

# Introduction: The roots and diffusion of time-geography

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## Book Chapter

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# 1 Introduction

## The roots and diffusion of time-geography

*Kajsa Ellegård*

The material world within human reach is altered not by words but by the grasp of the hand. The word-makers are in power, but for their decisions to turn into something more than vibrations in the air, one, some or all people must engage with material things.

(Hägerstrand 2009: 27, my translation)

The citation above captures the core of time-geographical thinking, urging people, whether they are common citizens, decision makers, planners, scientists or in other occupations, to consider the role of the material world when striving for change. Time-geography emanates from the scientific works of the Swedish human geographer Torsten Hägerstrand and his research group. Subsequently, many researchers in the international scientific community have furthered the development. In 2020, fifty years will have passed since Hägerstrand published the pathbreaking article “What about people in regional science?” (Hägerstrand 1970a), which still is frequently cited.<sup>1</sup> In an era where most publications are popular for a short period it is interesting to find out why a fifty-year-old article still gains interest. By presenting examples of current time-geographic research in the global context, this book will show why Hägerstrand’s thoughts presented in that article yield such a long-lasting interest. The contributors are researchers in geography and occupational science, for whom time-geography serves as one source of inspiration.

Before presenting the chapters in this book in more depth, a background to time-geography is given. First, there is a short biography of Torsten Hägerstrand which puts his life and scientific work into a societal and geographic context. Thereafter, time-geographical concepts are briefly presented.

### **Torsten Hägerstrand’s work in a societal context**

Like many other Western countries, Sweden went through a rapid industrialization and urbanization process during the 20th century, accelerating from the 1930s. Hägerstrand, born in 1916, experienced this process in the flesh. Societal change, then, characterized the country in which he grew up and worked. However,

changes in society are not easy to capture for people living in the ongoing processes, even though elements of the changes might be obvious if looked upon one by one. The time-geographic approach is Hägerstrand's effort to provide intellectual and conceptual tools to capture, describe and analyze the evasive phenomena of ongoing change processes in society and nature.

Torsten Hägerstrand grew up in a small municipality in southern Sweden where his father was a schoolmaster. While attending his father's class, as well as at home, he was exposed to the new school subject *home area studies*<sup>2</sup> and the didactics of the Swiss pedagogue Pestalozzi, underlining the importance of starting the learning process with the simple and then going on with building an understanding of increasingly complicated contexts. Home area studies included teaching about phenomena that coexisted in the region where the children lived. The schoolchildren were exposed to lectures about, for example, local plants, animals, buildings, industries, services, landscape and infrastructure. This was intended to enable them to experience and reflect on the combined outcome of all these phenomena in their neighborhood and identify the wider context of which the individual phenomena were parts (Hägerstrand 1983, 2006; Carlestam 1991; Ellegård and Svedin 2012).

Such a contextual approach is foundational for the scientific thinking and works of Torsten Hägerstrand. As a university student, he was disappointed by the specialization in academia, with its disciplines and the lack of communication between them. He found geography to be one of the least specialized disciplines, but with its own problem, the dominant descriptive regional geography school. Hägerstrand was interested in finding the general principles behind what appeared in a region, and was critical of the static descriptions provided by regional geography (Hägerstrand 1983).

As a PhD student, Hägerstrand was sent by his professor to study what happened in a region from which many people had emigrated due to hard times and famine and gone to the USA during the 19th century. His task was to investigate the abandoned houses, supposedly left by emigrants, marked on the map of the study area, Asby parish in Östergötland county. He found from site visits that these houses were located on extremely low-fertility land. Hägerstrand searched for additional sources of information to deepen his investigation and started to study the church registers, wherein the priests had noted important events in the life of each inhabitant in the parish (e.g. birth, family, marriage, moves between dwellings, emigration and death) (Hägerstrand 1947, 1950). From the combination of information from maps, field visits, and the church registers where he could follow the unique individuals over their lifetime,<sup>3</sup> he concluded that the families who had left the abandoned houses were not the emigrants. Instead, the emigrants came from farms located on more fertile land. Even if they were not rich, they had enough to afford tickets. The former inhabitants of the abandoned houses had moved to the houses that were left by people who had emigrated from these slightly better-off farms. From this research, Hägerstrand identified migration chains, which at the time was something new (Hägerstrand 1951, 1962). The research on migration chains combined the two dimensions of space and time

in the study of migration, and it was Hägerstrand's first contribution to a more general orientation within geography.

Hägerstrand's next contribution to geography was in the field of innovation diffusion. Here too he combined the time and space dimensions, now following the geographical spread of innovations in Asby parish. This research, resulting in his PhD thesis "Innovation diffusion as a spatial process" (Hägerstrand 1953, English translation 1967), was an influential contribution, not only to innovation research but also to the quantitative revolution in geography, since he used probability and simulation models in the analyses.

His innovative works, both on migration chains and diffusion of innovations, were in themselves a critique of the dominant regional geography school, in which regions were classified from descriptions based on the nature and human activities at the time of the research. Even if Hägerstrand's research, in both cases, was performed with empirical data from one and the same region, he created general knowledge based on the theoretical principles applied on the studied processes in this region.

The above-mentioned research by Hägerstrand gave him a position among the top geographers in the world. The geography department at Lund University, Sweden, where he worked, became attractive among geographers, and many influential international scholars went there for discussions and inspiration.<sup>4</sup>

However, from the mid-1960s Hägerstrand left both the migration and innovation research behind. Instead, he strived to combine and further develop some fundamental and general insights from these studies in order to formulate a theoretically coherent abstract worldview that would be useful for analyzing and explaining processes in the time-space. Concretely, he was interested in how human activities influence the landscape, how resources are exploited and how activities are organized and performed to sustain both human life and nature. Hägerstrand was anxious about the ongoing overexploitation of limited natural resources and life-supporting systems. He was interested in human-induced processes reshaping the landscape and the conditions these give rise to for living species. Such knowledge might help decision makers to take action against non-sustainable development trends (Hägerstrand 1974b, 1976).

The intended approach, then, should be generally applicable and useful for analyzing and understanding the effects of the change processes in which a manifold of different existents and phenomena are involved in their material contexts (Hägerstrand 1988b). The material contexts concern both urban settings and rural areas (landscape in a broad sense) because change processes will influence what happens in both. Hägerstrand hoped that by providing general concepts and a visual language in a coherent approach, researchers might increasingly bridge gaps between disciplines (Hägerstrand 1991).

The endeavor to develop such an approach, which eventually was labeled time-geography, took off when Hägerstrand was awarded a big grant for a research project on the process of urbanization in Sweden.<sup>5</sup> In this period, the urbanization was intense, and there was an urgent need for understanding the process and its impact on people and society. In the research project,

Hägerstrand's research group studied people's daily lives, mainly in urban settings. They observed people's daily outdoor movements and collected activity diaries in order to identify routines and general patterns in persons' daily activities, including transportation.<sup>6</sup> They presented ideas about how to organize activities, like work, services, housing and transportation in urban contexts and utilized time (scheduling) and space (localization) as core dimensions to analyze the fit between the location of such activities and people's daily needs. Normative activity programs consisting of sequences of activities of importance for individuals in their households were suggested. These were tested in urban settings with various locations of workplaces, dwellings and transportation systems (Hägerstrand 1970b; Hägerstrand and Lenntorp 1974). The urbanization process called for urban and regional planning. Partly, the research of Hägerstrand's group was financed and performed within the Swedish governmental programs for urban and regional planning of the 1970s, in which Hägerstrand was much engaged<sup>7</sup> (Hägerstrand 1970b, 1972, 1988a; Hägerstrand and Lenntorp 1974). Additionally, and even more important, the data material was used as the empirical fundament for developing time-geographic concepts and its notation system, which serve as means for theoretical thinking and communicating about people's activities and geographical movements in the time-space.

### **Time-geographic assumptions and concepts: a brief orientation**

The time-geographic approach is based on assumptions that pave the way for its specific concepts. Time-geography also includes a notation system, which is a tool that helps clarify time-space concepts, relations and processes that otherwise, if observed at all, just might seem to be non-related even though entangled (Hägerstrand 1970a, 1974a). The notation system has a visual expression, which provides insights about processes that are very hard to explain with an ordinary vocabulary. Words do not express the time-space extension of processes analyzed with enough precision, and words do not make clear the material dimension of phenomena. The visualizations are useful when investigating contexts wherein many different kinds of phenomena must be coordinated and find room to meet in the time-space (Carlestam 1991). The basic time-geographic assumptions concern ideas about the indivisible individual as a study object, and how to handle time in time-space analyses (Hägerstrand 1970a, 1974a, 1985, 2009), and the most important concepts are: individual, individual path, bundle (two or more individual paths), prism, population, project, constraints and pocket of local order (Hägerstrand 1970a, 1985; Lenntorp 2004).

In time-geography, the concept *individual* is used in a general way, e.g. for things, animals and human beings. Initially, time-geography was criticized for this stance; the critics believed that humans should not be regarded as physical phenomena.<sup>8</sup> Hägerstrand was well aware that humans have specific properties, but he underlined that human beings also have material bodies that take place and that this physical property is not only important, it might even be decisive for what an individual engages in (Hägerstrand 1985, 2009).

The wide denotation of the concept “individual” is based on Hägerstrand’s ambitions to create concepts that can be used for general purposes, and in his studies of processes in the time-space he was eager to explain exactly what was denoted by the general concepts, using concrete examples in his texts. An activity, like laying the table, demands coordination of different kinds of individuals in the time-space. The table, tablecloth, plates, glasses, cutlery, and the person performing the activity are examples of individuals involved. This underlines the material presence of both the person and the things used to perform the activity, and by no means implies that the person performing the activities equals the non-living things in other ways. Rather, the person exerts power over the other kinds of individuals and has a plan to lay the table. The non-living individuals do not actively influence the human’s activities, but they are important prerequisites, resources, for the person’s opportunities to fulfill the activity according to the plan. The ordering of things might affect people’s plans and activities. Also, the table can be laid in different ways and the knowledge and skills of the person doing it are decisive for the result. A three-year-old child will lay the table in another way than his mother or the skilled waiter at the restaurant. The influence of persons’ different abilities and knowledge indicate that a mere picture of the time-space process is not sufficient for an analysis, but it helps when exploring the process.

From a time-geographic perspective, each individual has the same amount of time every day (they exist for 24 hours) and every individual is, by its physical body, located somewhere. Everyone also has to use all available time each day, albeit by mere existence at some location. The flow of time is assumed to have a constant pace, and individuals’ existence can be measured by clock time. This assumption is made for analytical purposes.<sup>9</sup> Most human individuals are aware of time even though they experience it differently. In time-geographically inspired research, humans’ subjective ideas about time can be related to the clock time, thereby bringing interesting thoughts and insights to the analysis.

The time dimension has three important parts: past, now and future, as illustrated in Figure 1.1a. The *past* includes what has happened and it cannot be changed. However, what happened at an earlier point in time can be reinterpreted afterwards.<sup>10</sup> The *future* is time to come, and human individuals make plans for the future. However, all opportunities open for an individual in the future are not fulfilled. First, because the future includes many more possibilities than can be realized, and, second, because of risks of collisions with other individuals, with their prisms, including movements and projects. *Now* is the most obvious part along the time dimension, and at the same time the most difficult to grasp. Now is just an instant, and everybody exists in this instant, which in time-geography is regarded as a continuously moving now. In time-geography, accordingly, now is regarded as the constant transformation of future into past and thereby now constitutes the only point in time when actions can be taken and changes made.

In time-geography, an individual is assumed to be an indivisible physical unit at the scale chosen for the study. This is one outcome and generalization from Hägerstrand’s migration studies in Asby parish, where he followed unique human individuals over their lifetime. When combining a lot of information about each

person, he revealed that the dominant belief among geographers, that the abandoned houses in the study area were left by emigrants, was wrong. He showed that there was no simple correlation between empty houses and emigrants. Instead, by following the unique humans' movements in space over time he identified the general principle of migration chains. The unit of investigation, then, was the physical individual with her lifelong sequential movement chain, rather than, on one hand, the number of empty houses and the number of emigrants on the other. Hence, Hägerstrand's investigation of migration was based on an assumption that the living individual is an indivisible physical unit from birth to death and the non-living individual is indivisible from its construction to its destruction. Hägerstrand later used the concept "continuant" for the indivisible individual in order to underline that there are individuals of different kinds (Hägerstrand 2009).

The indivisible individual and the time dimension based on clock time (with its past, now and future) lay behind the time-geographical concepts and the notation system used to visualize and investigate processes in the time-space. In time-geography, the concept *individual path* is used to follow the sequence of movements in the time-space of any individual, irrespective of whether it is a thing or a person (Hägerstrand 1970a, 1981). The individual path is not just a tool for visualizing movements by individuals involved in processes in the time-space and their relations therein, it is also a way to get to grips with the processual thinking of time-geography. The individual path is visualized by a continuous line in a diagram along two main dimensions: time and space, see Figure 1.1b. The individual path does not show the individual in itself, instead it is the track or protocol of the individual's previous moves in the time-space, revealing the unique movement pattern of that individual. Thereby the individual path is useful for describing and analyzing where an individual has been located in the past and

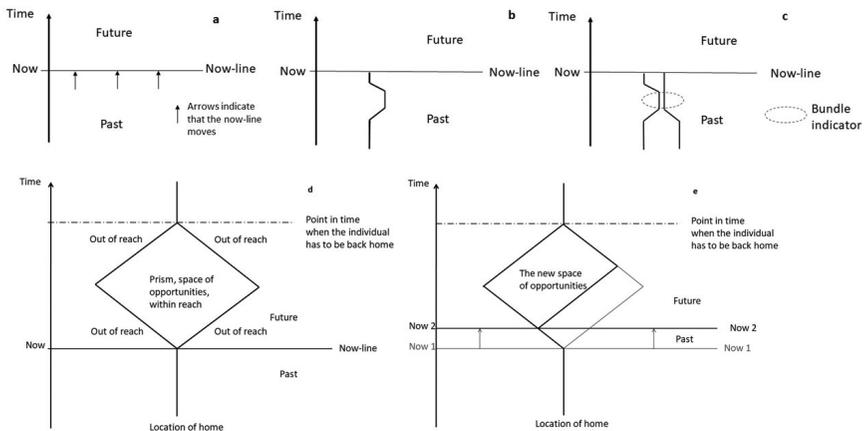


Figure 1.1 Time, with its past, now and future (a); the individual path in the past (b); two individual paths as a bundle (c); the prism principle (d); the changing prism shape as time goes by (e)

until now. When more than one individual is involved, one individual path for each of them is shown (see Figure 1.1c). When the individual paths are located at the same place at the same time they form a *bundle*, which might be used to illustrate collective activities.

But what about the future? As indicated, the future offers more opportunities than a human individual can realize, and the individual has to choose between the opportunities. Time-geography does not predict what choices will be made, instead it reveals what is the space of opportunities or, with another expression, what are the limits of her opportunities. The time-geographic concept for the future space of opportunities for an individual is *prism* (Lenntorp 1976; Miller 1991). The prism is delimited by the individual's geographic location at the now, the maximum speed the individual can move at and the point in time in the future when the individual has to be back at the point of departure, or at another specific place, as illustrated in Figures 1.1d and 1.1e. Then, the prism always opens now, balancing on the now-line. As the now moves upwards along the time-axis, *ceteris paribus*, the original prism shrinks, which means that the space of possible location gets smaller. Again, as the now moves upwards along the time-axis, the individual will pass only one of the possible geographical locations at a time, thereby defining the location of the individual path. Consequently, from all the opportunities in a prism, just one can be realized and when now has moved from the bottom of the original prism, the individual path shows how the individual chose to move.

A *population* consists of many individuals of the same kind that exist in a confined region during a delimited period of time (Hägerstrand 1988b, 1972). Then, a population might consist of either e.g. human individuals, birds, flowers, tables, which all are material individuals. Within each region, individuals from many kinds of populations that exist together, some of them exert power over others. Individuals in human populations usually control the existence of individuals in other populations. Humans use individuals from other kinds of populations as resources for creating a life as good as possible for themselves. For example, humans use plants and animals as resources, for producing food, clothes and pleasure. Another example is the large-scale use of fossil-fueled cars, which creates freedom for people to move over great distances at an individual level, but has immense environmental effects on, for example, animals, plants, human health and climate change.

The assumption about the indivisible individual brings a novel way to consider the relation between the individual and aggregate levels. Hägerstrand's idea was that time-geographic studies should allow researchers to shift from micro to macro level without losing important information about the indivisible individuals in the shift between the levels. This can be achieved by, for example, using the individual with her continuous activity sequence (e.g. migration history or daily activity sequence) as the unit of analysis also at aggregate levels (Hägerstrand 1972, 1974; Hellgren 2015, Vrotsou 2010).

The time-geographic concept *project* is used for specifying what activities human individuals perform in order to achieve goals that are set up (Hägerstrand

1970a, 1985; Ellegård, 1999). A project, consequently, consists of various kinds of activities that, once they are realized contribute to goal fulfillment. There are individual projects, which relate to goals set by an individual and consist of activities to be performed by the individual herself. There are also organizational projects, which are created by the individuals who are in charge of an organization. In a household with small children, the parents usually set the goals and create household organization projects. At a workplace, the management sets the goals and organizes what activities are to be performed by what employees to achieve the goals of the organizational projects. In both kinds of organizations, the involved persons (children and parents in the household and the management and employees at a workplace) are expected to perform the different kinds of activities that taken together contribute to the goal fulfillment. One and the same activity can be part of more than one project and these kinds of synergies facilitate people's achievement of goals. Also, some projects fail since the individual, or individuals, who should perform the activities meet various kinds of constraints that cannot be overcome.

The time-geographic concept *constraint* is used to specify what hinders human individuals from performing activities in their strivings to achieve the goals of their projects. There are three types of time-geographic constraints: *capacity* (also called capability) constraints, *authority* (also called steering) constraints and, finally, *coupling* constraints (Hägerstrand 1970a; Lenntorp 1976; Mårtensson 1979). Capacity constraints relate directly to the individual's abilities, properties, knowledge and available tools to perform activities. Authority constraints relate to rules, laws, agreements and regulations that are to be followed by individuals in an organization or the society as a whole. Coupling constraints differ from the other two since they overtly include the necessity to couple individuals to each other in the time-space in order for them to successfully perform an activity. For example, in order for a human person to eat, she has to be located at the same place at the same time as the meal is there to be served. In a similar way there are coupling constraints as regards children and adults, e.g. the small child has to be picked up by an adult when the nursery school closes in order for the child to get home and be continuously cared for.

The constraints are interrelated and influence each other. For example, the law says that parents should care for their children, which is an authority constraint giving rise to a coupling constraint. Parents can delegate the care for a while and take the child to a nursery school. Thereby the coupling constraint between the child and the parent is eased while the authority constraint is still there, but a coupling constraint is created between the child and the nursing person. Another example concerns communication technology innovations, which make it possible for people located at different places to communicate, thereby the limits of their capacity to shout or write a letter are overcome. This is a case where the capacity constraints are eased and the technologies help people to overcome coupling constraints.

The time-geographic concept for a place where people regularly perform activities in certain projects, like a home, a workplace, a shop or a city district, is *pocket of local order* (Hägerstrand 1985; Lenntorp 2004; Ellegård and Vilhelmson, 2004).

A pocket of local order is created by people, who set rules for the use of this place and furnish it with things that are important for the fulfillment of the projects to be performed. The order also influences the flow of people (or other individuals) that may enter into the pocket. Homes, factories, offices and shops, then, are ordered in ways that facilitate the specific activities needed for achieving the goals of different kinds of projects, like living a convenient life in the home; producing goods in the factory; supplying services in the shop. The order might change when new conditions appear, like new projects, new people or new ideas. A city district as a pocket of local order is governed by planners and policy makers and it is lived in by its inhabitants who also influence its performance, but it is also used, and influenced, by other people getting there for visits, shopping, work and other activities. The order of a city district as a pocket of local order is planned to facilitate daily life, but the outcome does not always correspond to the plans. Hägerstrand commented about the influence of the material world on the realization of human plans:

it is very easy to dream up blue-prints for new undertakings but very hard to imagine their fate and their consequences for other legitimate processes when put into practice. Perhaps the trouble is that thought does not encounter in its own world the constraints of space and time.

(Hägerstrand, 1976: 334)

Consequently, the order and material furnishing created can help reveal what kind of pocket of local order it is. The order is upheld by the people involved and can be changed when new needs appear due to new projects of other circumstances. In a family a new order is created e.g. when a baby is born, which also means that at least one new project starts: to raise a child. The new order created is upheld until something happens that calls for a reorganization of it.

These concepts and visualization principles are in various ways and to different extents used by the authors of the chapters in this book, exemplifying the use of the time-geographic approach around the world. It can be seen as an example of geographic diffusion of time-geography as an innovation. Some chapters deal with criticism that over time is directed towards time-geography and suggest how to develop the approach to meet the criticism. Taken together, the authors give creative and constructive contributions to the further use and development of the time-geographic approach.

### **Use of time-geography in the global context**

The contributions to this book are thematically organized. The first two contributions concern the theme of human life in settings influenced by the urbanization process. Thereafter follow two chapters on the communication theme, one concerning physical transportations and the other how information and communication technologies influence daily life activities. The third theme shows the use of time-geography for getting a deeper understanding of meaning, emotions,

feelings, experiences in people's everyday life. Finally, there is a theme about the landscape in time-geography, focusing on how that concept is elaborated on in Hägerstrand's writings.

***Time-geography: investigating people's living conditions in urban settings***

Many time-geographical concepts were developed during the late 1960s in the research about the urbanization process in Sweden (Hägerstrand 1970c, 1990). Then, attention was paid to societal problems emanating from strict partitions between different planning sectors, where, for example, transport systems were planned separately from the location and scheduling of work and services. Time-geography developed conceptual tools to put to the fore the need for coordinating the planning efforts in different sectors. An important proposition was the urge to consider the household as a social unit within which work and household chores are divided between its members regarded as physically indivisible individuals (Hägerstrand and Lenntorp 1974; Ellegård et al. 1977). Largely, this concerns coupling individuals in the time-space so that they can perform activities in projects of importance for themselves, their household and for other organizations they are involved in. Hence, it concerns structural as well as household and individual levels.

Chapters 2 and 3 of the book deal with time-geographically inspired research on the conditions for people in urban settings in two different cultural traditions, Japan and China. Household division of labor, childcare and location of work and housing in cities of the two countries are analyzed, both separately and in comparative studies. Besides presenting empirical time-geographic research, the chapters also give insights about the introduction of time-geography and its development in general in these two countries. In many non-native English-speaking countries, researchers publish at least some works in their native language; this was the case in Sweden with Torsten Hägerstrand and his research group, and with researchers in Japan and China. Therefore, there is limited knowledge in the international English-speaking research community of how the interest in time-geography commenced and grew there. Hence, Chapters 2 and 3 illuminate the diffusion process and use of time-geography in Japan and China.

In Chapter 2 "Time-geography in Japan: Its application to urban life", Kohei Okamoto and Yoshio Arai give the background to the introduction of time-geography to Japan and exemplify how the approach is used. Interestingly, time-geography was introduced to Japan merely as a side effect of a university professor's interest in quantitative methods in geography and his visiting Hägerstrand in Lund to discuss the quantitative approach in innovation diffusion research. Then, in the mid-1970s, time-geography was brought to Japan and young researchers formed a study group to learn more. They found the approach useful for studying the problems emerging from the clash between, on one hand, young dual-income families' need for accessible childcare and, on the other hand, the Japanese work culture with its long working hours. There were

long geographic distances between new suburban dwellings and the city center workplaces, causing long commute times. The strong tradition of women being in charge of the children and household chores made it troublesome for women to combine a career, demanding time-consuming commuting, with having children. Wives started to work part time, stopped working after having a child or had no children. Here, the time-geographic coupling constraints provide clues to explain why women's labor force participation is limited. The need for at least one adult to continuously look after children requires parents' presence or nursery arrangements. There is a need for structural changes in the society, and the authors give a time-geographically inspired suggestion of how to solve the problem with parents' accessibility to nursery schools on their way to and from work. The Japanese government recognizes the problems with low birth rates and the shrinking labor force but the measures they suggest are limited to working hour regulations. From a time-geographical perspective, Okamoto and Arai conclude that the government's suggestions "have focused exclusively on the time at work, while they have not considered that time might affect the family and community" (Okamoto and Arai, Chapter 2). Hence, the authors argue for a wider, contextual take to solve the structural problems rooted in the work culture traditions. Solutions based on the micro-level understanding of the daily life of the households gained from time-geographic studies can pave the way for macro-level structural changes.

Experiences of big societal changes in rapidly urbanizing Sweden were one source of inspiration for Torsten Hägerstrand in his development of the time-geographic approach. Big societal changes are currently going on in China, and in Chapter 3 "The time-geographic approach in research on urban China's transition", Yanwei Chai, Yan Zhang and Yiming Tan present how the time-geographic approach was introduced and employed in research on the urbanization in China. Yanwei Chai brought time-geography to China via Japan, where he did his PhD studies in the 1990s, and engaged in the Japanese time-geography research group. Researchers from the two countries made comparative studies of everyday life in cities of different sizes in Japan and China, and concluded that there is a much more even distribution between spouses, both of time spent out of home and working hours, in the Chinese cities than in Japan. The transition of Chinese society from a planned into a more market-orientated economy, however, has far-reaching consequences for daily life in the cities, and the effects differ a lot depending on what type of area people live in. The very organization of the traditional *danwei* compounds, based on close location of workplaces, services, administration, schools and dwellings, made some coupling constraints for people living there relatively weak. However, location of factories in cities close to housing resulted in severe pollution and health problems, and relocation of workplaces is ongoing, which increases the need for longer daily travel to work and affects families' opportunities to spend time together. Modern suburban housing areas located far from workplaces in the city center and industrial districts, force people to commute long distances and increase their use of fossil-fueled cars. This affects the environment, the commuting time and the household activity organization, including the

household members' opportunities to jointly perform activities. To some extent, the time-geographic approach is used also for urban planning purposes in China. For example, based on time-geographical principles a tool is developed which produces real-time information about the traffic situation in big cities. It can help people avoid crowded routes. Research on GIS-based geovisualization of people's activities in the urban time-space in Chinese cities reveals the time-space constraints imposed by the built environment. The authors suggest that one development of time-geographic research in China is to include the concepts "project" and "pocket of local order" to find out in more depth what the transition of the society means for the everyday life of people living in various types of neighborhoods in urbanized China.

### ***Time-geography for green transportation and communication with mobile ICT devices***

The coupling constraint concept in time-geography deals with the need for individuals to coordinate their activities in the time-space in order to fulfill the goals of the projects they pursue in daily life. Much research concerns how to overcome coupling constraints by improving people's opportunities to come together (couple) at the same geographical location by transportation. Here, the time-geographic concept "prism" is useful and helps reveal differences between people depending e.g. on their access to various kinds of transport means, and their use of the transit network in rush hours. Chapters 4 and 5 have two different takes on how to handle couplings, one by physical transports, and the other by using mobile electronic communication technologies. The chapters discuss two communication-related problems in modern society: environmental effects of transportation are the focus of Chapter 4, while Chapter 5 pays attention to the effects of the increasing embeddedness of ICT in most of the daily activities of young people.

In Chapter 4 "Green, healthy time-geography: Using time-geographic concepts for sustainable mobility planning", Harvey J. Miller, Ying Song and Calvin P. Tribby put to the fore the need for transforming the currently unsustainable mobility system into a more sustainable one, with a focus on favoring positive social, environmental and health effects. The authors suggest a sustainable mobility planning model in contrast to the current conventional planning and refer to results from studies of changes in the transportation system. Two research projects are presented, both aiming at developing methods for transport planning that facilitate sustainable mobility. Methods for estimating expected energy consumption and emissions within prisms are developed, thereby furthering time-geography analytically. Walking is a sustainable and healthy way to move, and in this chapter walkability, built environment and public transit are analyzed by time-geographic principles. These studies show that environmentally important research on daily transit is fruitfully performed by using time-geographic concepts and tools. The more the effects of climate change will appear in people's daily lives, the more important it will be for transit system planners and urban planners to present alternatives to fossil-fueled transport means. Then, one prerequisite is that the daily

projects and activity sequences of the indivisible individuals still is performable, and for that purpose the time-geographic approach is inspirational.

Communication with electronic information and communication technologies (ICT) is, at least rhetorically, an alternative to physical transportation. A recurrent question for time-geographers concerns how to handle secondary or simultaneous activities and increasingly so when the use of ICT explodes and permeates most daily activities. In Chapter 5 “Bringing the background to the fore: Time-geography and the study of mobile ICTs in everyday life”, Eva Thulin and Bertil Vilhelmson elaborate on this issue taking Swedish young people’s mobile ICT use in daily life as a point of departure. They discuss what happens in the daily activity sequences of these young persons when they increasingly use mobile communication technologies as an integrated part of their daily life. The authors contribute to the time-geographic approach by suggesting and testing two concepts for ICT-related mobile communications: foreground and background activities. The young people increasingly and continuously are online, irrespective of what kind of activity they engage in, be it traditional activities (with the mobile ICT device online in the pocket) or ICT-mediated foreground activities. Mobile ICT communication breaks into most activities, demanding immediate re-action in foreground as well as in background activities. The young people develop strategies to manage the technology, which impose two different kinds of problems on their daily life. On one hand, the technology is enabling by offering opportunities to stay involved in processes going on at other geographic locations, while, on the other hand, it causes frictions between mundane activities, like homework, lectures and meals, since the mobile ICT-generated online background activities intermittently call for attention, hence disturbing the ongoing foreground activity. There are also signs of young people getting stressed from situations where they are not in control of such sudden breaks in their activity sequence. The chapter contributes with suggestions about how to integrate suddenly appearing activities of short duration into time-geographic analysis of daily life.

### ***Time-geography: experiences, emotions, health and well-being***

In the early days, time-geography, and especially its notation system, was criticized for being physical, not considering human subjectivity, experiences and feelings (Buttimer 1976; Hägerstrand 2006; Giddens 1984; Rose 1993; Baker 1979). Sometimes the notation system was confused with the time-geographic approach as a whole. Time-geographers (Hägerstrand 1983, 1985, 2009; Lenntorp 1976; Mårtensson 1979) argued that time-geography has a materialistic appearance, which is the basis towards which people’s experiences and feelings can be related. The notation system, which precisely shows where in the time-space an individual is located, is one component of the time-geographic approach, which should be considered in conjunction with time-geographical concepts, like project, pocket of local order and constraints. The social science criticism does not consider the original intention of Hägerstrand: to create an approach that can handle individuals of different kinds, not only humans, in a similar way based on their

mere time-space existence. For Hägerstrand, then, it was important to underline the material dimension of humans and their geographical relations. Hägerstrand's interdisciplinary ambitions with the time-geographic approach were to provide researchers with a way to root studies in the material world, which paves the way for extending the analyses with theories from their own research fields. Chapters 6 and 7 present two different ways to extend time-geographically inspired analysis, with theories from social science in Chapter 6 and occupational science in Chapter 7. The chapters contribute to the discussion about how subjective dimensions can be integrated with and enrich time-geographical analyses.

Chapter 6, "A relational interpretation of time-geography" by Martin Dijst puts to the fore psychological theories of existential feelings and people's relational needs and elaborates on how these might enrich time-geography. Social scientists' criticism of time-geographical representations (the individual path) visualizing an individual's movements in the time-space is the background to Dijst's contribution, where he is inspired by actor-network theory, phenomenology and emotional geography. These theories are used to inform the efforts to extend the time-geographical framework with relational conceptualizations and to get to grips with people's relations and their inner world, thereby complementing the outer world representation of traditional time-geographic notations. The chapter deals with social interaction and emotions in the time-space and suggests new concepts that theoretically pave the way for relational and emotional analyses in time-geographic studies of daily life, like relational string, assemblage of relational strings and embodied exposure. This chapter contributes to furthering micro-level social science use of time-geographic analyses, theoretically informed by psychological research. Insights of this kind may also inform urban and regional planning to create material environments where the existential feelings and relational needs of human individuals are considered.

Chapter 7, "The time-geographic diary method in studies of everyday life", illustrates the use of the time-geographic approach by non-social science researchers. The author Eva Magnus is an occupational scientist, active in the field of medicine and health. Her research is micro level oriented, focusing on the human's abilities (and disabilities) in performing daily life activities in various material, social and geographical contexts. She exemplifies the use of the time-geographic diary method and the constraint concepts in occupational science research and occupational therapy practice in the Scandinavian context. Three types of individual paths are constructed from the diaries, illustrating first a human's activity sequence, second geographical location and movements and third their social companionship in the course of the day. These illustrations deliver background information about phenomena that are hard to capture in traditional treatment situations because of their mundane and evasive nature. Such visualizations based on the client's own diary notes are used as a common ground for discussing with clients what kind of emotions and feelings they experience when they do what activity, where and with whom, and subsequently ideas are developed about what actions can be taken to improve daily life. Thereby, the treatment is grounded on the experiences and descriptions of the client herself, which facilitates the interpretation of what

problems and constraints the person meets in her daily life. Magnus also shows that the results from this kind of analysis may serve as arguments for structural changes when occupational scientists engage in discussions with policy makers.

### *Time-geography and the landscape*

Torsten Hägerstrand was not just interested in people, he was interested in how people and other living individuals coexist and use both each other and non-living individuals located in the landscape to sustain themselves. The home area studies from his school years were inspirational for this orientation of time-geography. In his research about the life conditions among the inhabitants in and emigrants from Asby parish, he conducted extensive fieldwork in the landscape. The outmigration of people from the farms led to rapid changes in the landscape. Non-material individuals that previously had played an important role for sustenance on small farms, like tools and buildings, were left behind; they no longer served as resources for humans. Hägerstrand had a deep interest in the landscape and its processual changes due to variations in ongoing activities, and he wrote about it, often in Swedish (e.g. Hägerstrand 1961, 1988a, 1993, 2009). The complex issue concerning understanding of the reshaping of a landscape integrates phenomena like human projects, the constitution of the nature and climate, individuals in the different populations existing therein, societal rules and regulations, previously constructed buildings and other artefacts, which taken together influence the process. It is an ambiguous task to create a scientific approach that can capture all these in a comprehensive way. Hägerstrand's final book, *The Fabric of Existence* (2009) is an effort to argue for time-geography as an ecological approach to analyze processes that influence the ecological and social aspects of sustainability. The ever-changing configurations (bundles) of various kinds of individuals in the landscape, driven by human projects and power, then, are the basis for the processual landscape (Hägerstrand 1993).

In Chapter 8, "What about landscape in time-geography? The role of the landscape concept in Torsten Hägerstrand's thinking", Tomas Germundsson and Carl-Johan Sanglert put to the fore the strivings by Hägerstrand to integrate the landscape into the time-geographic approach. They find that time-geographers have paid limited attention to the landscape concept. Against a biographically inspired background the authors show how Hägerstrand struggled with and developed the landscape concept. The authors underline the importance of the mutual relation between landscape as a view and Hägerstrand's concept of processual landscape. They make clear that the landscape of Hägerstrand is not just a place, it has to do with the scene where individuals exist and relate to each other, from their birth until death, and their activities in a manifold of projects. The landscape, then, is not just a concept for a physical phenomenon, it is where the social and the physical meet and it is always changing due to this. "For Hägerstrand, the landscape thus functioned as a unifying framework in which almost any kind of question or theme could be studied, transcending the established boundaries of academic disciplines and branches of administration" (Germundsson and Sanglert, Chapter 8). The authors underline the dialectic relation between time-geography

and landscape in Hägerstrand's thinking and their contribution lays a foundation for further synthesizing landscape research with the time-geographic approach.

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### Notes

- 1 According to Google, by March 14, 2018 this article had been cited 4,014 times, while by April 1, 2012 it had been cited 1,772 times according to Shaw (2012).
- 2 In Swedish *hembygdsforskning* (Hägerstrand 1983).
- 3 Or at least until they emigrated or left the parish for other reasons.
- 4 The department launched the book series "Lund Studies in Geography C, General and Mathematical Geography", which includes contributions by e.g. William Bunge, Edgar Kant, William Garrison, Antoni R. Kuklinski, Richard Chorley and Peter Haggett.
- 5 In the mid-1960s he had a big grant from the Swedish Riksbank (National Bank of Sweden), which decided to fund research in social science and humanities as part of the bank's celebration of its 300-year anniversary in 1966. This grant laid the foundation for the Research Group in Human Geographic Process and System Analysis at the Department of Geography, Lund University, mostly referred to as the time-geography research group.
- 6 There are unpublished reports (nos. 3, 17, 38, 39) from this project in the series *Urbaniseringsprocessen* (1969–1970).
- 7 A substantial part of Hägerstrand's publications stems from works in urban and regional planning and in physical national planning. He also initiated the principle of setting coordinates to all real estate in Sweden in the national register of buildings, which made the administrative geographical borders less of a problem for research and planning.
- 8 Time-geography developed within a social science, and most social science researchers are primarily occupied with human individuals. When the same concept is used for things and humans, criticisms about physicalism appear (Buttimer 1976, Baker 1979).
- 9 We do not know if time exists, but we know that it is useful and convenient to measure something we call time by clocks.
- 10 It can be reinterpreted by people who participated in the event, but also by others. Also, people's memory might result in reinterpretation, since some parts of an event might fall out of memory or appear when something else triggers them.

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