these materials and products have to be transported to the building plot and at last the construction of the building itself. Understandably the whole procedures need lots of energy and resources. If we take into account the whole life cycle effort of resources and energy, it becomes immediately clear

that this initial stage of a buildings life cycle requires the by far biggest share.

Further high peaks of energy and resources effort are usually phases of reconstruction or remodelling. The final peak of a buildings life cycle is reached when demolishing and disposing the materials. Perhaps in a further step a new building will be erected and the life cycle starts again.

The longer the period between erection and demolishing the less resources are spent on average per year. The more years of occupation the lower the average amount of spent resources and energy.

Of course the ongoing consumption of energy (heating, cooling, electricity etc.) is of importance as well as the sort of used materials. But independently from this the duration of buildings "life" remains as one main (and often not fully recognized) factor of life cycle sustainability which used to be frequently underestimated or not even realized in its whole momentous context.

The duration of buildings existence usually depends on two major qualities: the technical/material/physical quality and the human quality.

As we all know the physical quality depends on the used materials and the structural engineering.

But what does the human quality rely on? That is depending on physiological, psychological and social factors (see below). What we can state in advance is that, the higher the human quality or living quality of a building the longer it will tendentially be used, the less often it will be reconstructed or remodelled in order to meet the human needs or even demolished and built new - which of course is related to the highest waste of resources and energy.

The longer the period of occupation, or more specifically the longer the period between constructing and reconstructing or demolishing the higher is generally the impact on life cycle sustainability.

## **(2) Reduction of urban sprawl and splinter development / dispersed settlements**

The second aspect concerning sustainability and human housing quality is dealing with the topics urban sprawl and uncontrolled settlements in the open country - the so called dispersed settlements.

It is well known that dispersed settlements from an ecological point of view used to be highly problematic. First of all they produce much more traffic compared to compact settlements; second, the whole infrastructure that has to be build and maintained in order to reach every single house is enormous; third, they also usually need much more resources and energy during building and occupation; and so on. So this form of settlement used to be on principle not very sustainable at all.

But what has this got to do with housing quality?

The less quality high density housings are able to provide, the more often people tend to built their own "sweet" home out in the country. In order to prevent dispersed settlements we have to construct buildings of high living quality in higher density areas. Consequently we may reach the point that wishes to change the habitat do not come up in peoples minds that easily.

## **(3) "Leisure escape" from cities**

The lower the habitation quality of housings plus surroundings used to be in cities and in high density areas, the stronger the intentions of people to leave the place any time they are able to. Human beings are usually looking for places which fit to their natural needs and which are offering some recreational values.

So some people seek to build or buy a second home close to nature if they can afford it. Some people are renting their little green spaces or allotment gardens where they can stay near the city. In Austria and parts of Germany such spaces are called "Schreber-Gärten". In Russia and eastern Europe the so called datchas are very common for the same reason. Usually a datcha is a small weekend house with a little garden around. Similar trends can be obeyed in many regions all over the world.

All these trends lead to the same consequences: They produce more traffic and also a higher consumption of energy and resources. And all these trends have the same purpose: to compensate the deficiencies and errors of urban housings and housing developments.

If a residential area is able to provide a high habitation quality and additionally some recreational effects, the inhabitants would have less reasons to escape from their home at any spare time. And they would of course have less reasons to build or buy a second home in the nature, too.

### **Intermediate Conclusion**

The term habitation quality or human quality reveals as one of the major factors for the sustainability of buildings and settlements. If we disregard the human quality factor in its whole momentous impact, the topic sustainability of housings can hardly be reached.

Concerning traffic and housing there are two studies recently published [1], [2] dealing with the connections between individual mobility and housing.

These studies are posing very clearly, that certain forms of housing produce either more or less individual motorised traffic. In very dispersed regions the level of motorisation is the highest. (Which means the number of motorised vehicles per 1000 inhabitants is the biggest.) This context is not a big surprise but there is another result which is very remarkable concerning the entire energy consumption of a family household including everything: heating/cooling, electricity etc. plus traffic. If one compares the overall energy consumption of a so called low-energy-house with car to an average standard house without car, the latter features a much more better performance. Types of settlements where people need at least two or more cars are much less sustainable even if the buildings themselves were constructed in a sustainable way. As a first main conclusion we have to develop types of housings and settlements where people don't need cars or even do not have the desire to use them very often.

Other results of the studies show very clearly, that dispersed settlements require an outstanding higher amount of infrastructure concerning not only streets but anything else like electricity, water supply, wastewater disposal and so on. The effort is not only higher when constructing all the infrastructure but also during the whole life cycle for maintaining the infrastructure and keeping it in appropriate condition.

So what shall we do now? Shall we force people to live in high density areas? Despite the fact that this would not be very humane it would not be very effective too - because of (3).

It would be much more effective to develop housings and settlements of high density plus high habitation quality where people like to live and where they do not have the desire to escape anytime they can, where they are encouraged not to use cars but other forms and means of locomotion.

As a summary we can state that high density without high human quality is senseless and sometimes counterproductive.

If we consider the results of (1), (2), and (3) we can conclude that it all mainly depends on one central term - the human quality of housings. Therefore the first step ought to be explaining the "human housing quality", which has been done during the theoretical and empirical research presented in this paper.

## **(B) Research Report Part I: Housing Theory and Science**

### **(B1) Background and Problem Definition**

The theoretical research dealt with the exploration of the scientific basics for designing and analysing human living spaces (=human habitats). During the research an overall theoretical conception - a **theory of human habitat systems** (shortly 'habitat theory') [3] has been developed which is able to comprise the complex systemic interconnections between human being, dwelling and housing environment. The term 'habitat' includes in this context the whole living space related to housing: dwelling plus interior as well as exterior areas (green spaces, balconies, terraces etc.) and the immediate surrounding field.

The main aim behind was to generate a comprehensive theoretical conception which indicates profound conclusions for conceiving housings close to human nature and needs, based on stringent scientific fundamentals.

From the theoretical perspective there is a deep gap between architecture and human sciences.

- Architects are planning and developing habitat-structures (buildings and spatial structures). They are therefore concerning themselves with housings a priori – i.e. before they are inhabited. So the architectural education is mainly based on technical and artistic fundamentals that are adjusted to the construction and forming of buildings.
- Human scientists (like psychologists) can rely on a wide scientific fundament that is primarily related to the human being. They are ordinarily investigating housings after they have been erected and inhabited for a while (i.e. a posteriori). The real objects of investigation are thereby human beings in the respective spatial or social context. They do not offer an appropriate methodology for analysing housing concepts. They may give advices by mentioning some relevant aspects from their special perspectives, but it is commonly not their aim to create theories for planning housing structures.

Behind that planning theoretical deficiency another main deficit is hidden. There has been no definition of the **human habitat** itself so far - a definition which is valid from a general scientific perspective and which describes the essential characteristics of a human habitat in a compact and practicable way - so that it can be used as a basis for the creation of a housing theory.

As one result of that splitting a scientific conception was missing which could define human habitats in such a comprehensive way that conclusions for forming and conceiving housing structures can be drawn. This "lack of theory"[4] has been mentioned several times in the respective scientific literature [5], [6] and has been extremely evident within the housing-related sciences, especially in architecture [7].

The specific aims of this work can be explained by mentioning the leading questions: Which characteristics do edificial or spatial structures have to feature in order to be able to become a humane living space (a habitat) in its best sense - and therefore also become sustainable in an human way? And: How can the human quality of a habitat be defined scientifically?

Leading hypothesis: The human quality of a habitat is determined by the quality and quantity of the actual and possible relations between the human being and his habitat plus environment. Therefore the whole "system" human-dwelling-environs (= habitat system) had to be ascertained and defined.

Working hypothesis: The human quality of a habitat can be defined by identifying the respective habitat system.

In this context the theory of human habitat systems is providing a tool to define the human quality of apartments, buildings, residential areas etc. - be they either planned or built.

## (B2) Short Portrait of the Research Work

The research has been carried out on 3 main levels. (see also scheme A)

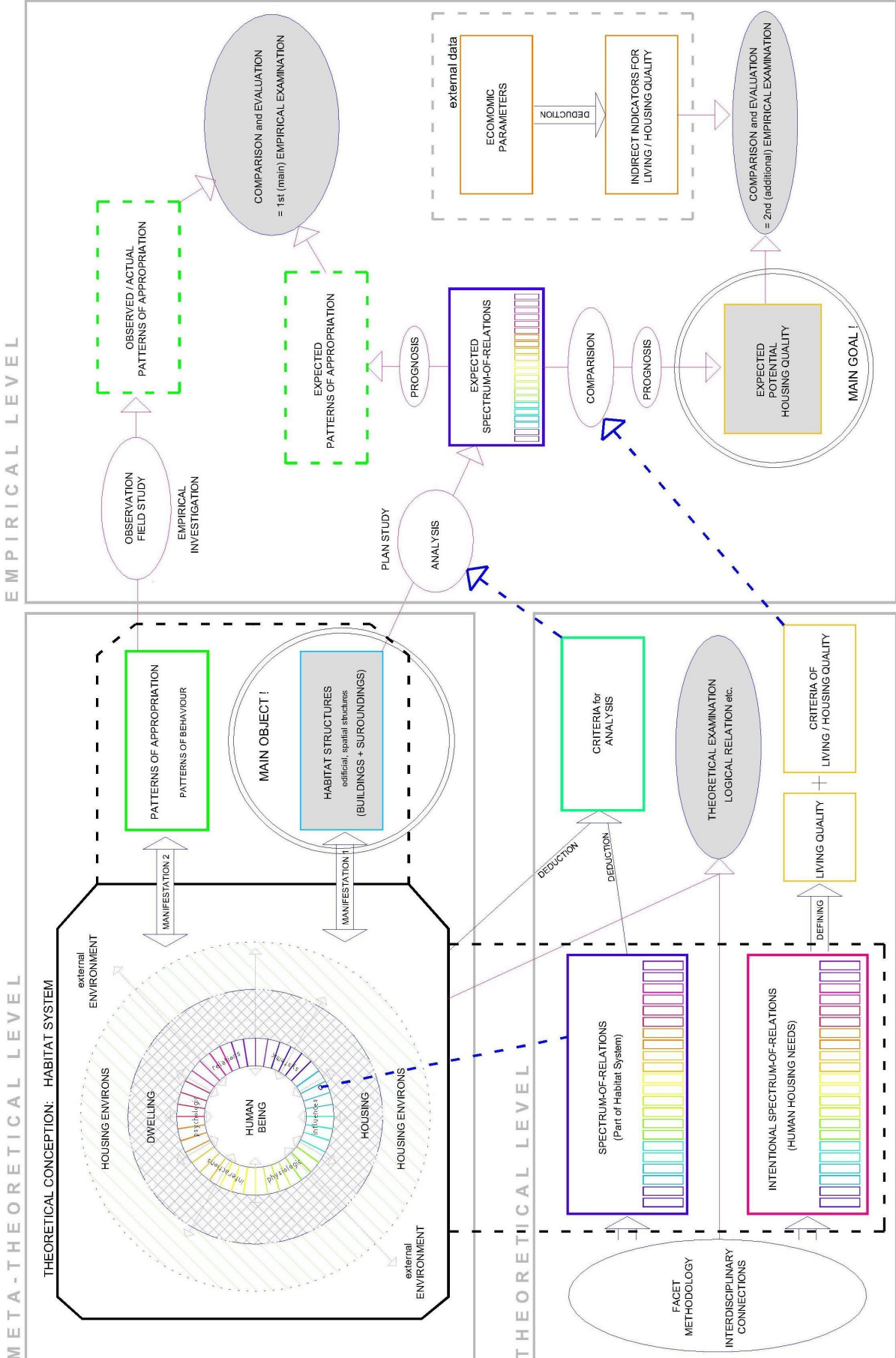
### (1) Meta-theoretical Level (Scientific Theoretical Work)

On the first level the theoretical fundamentals - a **theory of human habitat systems** - had been conceived by a detailed definition of:

- the habitat system and its primary components/elements
- the relations and exchange processes, which are determining the characteristics of the system
- the interconnections between habitat system and the edificial, spatial structures (**habitat structures**) which are representing the physical manifestation of a habitat system
- the interconnections between habitat system and patterns of use and behaviour of their inhabitants (**patterns-of-appropriation**) which are representing the behavioural manifestation of a habitat system.

According to the main aim the theoretical conception has been composed systematically and pursuant to clear scientific theoretical principles (e.g. Logic of Research, C. Popper [8]). The **primary target** was to structure the theoretical conception logically and traceably with clear sentences which can be examined theoretically and/or empirically.

SCHEME A : METHODOLOGY Overview



## **(2) Theoretical Level**

### **(2a) Spectrum-of-Relations and Human-Housing-Needs [10]**

On this level the relations between the human being and his housing environment have been compiled. Which interconnections, exchange processes and relations are there on principle between a human being and his housing environment?

The first main target was to explain and define the relations within a habitat system, between a human being and his habitat, his living environment (the spectrum-of-relations).

The second main target was to explain and define the most important needs that are related to the habitat and generally to "homo sapiens". This is of special importance because the term "living/housing quality" can only be defined by the help of the so called human-housing-needs (the intentional spectrum-of-relations).

In order to meet these objectives, interdisciplinary connections have been assembled systematically. Especially human sciences like housing psychology first of all, as well as environmental psychology, social and developmental psychology, housing physiology, building biology etc. provided substantial contributions to the whole spectrum.

### **(2b) Theoretical Examination**

The newly developed theoretical conception had to comply with the following criteria [9]: It has to be synthetic without internal contradictions. This also implies a theoretical examination in the form of logical analysis. It must not be metaphysical or esoteric etc. Which means that it must not defy examination, be it empirical and/or theoretical.

## **(3) Empirical Level**

The empirical examination consisted of analysing existing housing objects.

### **(3a) Analysing habitat structures [11]**

Step 1, Compilation of Criteria for Analysis: First the criteria and parameters for analysis have been derived from the theoretical basis (the human habitat system including the spectrum-of-relations). In this initial stage the **methodology of analysis** had been conceived in general.

Step 2, Selection of built examples: Because the habitat theory is meant to be of general validity, it was essential to choose an appropriate variety of different housing objects.

Step 3, Analysing work: The selected housing objects had been investigated by studying and analysing plans and other documents. The analyses are primarily able to generate two results: the expected patterns-of-appropriation and the expected housing/living quality of the respective object.

### **(3b) Documenting the patterns-of-appropriation**

A habitat system is manifesting itself in a behavioural sense in the form of patterns-of-appropriation - i.e. patterns of use and behaviour of their inhabitants. Appropriation is in this context standing for establishing a relationship to one's own living environs and it also means that a physical, spatial environment becomes a personal living space (a habitat!). Appropriations can be empirically explored and described by observing actual processes (behavioural patterns) or traces and signs of use, adaptation, shaping, forming etc. I.e. patterns-of-appropriation are empirically recognizable.

### **(3c) Evaluation and Empirical Examination**

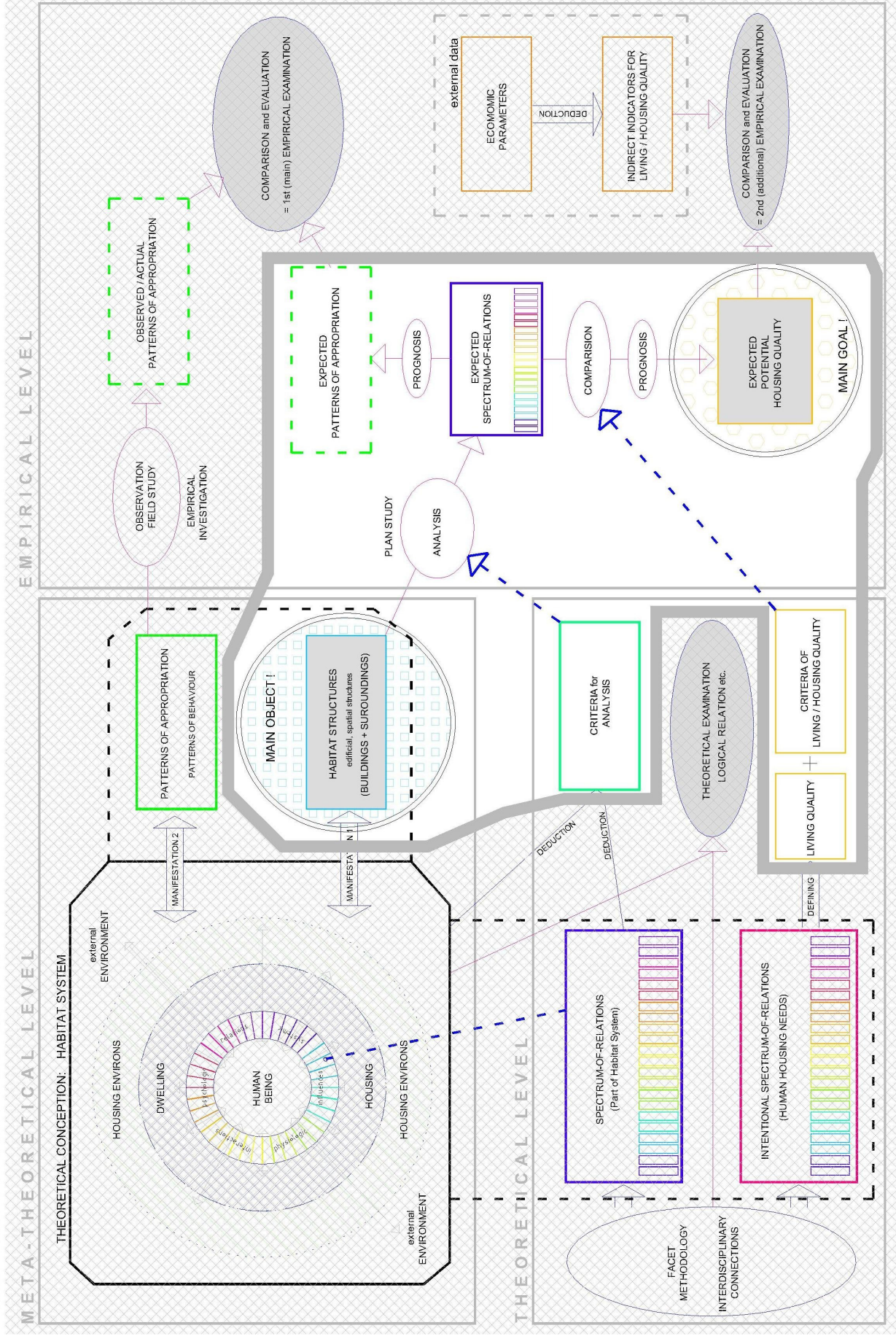
First Empirical Examination plus Evaluation: The next step has been represented by the evaluation of the findings and conclusions of analysis (3a) and field research (3b).

By **comparison** between the expected patterns-of-appropriation (3a, step 3) and the observed actual patterns-of-appropriation (3b) the habitat theory or respective sentences of the theory could have been verified or falsified.

Second Empirical Examination: Additionally the results of analysis has been compared with several so-called "economic" parameters (as far as available) like vacancies, duration of occupancy etc. All those parameters are representing in this context indirect indicators for housing quality.



# **SCHEME A -1 : Practical Use Overview**



## **(B3) Conclusions and Resume**

### **Potential Impact on Sustainable Housing Practice (Analysing, Planning and Designing)**

The potential impact can be explained by comparing the two schemes A and A-1: After the research works the potential practical use became clearly visible. By means of the criteria for analyses we are able to check out the potential housing/living quality of buildings and residential areas in detail and in advance; and we are able to define the expected patterns-of-appropriation in advance.

This leads us to one major goal: it becomes possible to carry out analyses on a scientific and systematic basis **before** the building is erected and occupied, still **during the stage of planning**.

Afterwards we are able to return to the main task and to answer the initial question:

How can we enhance the human quality of housings and settlements and therefore also their sustainability?

- By using this sophisticated methodology of analysis during planning and hand in hand with planning.
- By using this methodology of analysis before reconstructing a housing complex, remodelling a building, or redeveloping a whole housing settlement.

Finally optimization of habitation quality as well as reduction of deficits become possible. By a clear and detailed definition of the specific qualities of an object, such analyses could support avoidance of deficiencies and provide the basis for various improvements concerning the human-related aspects.

### **Sustainability plus Benefit to the Inhabitants**

The research results could provide contributions to enhance sustainability on three levels:

- ecological sustainability: prolonging the life-cycle endurance of buildings; reduction of dispersed settlements, splinter developments, urban sprawl; reduction of leisure "escape" and traffic etc.
- social sustainability, of course: increase of human housing quality, living quality, better interpersonal relations between the inhabitants, etc.
- and also economic sustainability: higher occupation rate, higher quality for equal price, etc.

The benefits are on principle valid for all forms of housing, i.e. the high-budget as well as the low-budget segment. With the latter there are even much more improvements necessary and possible.



## References

- [1] "Wie Wohnen Mobilität lenkt", VCO-Forschungsinstitut, Wien 2010
- [2] Tobias Weiß, "Nullenergiegebäude im städtischen Kontext" (engl. Zero-Energy Buildings in an Urban Context), in Journal "Erneuerbare Energie" 01/2013, p.32-35, Ed.: AEE Institute of Renewable Energy, Gleisdorf
- [3] Harald Deinsberger, "Funktionalität im Wohnbau" - Wann "funktioniert" ein Wohnbau in menschlicher Hinsicht? ("*Functionality of Housings*") in "Cloud-Cuckoo-Land", International Journal for Architectural Theory, Nov. 2012, Ed.: Brandenburgische TU Cottbus in cooperation with American and Canadian universities, online: [www.cloud-cuckoo.net](http://www.cloud-cuckoo.net)
- [4] cf. Eduard Geisler, "Psychologie für Architekten" (Psychology for Architects), p.75, Deutsche Verlags-Anstalt, Darmstadt, 1978
- [5] cf. Peter King, "Using Theory or Making Theory: Can there be Theories of Housing?" p.41 in Housing, Theory and Society, Vol.26, No.1, Pub.: Routledge Informa Ltd London 2009
- [6] cf. Allen, C. & Gurney, C. "Housing and Social Theory", p.3-5, European Network for Housing Research Newsletter, 3/1997
- [7] cf. Antje Flade "Architektur - psychologisch betrachtet", S. 56, Verlag Hans Huber, Bern, 2008
- [8] Karl Popper, "Logik der Forschung" ed.: Herbert Keuth, Mohr Siebeck Verlag, 11.Aufl., Tübingen 2005
- [9] cf. Karl Popper "Logik der Forschung", p.15f, ed.: Herbert Keuth, Mohr Siebeck Verlag, 11.Aufl., Tübingen 2005
- [10] cf. Harald Deinsberger, "Die Psycho-Logik von Wohnbaustrukturen" Die Beziehung Mensch-Wohnung-Umfeld und ihre systemischen Grundlagen, BoD Verlag, Norderstedt/Hamburg 2007
- [11] cf. Harald Deinsberger, "Interpretation or Analysis of Housings" Contradiction or useful Completion ... and what about the Theory of Housing? ("*Wohnbau-Interpretation oder Wohnbau-Analyse*" Widerspruch oder sinnvolle Ergänzung ... und wo bleibt die Wohnbau-Theorie dabei?), in "Cloud-Cuckoo-Land", International Journal for Architectural Theory, Dec. 2008, Ed.: Brandenburgische TU Cottbus in cooperation with American and Canadian universities; online: [www.cloud-cuckoo.net](http://www.cloud-cuckoo.net)
- [12] cf. Oscar Newman, "Creating Defensible Space", Institute for Community Design Analysis, Rutgers University, 1996