Collective benefit as generator of individual benefit.

Resonance based Design Method and its Application in Transferring Single-family House Qualities to Cooperative Multi-family housing

AMELIE MAYER, NATALIE PLAGARO COWEE, ULRIKE STURM, PETER SCHWEHR

University of Lucerne (HSLU), Competence Centre for Typology & Planning in Architecture (CCTP)

ABSTRACT

The Resonance based Design Method (RbD_Method) is presented as a tool of abstract knowledge which is applied to the specific project of transferring the qualities of single-family house (SFH) to multi-family housing (MFH). The RbD Method is a tool that can be used to plan buildings that are fit for the future and retain their value over a long period of time. In analogy to those which occur in evolution, cooperation and resonance are processes which play a decisive role in value retention strategies for architecture. The model is based on the recognition that built systems are more than the sum of their building components. What distinguishes a building as a living space from the addition of all its individual elements is constant cooperation and resonance from the outside in, and the inside out so as at different scales. Examples of this are the collaboration in planning teams, interaction between the building and its users, its location, cooperation amongst users themselves and at a smaller scale the interrelation of sub-systems within the building, etc. This approach leads to a systemic understanding of a building in which various tangible and intangible sub-systems are in constant interaction with each other. The tool is used to record and compare projects in which strategies to increase cooperation and resonance have been applied. To illustrate a practical application of the tool, a research project with the aim of increasing the resonance of MFH is recorded. Considering that 70 per cent of the world population is expected to be urban by 2050, research aiming to upgrade the MFH conditions achieving the same qualities as those of a SFH, offers an interesting contribution to the current process of constant urban densification. The MFH, considered in this project as part of densification strategies, is understood as a cooperative process amongst individuals which contributes to solve the collective problem of urban sprawl; in order to be considered a successful alternative to the SFH, MFH needs not only to solve the collective problem but furthermore to result in an advantage for individuals. How can collective sustainability yield individual benefit and vice versa, how can advantages for the individuals yield collective benefit? Following cooperative patterns, interviews were carried-out with people living in SFH to find-out which conditions would be an incentive for them to live in a multi-storey building. Based on these findings, strategies are proposed to increase the preferences for MFH, which not only consider the possibilities in the building itself, but also the requirements on the spatial and social environment, covering a range of physical, psychological and social aspects. The application of such strategies results in high user acceptance and allows the also adaptive buildings to retain their value over a long period of time. With the help of the RbD Method, buildings are recorded and compared with each other. Knowledge gained on the strategies may also be applied to other designs in a similar context.

Keywords: Evolution, Cooperation, Resonance, Adaptation, Flexibility, Open Building, single-family house, multi-family housing, Planning Strategies, collective benefit, individual benefit.

INTRODUCTION

In architecture, change is a reliable constant. Dealing with this requires strategies in planning, constructing, and operating buildings. Demands for a building stock that is both attractive and functional over a longer time period call for its ability to adapt to new requirements. The aspired (not only monetary) long-lasting value retention of the building stock lies at the heart of sustainable construction. If the building stock gives a satisfying answer to the evolving preferences and expectations of the society, it will retain its value during a longer period.

For this reason, a project cycle was initiated at Competence Centre for Typology & Planning in Architecture (CCTP) with the aim of creating an abstract theoretical model to develop planning recommendations for adaptive, i.e. reactive, and "active" buildings and neighbourhoods. Considering that it is expected that 70 per cent of the world population will be urban by 2050, research pointing to upgrade the multi-family housing (MFH) conditions, achieving the same qualities as those of a single-family house (SFH), offers an interesting contribution in an actual process of constant urban densification. The MFH, considered in this project as part of densification strategies, is understood as a cooperative process amongst individuals which contributes to solve the collective problem of urban sprawl; in order to be considered a successful alternative to the SFH, MFH needs not only to solve the collective problem but to result also in an advantage for individuals. How can collective sustainability yield individual benefit and vice versa, how can advantages for the individuals yield collective benefit? How can a MFH be planed and designed in order to offer its users similar quality conditions to those of a SFH?

To establish the essential theoretical fundamentals, evolution theories were intensively analysed and evaluated. Theories discussed by evolutionary and molecular biologists provide indications on the principle mechanisms of development and adaption. By taking the Darwinian evolutionary algorithm, comprising of variation, selection and reproduction, it could be proved in a preliminary study that the algorithm could in principle, also be applied to architecture. [1] However, it also showed that important phenomena of changes relevant to architecture could not be explained:

In Darwin's theory, development occurs as an unfocussed, slow moving and seemingly random process, whereas architectural design is usually a deliberate and purposeful process in which knowledge is applied and passed on. Furthermore, Darwin's theory gives the impression that the species are in continuous competition and struggle for survival, and can only successfully occupy an ecological niche when the competition has been forced out. The latest research results in molecular and evolutionary science do not dispute the validity of Darwin's evolutionary algorithm, but contradict the "struggle for life" and random mutation as an evolutionary principle. [2]

"Evolution is not the development of lone warriors, it is the development of biological systems" [3] and further: "The «behaviour» of living systems to try out new (…) variations in a creative manner, and in doing so, become more and more complex, is inherent in itself." Organisms are equipped with a biological sensorium that enables them to "adapt themselves and, triggered by changes in their particular environment («stressors»), change themselves". [3] In doing so, the biological principles of cooperation and resonance are applied. This process is contrary to Darwin's theory of natural selection, not random, but a controlled, cooperative and creative activity.

LIVING SPACES AS A COOPERATIVE PROJECT

Applied to architecture, according to Bauer, [3] it is apparent that the built systems are more than the sum of their building components. What distinguishes a building as living space from the addition of all its individual elements are constant cooperation and resonance from the outside in and the inside out. Examples of this are the interaction between users and planning teams, reactions to the location, interrelation between building parts, etc. This approach leads to a systemic understanding of

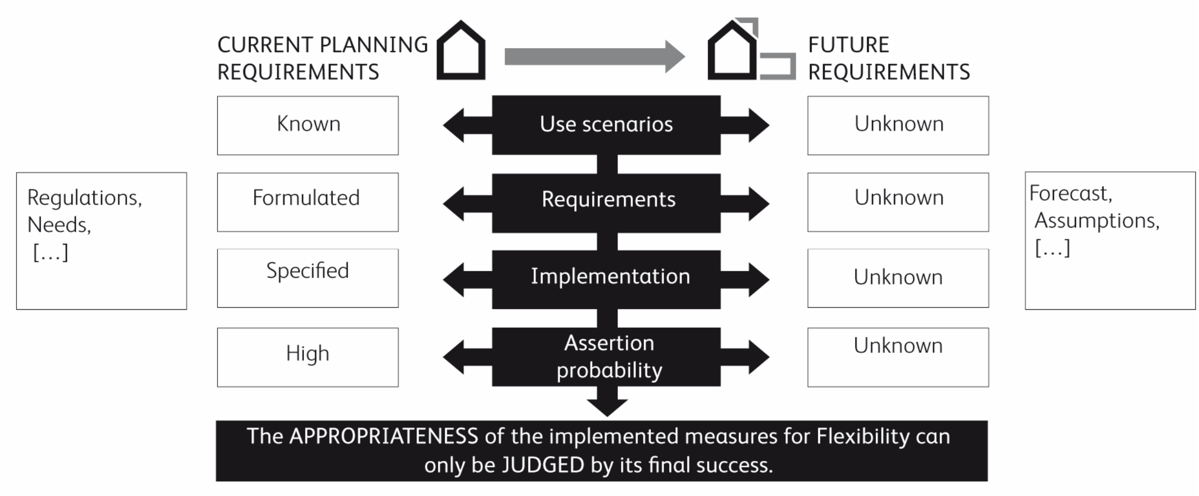

Figure 1: Dilemma of evaluating flexible measures [7]

a building, not as a static object, but as living space in which various tangible and intangible sub-systems are in relationship with each other. The building as an "active programme": According to John Habrakens "open buildings", we must demand that our buildings "as a material form be brought to life"[4] and suddenly, a complicated building planning problem becomes a complex living space planning problem.

As an "open system", the architectural living space is an "adaptable" system, i.e. the behavioural possibilities of the system are variable and diverse. That is why a problem in this living environment cannot be finitely solved despite time and effort spent, and adequate knowledge. It is a complex system that can be planned and controlled only to a certain extent. Planners are faced with the dilemma, in spite of it being impossible, to achieve the highest possible level of certainty in their planning process. This uncertainty can only be overcome by gathering specific information. Core element in the design process is consequently to obtain correct information, and to evaluate and compare it. In the process, the entire planning team, including the users involved, is reliant on a cooperation and resonance based planning method.

EVOLUTIONARY PRINCIPLES OF COOPERATION AND RESONANCE APPLIED TO DENSIFICATION PROCESSES

Like genetic systems in evolution, buildings can also, "only fulfil their function in close cooperation with their environment" according to Bauer [5] and because of this, are significantly influenced by environmental factors. Changes in environmental factors trigger stressors that constantly pressurise our buildings to adapt. We distinguish between stressors at context level (e.g. a new road in the neighbourhood), at the user level (e.g. the desire for more space), and at a building element level (e.g. normal wear and tear - windows not sealed). The stressors are often combined and overlapped.

In the conception of adaptable and long lasting buildings, we must take into account the interaction between the stressors and the entire building system. The pressure applied by the stressors on designed and constructed buildings requires cooperative planning understanding of teamwork and building combined with the target to achieve the highest possible resonance between the building and its users. In current evolutionary research, genetic systems are seen as a unit formed by "gene and environment, relationship

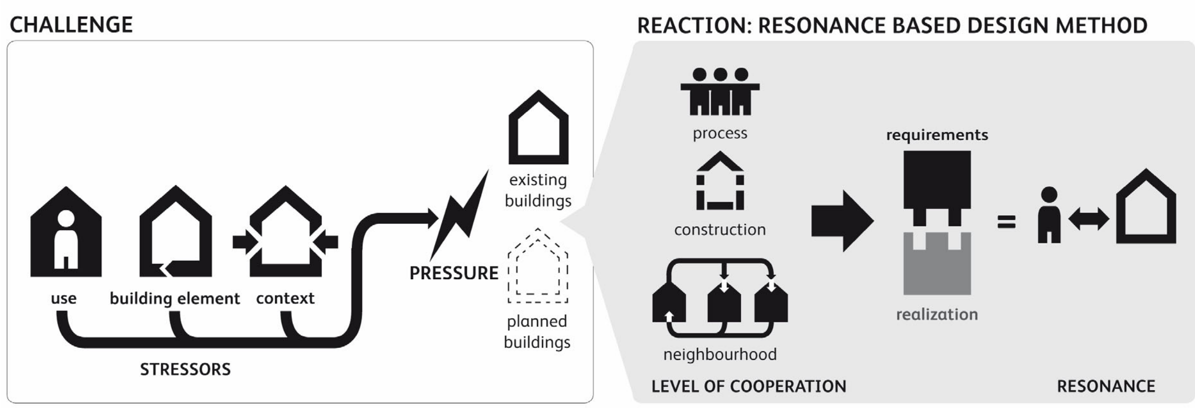

Figure 2: The evolutionary principles of cooperation and resonance in the design process for long-lasting value retention of buildings.

experiences and physical biology" which is "part of a cooperative project". [5] This is the case of the previously mentioned MFH project which will be explained in detail later. The building as a cooperative project is perceived by its users upon completion. This is when successful planning becomes evident. If the users succeed in establishing a positive relationship to the building and the architectural space develops into a living space, the measures have achieved a positive effect, i.e. a resonance.

In a physical sense, resonance is defined on the one hand as a) oscillation excitation of sound waves of the same frequency, reverberation of another object or other system capable of resonance (phys.); b) amplification and refinement through vibration in the overtones (for every fundamental tone, scarcely audible, resonating, higher-pitched partial tones which produce a sound (mus.); and on the other hand reactions (e. g. discussions, remarks) that have been triggered or suggested by something and which relate to it; echo, approval, understanding, effect. [6]

Applied to architecture, resonance should not only be seen as fulfilling a function in the sense of a reaction to the requirements, but also includes the viewer's subjective emotional perception. Both assume the presence of a sender and receiver, and the ability to establish contact with one another. Without these requirements, no resonance can take place between the sender (building) and the receiver (user). The aim of densification processes in architecture must be to generate positive resonance from the users in order to achieve highest possible acceptance. Special attention is therefore to be given to activating and reinforcing the latent resonance potential during the planning process.

RESONANCE BASED DESIGN METHOD - MOTIVATION AND STRUCTURE

These considerations lead to the conviction that cooperation and resonance should be a decisive planning maxim when planning future-oriented and sustainable neighbourhoods following high densification policies. Sustainability is strongly linked to user acceptance and in turn, with the adaptability of the building. Therefore, buildings designed to be sustainable are able to react to changing requirements, achieve high acceptance and have lasting value retention.

«Adaptability is an indicator for long value retention. The building is able to react to new requirements with reasonable cost, time, and effort. » [7]

The Resonance based Design Method based on evolutionary basic principles of cooperation and resonance, aims to ensure that during the entire planning process the necessary information is made available, and that scenarios can be created from it. This process from design to realization of the building and its transmittal is an iterative process in which solutions are produced and selected. At the end of this sequence of creating and evaluating, the scenario appearing to be the most appropriate solution is selected - the planning codification. [1]

The Resonance based Design Method uses a matrix to correlate the planning process with the three cooperation levels: process, construction, and neighbourhood. From this, specific cooperation and resonance based strategies and building measures are generated, and at the same time, opportunities as well as risks can be formulated. The tool is designed as an "open system", a "smart system", in which the available criteria can be extended or even modified. The model can be used in planning and for the evaluation of existing designs and buildings that successfully withstand the pressure of selection because of their high adaptability potential and user orientation. The resulting classification system makes it possible to analyse and record strategies applied to a specific project according to the stored cooperation and resonance criteria, evaluating also the collective or individual benefit which the strategy yields. These buildings are compared with each other and the strategies are available as possible solutions for other designs. The strategies applied on each project can be evaluated in order to record them for them being selected, varied or reproduced in future developments (evolutionary algorithm). The recorded designs and buildings are catalysts in encouraging and leading discussions. The system allows different interpretations and offers no hard truth

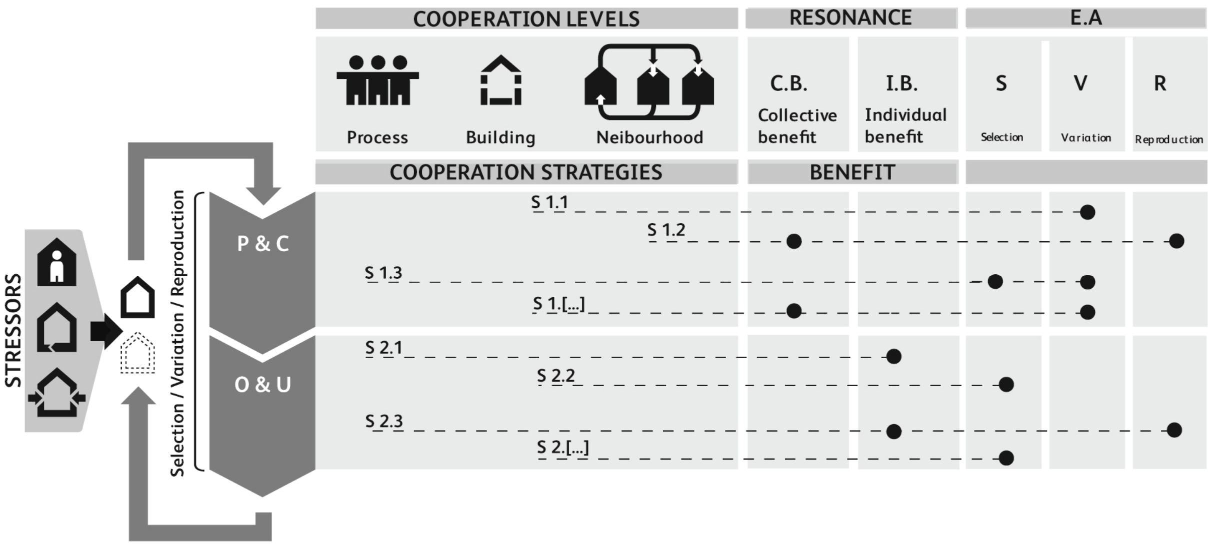

Figure 3: Basic concept Resonance based Design Method.

Legend: P&C: Planning & Construction; O&U: Operation & Use; E.A: Evolutionary Algorithm; S: Selection; V: Variation; R: Reproduction

RESONANCE BASED DESIGN METHOD - PRINCIPLES AND STRATEGIES FOR ACHIEVING COLLECTIVE BENEFIT SECURING INDIVIDUAL BENEFIT, THROUGH UPGRADING MULTI-FAMILY HOUSING WITH SINGLE-FAMILY HOUSE QUALITIES

As mentioned above the abstract knowledge of the RbD Method has been applied to the specific project of upgrading MFH for the sake of collective benefit while securing individual benefit. The means for achieving such goal are based on the findings of a research project carried out by the Competence Centre Typology and Planning in Architecture (CCTP, HSLU – T&A Lucerne, Switzerland) and the Competence Centre for Regional and Urban Development (CC StaR, HSLU – SA Lucerne, Switzerland) for 'transferring qualities of the single-family house to multi-family housing' (SFH/MFH), a project supported by the Swiss Commission for Technology and Innovation (CTI).

Starting point for this project was the fact that in Switzerland a SFH symbolises high quality living for many people. However, in combination with the steady population increase and its related growing demand for housing, this ideal contributes to a loss of around 11 hectares of agricultural land every day. Forward-thinking stakeholders, authorities and contractors are therefore required to come up with solutions that reduce urban sprawl and offer the qualities of a SFH at the same time.

ADDED VALUE OF COOPERATIVE PROCESSES SHOWN ON THE EXAMPLE OF MULTI-FAMILY HOUSING WITH SINGLE-FAMILY HOME QUALITIES

If we consider tenants living together in a MFH to be a cooperation project – as opposed to a SFH as an individual project – the added value resulting from the cooperative processes becomes evident in many ways: for example, occupants living in Swiss MFH can sporadically rent additional rooms as guest apartments or ateliers without having to pay for their continual upkeep as in a SFH. People living in apartments are also more flexible when it comes to relocating, because apartments – especially those in urban areas – are currently easier to sublet or sell than a SFH. In spatial terms, the communal outside areas of multifamily houses can offer a more varied range of facilities than in an individual garden because of the space available. Local authorities often benefit from higher tax revenue per square meter in comparison to areas with SFH. [8] There are also ecological benefits as MFH tend to use less grey energy in comparison to SFH. Overall, the obvious advantages of MFH created through a cooperative process yield collective benefit: MFH is more in line to meet the demands of social, ecological and economical sustainability than SFH. Nevertheless, especially when it concerns specific, individual benefits which account for occupants' social well-being, it is necessary to consider specific aspects when building MFH. Therefore, according to the RbD Method, the question was the following: which strategies can achieve the most positive resonance in this sector?

GENERIC STRATEGIES TO PROMOTE POSITIVE RESONANCE EXEMPLIFIED BY MULTI-FAMILY HOUSES WITH SINGLE-FAMILY HOME QUALITIES

So that the collective benefit resulting from the cooperative process in MFH construction mentioned above becomes tangible for users, or offers them a concrete added-value which makes that a move to a MFH seems more attractive, three strategies were developed for the long-term promotion of positive resonance: in the planning phase, the expectations of SFH occupants, which were specifically assessed in interviews, are incorporated in the concept; in doing so, the MFH are designed to suit those addressed. Based on that, the concept is consequently developed from a series of characteristics that was compiled according to the expectations communicated in interviews. Finally, the buildings can be adapted in various ways to suit the life stages of their users during the operation phase.

Evaluating the expectations of single-family home occupants.

To explore the living preferences of SFH occupants, 22 persons were interviewed in an exploratory study. [9] [10] These participants had already decided in favour of a SFH but their decision had been made recently.

Overall, the survey shows that psychological, social and spatial aspects play a major role in deciding for a SFH. Criteria such as privacy, freedom to decide and design, being close to nature, the number of rooms, child safety, hobby rooms on the premises and private outside areas were emphasised. Garages and storage rooms also appeared to be important, as well as a good relationship with the neighbours. This was almost as important as legal and financial independence. Proximity to urban life was also decisive, whereby respondents understood this to be a journey of up to 20 minutes. It was noticeable that coincidences also frequently contributed in deciding for a SFH (because a property was inherited etc.). Apart from that, many people thought that a SFH is for example less expensive than common-hold property.

In answer to the question under what conditions would respondents be willing to move to MFH, it was apparent that, adequate seclusion and sufficient sound insulation was of great importance. It would also depend on the number of parties in the building. The majority of SFH owners would not be willing to live in a building with more than five or six parties. Many of them would consider living on the ground floor or the top floor, but not in-between. MFH would also have to be built to ecological standards and, in order to be attractive, cheaper than a SFH.

Strategies for achieving single-family home living quality in multi-family housing

Based on the interview results mentioned above, eight types of MFH were selected and generic strategies were developed to promote SFH qualities in MFH. In the following paragraphs these generic strategies are represented in form of interchangeable measures. The measures provide stimuli for planners to be able to offer new MFH designs with SFH qualities.

Generic strategies

The strategies for upgrading the MFH with qualities of SFH [11] [12] have been structured, developed and integrated in a table (figure 4) as the RbD Method for planning MFH with SFH qualities; cooperation phases, cooperation levels, the resonance which is yield by each strategy and the future use which can be made of such strategy, has been considered in the table.

RESONANCE BASED DESIGN METHOD FOR THE UPGRADE OF THE MULTI-FAMILY HOUSING TYPOLOGY

Type of Strategies	Cooperation Phases		Cooperation Levels			Strategies	Resonance		Evolutionary Algorithm for future projects		
	Planning & Construction	Operation & Use	Process	Building	Neighbourhood		Collective benefit – +	Individual benefit – +	Selection Yes/No	Variation Yes/No	Multiplication Yes/No
1. Privacy						S1.1...S1.n					
2. Freedom to design and decide						S2.1...S2.n					
3. Being close to nature						S3.1...S3.n					
4. Use flexibility						S4.1...S4.n					
5. Imission protection						S5.1...S5.n					
6. Private outside space						S6.1...S6.n					
7. Semi-private outside space						S7.1...S7.n					
8. Children's safety in public outside space						S8.1...S8.n					
9. Garage space / Storage						S9.1...S9.n					
10. Adaptability of rooms						S10.1...S10.n					
11. Living with the neighbours						S11.1...S11.n					

Figure 4: Resonance based Design Method for the upgrade of the Multi-Family Housing typology

S1. Privacy:

S1.1 Reduced number of apartments for each entrance (ideally not more than 6) and of apartments per floor (max. 2); S1.2 Horizontal / vertical offset of private outside areas; S1.3 Creating 'thresholds' between living space and semi-public areas (gardens, borders, raised levels etc.); S1.4 Utility rooms in the apartment (laundry facilities, storage room); S1.5 Above-average sound insulation in indoor and outdoor areas.

S2. Freedom to design and decide:

S2.1 Co-determination possibilities during the planning process.

S3. Being close to nature:

S3.1 Choosing an appropriate location near to local recreational areas; S.3.2 Enhancing landscape character of communal outside areas and variety of its use; S.3.3 Overlooking greenspace by orienting apartments toward a near-natural outdoor space; S.3.4 Orienting apartments towards outside areas on the ground floor or to roofgardens.

S4. Use flexibility:

S4.1 Use-neutral design of the rooms (min. 3 m wide); S4.2 Layout of habitable rooms on one floor, barrier-free; S4.3 Ideally, one room more than the number of persons.

S5. Imission protection:

S5.1 Creating a sense of enclosure (e.g. one or more-sided courtyards); S5.2 Orienting the habitable rooms toward the courtyard; S5.3 Horizontal / vertical offset of the private outside areas (distance to the neighbours); S5.4 Encourage sound absorption by planting in outside areas; S5.5 Above-average sound insulation in indoor and outdoor areas; S5.6 Adequate Regulations.

S6. Private outside space:

S6.1 Different outside areas for each apartment (private space and garden); S6.2 Ensure adequate privacy of outside areas (screens, shields, hedges etc.); S6.3 Gardens outside ground floor apartments, on the roof or on top of the garage nearby; S6.4 Direct exits from several sides of the apartment into the garden; S6.5 Providing opportunities to rent allotments.

S7. Semi-private outside space:

S7.1 Clearly allocating the function of each individual area; Boundaries between conflicting uses; S7.2 Clear definition of uses; Potential to adapt buildings to different uses (some left undetermined); S7.3 Varying series of spaces and creative solutions for thresholds; S7.4 Incorporate existing focal points and landmarks; S7.5 Using high grade, robust and durable materials; S7.6 Coherent transitions between living space and public spaces.

S8. Playspaces / Children's safety in public outside space:

S8.1 Creating a sense of enclosure (e.g. one or more-sided courtyards); S8.2 Child-friendly design of outside spaces (for different age groups); S8.3 Possibility to overlook playspaces from the apartments; S8.4 Promoting subjective sense of safety; Combination of safety and isolation requirements.

S9. Garage space / Storage:

S9.1 Storage in apartments (built-in cupboards or separate storage space); S9.2 Externally accessible storage for children's toys etc.; S9.3 Placing storage spaces near entrances; S9.4 Choice of room or garage at ground level; S9.5 Combination of garage spaces with storage space; S9.6 Car-sharing scheme to reduce number of parking spaces.

S10. Adaptability of rooms:

S10.1 Flexible allocation of living space during the planning and / or use phase; Variability of size of apartments (modular floor plans); S10.2 Possibility to adapt apartments and outside areas in accordance to life stage; S10.3 Options for extensions (e.g. rooms or loggia, garage or rooms); S10.4 Possibility to convert the apartment into two units (e.g. granny flat); Possibility to rent extra rooms (home office, common rooms).

S11. Living with the neighbours:

S11.1 Outdoor areas where people can meet and/or common rooms; S11,2 Planning processes during which residents have the opportunity to get to know each other early on.

CASE STUDIES

The contrasting of the above listed generic strategies with twenty built MFH projects in central Switzerland shows the following results: On the one hand it is confirmed that MFH with SFH qualities have already been constructed. On the other hand it can be seen that the SFH qualities are often limited to the interior of the apartments in the case of the MFH. Here only the storage areas and the private outside areas pose a challenge. Concerning the semi-private areas in the apartment complex (entrance areas, stairways, community rooms, semi private outdoor areas etc.) the analysed examples - which represent different scales of MFH –often achieved worse results. To improve the SFH qualities in those areas planners should pay more attention to the design of the semi-private outdoor areas. Furthermore additional storage room could be of advantage. Depending on the site and the users of the individual MFH, also larger entrance areas which allow the users to individually design the access areas of their apartments could generate an added value. Finally, contrasting the built reality with the generic strategies shows that many of the chosen MFH sites do not offer SFH qualities. A more deliberate choice of the sight could also bring further advantages.

Certain aspects of those results become clear examining the MFH case study "Stöckacker South" planned by Michael Meier and Marius

Hug Architects (Zurich, Switzerland) and Armon Semadeni Architects (Zurich, Switzerland). The housing estate shall be finished in 2015. By then it will replace an existing apartment complex in Bern Bümplitz-Oberbottingen. The estate is well accessible by public transportation. It is also close to schools and areas for sports and leisure activities.
The two-story, stapled so-called "town house apartments" in "Stöckacker South" fulfil the wish for SFH qualities especially well. Each apartment can be accessed separately from the outside, has two floors, creates thereby a very amply room impression and has a private garden area directly in front of it. In the living and dining area each apartment can be separated in two rooms by a sliding wall. This enables the users to flexibly adapt the room structure to their momentary needs. As there are always two "town house apartments" stapled on each other the upper one has its garden on the roof top. Together the three- to four-story buildings of "Stöckacker South" enclose a semi-private outdoor area. A variety of different outdoor places with various degrees of privacy are offered to the inhabitants. A broad variety of apartment layouts enhances a mix of inhabitants at the bigger scale. The apartment complex is thereby not limited to family housing. An added value in comparison to SFH standards is generated by several available common rooms, a nursery school and a flexible community room. Stores etc. find their place in the ground floor areas of single apartment blocks at "Stöckacker South".

The following table shows a summary of the generic strategies established by the RbD Method which are constrasted with the "Stöckacker South" case study.

Type of Strategies	Cooperation Phases		Cooperation Levels			Strategies	Resonance		Evolutionary Algorithm for future projects		
	Planning & Construction	Operation & Use	Process	Building	Neighbourhood		Collective benefit – +	Individual benefit – +	Selection Yes/No	Variation Yes/No	Multiplication Yes/No
1. Privacy						S1.1, S1.3					
2. Freedom to design and decide											
3. Being close to nature						S3.1 - S 3.4					
4. Use flexibility						S4.1					
5. Imission protection						S5.1, S. 5.4					
6. Private outside space						S6.1, S 6.4					
7. Semi-private outside space											
8. Children's safety in public outside space						S8.1 - S8.4					
9. Garage space / Storage						S9.1					
10. Adaptability of rooms						S10.1					
11. Living with the neighbours						S11.1					

Figure 5: Resonance based Design Method, Case study “Stöckacker South”

Having contrasted the “Stöckacker” case study with the generic measures for improving MFH with SFH qualities, certain aspects have been identified as holding a potential for improvement:

For example, SFH residents, as mentioned previously, attach great importance to freedom of choice in design. This means, to improve SFH qualities the users should be allowed to take a controlled influence in the planning phase. Thereby the "SFH flair" could be supported. Furthermore, as seen in Germany and Austria, this kind of cooperative negotiation process can also contribute to a conflict-resistant and more stable neighborhood. [13] At the moment of analyses, the planning of the outdoor areas at the „Stöckacker" case study was not finished (estimated completion 2015). As a recommendation, a clear allocation of the functions of different areas and boundaries between conflicting uses would be of advantage (e.g. separation of public and private domain, acoustic barriers and clear definition of areas to play or relax). In addition, offering rental of gardens in the semi-private outside spaces could be of interest. Considering SFH-standards, a certain lack of additional storage areas (e.g. for children's toys and outdoor gear), in the apartments so as separately, has also been identified. Furthermore, the analysed "town house apartments" can be adapted with difficulties in accordance to the life stage of the users. In order to allow an easier adaptability to the user's life stage, both floor levels of the "town house apartments" should be accessible separately with a lift and constitute an independent living unit itself to enable inhabitants to partially rent-out/sell-out spare spaces. Such long-term adaptability plays a major role particularly as the idea of a SFH is often linked to the conception of safety and stability. [14] That means that people who buy a SFH – on an emotional level – assume that they can retain it as a 'stable place to live'. Furthermore, if long term adaptability is possible there is also the advantage of preventing the long-term decrease of population density that occurs in traditional SFH estates. This contributes significantly to increasing space per person. [15] Effectively communicated, this type of adaptability also has an explicit advertising effect because in this respect, MFH often have an advantage over typical SFH.

3. OUTLOOK

As the case study shows, the evolutionary principles of cooperation and resonance hold great potential for the planning and evaluation of future-oriented, sustainable buildings. Demands to boost resonance forces us, as planners, to take a holistic view, consider the user's perspective, and to work with scenarios for use, operation, and maintenance: The architectural object becomes a complex living space to be planned. In this process, we rely on information that can be gained only through cooperative understanding of planning and building. The raster of the RbD Method is currently undergoing intense testing. This also involved applying it to the research results from the SFH/MFH project, whose results were described previously. For the future, apart from collecting further case studies, the greatest challenge will be to develop the tool as an "open und smart system" so that criteria can be changed, whilst the tool retains a coherent basic structure. If this is successful, the tool will become an aid targeting the holistic development of strategies as shown by the example of MFH with SFH qualities.

The SFH/MFH project proves that there are clients who could imagine living in MFH instead of a SFH. They accounted for about one third of the persons interviewed. In addition, one can assume that an appropriate offer - even if this involves an acceptable rise of living costs - would appeal to some clients who already live in MFH in favour of the urban environment. To be able to use this potential, appropriate living space that targets added value must be made available. This conception is based on the analysis of factors that contribute to positive resonance which can be induced by the RbD Method. However, if we succeed in using the potential the RbD Method shows, bearing the aspects listed in mind, MFH with SFH qualities can contribute significantly to future sustainable urban development and the preservation of the environment. With this in mind, other projects using the RbD Method will be developed in the future and their potential will be evaluated.

REFERENCES

[1] Schwehr, Peter, *Evolutionary Algorithms in Architecture.* - open house international. Vol. 36 no.1, 2011

[2] Schurz, Gerhard, *Evolution in Nature und Kultur: Eine Einführung in die verallgemeinerte Evolutionstheorie* - Spektrum Akademischer Verlag Heidelberg, 2011

[3] Bauer, Joachim, *Das kooperative Gen: Evolution als kreativer Prozess* - Wilhelm Heyne Verlag München, 2010

[4] Bosma, K; Van Hoogstraten, D; Vos, M; *Housing for the Millions: John Habraken and the SAR (1960-2000)* - NAi Publishers, Rotterdam, 2000

[5] Bauer, Joachim, *Prinzip Menschlichkeit: Warum wir Natur aus kooperieren* - Wilhelm Heyne Verlag München, 2008

[6] Duden - *Das Große Fremdwörterbuch. Herkunft und Bedeutung der Fremdwörter.* 4. aktualisierte Auflage. - Dudenverlag Mannheim, Leipzig, Wien, Zürich, 2003

[7] Plagaro Cowee, N.; Schwehr, P., *Die Typologie der Flexibilität im Hochbau.* – Interact: Hochschule Luzern, 2008

[8] Scheider, Alex; Peyer, Marco; i.A. des Baudepartements des Kantons Aargau, *2011: Kommunale Raumplanung zwischen Aufwand und Ertrag. Finanzielle Konsequenzen siedlungsplanerischer Massnahmen. - Baudepartement des Kantons Aargau*; - Abt. Raumplanung, 2011

[9] Peter, Colette, *Vorstudie über Wohnpräferenzen (zukünftiger) Einfamilienhausbewohner/innen; Hochschule Luzern* - Soziale Arbeit, 2009 as proposed by Schmitt el al, 2006

[10] Weischer, Christoph, *Sozialforschung. Reihe UTB Soziologie, 2924.* - UVK Verlagsgesellschaft, Konstanz, 2007

[11] Mayer, Amelie; Sturm, Ulrike; Schwehr, Peter et al.: *EFH/MFH. Zwischenbericht 1; Hochschule Luzern* - Technik & Architektur. Kompetenzzentrum Typologie &Planung in Architektur. Luzern, 05.11.2010

[12] Mayer, Amelie; Sturm, Ulrike; Schwehr, Peter et al. : *EFH/MFH. Zwischenbericht 3; Hochschule Luzern* - Technik & Architektur. Kompetenzzentrum Typologie &Planung in Architektur. Luzern, 30.04.2012

[13] Temel, Robert; Lorbek, Maja; et al: Baugemeinschaften in Wien. *Endbericht 1. Potentialabschätzung und Rahmenbedingungen.* – Wien, 2009

[14] Mag. Moser, Winfried; Dr. Reicher, Dieter, *Was ist so schön am Eigenheim. Ein Lebensstilkonzept de5 Wohnens.* – Graz, 2002