Chapter 6

Practical Value of User-Centred Spatial Statistics for Responsive Urban Planning

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Additional information is available at the end of the chapter

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Abstract

This chapter addresses spatial statistics via an alternative perspective, focusing on evidence-based people-spatial relationships and related measures, quantifications and qualifications, and by this, it provides rather specific spatial information and spatial statistics about urban environments. It is based on time quality assessment (TQA), a time-people-place-oriented approach for the analysis and simulation of the quality of living environments, backgrounded with the method of behaviour mapping. It shows that the quality of the time spent on a certain activity in a certain place indicates the quality of the living environment. It also shows that the quality of the time spent depends on what a person can afford, and it provides an evaluation of the quality of living environments with a measure of good/bad time. The practical value is in the provision of empirical knowledge to support planning guidance based on user-centred small-scale spatial statistics, which is able to inform top-down and bottom-up decision-making processes for people-friendly living environments.

Keywords: spatial-temporal statistics, urban planning, quality of life, behaviour mapping, bottom-up, user-centred, evidence-based, time quality

1. Introduction

Our (urban) living environment, composed of material and non-material components and relations among them, including an infrastructure and other built components, ecosystems, their inhabitants and users (e.g. people, animals, vegetation) and other entities (e.g. various enterprises, cultural and political entities, etc.), is a dynamic, complex system (e.g. [1–3]). In general, such a system is unpredictable (e.g. [4, 5]). It is composed of known invariable components (e.g. macro-location, general climate conditions, certain elements of the environment in the considered time period, etc.); known variables (those of which we are aware, but their quality or quantity is unknown or variable, e.g. infrastructure, [built] environment, individuals, their habits, their occupations, their routines, etc.); and unknown variables (those

of whom we are not aware and/or cannot determine, e.g. daily politics and unpredictable disasters).

In approaching the system from a large scale in certain circumstances, the analysis and simulation of selected aspects within the selected condition limits may appear simple (i.e. it is possible to determine the simple approximations of relations, e.g. linear). However, such an approach in general does not result in appropriate useful results. On the other hand, the determination of very complex relations in the large-scale analyses may result in very unreliable results and uncontrollable simulations.

Considering the above, an attempt to start with a more profound investigation of the components of the system that are of concern to us and their relations to other components, i.e. to the system, appears reasonable. At that level, relations are more simple (or less complex), and it is more likely that simple approximations result in acceptable outcomes. Yet, the simultaneous monitoring and valuation of higher-level results (i.e. mass result, larger scale) is important. This calls for the use of the bottom-up approach, based on small rather than big data, which may help with interpreting or informing big data in spatial statistics (e.g. [6]).

This chapter addresses people-spatial relationships, their quantifications and qualifications and related measures for bottom-up evidence-based and user-centred urban planning. Based on time quality assessment (TQA), a time-people-place-oriented approach for the evaluation of the quality of living environments, this chapter provides specific types of spatial information about urban environments and challenges the current two-dimensional land-use perspective in urban planning with a dynamic and comprehensive perspective, taking into account users, the activities in which they are involved and the environments in which these activities are taking place, analysing three key parameters: time balance, economic balance and time-quality balance. The chapter shows that the quality of the time spent on a certain activity in a certain place indicates the quality of the living environment. It also shows that the quality of the time spent depends on what a person can afford, and it provides an evaluation of the quality of living environments with a measure of good/bad time. This chapter provides empirical knowledge based on user-centred small-scale spatial statistics to support practical guidance for informing decision-making processes for people-friendly living environments.

In relation to spatial planning assistance, keeping behaviour patterns in mind, interest has been increasing in the development and implementation of approaches based on information computer technology (ICT) and geolocated social media data (e.g. [7, 8]). However, to be able to talk about the quality of living environments via a time-people-place-oriented approach, first, time as a dimension also has to be applied to non-transportation activities. Reference [9] addressed the travel-time ratio and examined the relationship between travel time and stay time (keeping the goal of the travel in mind). Such an approach is particularly useful in the evaluation of the actual temporal scheme of a person's routine. However, it does not comment on the quality of the time spent on travelling or on staying. In this respect, the chapter addresses the quality of living (environments) via the quality of time spent within peoples' daily routines.

The quality of time spent on an activity is a complex function going beyond the quantity of time spent on a certain activity in a certain place. However, it combines the basic economic

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ability of a profile, the assessment of the conduciveness of the physical environment and the pleasantness of the activity taking place there. Contemporary responsive urban planning on a general level refers to the quality of living environments and well-being. In relation to the development and current state of the field of approaches towards assessing or measuring quality of living, a variety of comprehensive concepts related to quality of life exist, usually referring to the quantitative social, spatial and economic aspects (e.g. [10–13]). A literature review shows that although quality of life is recognised as a general concern, little consensus has been reached on a definition of quality of life or on the factors/predictors of an individual's quality of life (e.g. [14, 15]). In the past decade, the quality-of-life concept has also been focussing on well-being, health and standard of living addressed via softer indicators, such as happiness, life satisfaction and the like [16].

However, despite the fact that many strategic documents (e.g. [17]) presenting fundamental objectives for smart, sustainable and inclusive growth have emphasised the importance of local development towards quality of place and the well-being of people, quality-of-life-oriented studies still lack a focus on detailed actual and local-level aspects, which may better interpret or indicate quality of life and living environments. In relation to this, [18] argues that the actual implementation of such objectives in real-life situations (on a scale of 1:1) is often vaguely realised. In this framework, this chapter introduces the prototype of the TQA approach and shows how the model can work. TQA has been introduced as an alternative approach for assessing the effectiveness of human environments for living [19], using bottom-up evidence-based spatial statistics. In city planning and design processes, the TQA of living environments represents a potential universal baseline, where the TQA approach examines relationships between characteristic socioeconomic profiles acting in certain environments.

2. TQA approach

The current development stage of the TQA approach is characteristic of a clearly stated and well-developed concept, based mostly on theoretical simulations. A fully fledged investigation was not implemented. The concept foresees that calibration regarding quality of activity follows target-group questionnaires, interviews or appropriate ways of crowd sourcing (e.g. Web public participation, social networks) depending on the environment where the approach is applied. Similarly, quality parameters and weights used initially follow a combination of expert knowledge (e.g. sociological studies of everyday life, studies addressing placemaking and place attachment, a combination of expert knowledge from the fields of environmental psychology, urban planning and design) and data collected from the relevant target groups. This chapter discusses a new approach and illustrates its applicability to and value mostly for examples that simulate possible real situations. The comments are based on selected cases, theoretically set up and occasionally proven for some territories, knowing their socioeconomic characteristics (source: Statistical Office of the Republic of Slovenia [SURS]; Surveying and Mapping Authority of the Republic of Slovenia [GURS]), place characteristics (e.g. spatial-site analysis, behaviour-mapping analysis, GURS) and commuting possibilities for the theoretical

target profile, using Michelin or similar portals. To keep the discussion manageable, the simplification of parameters or situations is used.

Three main pillars of input data are relevant for the approach: data related to the user profile, data related to the activity for which the suitability of the area is examined and data related to space. In general, the collected data refer to five binds of information: population, housing, leisure and recreation, services and transport, and they provide a possible examination of:

- facilities that examined territories shall provide,
- mobility networks that assure accessibility to these facilities and
- facilities in correlation with population densities.

The population can be grouped into various groups, based on common crucial characteristics, resulting in segments of the population. One such segment of the population is defined by boundary profiles and characteristic profiles (e.g. central profile, the most representative). Accordingly, it is possible to define the limits of the population of the studied area and the edge conditions of/for such a population within the area. Further, individual profiles are necessary to define, as they can help to describe the population in the studied area. They can be set up from available statistical data or any other relevant source (e.g. questionnaire) regarding demographic and social parameters, such as age, gender, family status, education, occupation, income and the like.

Based on crucial boundary characteristics, variations of individual profiles are designed by logical filters or on the basis of known data about the population of the area of interest. Further, the implementation of the TQA approach builds on the assumption that if boundary profiles are satisfied, all profiles within the studied segment of the population are covered.

To get as thorough of an insight as possible into a segment of the population in the context of this chapter, the daily routines of boundary profiles are important. There are as many routines as there are boundary profiles. However, there can be fewer different routines as there are profiles, as some profiles can have the same daily routines. An analysis of the daily routines of boundary profiles can result in the compatibility of various segments of the population in certain areas, as daily routines may explain similarities in people's interests. The implementation of TQA results in the acceptability and quality of places for a particular segment of the population, and it enables an examination of how well a certain place suits this group of people and how well it enables their co-habitation. The final result of the TQA approach is a time-quality balance of a profile.

Thus, the key points for any scenario or spatial development defined in this approach are the user profile, activity and space, where three conditions related to the user profile, acting in a certain territory, are analysed:

- time balance,
- economic balance and
- time-quality balance.

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2.1. Time balance

Time balance shows how comfortably the user spends time in his/her (living) environment; how comfortably a segment of the population can live in a certain area, i.e. how a chosen routine is manageable for an individual in the available time frame; and whether a person can achieve necessary and optional activities within the available limits of the time frame (e.g. 24 h/day, within the schedules/opening hours of available capacities for the selected activities). A comparative analysis of more segments of the population shows the abilities of the co-habitation of various segments of the population in the same area. It also shows if any segment of the population is being disregarded or favoured. This means that the time-balance category is place dependent. This is closely linked with spatial characteristics (e.g. structure of the place, infrastructure, program, etc.). Time balance is possible to establish when one has a defined profile, routines and belonging space(s). Time balance shows how comfortably time is offered to the user through his/her (living) environment.

The time spent on each action should be shorter or equal to the available time for that action and should be accommodated within the time sequence available for the action:

$$T_{Rqi} \leq T_{Avi} \tag{1}$$

where T_{Rqi} = time required for action i; T_{Avi} = time available for action i.

For an illustration, when one does not manage that action in time, the person is late. However, the minimum required condition—although it is not always sufficient—is to do everything required in the entire available time frame (e.g. to do all daily routines in 24 h):

$$\sum_i T_{Rqi} \leq \sum_i T_{Avi} \rightarrow T_{Rq} \leq T_{Av} \tag{2}$$

Time-balance analysis shows a balance of necessary and optional activities. In the situation of assessing the suitability of a neighbourhood for a certain profile, first checking the criteria at the level of time balance is the profile's ability to fulfil activities. If the profile is not able to fulfil necessary activities, the neighbourhood is not suitable for it, and if the profile is not able to fulfil optional activities, optional activities must be re-organised against a new priority list.

2.2. Economic balance

Economic balance is a category that represents the subject's income and expenses for necessary and optional activities, and a financial framework within which the subject is flexible to be able to perform each of the activities in a certain environment, i.e. whether the selected activities can be afforded per person within a household and whether the incomes and expenses of a household per person enable these activities to be fulfilled.

The basic information addressed is a household's incomes and expenses for necessary activities and optional activities. The expenses of a household should not exceed the incomes:

$$\sum_i M_{Rqi} \leq \sum_j M_{Avj} \rightarrow M_{Rq} \leq M_{Av} \tag{3}$$

where M_{Rqi} = money required for expense i; M_{Avi} = money available from source j.

Incomes are classified as regular (e.g. salary earned in working time every working day); other regular (e.g. pension, rent); and irregular (e.g. property selling). Expenses are classified as: residential expenses; basic basket expenses (e.g. food, clothes); other necessary expenses (e.g. nursery, school); other optional expenses; and travel expenses for commuting as a part of a daily routine.

2.3. Time-quality balance

Time-quality balance calculates the time spent in terms of both activity and environment. The component of time-quality balance shows when a financial situation allows activities to happen; how well the time needed for them has been spent in total; and how much of the entire time taken for all of the activities per day is considered good quality and how much of it is bad quality. Time-quality balance shows the final quality of the time spent within a routine and reflects on the quality of the living environment in which the profile lives. Thus, with this final parameter, the TQA approach shows whether a segment of the population can live in a certain area and how comfortably:

$$K_{TQ} = \frac{T_Q}{T_{Sp}} = \frac{\sum_i T_{Qi}}{\sum_i T_{Spi}} = \frac{\sum_{ij} T_{Spi} \times F_{Qij} \times F_{Wij}}{\sum_i T_{Spi}} \tag{4}$$

where $\sum_j F_{Wij} = 1$ and $-1 \leq F_{Qij} \leq 1$; where K_{TQ} = time-quality coefficient; T_Q = evaluated portion of time (+ sign: good time; - sign: bad time); T_{Qi} = evaluated portion of time within time interval i; T_{Sp} = time spent; T_{Spi} = time spent within time interval i; F_{Qij} = quality of quality component j within time interval i; F_{Wij} = influence (weight) of quality component j within time interval i.

Following the TQA approach, two time-quality components are proposed:

AC = activity component; SC = space component

therefore

$$j \in \{AS, SC\} \Rightarrow F_{Wi,SC} = 1 - F_{Wi,AC} \tag{5}$$

2.4. Behaviour map: a means of TQA interpretation

To implement TQA as a universal evaluation tool for quality of place in relation to its usage, behaviour mapping [19] is seen as a key part of the process. This is true especially where behaviour maps extract behavioural evidence into layers of spatial information to provide a better understanding of the individual and the collective patterns of use that emerge in a place.

Behaviour mapping is a method and tool for analysing usage-spatial relationships originating from the field of environmental psychology in the 1970s of the twentieth century [20]. It is a

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product of observation and a tool for place analysis and design at the same time, and as such, it represents a means for recording behaviours in a spatial setting and the final results of the observation of dynamic patterns of spatial occupancies, visually expressing structural relations between the characteristics of places and their use(r)s. Behaviour maps can contain broad spectrums of information, from location, type of activity and duration of activity to many other characteristics, depending on the research question, aspects or issues. Therefore, they act as effective media for dealing with the spatial and dynamic patterns of the usage of places. Due to their graphic nature, visualising relationships between various—not necessarily physical—characteristics of places and their users, they can be seen as a valuable tool for improving bottom-up generated data and for providing new insights for spatial statistics. Practically, they can provide the recognition and understanding of possible or expected uses in places, their frequencies and their intensities, and as such, they may lead towards more effective and responsible planning and design practice and towards the achievement of better quality of living. Knowing actual activities in places and their characteristics in places is important for the identification of quality of everyday living and for directing and stimulating the suitability of territories for occupancy.

Some fundamental conditions need to be met before any recording of behaviour can start. It is necessary to define the area to be observed, to clearly define the types of activities and details about behaviours to be observed, to schedule specific times and their repetitions for observation, and to provide a system of recording, coding, counting and analysing with either a low- or high-tech recording approach. This chapter argues for behaviour mapping as both an analytical tool for monitoring daily routines and as a means of the interpretation of the TQA approach, and by this, it is promoted for the provision of bottom-up generated datasets as a basis for user-centred spatial statistics. Behaviour mapping has the capacity to address the social needs, locations, dimensions, frequency, intensity and co-habitation of activities in places directly. It refers to groups and individuals as well as social-relations change.

Thus, such behaviour maps can be used to capture the knowledge that brings the indirect insights of usage-spatial relationships and to visualise abstract notions and essentially the non-spatial characteristics of physical environments. In relation to TQA, one of the key pieces of information offered is time-related characteristics. A behaviour map can show two significant temporal dimensions: (1) for how long a certain activity is going on in a certain place and (2) on which day or in what other time-unit sequence the activity has been taking place. In the TQA approach, behaviour is usually defined by a daily routine but allows the consideration of other situations, e.g. a weekly routine and extraordinary routine.

The challenge of this concept is to shift the understanding about and focus on datasets for city analysis towards people and places. Assisted with behaviour mapping, this alternative approach provides a time-based perspective on the activities and engagement of people.

3. TQA implementation: case of Posavje District, Ljubljana, Slovenia

Posavje is one of Ljubljana's 17 districts; it features a wide range of spatial and living situations, from dense and high residential neighbourhoods to rural, mostly agricultural areas, and it

includes a transport point of view supplied by public bus services and the regional railway track. To illustrate the TQA approach, the assessment of quality of living environments via quality of time for a family man was modelled. Time-quality assessment for the daily routine of a profile living in two different micro-locations within the same neighbourhood was analysed and simulated. Further, regarding the contemporary demographic situation across Europe, attention was paid to elderly people—one of the vulnerable user groups—assuming that when some settings and arrangements are good for them, it is quite likely that they may suit other users, too. Four different locations within four characteristic neighbourhoods in the area were analysed and simulated (**Figure 1**).

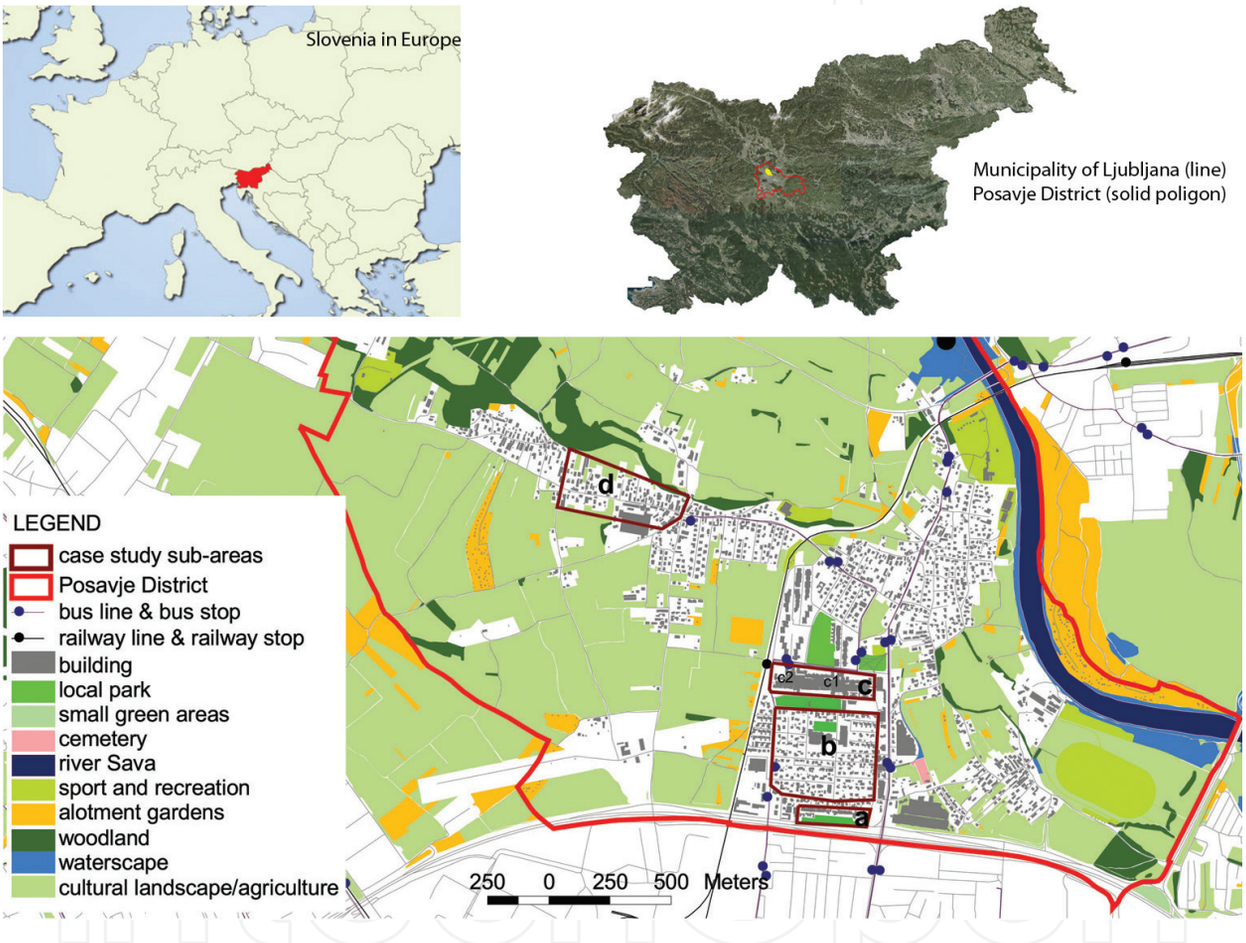

Figure 1. Case study area.

Time-quality assessment for the daily routine of a profile living in four different types of locations within the area was simulated using the TQA approach. High-rise flats that also provide accommodation unit for elderly people by the highway is denoted by the letter a; the area of individual houses by b; high-rise flats in the centre of the neighbourhood, close to the community centre, by c; and the area of a compact rural settlement by d, where d1 is assigned to the current state of d. The letter F denotes a profile of a working family man with pre-school children. The simulation examines two micro-locations in high-rise flats in the centre of the neighbourhood, close to the community centre, c1 and c2. The letter E denotes the profile of an

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elderly man; therefore, Ea, Eb, Ec1 and Ed1, respectively, are denotations of one of the possible daily routines of such a person, regarding the location of his home. Examples show daily routines in nice weather during spring or autumn.

The first case (Fc1 and Fc2; Section 3.1) is focused on the procedure of the TQA approach; setting up a profile; and defining and monitoring a routine and time-balance assessment, economic assessment and time-quality assessment as a final result of the process. Meanwhile, the second case (Ea, Eb, Ec1 and Ed1; Section 3.2) is focused on the characteristics of the routine of the profile living in different areas within the studied territory and their feasibility regarding the circumstances (Ed1–Ed4).

No absolute measure of quality of living space exists. One always compares two spaces to declare the quality of each, where one or both spaces may be fictive. The quality of one space may be defined in relation to another known or defined quality, whereas the parameters of quality depend on the purpose of the space and/or the user(s) of the space. Something that is important for one user may not be as important for another user or may not apply to other users at all.

The TQA approach extracts the time spent on any activity into the good or the bad portion. The rest of the time, not classified as good or bad, is considered as the indifferent portion of time. In the TQA approach, satisfaction with time is valuated using a scale from -100% satisfaction (complete dissatisfaction) to +100% satisfaction (complete satisfaction), where 0% satisfaction would mean that the user is indifferent to the time spent in a certain space.

To generalise in such a valuation:

- a good time is represented by a positively signed percentage of satisfaction;
- a bad time is represented by a negatively signed percentage of satisfaction; and
- the rest is identified as indifferent time.

This also indicates that a good time and a bad time can neutralize each other, e.g. good time = -bad time (e.g. 1 h of good time + 1 h of bad time = 0).

The measure of quality is the quantity of good time (or bad time if the result is negative) after summation. The sum of the absolute values of the quantity of time (good + bad + indifferent) may not exceed the absolute value of the available time (e.g. 24 h/day).

Further evaluation that introduces time as the universal measure for the quality of environments refers to activities and spaces linked to these two components of time (activity component—FQAC, spatial component—FQSC) by weight (FWAC, FWSC), i.e. how much of an influence each of the components has on the quality of time spent in a place for this certain activity. This thought depends on the profile's preferences, which may also depend on affordances (e.g. economic ability). The weight of each quality component describes how much each component contributes to the potential quality of time, e.g. the potential satisfaction with the time spent in the given place. These two parameters finally shape the activity-place relationship in a daily routine, and they are, for comparative purposes, finally transferred into the coefficient of time quality and time-quality balance (KTQ and TQ).

In all of the examples referring to the implementation of the TQA approach, the following parameters are assessed and/or calculated:

TSp, time spent (hours, minutes); FQAC, quality of activity component of time (%); FQSC, quality of spatial component of time (%); FWAC, influence of activity component of time (%); FWSC, influence of spatial component of time (%); KTQ, coefficient of time quality; TQ, quality time (hours, minutes).

When implementing the TQA approach, it must be remembered that time balance and economic balance are absolute objective measures, while time-quality balance is always subjective. Hence, it shows how one place may be better (e.g. provides higher benefit/comfort for the user) than the other and always needs to be commented regarding the context. In this respect, although economic balance represents an absolute value, it is linked to location.

3.1. Family man living in urban area

The simulation illustrates activity-place relations and time-quality balance (TQ) for a total daily routine for two variations of the same main socioeconomic profile from the same neighbourhood. The initial results are related to the time spent on the activities and the basic qualities of activities and places. Further evaluation introduces time as the measure for quality, referring to activities (activity component of time—FQAC) and places (spatial component of time—FQSC), taking into account the weight (FWAC, FWSC) of each quality component, which describes how much each component contributes to the potential quality of time. The final results are the coefficient of time quality (KTQ) and time-quality balance (TQ).

3.1.1. Profile and time balance

For an illustration, a segment of the population is presented. It is defined as an educated man with a permanent job and family. Age, family income and number of children are selected as three key characteristic parameters for setting up boundary profiles of such a segment of the population. The age ranged from the beginning of the carrier (30-year-old man) and towards the end of the carrier (55-year-old man). Boundaries regarding family incomes are represented by low-income educated family (2.400 EUR per month) and high-income educated family (12.000 EUR per month). Boundaries for the number of children are one child and four children. Based on these characteristics, eight combinations of profiles are possible (**Table 1**).

Discussing the possible daily routines of such eight profiles, generally, two different schedules exist: Those with more children spent more time on preparation activities and on dropping-off/picking-up activities. However, the assumption is that their final daily routines differ much more, including the time valuation of journeys among the activities, and the consideration of their working and opening hours.

3.1.2. Economic balance

The selected profile, used for an illustration of the TQA approach, is a member of a household characterised by: family with two adults (age 30–55), two children (age 1–15) and incomes (net) of 40.000 EUR/year, i.e. one parent earns 22.000 EUR, while the other earns 18.000 EUR,

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	parameters of the profile						necessary stops at the daily routine							
	age		family income		children		home	home	nursery / school	work	shop	nursery / school	home	
profile	30 years	55 years	2400 per month	12000 per month	1	4	sleeping	preparation for go to work	dropping of children	working	daily shopping and services	picking up children	dinner preparation + dinner	time spent at all specific locations
E 1	x		x		x		8 h	30 min	5 min	8 h	20 min	5 min	30 min	**17h 30min**
E 2	x			x	x		8 h	30 min	5 min	8 h	20 min	5 min	30 min	**17h 30min**
E 3	x		x			x	8 h	45 min	10 min, 5 min	8 h	20 min	10 min, 5 min	45 min	**18h 20min**
E 4	x			x		x	8 h	45 min	10 min, 5 min	8 h	20 min	10 min, 5 min	45 min	**18h 20min**
E 5		x	x		x		8 h	30 min	5 min	8 h	20 min	5 min	30 min	**17h 30min**
E 6		x		x	x		8 h	30 min	5 min	8 h	20 min	5 min	30 min	**17h 30min**
E 7		x	x			x	8 h	45 min	10 min, 5 min	8 h	20 min	10 min, 5 min	45 min	**18h 20min**
E 8		x		x		x	8 h	45 min	10 min, 5 min	8 h	20 min	10 min, 5 min	45 min	**18h 20min**

Table 1. Parameters of the profile and its minimal time required for necessary activities in a daily routine, excluding commuting.

which equals approximately 11 EUR/working hour for the first and 9 EUR/working hour for the second.

Three characteristic situations are simulated (see **Table 2**). In the given neighbourhood, the basic level of expenses of such a household would be approximately 30.000 EUR/year. In the case where the family rents their apartment, their expenses are as follows (see case 1, **Table 2**): 12.000 EUR for residential expenses; 11.500 EUR for basic basket expenses (e.g. food, clothes); 4.400 EUR for other necessary expenses, such as nursery, school or the possession of a family car; 700 EUR for other optional expenses, such as hobbies, extra travel, vacations and extra insurances; and 1.400 EUR for commuting as a part of a daily routine, considering they are using public transport and they manage daily routines within the range of the city public transport area. In this case, the household may save 10.000 EUR/year = (40.000 – 30.000) EUR/year. However, their lives are rather ascetic.

In this case, if the family faced higher expenses (medium level), their earnings would soon become negligible or none. As simulated in **Table 2** (case 2), residential expenses are 15.600

	Earnings	Residential expenses	Basic basket	Other necessary expenses	Optional expenses	Commuting	Total	Savings
Case 1 [EUR]	40.000	12.000	11.500	4.400	700	1.400	30.000	10.000
Case 2 [EUR]	40.000	15.600	15.400	4.400	3.200	1.400	40.000	0
Case 3 [EUR]	40.000	4.600	15.400	4.400	3.200	1.400	29.000	11.000

Table 2. Examples of economic balance for three cases of the same profile.

EUR (12.000 EUR + 3.600 EUR), i.e. the family strives for better commodities and affords a larger apartment, assuring a room for every child. They increase the budget for basic basket goods to afford higher-quality products: 14.400 EUR (11.500 EUR + 3.900 EUR). For other necessary expenses, such as nursery, school or the possession of a family car, they spend the same as in case 1, 4.400 EUR. They put more of their budget towards other optional expenses, such as hobbies, extra travel, vacations and extra insurances, 3.200 EUR (700 EUR + 2.500 EUR), and they keep the same budget for travel expenses, 1.400 EUR. In this case, the balance is ±0 EUR/year = (40.000 – 40.000) EUR/year. This case (case 2, **Table 2**) illustrates the maximum standard that such a family could afford in the given neighbourhood. In the event they are satisfied with a less expensive apartment, they can accrue some savings. This can be achieved by changing the location or some other quality of the residence (e.g. size, building quality). However, this might increase time requirements for daily travel or decrease satisfaction during the time spent at home.

In the case the family owns the apartment (case 3, **Table 2**), the yearly residential expenses are considerably lower since the main expense (buying a flat) was realized in the past already. For a medium level of expenses, i.e. they spent 40.000 EUR/year, the savings would amount to approximately 11.000 EUR/year, allocating 1.000 EUR/year for the maintenance of their investment. In such a case, the considered family could easily afford a medium level of expenses or even a higher level (e.g. afford a better apartment or a second car). The question is the effect of each improvement on quality of living. The examples show that in the case where the incomes of such a household amount to less than 30.000 EUR/year and they do not have owner status but instead must rent an apartment, they could not afford to live in the given neighbourhood. In the case where they own an apartment, they could live there and even afford a slightly higher level of other expenses. Savings are usually also an important component of the financial security of a household and consequently influence satisfaction. Therefore, the ability of a household to create some savings in a given environment is not negligible.

3.1.3. Time-quality balance

Simulating time-quality balance for the same profile, with exactly the same daily routine, living in the same neighbourhood but on the other side, close to the railway line, would show that the time-quality balance would decrease. This is especially the case if the quality of the spatial component of time for sleeping, which represents a great portion of good quality time, is considered as rather bad. In such a case, instead of having 10 h 5′ (Fc1; $K_{TQ} = 0.42$) of a good quality of time per day, Fc2 has 8 h 38′ of a good quality of time per day ($K_{TQ} = 0.36$) (**Table 3**).

3.2. Elderly living in urban area

The profile was defined based on socioeconomic statistical data. The time and economic balance of the profile was assessed as positive. Data on time and activity were collected on the basis of a combination of approaches: field work related to spatial analysis, including facilities and services (e.g. open/green space, recreation, culture, public transport), and accessibility; and a pilot behaviour observation of the selected areas to get an idea of the behaviour patterns of elderly in the area, including the duration of activities in the environment (e.g. how

		Fc1									Fc2								
		T_{Sp}	T_{start}	T_{end}	F_{QAC}	F_{QSC}	F_{WAC}	F_{WSC}	K_{TQ}	T_Q	T_{Sp}	T_{start}	T_{end}	F_{QAC}	F_{QSC}	F_{WAC}	F_{WSC}	K_{TQ}	T_Q
home	sleeping	8 h 0 '	22:30	06:30	100	30	50	50	0,65	5 h 12 '	8 h 0 '	22:30	06:30	100	0	50	50	0,50	4 h 0 '
home	preparation for go to work	1 h 0 '	06:30	07:30	0	90	40	60	0,54	32 '	1 h 0 '	06:30	07:30	0	90	40	60	0,54	32 '
by bicycle	going to nursery	5 '	07:30	07:35	50	60	40	60	0,56	3 '	5 '	07:30	07:35	50	60	40	60	0,56	3 '
nursery / school	dropping of children	10 '	07:35	07:45	30	60	40	60	0,48	5 '	10 '	07:35	07:45	30	60	40	60	0,48	5 '
by bicycle	going to work	25 '	07:45	08:10	30	-10	40	60	0,06	2 '	25 '	07:45	08:10	30	-10	40	60	0,06	2 '
work	working	8 h 0 '	08:10	16:10	-20	0	50	50	-0,10	-48 '	8 h 0 '	08:10	16:10	-20	0	50	50	-0,10	-48 '
by bicycle	going from work, to pick up children	25 '	16:10	16:35	30	-10	40	60	0,06	2 '	25 '	16:10	16:35	30	-10	40	60	0,06	2 '
nursery / school	picking up children	15 '	16:35	16:50	50	60	40	60	0,56	8 '	15 '	16:35	16:50	50	60	40	60	0,56	8 '
by bicycle	going from work, to do shopping	5 '	16:50	16:55	50	60	40	60	0,56	3 '	5 '	16:50	16:55	50	60	40	60	0,56	3 '
shop	daily shopping and services	20 '	16:55	17:15	0	0	20	80	0,00	0 '	20 '	16:55	17:15	0	0	20	80	0,00	0 '
by bicycle	going home	5 '	17:15	17:20	30	60	40	60	0,48	2 '	5 '	17:15	17:20	30	60	40	60	0,48	2 '
by bicycle	going to recreation	5 '	17:20	17:25	70	60	50	50	0,65	3 '	5 '	17:20	17:25	70	60	50	50	0,65	3 '
gym	recreation + socialising	1 h 30 '	17:25	18:55	100	80	60	40	0,92	1 h 23 '	1 h 30 '	17:25	18:55	100	80	60	40	0,92	1 h 23 '
by bicycle	comming from recreation	5 '	18:55	19:00	70	60	50	50	0,65	3 '	5 '	18:55	19:00	70	60	50	50	0,65	3 '
home	dinner preparation + dinner	45 '	19:00	19:45	100	90	60	40	0,96	43 '	45 '	19:00	19:45	100	80	60	40	0,92	41 '
home	home with a family	2 h 45 '	19:45	22:30	100	80	60	40	0,92	2 h 32 '	2 h 45 '	19:45	22:30	100	60	60	40	0,84	2 h 19 '
		24 h 0 '							**0,42**	**10 h 5 '**	**24 h 0 '**							**0,36**	**8 h 38 '**

Table 3. Time quality balance for Fc1 and Fc2.

much time they spent coming from A to B, how much time they spent in a local park or library). An interview with an active member of the local community, an elderly person living in a high-raised flat area, was conducted and included questions about the daily routine there; the environmental, social and economic commodities associated with living there; and the like.

Parameter calibration was done with a combination of discipline tacit knowledge, expert knowledge and target-group involvement; the space component as a combination of field work, cartographic materials, expert knowledge and target-group involvement (indirectly with behaviour mapping, directly via interviewing); and the activity component of target-group involvement (indirectly with behaviour mapping, directly via interviewing).

		home	home	public space O	cafe	public space O	shop	public space O	home	home	home	public space O	public space O	public space	bus	public space O	public space I	public space O	bus	public space O	home	home	
		sleeping	morning at home + breakfast	walking to the cafe	socialising	walking to the grocery store	shopping	walking back home	cooking	having lunch	resting at home	walking in the neighbourhood	relaxing in the park / green area	walking to the bus station	travelling by bus	walking to the library	in the library	walking from the library	travelling by bus	walking home	dinner preparation + dinner	easy evening at home	
Ea	T_{Sp}	8 h 0 '	2 h 30 '	10 '	1 h 30 '	0 '	30 '	10 '	1 h 30 '	1 h 0 '	1 h 30 '	15 '	1 h 35 '	0 '	0 '	10 '	1 h 0 '	5 '	30 '	5 '	1 h 0 '	2 h 30 '	**24 h 0 '**
	T_{start}	22:30	06:30	09:00	09:10	10:40	10:40	11:10	11:20	12:50	13:50	15:20	15:35	17:10	17:10	17:10	17:20	18:20	18:25	18:55	19:00	20:00	
	T_{end}	06:30	09:00	09:10	10:40	10:40	11:10	11:20	12:50	13:50	15:20	15:35	17:10	17:10	17:10	17:20	18:20	18:25	18:55	19:00	20:00	22:30	
	F_{QAC}	100	80	60	80	40	25	30	60	80	85	75	90	60	-10	60	100	40	-10	40	80	100	
	F_{QSC}	-20	60	20	65	20	0	20	60	60	-20	30	80	60	-10	60	80	50	-10	10	60	40	
	F_{WAC}	50	50	50	60	50	60	50	50	50	40	40	40	50	70	50	40	50	70	50	50	40	
	F_{WSC}	50	50	50	40	50	40	50	50	50	60	60	60	50	30	50	60	50	30	50	50	60	
	K_{TQ}	0,40	0,70	0,40	0,74	0,30	0,15	0,25	0,60	0,70	0,22	0,48	0,84	0,60	-0,10	0,60	0,88	0,45	-0,10	0,25	0,70	0,64	**0,54**
	T_Q	3 h 12 '	1 h 45 '	4 '	1 h 7 '	0 '	5 '	3 '	54 '	42 '	20 '	7 '	1 h 20 '	0 '	0 '	6 '	53 '	2 '	-3 '	1 '	42 '	1 h 36 '	**12 h 55 '**
Eb	T_{Sp}	8 h 0 '	2 h 30 '	5 '	1 h 30 '	0 '	30 '	5 '	1 h 30 '	1 h 0 '	1 h 30 '	5 '	2 h 5 '	0 '	0 '	10 '	1 h 0 '	5 '	20 '	5 '	1 h 0 '	2 h 30 '	**24 h 0 '**
	T_{start}	22:30	06:30	09:00	09:05	10:35	10:35	11:05	11:10	12:40	13:40	15:10	15:15	17:20	17:20	17:20	17:30	18:30	18:35	18:55	19:00	20:00	
	T_{end}	06:30	09:00	09:05	10:35	10:35	11:05	11:10	12:40	13:40	15:10	15:15	17:20	17:20	17:20	17:30	18:30	18:35	18:55	19:00	20:00	22:30	
	F_{QAC}	100	80	60	80	40	25	30	60	80	85	75	90	60	-10	60	100	40	-10	40	80	100	
	F_{QSC}	50	90	25	65	25	0	25	90	90	50	35	80	60	0	60	80	50	0	10	90	90	
	F_{WAC}	50	50	50	60	50	60	50	50	50	40	40	40	50	70	50	40	50	70	50	50	40	
	F_{WSC}	50	50	50	40	50	40	50	50	50	60	60	60	50	30	50	60	50	30	50	50	60	
	K_{TQ}	0,75	0,85	0,43	0,74	0,33	0,15	0,28	0,75	0,85	0,64	0,51	0,84	0,60	-0,07	0,60	0,88	0,45	-0,07	0,25	0,85	0,94	**0,76**
	T_Q	6 h 0 '	2 h 8 '	2 '	1 h 7 '	0 '	5 '	1 '	1 h 8 '	51 '	58 '	3 '	1 h 45 '	0 '	0 '	6 '	53 '	2 '	-1 '	1 '	51 '	2 h 21 '	**18 h 19 '**

Table 4. Time quality balance for Ea and Eb.

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3.2.1. Time-quality balance analysis for profile from various locations

The results in **Tables 4** and **5** indicate that the best living conditions for an elderly person are the areas of b and c, while area a is disadvantageous primarily due to highway pollution (noise, air pollution) and partly due to remoteness regarding the community/neighbourhood centre. Area d is a bit remote, which is significant for agricultural production activities (early morning noise, season noise, smell), a mixed zone of living-agriculture-small-industry

		home	home	public space O	cafe	public space O	shop	public space O	home	home	home	public space O	public space O	public space	bus	public space O	public space –	public space O	bus	public space O	home	home	
		sleeping	morning at home + breakfast	walking to the cafe	socialising	walking to the grocery store	shopping	walking back home	cooking	having lunch	resting at home	walking in the neighbourhood	relaxing in the park / green area	walking to the bus station	travelling by bus	walking to the library	in the library	walking from the library	travelling by bus	walking home	dinner preparation + dinner	easy evening at home	
Ec1	T_{Sp}	8 h 0 '	2 h 30 '	5 '	1 h 30 '	2 '	30 '	5 '	1 h 30 '	1 h 0 '	1 h 30 '	5 '	2 h 3 '	0 '	0 '	10 '	1 h 22 '	0 '	0 '	8 '	1 h 0 '	2 h 30 '	**24 h 0 '**
	T_{start}	22:30	06:30	09:00	09:05	10:35	10:37	11:07	11:12	12:42	13:42	15:12	15:17	17:20	17:20	17:20	17:30	18:52	18:52	18:52	19:00	20:00	
	T_{end}	06:30	09:00	09:05	10:35	10:37	11:07	11:12	12:42	13:42	15:12	15:17	17:20	17:20	17:20	17:30	18:52	18:52	18:52	19:00	20:00	22:30	
	F_{QAC}	100	80	60	80	40	25	30	60	80	85	75	90	60	-10	60	100	50	-10	50	80	100	
	F_{QSC}	30	90	60	65	60	0	60	90	90	30	60	80	60	0	60	80	60	0	60	90	80	
	F_{WAC}	50	50	50	60	50	60	50	50	50	40	40	40	50	70	50	40	50	70	50	50	40	
	F_{WSC}	50	50	50	40	50	40	50	50	50	60	60	60	50	30	50	60	50	30	50	50	60	
	K_{TQ}	0,65	0,85	0,60	0,74	0,50	0,15	0,45	0,75	0,85	0,52	0,66	0,84	0,60	-0,07	0,60	0,88	0,55	-0,07	0,55	0,85	0,88	**0,73**
	T_Q	5 h 12 '	2 h 8 '	3 '	1 h 7 '	1 '	5 '	2 '	1 h 8 '	51 '	47 '	3 '	1 h 43 '	0 '	0 '	6 '	1 h 12 '	0 '	0 '	4 '	51 '	2 h 12 '	**17 h 34 '**
Ed1	T_{Sp}	8 h 0 '	2 h 30 '	5 '	1 h 30 '	15 '	30 '	15 '	1 h 30 '	1 h 0 '	1 h 30 '	5 '	1 h 30 '	0 '	10 '	5 '	1 h 10 '	5 '	10 '	10 '	1 h 0 '	2 h 30 '	**24 h 0 '**
	T_{start}	22:30	06:30	09:00	09:05	10:35	10:50	11:20	11:35	13:05	14:05	15:35	15:40	17:10	17:10	17:20	17:25	18:35	18:40	18:50	19:00	20:00	
	T_{end}	06:30	09:00	09:05	10:35	10:50	11:20	11:35	13:05	14:05	15:35	15:40	17:10	17:10	17:20	17:25	18:35	18:40	18:50	19:00	20:00	22:30	
	F_{QAC}	100	80	60	80	40	35	40	60	80	85	75	75	60	-10	40	100	40	-10	40	80	100	
	F_{QSC}	20	80	-10	80	-10	0	-10	80	80	20	30	60	30	0	50	80	50	0	-10	80	60	
	F_{WAC}	50	50	50	60	50	60	50	50	50	40	40	40	50	70	50	40	50	70	50	50	40	
	F_{WSC}	50	50	50	40	50	40	50	50	50	60	60	60	50	30	50	60	50	30	50	50	60	
	K_{TQ}	0,60	0,80	0,25	0,80	0,15	0,21	0,15	0,70	0,80	0,46	0,48	0,66	0,45	-0,07	0,45	0,88	0,45	-0,07	0,15	0,80	0,76	**0,65**
	T_Q	4 h 48 '	2 h 0 '	1 '	1 h 12 '	2 '	6 '	2 '	1 h 3 '	48 '	41 '	2 '	59 '	0 '	-1 '	2 '	1 h 2 '	2 '	-1 '	2 '	48 '	1 h 54 '	**15 h 34 '**

Table 5. Time quality balance for Ec1 and Ed1.

			Ed2							Ed3							Ed4						
	F_{WAC}	F_{WSC}	T_{Sp}	T_{start}	T_{end}	F_{QAC}	F_{QSC}	K_{TQ}	T_Q	T_{Sp}	T_{start}	T_{end}	F_{QAC}	F_{QSC}	K_{TQ}	T_Q	T_{Sp}	T_{start}	T_{end}	F_{QAC}	F_{QSC}	K_{TQ}	T_Q
sleeping	50	50	8 h 0 '	22:30	06:30	100	20	0,60	4 h 48 '	8 h 0 '	22:30	06:30	100	20	0,60	4 h 48 '	8 h 0 '	22:30	06:30	100	20	0,60	4 h 48 '
morning at home + breakfast	50	50	2 h 30 '	06:30	09:00	80	80	0,80	2 h 0 '	2 h 30 '	06:30	09:00	80	80	0,80	2 h 0 '	2 h 30 '	06:30	09:00	80	80	0,80	2 h 0 '
walking to the cafe	50	50	5 '	09:00	09:05	60	-10	0,25	1 '	5 '	09:00	09:05	60	-10	0,25	1 '	5 '	09:00	09:05	60	-10	0,25	1 '
socialising	60	40	1 h 30 '	09:05	10:35	80	80	0,80	1 h 12 '	1 h 0 '	09:05	10:05	80	80	0,80	48 '	1 h 0 '	09:05	10:05	80	80	0,80	48 '
walking to the grocery store	50	50	15 '	10:35	10:50	40	-10	0,15	2 '	30 '	10:05	10:35	-10	0	-0,05	-2 '	30 '	10:05	10:35	-10	-10	-0,10	-3 '
shopping	60	40	30 '	10:50	11:20	35	0	0,21	6 '	30 '	10:35	11:05	25	0	0,15	5 '	30 '	10:35	11:05	25	0	0,15	5 '
walking back home	50	50	15 '	11:20	11:35	40	-10	0,15	2 '	35 '	11:05	11:40	-30	-5	-0,18	-6 '	40 '	11:05	11:45	-30	-10	-0,20	-8 '
cooking	50	50	1 h 30 '	11:35	13:05	60	80	0,70	1 h 3 '	1 h 30 '	11:40	13:10	60	80	0,70	1 h 3 '	1 h 30 '	11:45	13:15	60	80	0,70	1 h 3 '
having lunch	50	50	1 h 0 '	13:05	14:05	80	80	0,80	48 '	1 h 0 '	13:10	14:10	80	80	0,80	48 '	1 h 0 '	13:15	14:15	80	80	0,80	48 '
resting at home	40	60	1 h 30 '	14:05	15:35	85	20	0,46	41 '	1 h 40 '	14:10	15:50	85	20	0,46	46 '	2 h 0 '	14:15	16:15	85	20	0,46	55 '
walking in the neighbourhood	40	60	5 '	15:35	15:40	75	30	0,48	2 '	5 '	15:50	15:55	75	30	0,48	2 '	5 '	16:15	16:20	75	30	0,48	2 '
relaxing in the park / green area	40	60	1 h 15 '	15:40	16:55	75	60	0,66	50 '	1 h 15 '	15:55	17:10	75	60	0,66	50 '	35 '	16:20	16:55	75	60	0,66	23 '
walking to the bus station	50	50	0 '	16:55	16:55	60	30	0,45	0 '	0 '	17:10	17:10	60	30	0,45	0 '	0 '	16:55	16:55	60	30	0,45	0 '
travelling by bus	70	30	0 '	16:55	16:55	-10	0	-0,07	0 '	10 '	17:10	17:20	-10	0	-0,07	-1 '	0 '	16:55	16:55	-10	0	-0,07	0 '
walking to the library	50	50	20 '	16:55	17:15	20	-20	0,00	0 '	5 '	17:20	17:25	40	50	0,45	2 '	20 '	16:55	17:15	20	-20	0,00	0 '
in the library	40	60	1 h 10 '	17:15	18:25	100	80	0,88	1 h 2 '	1 h 10 '	17:25	18:35	100	80	0,88	1 h 2 '	1 h 10 '	17:15	18:25	100	80	0,88	1 h 2 '
walking from the library	50	50	0 '	18:25	18:25	40	50	0,45	0 '	5 '	18:35	18:40	40	50	0,45	2 '	0 '	18:25	18:25	40	50	0,45	0 '
travelling by bus	70	30	0 '	18:25	18:25	-10	0	-0,07	0 '	10 '	18:40	18:50	-10	0	-0,07	-1 '	0 '	18:25	18:25	-10	0	-0,07	0 '
walking home	50	50	35 '	18:25	19:00	-10	-30	-0,20	-7 '	10 '	18:50	19:00	40	-10	0,15	2 '	35 '	18:25	19:00	-10	-30	-0,20	-7 '
dinner preparation + dinner	50	50	1 h 0 '	19:00	20:00	80	80	0,80	48 '	1 h 0 '	19:00	20:00	80	80	0,80	48 '	1 h 0 '	19:00	20:00	80	80	0,80	48 '
easy evening at home	40	60	2 h 30 '	20:00	22:30	100	60	0,76	1 h 54 '	2 h 30 '	20:00	22:30	100	60	0,76	1 h 54 '	2 h 30 '	20:00	22:30	100	60	0,76	1 h 54 '
			24 h 0 '					**0,63**	**15 h 13 '**	**24 h 0 '**					**0,62**	**14 h 51 '**	**24 h 0 '**					**0,60**	**14 h 19 '**

Table 6. Time quality balance for Ed2, Ed3 and Ed4.

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activities, relative weakness in the supply of daily goods, poor capacity and poor management of the spatial infrastructure and therefore also traffic safety issues. However, in comparison to area a, the major advantages are direct contact with green areas, slightly better logistics towards the library and local community centre and lower traffic influence.

3.2.2. Time-quality balance simulation for profile from rural area in the case of changes

Ed2, Ed3 and Ed4 are simulations of daily routines of the profile in the case of the degradation of area d (**Table 6**). Ed2 simulates a situation where the end bus stop is cancelled, so the area is no longer provided with public transport. Ed3 simulates a situation in which the local supply of daily goods (which is of poor quality already) is completely cancelled, whereas Ed4 simulates a situation in which the area is without a bus and a local grocery supply.

Simulated changes indicate a similar decrease of the comfort of the feasibility of the examined routine due to the cancellation of either a bus (Ed2) or a local grocery supply (Ed3). In the case of the cancelation of both facilities, the daily schedule has to be modified, which manifests in time balance (e.g. less socialising and afternoon green-area walking, more necessary walking [commuting] and resting). In this simulation, the profile finally loses 1 h 15′ quality time. However, in the Ed4 situation, the routine, which includes shopping and library visiting, is feasible only in good weather conditions, while in the cases of Ea, Eb, Ec1 and Ed1, such a routine is also manageable in other weather circumstances.

4. Discussion

Implementing the TQA approach results in several levels of outputs, i.e. several evidence-based user-centred data available to inform the spatial statistics of territories. They are data on time balance, data on economic balance and data on time-quality balance.

Such data are linked to both locations and profiles. They enable one to compare profiles within different locations in the area or to inform about the suitability of a certain location in the area for various profiles. Further, they indicate a comparative suitability level of a location for living for a chosen profile against some other location for the same profile, as well as the suitability of a location for one profile in comparison to another.

In providing sufficient repeated analyses or simulations (taking into account various circumstances and edge conditions; e.g. weather conditions), such results can be visualised on a behaviour map showing a profile's suitability map for living. When more profiles are involved, a suitability map for living of a community with certain characteristics (minimum profile—the weakest link; average profile—general public in the area) in an area is the final output. Moreover, results can also show which profile can reach the minimum satisfaction level at a certain location in the area and the mapping suitability for the weakest profiles of the community, where different profiles are recognised as the weakest at different locations within the studied area.

Information offered by the TQA approach is useful for any kind of place user, from individuals to check locations, e.g. where to live or work, to decision-makers at various governance levels. The distribution of such information is possible through the upgrade of existing available information systems. Such information is under a constant refinement process referring to two main sources: available geoinformatics and spatial data, and direct and indirect participatory data. TQA as a monitoring or development-control approach is applicable to authorities and individuals for establishing new developments in a place, searching for measures of improvements, the comparison of different locations for one particular use and the comparison of various measures in a certain location.

5. Conclusion

This chapter presents and debates a spatial interaction approach for collecting, analysing and monitoring evidence-based data to assess quality of space for a certain use (activity) and a certain user (profile) via analysis of the quality of time spent on that activity in a particular space or sequence of spaces, using the TQA approach. The TQA approach proposes time as the universal expression and measure of quality of living, using time balance, economic balance and time-quality balance as the key indicators for calculating the possibility and comfort of living in the given environment. Data as a result of such an approach are linked to locations and user profiles and are therefore useful for the comparison of profiles within different locations of the area, and judgement about the suitability of certain locations in the area for various profiles.

It illustrates activity-place relations and time-quality balance (TQ) for the total daily routine for variations of the same main socioeconomic profile from the same neighbourhood. The initial results are related to the time spent on the activities and the basic qualities of activities and places. Further evaluation introduces time as the measure for quality, referring to activities (activity component of time—FQAC) and places (spatial component of time—FQSC), taking into account the weight (FWAC, FWSC) of each quality component, which describes how much each component contributes to the potential quality of time. The final results are the coefficient of time quality (KTQ) and time-quality balance (TQ).

The applicable value of this approach is in showing the suitability of a certain location for a chosen profile in comparison with some other location for the same profile, or in showing the suitability of a location for one profile in comparison with another. This is especially important in spatial planning and investment decision-making processes, as simulating a community with certain characteristics represented via a bunch of profiles (e.g., minimum profile—the weakest link; average profile—general public in the area) allows for a comprehensive simulation of living conditions for future residents or other (business) users. In this respect, the TQA approach can be used for searching for measures for improvements in territories, the comparison of different locations for one particular use, the comparison of various measures in a certain location and establishing new developments in a place. The capability of contemporary ICT tools that serve as an interface between place and people can play a significant role in automating data. Especially, monitoring tools consisting of a smartphone application, a set of

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Web services and cloud computing and storage can provide very informative and rich information about the parameters relevant for the TQA approach. Such technology (e.g. [21]) enables insights into a real bottom-up understanding of the daily routines and circumstances with which people are involved, and it is worth linking with TQA in the further development of the approach and its implementation.

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References

[1] Costanza R, Wainger L, Folke C, Maler K G. Modelling complex ecological economic systems: Toward an evolutionary, dynamic understanding of people and nature. BioScience. 1993;43:545–555.

[2] Comfort L K, Sungu Y, Johnson D, Dunn M. Complex systems in crisis: Anticipation and resilience in dynamic environments. Journal of Contingencies and Crisis Management. 2001;9(3):144–158.

[3] Grimm V, Revilla E, Berger U, Jeltsch F, Mooij F W, Railsback S F, Thulke H H, Weiner J, Wiegand T, DeAngelis D L. Pattern-oriented modeling of agent-based complex systems: lessons from ecology. Science. 2005;310(5750):987–991.

[4] Bar-Yam Y. Complexity Rising: From Human Beings to Human Civilization. A Complexity Profile, Encyclopedia of Life Support Systems. Oxford, UK: EOLSSUNESCO Publishers; 2002.

[5] Encyclopedia Britannica. Complexity [Internet]. 2016. Available from: https://www.britannica.com/science/complexity-scientific-theory [Accessed: 2016-07-04]

[6] Polajnar M, Demšar J. Small network completion using frequent subnetworks. Intelligent Data Analysis. 2015;19(1):89–108.

[7] Chua A, Marcheggiani E, Servillo L, Vande Moere A. FlowSampler: Visual analysis of urban flows in geolocated social media data. In: Maria Aiello L, McFarland D, editors. International Conference on Social Informatics (SocInfo'14); 10–13 November 2014; Barcelona: Springer; 2014. pp. 5–17.

[8] Pucci P, Manfredini F, Tagliolato P, editors. Mapping Urban Practices through Mobile Phone Data. Springer Briefs in Applied Sciences and Technology, Politecnico di Milano: Springer; 2015. 90 p.

[9] Dijst M, Vidakovic V. Travel ratio time: The key factor of spatial research. Transportation. 2000;27(2):179–199.

[10] Allen L R, Gibson R. Perceptions of community life and services: a comparison between leaders and community residents. Journal of the Community Development Society. 1987;18(1):89–103.

[11] Norris T. America's community movement: Investing in the civic landscape. American Journal of Community Psychology. 2001;29(2):301–307.

[12] Oort F. Using structural equation modelling to detect response shifts and true change. Quality of Life Research. 2005;14(3):587–598.

[13] Baker D A, Palmer R J. Examining the effects of perceptions of community and recreation participation on quality of life. Social Indicators Research. 2006;75:396–418.

[14] Blomquist G C. Measuring quality of life. In: Arnott R J, McMillen D P, editors. A Companion of Urban Economics. London: Blackwell Publishing; 2006. pp. 483–501.

[15] Lora E, Powell A. A new way of monitoring the quality of urban life. UNU-WIDER Working Paper. 2011;12:1–24.

[16] The Organisation for Economic Co-operation and Development (OECD). Guidelines on Measuring Subjective Well-being [Internet]. 2013. Available from: http://dx.doi.org/10.1787/9789264191655-en [Accessed 2014-03-23]

[17] Leipzig Charter. Leipzig Charter on Sustainable European Cities. Leipzig; 2007.

[18] Marušić D, Goličnik Marušić, B. Model for valuation and simulation of quality of living environments. International Journal of Innovation and Regional Development. 2014;5(4/5):405–428.

[19] Goličnik Marušić B, Marušić D. Behavioural maps and GIS in place evaluation and design. In: Alam B M, editor. Application of Geographic Information Systems. Rijeka: InTech; 2012. pp. 113–139.

[20] Ittelson W H, Rivlin L G, Prohansky H M. The use of behavioural maps in environmental psychology. In: Prohansky H M, Ittelson W H, Rivlin L G, editors. Environmental Psychology: Man and His Physical Setting. New York: Holt, Rinehart & Winston; 1970. pp. 658–668.

[21] Starič A, Demšar J, Zupan, B. Concurrent software architectures for exploratory data analysis. Wiley Interdisciplinary Reviews, Data Mining and Knowledge Discovery. 2015;5(4):165–180.