



Time-geography approach during the COVID-19 emergency in Italy: a constraints study at national and local level

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Abstract

During the COVID-19 emergency, restrictions on individual and collective freedoms and the need to carry out smart working and distance learning clearly emphasized the importance of “space” and spatial relationships in everyday life. Indeed, the new constraints introduced during the lockdown have led us to reflect on the different modalities and temporalities of using both the real and the virtual space. The research was conducted at two levels within the scope of the time-geography approach and the related main concepts and investigation instruments. Specifically, at a national level, the perception of the various types of constraints during the lockdown were evaluated through an online questionnaire, highlighting in particular technological constraints. At a local level, the spatial-temporal organization of a group of university students was analyzed through a time-geographic diary and an individual path. The article describes the qualitative-quantitative methodologies and research instruments used, the sample of participants and the results of the two levels investigated. On the whole, the investigation confirms the topicality of Hagerstrand’s theory as well as its versatility and effectiveness in analyzing everyday life during the COVID-19 emergency.

Keywords: COVID-19, Individual Path, Perception, Space-Time Constraints, Time-Geographic Diary, Time-Geography

1. Time-geography and constraints during the COVID-19 emergency

Italy was one of the first European countries that had to face a rapid spread of COVID-19, especially in the Northern regions, and that imposed restrictive measures on the management of many types of economic activities and the provision of public administration services.

Specifically, the most restrictive and extended measures at a national level were enacted with the Ministerial Decree of 9 March 2020, the so-called “Io resto a casa” decree (“I stay at home”), which placed the entire country under lockdown until May 3rd, 2020. In an attempt to limit the spread of the coronavirus, schools, universities and many types of businesses were forced to close, working

hours and access to many public and private offices and services were reduced, and strict limitations were imposed on transportation and the free movement of citizens in public spaces and throughout the national territory.

In Italy, some geographical research has been carried out on the social, economic and environmental impacts connected to the spread of COVID-19, including the monographic issues “Geografie del Covid-19” (Bozzato, 2020) and “Epidemia, spazio e società. Idee e analisi per il dibattito e le politiche pubbliche” (Turco, 2020), and the research project “Atlante Covid-19” promoted by AGEI on the initiative of Emanuela Casti (Casti and Adobati, 2020). Some studies have analysed different regional reasons and susceptibility to contagion (Murgante et al., 2020; Borruso et al., 2020; Bertazzoni et al., 2000) and the use of GIS tools and mapping dashboards to represent, make available and disseminate information and research results (Dangermond et al., 2020).

The sudden restrictions imposed on individual freedoms with regard to movement and the use of public spaces, the requirement to carry out many work activities at home with various smart working modalities, the obligation to carry out all school and university lessons through distance learning unequivocally highlighted the importance of the categories of space and time and the social-spatial relationships in everyday life. Not only space but also time (although to a lesser extent) was subject to new forms, procedures and constraints of reorganization. Therefore, the new constraints imposed by the lockdown led one to reflect on the different modalities and temporalities of using space according to a time-geography perspective.

As well known, Hägerstrand created the time-geography approach in the late 1960s based on the fundamental concepts he had developed in a first publication in English in 1970 and then in 1985, and on a number of practical pieces of research and theoretical reflections conducted with students and collaborators (Lenntorp, 1999). From the 1990s onward, a renewed interest in time-geography, especially in studies concerning urban accessibility, was helped both by various types of software developed with the aim to

facilitate the conduction of analyses (Miller, 1999, 2005; Weber and Kwan, 2002; Jonsson et al., 2014) both by Geographic Information Systems and related applications (Shaw and Yu, 2009; Dijst, 2013; Kwan et al., 2015; Loraamm et al., 2020).

The fields of interest of time-geography have constantly widened: from studies on migrations to urban and regional planning, from the analysis and organization of transportation and communication to the sociology of work, from anthropology to occupational therapy, physiotherapy, psychology and psychiatry (Lenntorp, 1999; Shaw, 2012; Ellegård, 2019a, 2019b). Indeed, such widening has continued, although Hägerstrand’s approach has received criticism, in particular because it partly neglects subjective experiences, individual feelings, the relational context or also aspects related to gender (Buttimer, 1976; Baker, 1979; Thrift and Pred, 1981; Rose, 1993; May and Thrift, 2001).

Among the best known and widespread concepts of time-geography, this article mentions especially the individual path (a flow of events experienced as a sequence of activities), bundles of paths (a spatial-temporal conjunction of various paths which comes about when an individual enters into contact with other individuals for a certain period of time), constraints and pockets of local order. In 1970, Hägerstrand identified three groups of constraints (a concept used to indicate what hinders an individual – human being, animal or object – from carrying out a specific activity): capability (or capacity) constraints, authority constraints and coupling constraints¹. Capability constraints include the capabilities, properties, knowledge and tools at disposal to carry out a specific activity. They also refer to an individual’s physical and mental functions and to the resources he/she has at disposal. Authority constraints are products of culture and involve laws, regulations and agreements by which the members of a society or organization must abide. Coupling constraints refer to the need to group individuals (but also tools and resources) in space and time in order to carry out an activity or

¹ Also Lenntorp (1976) and Mårtensson (1979) concentrated their studies on constraints at the School of Lund.

achieve a certain objective (Ellegård, 2019a, 2019b). In literature, Information and Communication Technologies (ICT) fall within the capability constraints as they are considered tools. The obligation to carry out school and university lessons and many work activities² exclusively online during the lockdown highlighted new difficulties; therefore, the technological constraints were considered separately in this research.

Lastly, since citizens spent more hours than usual at home during the COVID-19 emergency, it was considered appropriate to mention what Hägerstrand (1985) defined “pocket of local order”, that is “a delimited part of the time-space, which for that time period and at that place is dominated by an order (furnishing, layout and things, and social agreements) created from human intentions, ideas and negotiations” (Ellegård, 2019a, p. 152).

As highlighted by Ellegård (2019b, p. 2), “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”. Therefore, such an approach was held particularly effective and versatile to analyses the many and sudden changes occurred in daily activities due to the spread of the pandemic. In fact, suggesting a relational (re)conceptualization of time-geography, Dijst emphasized that it “can increase understanding of health and social issues, such as social integration and cohesion” (2019, p. 114).

The article describes a study on the perception of space-time constraints during the COVID-19 emergency, developed at national level through an online questionnaire. Further in-depth research was conducted at local level with a group of university students. The space-time reorganization resulting from the constraints of the lockdown was investigated, through a daily diary and a diagram of an

² According to a time-geographic perspective, Yong-Young and Sanjo (2015) observed how smart working can contribute towards overcoming space-time constraints; as highlighted by Asgari et al. (2019), teleworking has a minimum impact on working hours and on the spatial-temporal organization of non-mandatory activities.

individual space-time path. The data collected was intentionally concentrated on the final period of the lockdown (from April 22nd to May 3rd, 2020), in order to base the research on perceptions and habits by then consolidated.

2. National level: perception of space-time constraints

2.1 Methodology, instruments and surveyed sample

The questionnaire on the perception of the real and virtual space during the COVID-19 emergency was proposed as an anonymous online survey through the Google Form platform.

A section of the questionnaire was dedicated to 20 items³ aimed to evaluate the subjective perception of living conditions during the lockdown. The research approach was based on the following items divided into 4 groups of constraints ascribable to time-geography:

- capability constraints: fear of infection, disease/s, taking care of sick people, managing the family (children, parents, etc.), keeping social relationships, remaining informed about the COVID-19 emergency;
- coupling constraints: sharing of domestic spaces with other people, sharing of public spaces, sharing of technological devices, working hours and possible closure of businesses, working hours and possible closure of public offices, working hours and possible closure of private healthcare facilities;
- authority constraints: resolutions provided for by governmental/ministerial decrees, resolutions provided for by (regional or local) administrative measures, police controls, control of the social context (neighbors, acquaintances, passersby);
- technological constraints: computer skills, Internet connection, mobile connection with “unlimited GB”, performing digital devices.

³ Participants indicated on a four-point Likert-type scale, ranging from 0 = “Not at all” to 3 = “A lot”, how much their temporal and spatial organization was influenced by each of these items.

The statistical analyses were performed using the software R version 3.6.3 “Holding the Windsock”. Mean scores and standard deviation were calculated for each item (Table 1). First, Exploratory Factorial Analysis (EFA) was performed with minimum residual solution and Oblimin rotation extracting one factor to evaluate whether all the items could be related to the same construct (latent variable, Table 2). Then we used the graphical analysis of the scree plot and the parallel analysis method to identify the optimal number of factors to retain in the EFA⁴. These two methods indicated four factors which was in line with the initial hypothesis of the research of four groups of constraints instead of the traditional three (Table 3). At last, four linear regression analyses were conducted to determine to what extent the proportion of each of the four factorial scores was explained by the independent variables (age, gender, education, occupation, geographical origin, housing conditions and urban/rural location) (Table 4).

The sample analyzed was composed of 2,294 respondents⁵, of whom 67% (1,556) were female, 33% (753) male, and less than 1% (4) were non-binary. The mean age of the participants was 43 ± 16 years (range 18-86 years old).

The participants living in an urbanized area amounted to 83% (1,909), while the remaining ones lived in a rural area. The respondents who spent the lockdown in the North-West of Italy amounted to 58% (1,328), while 19% (428) were in the North-East, 11% (255) in the Centre and 12% (283) in the South and on Islands⁶.

⁴ To verify the optimal number of factors to be extracted, the graphical analysis of the scree plot by Cattell (1966) was used, as well as Velicer's (1976) Minimum Average Partial (MAP) test and the parallel analysis (PA).

⁵ The questionnaire respondents amounted to 2,313; 19 under-age participants were excluded because the informed consent of both parents had not been provided. In the analyses some answers were eliminated because the participant had indicated more than one option.

⁶ On May 3, 2020, Italy recorded 210,717 cases of COVID-19, with 81,654 recovered and 28,884 deceased (data provided by the Ministry of Health). Compared to the total cases, 54% were in the North-West regions, 26% in the North-East, 11% in the Center and 9% in the South and Islands. A Pearson's Chi-squared test was performed to evaluate if the

With regard to educational qualifications, 1 respondent declared having a primary school certificate, 4% (90) a lower secondary school diploma, 35% (806) an upper secondary school diploma, 15% (342) a three-year university degree, 38% (871) a five-year university degree and 8% (184) a PhD.

The main employment sector was the tertiary (89%, 1,292), while the employees in the secondary sector and primary sector amounted to 10% (151) and 1% (17), respectively. Among those employed, 38% (554) worked for a private enterprise, 42% (620) were state employees and 20% (286) were autonomous workers.

Most of the respondents (1,990) lived with other people⁷ (mean score 2.25 ± 1.2). The respondents with children amounted to 43% (851), mean score 1.78 ± 1.12 per participant. The mean number of rooms per house was 5.39 ± 2.33 . The participants living in a house measuring more than 100 sqm amounted to 37%, while 27% were those living in a house measuring between 100 and 86 sqm, 28% between 85 and 51 sqm, and the remaining 7% within 50 sqm. Out of the total sample, 75% declared having at their disposal a space in their house for exclusive use. Lastly, 69% said they had a balcony or a terrace, 39% a garden, while 9% had none of the three spaces.

2.2 Analysis of the results

The preliminary analysis of the questionnaire evaluated that the constraints perceived the most, with higher mean scores (>2), concerned the resolutions provided for by the governmental/ministerial decrees, computer skills, Internet connection, mobile connection with “unlimited GB” and performing digital devices. In particular,

distribution of participant of the sample was homogeneous with respect to distribution of the COVID-19 cases in the geographical areas. The results were not significant ($X^2 = 12$, $DF = 9$, $p = 0.213$) showing that the distribution of the sample (NW 58%, NE 19%, C, 11%, SI 12%) and the distribution of the disease (NW 54%, NE 26%, C 11%, SI 9%) are not different.

⁷ In 65% of the cases, all the children lived with the respondent parent during the lockdown, in 15% only some of them, while in 20% of the cases the children did not live with the participant.

Internet connection was the item with the highest mean score (2.80) and the lowest standard deviation (0.44), thus highlighting quite a concentrated distribution of the answers around the mean score (Table 1). It could be easily explained considering that the ICT can help overcome some spatial-temporal limitations⁸ and, in the case of mobile devices, they enable the carrying out of various activities at the same time⁹.

Constraints		Mean	Std. Dev.
capability	Fear of infection	1.63	1.00
	Disease/s	0.82	0.98
	Taking care of sick people	0.53	0.88
	Managing the family	1.36	1.11
	Keeping social relationships	1.69	0.97
	Remaining informed on the Covid-19 emergency	1.85	0.97
coupling	Sharing of domestic spaces with other people	1.46	1.14
	Sharing of public spaces	1.06	1.13
	Sharing of technological devices	1.00	1.07
	Working hours and possible closure of businesses	1.26	1.08
	Working hours and possible closure of public offices	0.98	1.05
	Working hours and possible closure of private healthcare facilities	0.88	1.01
authority	Governmental/ministerial decrees	2.03	0.99
	Administrative measures	1.94	1.01
	Police controls	1.13	1.10
	Control of the social context	0.98	1.02
technological	Computer skills	2.48	0.64
	Internet connection	2.80	0.44
	Mobile connection with "unlimited GB"	2.57	0.69
	Performing digital devices	2.55	0.67

Table 1. Significance of the constraints with regard to the spatial-temporal organization of the day. Source: processing of the questionnaire's data.

⁸ As demonstrated by Schwanen and Kwan (2008), the Internet and the mobile phone can mitigate especially temporal constraints, whereas they affect spatial flexibility to a lesser extent.

⁹ An interesting piece of research by Thulin and Vilhelmson (2019) on the high-school students' use of mobile ICT made a distinction between "foreground and background activities".

The first EFA output showed that all the items loading were >0.3 extracting one factor, indicating they are all related to the same theoretical construct named "constraints"¹⁰. Table 2 shows the loadings of each item and allows evaluating which constraints are the most important in the total computation. The most influential items in order to determine the total score of the perception of constraints resulted to be regional or local administrative measures (0.62), working hours and possible closure of businesses (0.60), working hours and possible closure of public offices (0.59) and restrictions imposed by governmental and ministerial decrees (0.58).

Constraints		Items loadings
capability	Fear of infection	0.36
	Disease/s	0.34
	Taking care of sick people	0.33
	Managing the family	0.37
	Keeping social relationships	0.34
	Remaining informed on the Covid-19 emergency	0.36
coupling	Sharing of domestic spaces with other people	0.38
	Sharing of public spaces	0.39
	Sharing of technological devices	0.39
	Working hours and possible closure of businesses	0.60
	Working hours and possible closure of public offices	0.59
	Working hours and possible closure of private healthcare facilities	0.56
authority	Governmental/ministerial decrees	0.58
	Administrative measures	0.62
	Police controls	0.55
	Control of the social context	0.52
technological	Computer skills	0.31
	Internet connection	0.33
	Mobile connection with "unlimited GB"	0.35
	Performing digital devices	0.32

Table 2. Loading of the items with regard to the general factor "constraints". Source: processing of the questionnaire's data.

¹⁰ The factorability of the pool of items was evaluated positively (Kaiser-Meyer-Olkin measure of sampling adequacy = 0.81; Bartlett's test of sphericity (χ^2 (19) = 3944.5, $p < 0.001$); inter item correlation above 0.3 for 19 of the 20 items).

After deleting five items from the item pool¹¹, the final EFA with four factors solution explained 50% of the variance (respectively 15%, 13%, 12% and 10%). Table 3 shows the loadings of the items with regard to the 4 factors. All the factors indicate an adequate internal consistency with loadings above 0.3 with regard to a single factor for each item. The factorial analysis grouped 15 items in the four factors, confirming their attribution to the 4 groups of constraints postulated at the beginning of the research.

The advisability to keep the technological constraints distinct in the time-geography analysis during the COVID-19 emergency was confirmed when observing the score distribution of the 4-factor factorial analysis (Figure 1). In particular, the higher scores of the technological constraints confirm the respondents' perception of their importance.

Lastly, 4 linear regression analyses were conducted to verify if and how the perception of the 4 types of constraints was affected by variables involving personal, socio-economic, housing and territorial data.

With regard to technological constraints, the results of the linear regression¹² highlighted that: females perceived them more than males ($p < 0.001$); the older the age, the less they were perceived ($p < 0.001$); the higher the schooling, the more they were perceived ($p < 0.001$); students perceived them more than the unemployed ($p = 0.02$); retired persons perceived them less than the unemployed ($p = 0.002$), the employed ($p < 0.001$) and students ($p < 0.001$); there was a significant difference between the North-East and North-West (N-E < N-O) ($p = 0.002$).

With regard to authority constraints, the results of the analysis highlighted that: females perceived

them more than males ($p = 0.041$)¹³; the older the age, the less they were perceived ($p = 0.004$); the higher the schooling, the more they were perceived ($p < 0.001$); they were perceived more in urbanized areas ($p = 0.012$) than in rural areas.

The third regression¹⁴ used coupling constraints as dependent variable; the results highlighted that: the older the age, the more they were perceived ($p = 0.012$); retired persons perceived them less than the unemployed/jobless ($p = 0.026$) and the employed ($p < 0.001$); those who had a house with an outdoor space perceived them less ($p = 0.013$); those living in the South and on Islands perceived them more than those living in the North-East ($p = 0.001$) and North-West ($p = 0.003$).

The last linear regression analysis¹⁵ concerning capacity constraints highlighted that: females ($p < 0.001$) perceived them more than males; the older the age, the more they were perceived ($p < 0.001$); retired persons perceived them less than the unemployed/jobless ($p = 0.001$) and the employed ($p < 0.001$); the North-West ($p = 0.009$) and the South and Islands ($p < 0.001$) showed significantly higher scores than the North-East; the South and Islands ($p = 0.050$) showed significantly higher scores than the North-West.

On the whole, as expected, the technological constraints were perceived more by students using distance learning and by participants with a higher level of schooling. Such datum is most likely connectable to professions that had the possibility to make use of smart working. Authority constraints were particularly perceived in urban areas where the greater housing density probably imposed more frequent and accurate controls. Coupling constraints were perceived more by the older respondents and those living in the South and on Islands. Lastly, as predictable, capacity constraints were perceived more the older the age (a result ascribable to the higher death rate among the elderly and the media communication of such aspect) and by women (presumably more engaged in taking care of the family and sick people).

¹¹ A total of 5 items were eliminated because they did not contribute to a simple factor structure and failed to meet a minimum criterion of having a primary factor loading of 0.3 or above, no cross-loading of 0.3 or above and communality less than 2.0. "Control of the social context" and "Keeping social relationships" did not load above 0.3 on any factor and had communality of 2.9 and 2.1. "Sharing of technological devices" and "Sharing of public spaces" and "Sharing of domestic spaces" did not load above 0.3 on any factor therefore were deleted.

¹² The regression resulted significant with Adjusted R-squared = 0.08 (F (14; 2257) = 14.94, $p < 0.001$).

¹³ The regression resulted significant with Adjusted R-squared = 0.08 (F (14; 2257) = 14.94, $p < 0.001$).

¹⁴ The regression resulted significant with Adjusted R-squared = 0.019, F (14; 2257) = 4.133, $p < 0.001$).

¹⁵ The regression resulted significant with (Adjusted R-squared = 0.037, F (14; 2257) = 7.164 $p < 0.001$).

Constraints		Factor 1 technological constraints	Factor 2 authority constraints	Factor 3 coupling constraints	Factor 4 capability constraints
capability	Fear of infection	0.10	0.11	-0.09	0.52
	Disease/s	-0.01	-0.06	0.01	0.71
	Taking care of sick people	-0.07	-0.06	0.13	0.55
	Managing the family	0.04	0.12	0	0.36
	Remaining informed on the Covid-19 emergency	0.09	0.19	-0.09	0.38
coupling	Working hours and possible closure of businesses	0.05	0.15	0.66	-0.02
	Working hours and possible closure of public offices	0.01	-0.03	0.94	-0.04
	Working hours and possible closure of private healthcare facilities	-0.03	0.03	0.65	0.15
authority	Governmental/ministerial decrees	0.01	0.88	0.01	-0.03
	Administrative measures	-0.01	0.91	0	0.02
	Police controls	-0.02	0.38	0.20	0.12
technolog.	Computer skills	0.64	-0.01	0.03	0.03
	Internet connection	0.80	0.04	-0.04	-0.02
	Mobile connection with “unlimited GB”	0.71	-0.03	0.06	0.02
	Performing digital devices	0.80	-0.03	0	0

Table 3: Loading of the items with regard to the 4 factors. Source: processing of the questionnaire's data.

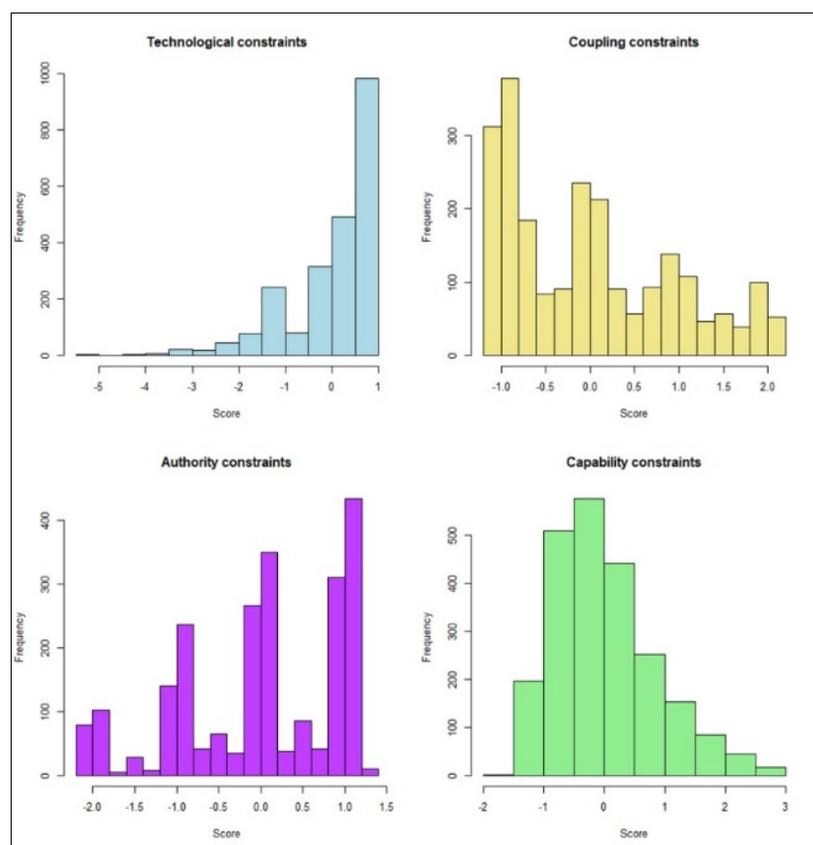


Figure 1. Score distribution with regard to the 4 factors. Source: processing of the questionnaire's data.

3. Local level: time-geographic diary and individual path

3.1 Methodology, instruments and surveyed sample

At a local level, the scientific scope of the research was to investigate the organization of activities, the daily management of time and space and the possible variations between weekdays and holidays. The educational aim was to lead the students to reflect on how the constraints imposed by the lockdown influenced the quality of their everyday life¹⁶.

In a preliminary phase, the students of the University of Genoa¹⁷ learned the fundamental principles and concepts of time-geography as well as the space-time notation system. In particular, since “a time-geographical visualization can be used as a starting point for an individual reflecting on her subjective experiences of an event or process” (Ellegård, 2019a, pp. 12-13), the time-geographic diary¹⁸ and the individual path were presented and adopted to evaluate the spatial-temporal organization of weekdays and holidays. Such research tools made it possible to identify the spaces (real and virtual), the hour of the day/night, the activities and sociality of the single individuals of the sample, obtaining an overall view of the rhythms adopted by each individual and by the group (Ellegård, 1999; Magnus, 2019).

Then, the students were asked to voluntarily keep two diaries and draw two diagrams of individual paths highlighting the activities carried out during weekdays and holidays indicating the hour of the day/night, and if conducted in the real space or the virtual space¹⁹. The diary was organized according to a pre-established division of the hours of the day/night with a 30-minute

interval and allowed the diarists to write down in their own words the activities carried out²⁰, the places and the other persons involved.

It was suggested to extend the time-geographic framework to manage both the physical world and the virtual one in a hybrid physical-virtual space (Yu and Shaw, 2007; Shaw and Yu, 2009) and to represent a conceptual model of the activities based on a multidimensional space (Couclelis, 2009). Following such suggestions, a two-dimensional Cartesian coordinate diagram was drawn up placing the 24 hours of the day on the vertical axis and the spaces on the horizontal axis (Figure 2). The pre-established list of spaces and online activities was graphically inserted in a modifiable image with PowerPoint to facilitate the students' drawing and the comparison of the graphs²¹.

Finally, the students uploaded the diaries and individual paths on the university's online platform. The results were then analyzed, and a collective debate was organized with the class for further considerations based on the preliminary analysis.

The sample of 46 students participating in the research was composed of 36 (78%) females and 10 (22%) males, with a mean age of 25 ± 5.44 years (range 21-53 years old); 39 persons (85%) had an upper secondary school diploma, 5 (11%) a 3-year university degree and 2 (4%) a five-year university degree. Among the participants, 36 (78%) were students (of whom 2 Erasmus students) and 10 (22%) were at the same time students and workers. The diarists who spent the lockdown in an urban municipality amounted to 33 (72%), and the remaining ones were in a rural municipality. More specifically, 29 subjects (63%) lived in the metropolitan city of Genoa and 9 (20%) in province of Savona, while the

¹⁶ Interesting examples of applications to university didactics are presented by Díaz-Munoz et al., 1999.

¹⁷ The third-year students enrolled in the Pedagogical and Educational Sciences degree attended Social Geography lessons online.

¹⁸ In the last years, the analysis of the time-geographic diary processed with specific software has aroused interest with regard to both human geography and occupational therapy (Ellegård, 2019a).

¹⁹ In order to guarantee the participants' privacy, each template (diary and diagram) was provided with an identification code.

²⁰ Lacking a software to analyze the diaries or a specific smartphone application to record the data, it was preferred to indicate pre-established intervals of time and adopt a simplified categorization of the activities, unlike what experienced in broader studies (Ellegård, 2019b).

²¹ On the right-hand side of the graph (= real space), the main spaces of the house were indicated (inside and outside) along with the public spaces; whereas, on the left-hand side (= virtual space), the most common activities carried out with a device (smartphone, tablet, PC, TV, console, etc.) were listed.

remaining ones spent the period outside the region of Liguria: 4 in Piedmont; 1 in Lombardy, 1 in Valle d'Aosta and 1 in Spain

(Valencia). Almost all the sample (94%) shared the house with other people.

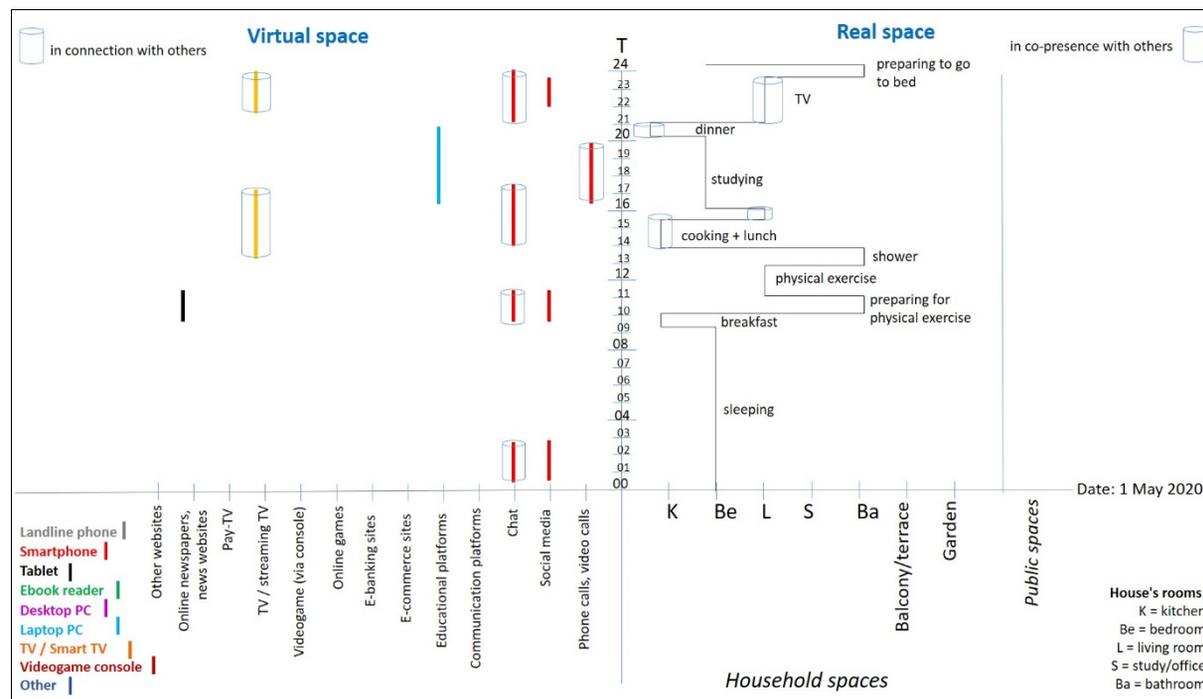


Figure 2. Individual path diagram (subject No. 29, female, born in 1998, living in an urban area).

Source: Individual path drawn up by a participant.

3.2 Analysis of the results

The analysis of the activities described in the time-geographic diaries highlighted the rhythm of waking hours-sleeping hours distinguished per gender, year of birth, weekday and holiday (Figure 3).

On a holiday²², the respondents woke up and went to bed on average later compared to the weekday²³, highlighting a slight behavioral distinction even during the lockdown. Indeed, on average, the sleeping hours on a weekday amounted to 7h 58' and on a holiday to 8h 50': almost an extra hour. Further differences in the

data do not appear related to gender, age or the fact of living in a rural area or urban area.

Subsequently, the activities described by the diarists were grouped and quantified in 15 categories²⁴ (Table 4). Considering the characteristics of the sample and the lockdown conditions in which the research was carried out, it was decided to make a distinction between the study and work categories and to consider cooking separately from eating breakfast, lunch and dinner, to highlight the time dedicated to the single activities.

²² The majority of the sample (Figure 3) woke up between 7:00 a.m. and 10:30 a.m. and 9 diarists between 11:00 a.m. and 2:00 p.m. (wake-up hour mean = 9:48). On average, the waking hours amounted to 15h 10'.

²³ The majority of the sample (Figure 3) woke up between 6:30 a.m. and 9:00 a.m., 12 diarists between 9:30 a.m. and 11:00 a.m. (wake-up hour mean = 8:28). On average, the waking hours amounted to 16h 02'.

²⁴ In the category "Taking care of pets" only the activities carried out in the domestic space were considered, while outdoor walks were considered in the category "Activities in the public space," as indicated in the diary and individual path.

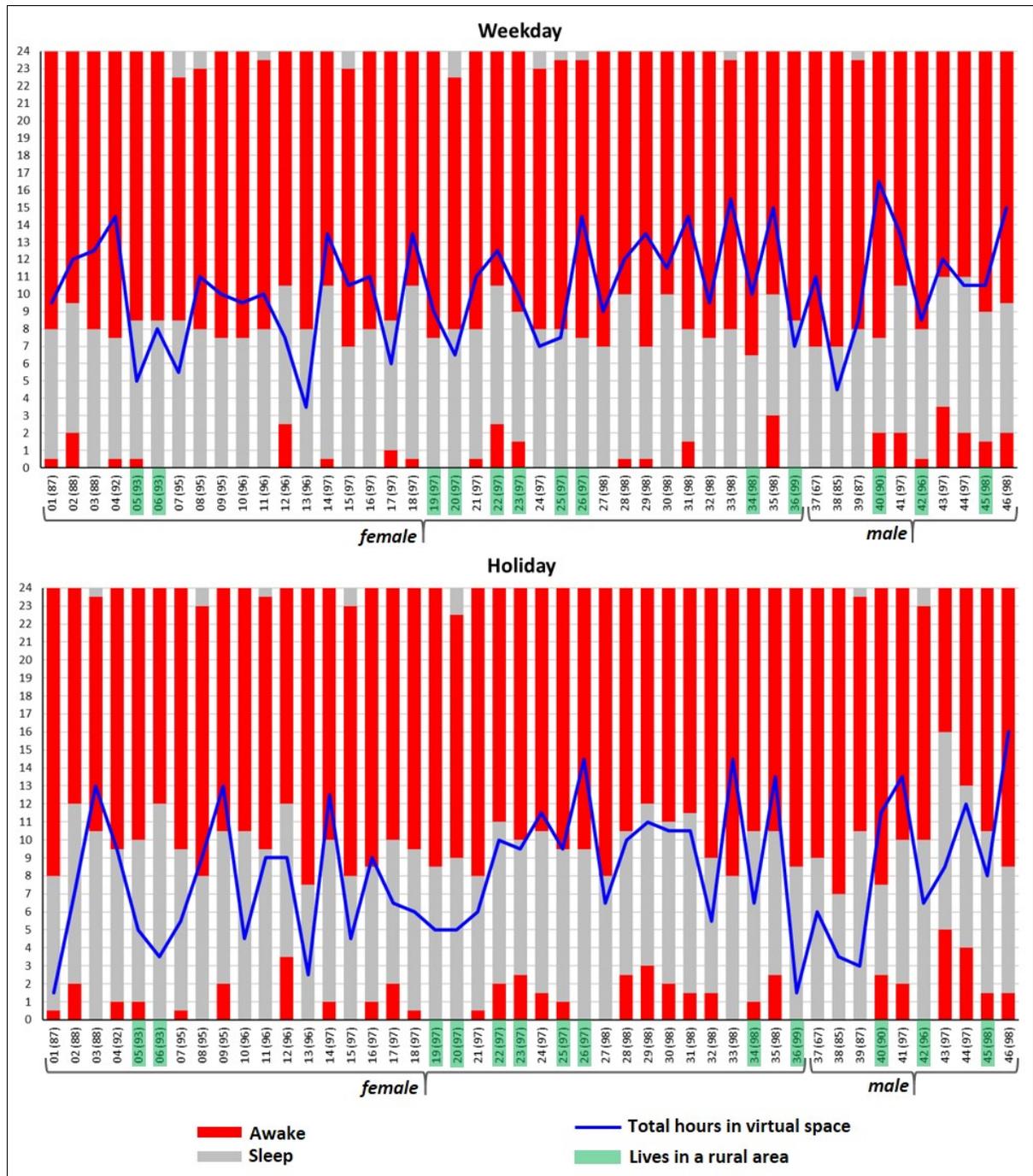


Figure 3. Rhythm of waking hours-sleeping hours of the sample on a weekday and on a holiday. Source: processing of data of the time-geographic diaries.

Categories of activities	Weekday				Holiday			
	Real space			Virtual space	Real space			Virtual space
	Mean (hrs, mins)	Standard deviation (hrs, mins)	Mode (hrs, mins)	% out of the tot. hrs spent by the group	Mean (hrs, mins)	Standard deviation (hrs, mins)	Mode (hrs, mins)	% out of the tot. hrs spent by the group
Resting	7,56	1,26	7,30	0	8,50	1,18	9,00	0
Personal care	1,08	1,01	2,00	29	1,09	1,01	0,30	29
Taking care of the family	0,14	0,59	0,00	32	0,09	0,47	0,00	0
Taking care of the house	0,23	0,40	1,00	29	0,30	0,48	1,00	33
Gardening (yard / vegetable garden)	0,03	0,13	1,00	40	0,14	0,43	2,00	41
Taking care of pets	0,05	0,19	1,30	14	0,05	0,20	0,30	0
Studying	5,46	1,58	6,00	80	2,49	2,11	2,30	49
Working	0,23	1,15	0,00	94	0,06	0,29	0,00	30
Free time	3,35	1,43	4,00	86	4,50	2,26	4,00	80
Breakfast	0,41	0,26	0,30	40	1,08	0,28	1,00	32
Lunch	0,59	0,26	1,00	34	0,36	0,26	0,30	40
Dinner	1,02	0,23	1,00	34	1,07	0,28	1,00	37
Cooking	0,44	0,45	1,00	55	1,08	0,59	1,00	41
Social relationships	0,40	0,50	1,30	93	0,44	0,46	1,00	93
Activities in the public space	0,20	0,37	1,30	20	0,32	0,58	1,00	47

Table 4. Hours per category on a weekday and a holiday, in the real space and virtual space.
Source: processing of the data of the time-geographic diaries.

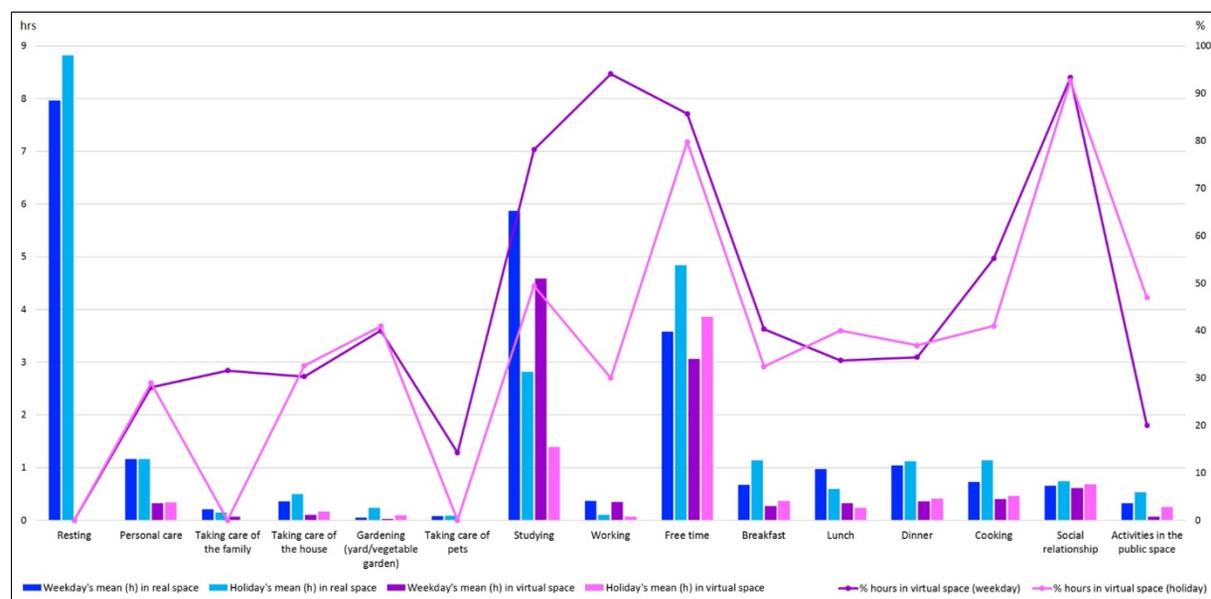


Figure 4. Mean hours per category of activities; percentage of hours spent in the virtual space with regard to the total hours per category. Source: processing of the data of the time-geographic diaries.

Activities such as taking care of pets (3 subjects), taking care of the vegetable garden and the yard (3 persons), taking care of the family (4 subjects) and working (6 persons) show very low mean scores because they were carried out by few people, and this is ascribable to the homogeneity of the sample of students per age, living conditions and housing²⁵ (Figure 4).

The activities carried out by most of the participants on a weekday were resting (mean score 7h 56' ± 1h 26'), studying (5h 46' ± 1h 58') and free time (3h 35' ± 1h 43'). For these cases, the standard deviation scores indicate a marked variability in the groups' behaviors. The other categories of activities show mean values equal or inferior to 1 hour, highlighting a similar trend between a holiday and a weekday (Figure 4). With regard to the total time dedicated to the single activities, the percentage of time spent in the virtual space through a device was higher in the case of studying (80% of the hours in the virtual space), free time (86% of the hours) and social relations (93% of the hours).

The main activities carried out on a holiday were resting (mean score 8h 50' ± 1h 18'), free time (4h 50' ± 2h 26') and studying (2h 49' ± 2h 11'); compared to a weekday, the time spent in these activities resulted more dilated in the first two cases and halved in the third. On a holiday, the group dedicated on average more time to eating breakfast and to cooking than on a weekday; whereas, the time dedicated to lunch was on average less. With regard to the time dedicated to meals, the standard deviation indicates a rather homogeneous behavior in the group. Furthermore, compared to a weekday, the meaningful decrease in the percentage of time dedicated to studying in the virtual space (49% of the total hours) is almost certainly ascribable to the absence of online lessons and webinars during the weekend; the percentage of hours in the virtual space was slightly lower also in the case of free time (80%); the percentage relating to social relationships remained constant (93%).

On a weekday, the sample spent more time in the virtual space (individual mean of 10h 34' ±

3h 08') compared to a holiday (8h 20' ± 3h 44'). The standard deviation highlights very diversified behaviors within the group, in line with what can be seen in Figure 3. In fact, on a holiday, 12 participants²⁶ spent in the virtual space a time equal to or higher than a weekday, while in 8 cases²⁷ there were consistent decreases (≥ 5 hours). Such behaviors do not seem directly connectable to gender, age or the fact of living in urban or rural areas.

On the basis of all the observations, it is possible to state that, despite the limitations imposed by the lockdown, the group had slightly different behaviors on a weekday and a holiday, in the latter case preferring to rest and free time, even if with very different situations within the sample.

Finally, like other examples in literature, the graphic superimposition of all the individual paths allowed an overview of the activities and the devices on the basis of the density of the colored lines drawn (Figure 5). On weekdays the participants mainly used the bedroom (used also to study, for relaxing activities and free time), the kitchen (where they also carried out online activities) and the living room. The time spent in the outside domestic spaces, such as balconies, terraces, yard or vegetable garden, was less at least during weekdays. Even more sporadic was the presence in public spaces, where the diarists went for short walks with the dog, to buy groceries or to work (in 1 case). In the virtual space, the most frequent activities were: the use of platforms for distance learning, to chat, to make phone calls or video calls and to watch the television, as well as to surf other types of websites. In particular, the use of the smartphone was definitely prevailing, followed by the use of the laptop PC and the television/smart TV; much less used were videogame consoles, desktop PCs and tablets, in 1 case the e-book reader was indicated and never the landline phone.

The analysis of the individual paths also highlighted a spatial-temporal and multifunctional reorganization of the houses, necessary during the lockdown to allow family members to carry out a

²⁵ For example, the 4 subjects that took care of the family dedicated a mean time equal to 2.22 ± 2.47 hours on a weekday and 1.45 ± 2.22 hours on a holiday.

²⁶ The 12 persons are indicated with numbers: 03, 05, 07, 09, 12, 17, 24, 25, 26, 41, 44, 46 (Figure 3).

²⁷ The 8 persons are indicated with numbers: 01, 02, 04, 10, 18, 36, 39, 40 (Figure 3).

series of additional activities besides the habitual ones. Therefore, houses are to be considered as pockets of local order, as well as every single room whose organization, function and use required an

agreement between the family members, and changed when new needs occurred (Ellegård, 2019a).

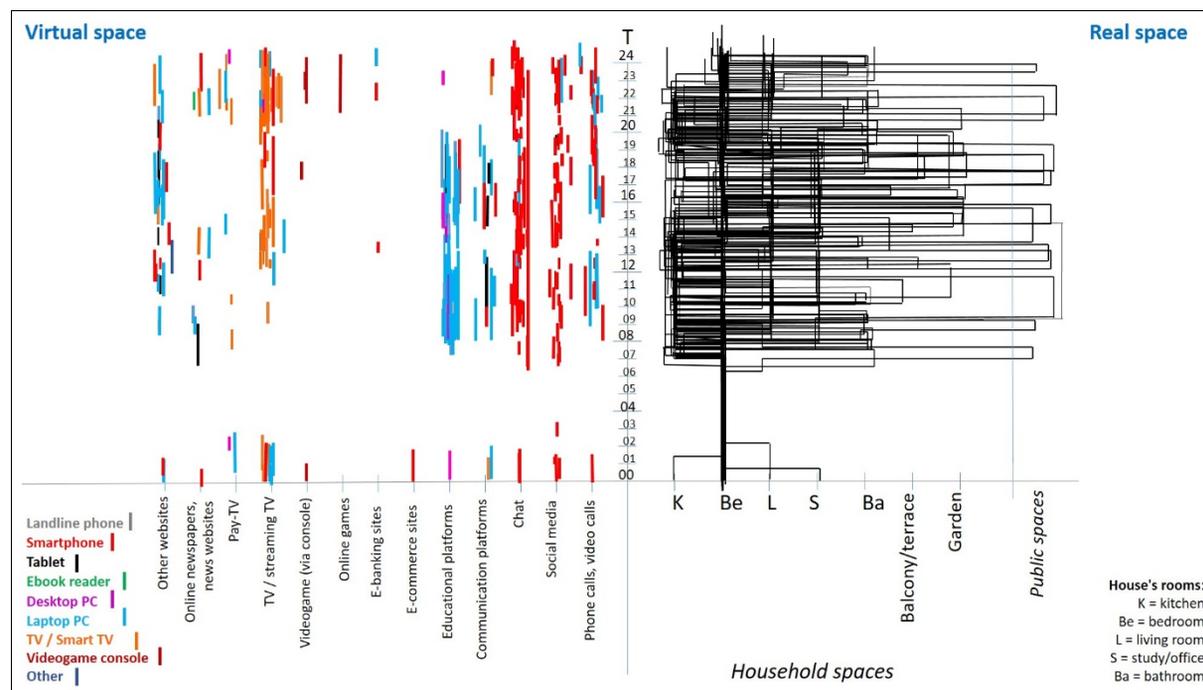


Figure 5. Individual paths in the domestic and public spaces, and activities in the virtual space on weekdays. Source: processing based on the individual paths.

4. Conclusions

In a period of remarkable restrictions on personal freedoms and the free movement of individuals in space, such as those imposed by the Italian government's decrees, it was particularly interesting to concentrate the research on the theme of constraints. In fact, as highlighted by Thrift (1977, p. 25), "What people cannot do is just as important as what they are able to do, and often more revealing". The real space and virtual space structure our experiences, organize them (also chronologically) and influence them. As a result of the lockdown conditions, it seemed appropriate to place the research in the context of time-geography. At the national level, the perception of the constraints was evaluated and, at the local level, the spatial and temporal reorganization influenced by the same constraints was analyzed. Indeed, as specified by Ellegård the 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" (2019b, p. 7).

With regard to the evaluation of constraints within the context of the lockdown, the analyses conducted on the national level confirmed the advisability to distinguish 4 types of constraints. The group of technological constraints was considered separately, as indicated by the factorial analysis which produces a simple structure with four factors. Further confirmation comes from the analysis of the items' mean scores. It highlighted that on average the constraints perceived as more restricting were ascribable to technology (IT skills, Internet connection, mobile connection with "unlimited GB" and performing digital devices) and authorities (resolutions of the governmental/ministerial decrees).

Considering the responses to the questionnaire, linear regressions showed that females are more sensitive to technological, authority and capacity constraints; then the most educated people are more affected by technological and authority constraints; the older the age the perception of technological, coupling and capacity constraints increases while that of authority constraints decreases. As far as employment is concerned, the active population is most affected by coupling and capacity constraints; technological constraints are felt more by students and employees. Moreover, the respondents from the North-West are more affected by technological and capacity constraints than the North-East; Northern Italy perceives coupling constraints more than the South and Islands. Overall, the social categories that expressed a greater perception of the constraints are women and the elderly. This could also reflect their greater fragility and exposure to the conditions of the emergency.

During the lockdown, digital technologies offered many opportunities to remain involved in economic, cultural and social processes. Indeed, they became the central tools in the spatial-temporal organization of everyday life and created a “superimposition” between the real space and the virtual space for a higher number of hours. Such aspect emerged clearly in the investigation conducted at a local level, whose objective was to acquire knowledge on individual opportunities and constraints and to investigate the sample’s spatial-temporal organization and adaptation strategies. The ICTs made it possible to reduce many spatial-temporal constraints, permitting the simultaneous management of several activities, but they seem to have emphasized some limits and divides²⁸ of the interactions in the real and virtual spaces. The confinement of all family members in the domestic space often imposed a negotiated management of devices and rooms

²⁸ The need for an Internet connection for many online activities in the households highlighted social and territorial inequalities in the access and use of ICTs. The difficulties that emerged during the lockdown fostered the entering into agreements, at the end of August 2020, for the realization of an ultra-fast broadband network in Italy managed by a public-private company.

and a more or less flexible organization of the physical spaces so as to allow all the members to carry out activities online. Therefore, despite all the opportunities offered by ICTs, the validity of time-geography foundations is confirmed because the individual always remains placed in the real space (Ellegard, 2019a).

In conclusion, the results of both the analyses conducted confirm the topicality of Hägerstrand’s approach, of the methods and instruments of time-geography, as highlighted in their application in the context of everyday life during the COVID-19 emergency. Furthermore, their use in university teaching reasserted their usefulness also at educational level; in the specific case, they allowed the students to reflect on the quality of life, as well as if and how much it had changed compared to the period prior to the lockdown. Moreover, they facilitated the questioning of the political, economic, social and technological problems that affect living conditions and especially the awareness of many bijective relations between the individual and local level and the social and national/global level.

In the late 1990s, Lenntorp considered the time-geography approach “at the end of its beginning” (1999, p. 158) and by now ready for a more mature phase. The time-geography currently confirms that it is, as already expressed by Lenntorp (1999), an attempt to build a wide structure of thought capable of carrying out two tasks: to connect knowledge concerning distinct scientific areas and daily practices; and to reveal relationships, whose nature escapes if the object of research is studied separately from its *milieu*.

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