MODELING LIFE SPACES, FROM DESCRIPTION TO DYNAMICS
first proposals

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Migration is usually studied as a simple change of residence, due primarily to data limitation rather than the lack of a conceptual framework. However, the fact that individuals interact with a large number of different locations throughout their life, through their activities or their social network, and that the knowledge of and acquaintance with these places shape their mobility is undisputed. The further theoretical proposal that these places form a territory can be traced back, in France, to a first stream of research which emerged among geographers in the early 1970's (Chevalier, 1974; Frémont, 1974; Metton, 1974). Fewer references are to be found in English (Hooimeijer, Van der Knaap, 1994; Ley, 1983; Hugo, 1982), though a number of modeling procedures of migration with reference to known territories can be found (Brown et al. 1970; Gordon, Vickerman, 1982). Therefore, essentially due to the lack of available quantitative data, the description and modeling of life spaces and furthermore the practical use of relevant measurement in the study of migration has yet to develop.
The objective of our paper is to present a set of possible methods to describe these territories. This constitutes a preliminary step to the creation of indicators for the study of mobility.
Taking advantage of a rich data source, the *Biographies et entourage* survey, and the abundant existing conceptual framework, we proceed here gradually, introducing alternative strategies for the quantitative measurement of different types of *reference spaces*. We deal first with static territories, such as the territory of origin, the childhood reference space, the life space at one point in time then proceed to tackle the dynamics of a specific one: the 'activity space' of a couple defined by the territory covered by their place(s) of residence and place(s) of work since the beginning of their union.

The life space, theoretical propositions

Among social science researchers, especially geographers and demographers, the notion of life space has developed with the aim of better understanding spatial mobility and of enriching the study of migration. Migration which is usually considered as a simple change of residence would be enriched if the acknowledgment that individuals interact with a large number of different locations, could somehow be taken into account.
The concept of life space covers a wide range of possible meanings.
We here deal with a territory "*constructed with all the places with which individuals are interacting simultaneously, directly or through the people who live there*". It covers "*the portion of space where individuals conduct their activities. This notion includes not only passing and staying places, but also every other place with which the individuals are in contact*" (Courgeau, 1988).
These include the *social space* –the set of locations defined by social relationships-, the *awareness space* –the territory with which people identify and which is not only based on experience-, the *activity space* which refers to the territory where people conduct their activities (Hooimeijer, Van der Knaap, 1994). But according to the studies and the data available these territories can differ wildly and cover quite different concepts: for example *awareness space* may be defined as the set of locations about which the individuals possess some knowledge and intervene in modeling the migrants' choice of destination (Brown et al. 1970). These territories are also constructed referring to different time scales from the *everyday* 'life space' where individuals conduct their daily activities to the 'life space' of the

life course regrouping all the residential locations (Bonvalet et al., 2007).The *activity space* can encompass all daily activities (shopping, working, leisure activities and so on…) or be precisely defined as a set of locations with which individuals have had direct contact as opposed to the *awareness space*.

Theoretical definitions abound but empirical research is more scarce. Quantitative information about the territories of individuals, not referring here to animal ecology, is hard to obtain. It is often monographic especially in ethno-anthropological research (Collignon, 1996), but also in geography where specific populations (Kokoreff, 1994; Avenel, 2000) were interviewed in a more qualitative fashion.

The data

The quantitative description of life spaces often comes up against a data problem. Indeed, in a practical way, it seems unworkable to gather all the various places taken into account by the extensive definition of life spaces, not only because of the cost it would imply, but also owing to the respondents' memory limits. But these definitions provide a sound theoretical framework for the more practical territories that empirical work can construct and analyze.

Table 1 : All locations collected in the *Biographies et entourage* survey

POSITION IN CONTACT CIRCLE	LOCATIONS ALONG THE LIFE COURSE		LOCATION AT A PARTICULAR POINT IN TIME	
	Work career	**Residences**	**Birth**	**Time of survey**
ASCENDANT RELATIVES •Maternal and paternal Grand parents	-	-	YES	
•Biological and adoptive parents	◄——►	◄- - -►	YES	YES
•Mother or father's spouse(s)	◄——►	◄- - -►	YES	YES
•Spouse(s) mother and father	-	-	-	YES
•Other persons with parental role	-	-	-	YES
EGO ◄——►	◄——►	+ ◄——► visited places	YES	YES
COLLATERALS •Spouse(s)	◄——►	◄- - -►	YES	YES
•Siblings	-	◄- - -►	YES	YES
DESCENDANT RELATIVES •ego's children	-	◄- - -►	YES	YES
•Spouse(s)'s children	-	-	-	YES
•Grand children	-	-	-	YES

Complete history, all locations: ◄——►
Partially reconstructed history: ◄- - -►

The *Biographies et entourage* survey conducted by INED in 2001, collected 2,830 life histories of individuals' contact circles (*entourage*). Family, residential and occupational event histories along four generations were recorded through interviews with people born

between 1930 and 1950 and living in the Paris region (Lelièvre, Vivier, 2001). For our study, this unique life event history data set provides information on a large number of different places for the respondent and his/her family members all along the life course (Table 1), such as all places of residence and work, birth places, residences of the respondent's contact circle members and other varied locations (boarding school, holiday home, week-end residence...). This allows to describe a large range of different life spaces using:

- Family locations such as the places of birth, the places of residence of the respondent's parents, children, siblings and spouse's parents;
- Everyday life locations, such as the places of residence and the places of work of the respondent and her/his spouse;
- Chosen locations, i.e. second homes and other locations visited regularly.

In this way, we cover simplified but comprehensive territories combining various types of location which reveal a wide variety of the respondent's spatial practices. This allows us to explore different methodological approaches as they present various challenges.

Life spaces: empirical propositions

Different types of life space can be defined for the purpose of measuring the portion of people's territory to which they relate or belong, with which they interact at particular moments or throughout their life. In this choice of potential reference territories, we thus propose to explore four of them:

-the ***territory of origin*** which describes *"where we come from"* comprising the six places of birth of the parents and grand-parents;

-the ***childhood reference space*** where individuals spent their early social life: *"where we grew up"* comprising all the places of residence where the respondents lived before the age of 14.

-the ***life space at the time of the survey*** *"constructed with all the places with which individuals are interacting simultaneously, directly or through the people who live there"*. This combines locations where people conduct daily activities (residence, work), which they visit (week-end, holiday residences) and places of residence of their parents, children and other family members.

-Finally, the ***couple's activity space,*** comprising the places of residence and work of both members of a couple, will here serve to explore the dynamics of life spaces. For that purpose, all places of residence and work of the respondents and their spouse are necessary (Massot, 1998).

The two reference spaces (territory of origin and childhood reference space) have been well identified and derive from qualitative sociological studies (Gotman, 1999; Bonvalet et al., 2007). The life space at the time of the survey is an empirical example of the conceptual life space presented by Courgeau (1988), and the activity space is a simplified parsimonious territory which allows a first approach to the dynamics of life spaces.

These four types of life space present different challenges for their description and statistical measurement (Lelièvre, Robette, 2005). The territory of origin is a memory space which does not necessary involve visits. The childhood reference space comprises a succession of locations and opens the question of how to model a territory made up of locations and durations. The life spaces defined here at the time of the survey combine locations of different natures, where people have different activities and various ties. Finally, with the *Biographies et entourage* survey providing information on the entire residential and occupational histories

of the respondents and their partners, we will attempt to model the dynamics of this territory which comprises a maximum of three locations and a minimum of one and evolves over the couple's shared life course.

To describe the individuals' life spaces and synthesize their main characteristics, different dimensions may be considered.
The first aspect to consider is the life space size, which can be represented by the number of distinct locations of the life space and its composition: each life space comprises different types of location (place of residence, place of work, residence of a family member...). Another important aspect is the dispersion of the life space locations, for which several options can be envisaged: while the spatial distribution of all the locations indicates its territorial extent, the dispersion of the locations around the respondent's place of residence indicates its degree of centrality within the life space, bearing in mind that the territories between these locations are not necessarily known or visited. The combination of these characteristics provides an initial description of the life space. The answers to the following questions depend on how each territory is designed: are the locations concentrated in a simple geographical area or are they dispersed? How do they vary among the members of the study population? Is the respondent's place of residence the center of gravity of his/her life space or is it isolated at the edge of the space?
Therefore we will successively examine the four territories which present increasing levels of complexity, in order to point at the difficulties. Obviously, the different methods can be generalized to describe the different types of life spaces, even though we proceed gradually.

1. The territory of origin

We are dealing here with a sentimental territory which does not necessary involve physical presence: *the place of origin, the place where we come from.* But its role is important if not crucial for understanding people's migration strategies all along the life course, especially so at the time of retirement (Warnes, 1993; Cribier, 1999).
Comprising the places of birth of parents and grand parents, its theoretical maximum size is six locations. Empirically, for data collected in a survey, two practical hurdles are encountered in terms of data availability: the difficulties certain individuals may have in naming those six places, and the variable in the geographical precision of the location given. In the *Biographies et entourage* survey, more than three-quarters of the respondents were able to give full information on the locations of their origin, with a geographical precision which ranges from the *département*[1] to the region. For residents of the Paris region born from the 1930s to the 1950s (survey respondents), 48.5% of their territories of origin are confined to one region only, with a further 10% having all places except one in a single region. A division along family branches appears for the others, with 14% of these territories divided spatially into a maternal *versus* paternal region. The *Biographies et entourage* survey respondents are characterized by their specific migration profile, as they "came to the capital" *en masse,* a fact that explains the quite varied types of origin described here for these generations.

2. The childhood reference space

The childhood reference space is a complex territory, a portion of residential trajectory comprising all the places of residence where the respondents have lived before the age of 14[2], whose influence on later mobility is strong and diverse (Courgeau, 1985). The challenge is to combine the varying number of geographical locations with the time spent in each place and

[1] the equivalent of a county.
[2] 14 was the minimum legal age for working for the generations of *Biographies et entourage*.

the number of moves (several residences can be located in the same municipality). Table 2 presents a tentative typology built on the combination of these three indicators expressed in the detailed geographical precision of the municipally. It shows a complex picture. Empirically for the *Biographies et entourage* survey respondents, 52% of their childhood reference spaces are situated in one municipality only, 90% of respondents have lived more than 8 years in the same municipality and 39% have moved within the same municipality (Table 2).

Table 2 : A proposed typology for childhood reference spaces

	Number of intra-municipal moves (*Difference between the number of dwellings and the number of municipalities*)			
Number of distinct municipalities	0	1	2 +	*Whatever the difference*
One only	*33.8*	*13.8*	*4.7*	*52.3*
Two	*16.5*	*8.3*	*3.4*	*28.2*
Three and more ≥ 8 years in 1 location	*5.4*	*3.2*	*1.5*	*10.1*
When there is a dominant location	***55,8***	***28,3***	***9,5***	***90,6***
Three and more, all periods < 8 years	*5.2*	*2.9*	*1.3*	*9.4*
Whatever the nb of municipalities	***60.9***	***28.3***	***10.8***	***100.00***

Source : Biographies et entourage survey *(2001).*

3. The life space at any point in time

This third type of life space examined here derives from the proposition to take into account at a particular point in time – in this case of the survey - the respondents'place of residence and place of work (in reference to the notion of ***activity space***), plus the respondents' parents' place of residence, their children's and sibs' places of residence i.e. their network space *(*in reference to the notion of ***social place)*** and some components of the space with which people identify, i.e. holiday places and others important places quoted by the respondents *(*in reference to the notion of ***awareness space)***. In the empirical application to the *Biographies et entourage* survey data, as we model the life space at the time of the survey only 49% of repondents work. This highlights the fact that our aim at this stage is primarily to use the data to test the methodology rather than to provide results for this particular sample. Figure 1 presents the locations of one respondent's life space an initial idea of the degree of variability across the sample.

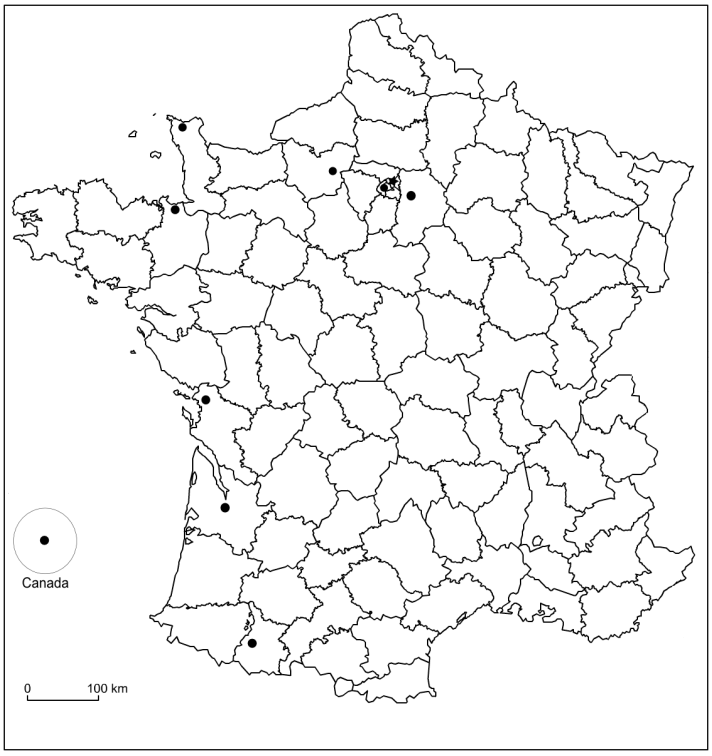

Figure 1 : The locations in Marianne's life space (an example from *Biographies et entourage*)

Marianne works and lives in Paris (with her husband). Her elder son lives in Saint-Malo (Ille-et-Vilaine). Her other son lives in Bordeaux (Gironde), her daughter in Canada. Her brother lives in the Paris region further away, her mother in La Rochelle (Charentes-Maritime) and mother in law in Lourdes (Hautes-Pyrénées). She also owns a holiday residence near Cherbourg (Manche).

The dimensions to be measured

The first dimension is the **number of different locations**[3] which here, by design, are contingent upon the size of the respondents' contact circle (a Pearson coefficient between the two is always significant).

The second measures the **composition** of the life space. For the survey respondents, half of the locations of their life space at the time of the survey correspond to the residences of their siblings and children. Obviously, some kind of weighting should be introduced reflecting the visits to the different locations of the life space, an item of information available in the survey.

A third dimension is the **polarization** of the life space, taking the place of residence as its "centre". To measure this, the distances between all locations are needed. They are computed here from their geographical coordinates, but other measures such as the traveling distance from one another could be a better proxy.

A fourth dimension is its **shape** but (i) the relations between the locations taken two by two are irrelevant, (ii) we have already observed that the significance of this territory lies less in its surface or in its perimeter and than in the relations between the respondents' place of residence and the different locations.

[3] Which can differ from the number of different places according to the geographical precision with which the places are located but we will not elaborate on this here when we could work with the municipality level of precision given in the data.

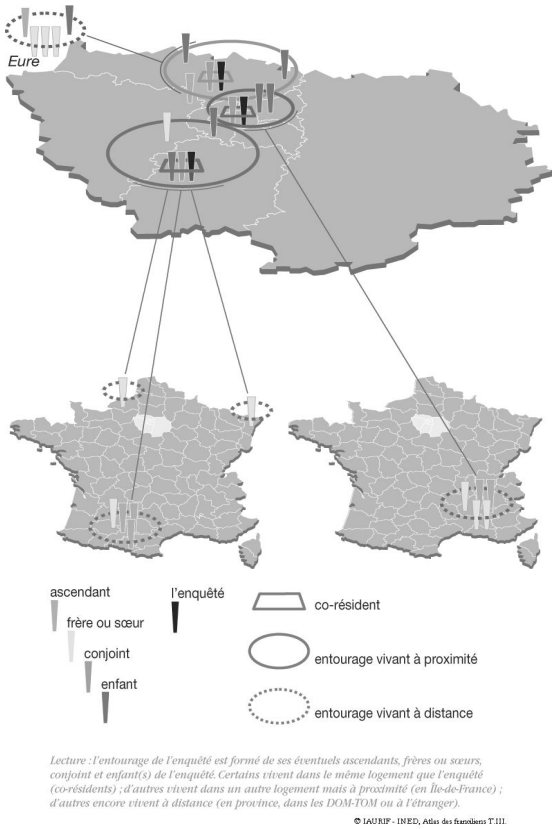

Figure 2 : Three territorial location of respondents' *entourage*
Source: *Biographies et entourage* survey

When represented on a map (Figure 2), the locations of the members of three different family networks (Lelièvre and Imbert, 2002), the distances between them and the accumulation of locations gives us this kind of representation, which delimits portions of the life spaces, here with a substitution of distance for concentration, i.e. there is a circle when concentration is high and distance short as well as when there is only one distant location (see Figure 2). Two questions arise:

✓should distance and concentration criteria be strictly cumulated to define a **hub**? The distance prevails in Figure 2;

✓can we consistently describe life spaces without hubs?

We can empirically classify both criteria:
1)the first step, using a Hierarchical Cluster Analysis on the spatial coordinates of all locations of each respondent's current life space, identifies clusters made up of locations according to their relative distance with respect to the total dispersion of each life space;
2)the second step aggregates clusters or isolated locations if the distance to the respondent's residence is smaller than a chosen threshold;
3)the third selects the clusters as hubs on a criteria which can either be concentration of locations, composition of the cluster, frequency of visits, etc. according to the data available and the research question.

The threshold is set taking into account the specificity of the sample. Here all clusters/ locations situated less than 50 km around the place of residence are grouped, characterizing the average distance between the centre of Paris and the outskirts of the region. And, for the sake of the demonstration, a concentration criteria of a minimum of three locations was chosen to define a hub.

Empirical testing: structuring the life space

Applied to the whole sample of the *Biographies et entourage* survey, the cluster analysis of individuals life spaces at the time of the survey (with 98% of heterogeneity explained) produces clusters, some of which are then merged when subjected to the distance criteria. The clusters obtained contain few locations: nearly two thirds (63%) comprise only one or two locations. The number of clusters per individual life space is also limited: 67% have less than four clusters. The criteria of a minimum of three locations to qualify as a hub is then finally applied, giving a typology of life spaces characterized by their hubs and satellites (isolated and distant locations in the territory). Table 3 presents the resulting distribution: only one-fifth of life spaces comprise more than two hubs.

Table 3 : Distribution of current life space of individuals by number of hubs

Nbr of hubs per life space	***Percentage***	***Cumulated Percentage***
0	14,6	14,6
1	64,0	78,6
2	20,1	98,7
3 and more	1,3	100,0

Source : Biographies et entourage survey *(2001).*

Let's illustrate this process with an example. Guillaume's life space (Figure 3) is made up of 10 locations which the Hierarchical Cluster Analysis consolidates into 5 clusters (dotted contour lines) grouping respectively:
-Guillaume's residence and work places and his son's place of residence,
-both his parents' places of residence,
-his daughter's place of residence,
-his brother's place of residence
-his sisters' places of residence,

Then all places in a radius of less than 50 km from the respondent's place of residence, are aggregated to the cluster containing the place of residence *(dashed contour line)*. So we have 4 clusters left.
Lastly, only the clusters containing at least 3 different locations are qualified as hubs: this life space contains 2 distant hubs *(continuous lines)* and 2 residual locations.

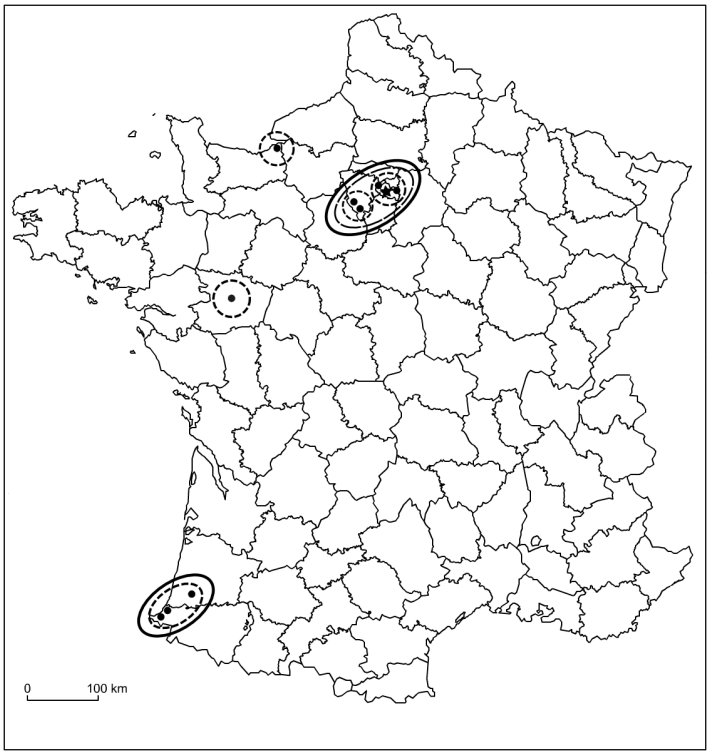

Figure 3 : The locations, clusters and hubs in Guillaume's life space (an example from *Biographies et entourage*)

Guillaume lives in a close suburb of Paris (Val-de-Marne), as does his son. He works in another suburb (Hauts-de-Seine) –all these locations are situated in the Paris region. His daughter lives in the Loire, his brother in Honfleur (Normandy), and his parents (separated) in Angers (Maine-et-Loire) His three sisters in Saint-Jean-de-Luz, Biarritz (Pyrénées Atlantiques) and Dax (Landes) in the South West of France.

Empirical testing: introducing characteristics

The next step considers the nature of the composition of the life spaces, by studying the nature of the locations forming the hubs, those where the respondent lives and the others, as well as the residual locations.

For the total sample (2,830 respondents, hence life spaces), with the additional distinction that the respondent's place of residence belongs in a hub or not, we get the following typology:

- 55% have a life space with one hub where they reside
- 21% have a life space with multiple hubs.
- 15% of the respondents have a life space without hubs,
- 9% have a life space with one hub where they don't reside.

Yet this analysis is distorted by the heterogeneity of the family network size and the different propensity of each type of location to be grouped. The respondents' place of work and the place of residence of their children have a greater than one-in-two chance of being in the hub where the respondent lives, while second homes and other visited places have a more than fifty percent chance of standing as a residual location.

Life space has just been examined as a static entity, observed at a precise moment, the time of the survey. But it is also a component of a history, which evolves along the life course: it is a dynamic entity. This link between space and time can be highlighted by comparing the current life space with locations tied to other periods of the life course, past or future.

First, we can explore the link between the current life space and a reference space of the past, i.e. the territory of family origins, defined by the birth places of the parents and grand-parents. More than fifty per cent of current life spaces encompass at least one birth place of an ascendant, whatever their structure. This denotes a strong tie, even though we are dealing with the specific *Biographies et entourage* sample drawn in the Paris region and where six out of ten respondents were themselves born outside the region. This place of origin belongs preferentially in a hub and considering that 58% of the territories of family origins are grouped in the same region (section 1.), it shows its strength as the respondents' reference space.

Second, we can test the influence of the current life space on future residential moves by examining the respondents' wish to move and the anticipated place of destination. Those who intend to move (36% of the respondents) are not randomly distributed across the life space configuration (Table 4). Indeed, only 19% of the respondents with unstructured current life space intend to move, whereas the proportion is 31% among those who live off-centred. A closer look shows that the number of hubs in the life space is not discriminating in the intention to move. Comparing desired destinations and the locations of current life spaces hubs, we observe that 36% of those whose residence is off-centred and who intend to move quote a destination located within the hub, suggesting that hubs are a potential destination.

Table 4 : Intended destination of the next move and current life space of individuals

	Intend to move (%)	
Type of life space	***Yes***	***Probably***
with one hub containing respondent's place of residence	22,5	14,1
with multiple hubs	25,8	15,7
without hubs	19,1	14,1
with one hub which does not contain respondent's residence	31,2	16,2

Source : Biographies et entourage survey *(2001).*

The structuring of current life space locations into hubs and webs of places, constitutes a new tool to be perfected. It enables us to introduce the description of life spaces, summarizing their size, composition, location, in a simplified but still precise manner. Rapid exploration confirms that the current life space determined by past inherited locations is also a determinant of future mobility, and consequently of the future life space.

4.The couples' activity space

The couples' activity space, which refers to "the radius within which the two members of a couple conduct their activities", is approached here through a maximum of three locations corresponding to their place of residence and place(s) of work (Clark, Kuijpers-Linde, 1996).
At the time of the survey, 78% of the respondents aged 50-70 lived in a couple. There is therefore information in the data set for 2,222 couples. These couples have different occupational profiles: in 29% of them both partners are inactive while in 37% both are working. The remaining ones, not surprisingly, count more couples where the male partner works and not his spouse (20.5%) than the reverse (13.5%).

The territories covered by the activity spaces of the surveyed couples are of various sizes, depending on the number and the distance between the different locations. When only one partner works (a third of the couples at the time of the survey), whatever the distance indicator, women consistently work closer to home (Table 5).

Table 5: Distances between the residence and work places of couple members at the time of the survey when only one of them works

	same département (%)	*same commune (%)*	*median distance (km)*	*mean distance (km)*
The man works	45,9	14,5	9,4	65,2
The woman works	60,4	25,6	4,9	46,2

Source : Biographies et entourage survey *(2001).*

In the case of bi-active couples (37% of respondents) Table 6 describes the distribution of the three locations, and whether the residence and work places are situated in the same *département* or even in the same municipality.
As observed before, 20% of the activity spaces are confined to the same municipality (*commune*), while 14% extend over three *départements*. Distances vary greatly from one extreme to the other. When the activity space covers two locations (39% of dual earners activity spaces extend over two *communes*), in more than half (54%) of the cases it is the couple's home and the woman's place of work which are the closest (Camstra, 1996; Genay, 1992).

Table 6: Spatial dispersion of the activity space at different geographical scales when both partners work

	département	*commune*
In the same location	37	20
In two different locations	48	39
In three different locations	14	41
Total	*100%*	*100%*

Corresponding locations	*commune (%)*
Home + Man's Workplace	22
Home + Woman's Workplace	**54**
Woman's + Man's Workplace	24

Source: Biographies et entourage, 2001, INED.

A rapid logistic regression of the respondents characteristics on the fact that both the home and the place of work are in the same *département* or *commune* shows (Table 7) that the distances between the home and both partners' work places depend not only on gender but also on other factors. The self-employed work closest to their home, while those in higher level occupations work further away from home. Having a suburban home means longer distances to work. Still having children at home also significantly affects the size of the activity space and favors smaller distances to work.

Table 7: Logistic regression of the location of the home and place of work in the same *department* or *commune*

	...same département	*...same commune*
Sex		
man	ref	ref
woman	1.900***	1.618***
Occupation		
self employed	3.574***	5.414***
Higher level occupations	ref	ref
Intermediate occupation	ns	ns
Clerical and sales workers	1.377**	1.985***
manual workers	1.776***	1.385*
Place of residence		
Paris	ref	ref
inner suburbs	0.378***	0.096***
outer suburbs	0.513***	0.121***
Children in the home		
none	ref	ref
At least one	1.219**	1.226**
Spouse		
working	ns	ns
Not working	ref	ref
N=working member of a couple at the time of the survey	*2183*	*2183*
-2 Log L	2852	2267

Data: Biographies et entourage, 2001, INED.

Changes in the couple's activity space

From the beginning of the union to the time of the survey, a couple's activity space evolves. Distances from home to work change over time, the number of locations in the activity space changes over time, the duration in each stage varies, the characteristics of the couple (occupation, children, etc….) also. All these dimensions can be modelled, typologies established and analyzed.

At the start of the process i.e. the beginning of their union, a majority of the respondents belong to working couples, 7 out of 10 were both working and in only 2 out of 10 the man was the sole earner (Table 8). At the time of the survey, aged between 50 and 70 years old, some of the respondents and/or their partners are now retired which translates into more couples where both partners are inactive and more where only the woman still works.

Table 8: Couples' activity status over time

	At the beginning of the union	*at the time of the survey*
Both partners inactive	1,5	10,5
man working	21,3	32,4
women working	6,5	18,3
Both partners working	70,7	38,8
Total	*100,0*	*100,0*

Data: Biographies et entourage, 2001, INED.

This evolution implies transitions all along the union life course. Several types of transition can be identified taking into account the changes in any of the three locations (place of residence, respondent's place of work, his/her partner's place of work). The existing work places (i) remain unchanged, (ii) change location or (iii) disappear; they alternatively (iv) appear or (v) remain unchanged. Five times five possibilities exist when both partners' work careers are combined. The place of residence either changes or does not, giving 25 times two types of transitions with a resulting 50 transitions between time *t* and *t+1*. Appendix A presents the most frequent transitions observed for the 2,222 respondents, aged 50-70, living in a couple at the time of the survey. Although 5 types of transitions reflect more than half of all observed transitions and 9 types capture more than three quarters, the range is nevertheless broad.

As we need to introduce a distance indicator into the different situations along the union, especially if we are to anticipate destinations in a migration analysis, a more appropriate way to examine change is to consider the following configurations of the activity spaces at any point in time. By cross-matching the activity or inactivity of each spouse and a proximity index (locations in the same *communes* or not), ten situations are identified (Table 9) with their associated transitions.

Table 9: Configurations of couples' activity spaces

nb of locations	man working	woman working	nb of distinct *communes*	R= home Mw= Man's Ww= Woman's place of work
1	No	No	1	-
2	Yes	No	1	R = Mw
2	Yes	No	2	R ≠ Mw
2	No	Yes	1	R = Ww
2	No	Yes	2	R ≠ Ww
3	Yes	Yes	1	R = Mw = Ww
3	Yes	Yes	2	R = Mw
3	Yes	Yes	2	R = Ww
3	Yes	Yes	2	Mw = Ww
3	Yes	Yes	3	all ≠

The mean number of transitions during the union is 2.55, and the use of a holistic approach to describe the whole history of the couple's activity spaces over time seems appropriate.

A typology of couples' activity spaces

To do so, several methods are available. The most common one, Optimal Matching Analysis (OMA), consists in representing the trajectories as sequences and computing divergences between these sequences (Abbott, 1995). It has often been used in works dealing with occupational or 'class careers' (Abbott, Hrycak, 1990; Halpin, Chan, 1998; Blair-Loy, 1999), but also with housing careers or residential trajectories (Clark et al., 2003; Stovel, Bolan, 2004).

However, the duration of couples' histories in our sample varies greatly: from less than a year to 53 years with a median value of 31 years. And yet while OMA can theoretically deal with trajectories of variable durations, it remains relatively complex to implement and it has seldom been tested (Stovel et al., 1996). Secondly, in the tradition of French Data Analysis, upon which we already relied to describe the life spaces at the time of the survey, Qualitative

Harmonic Analysis (QHA) offers an alternative method. It was developed at the beginning of the 1980's (Deville and Saporta, 1980) and then applied in the 1990's (Degenne, Lebeaux, Mounier, 1995; Barbary, Pinzon Sarmiento, 1998).
The analysis principle consists in splitting the trajectory into periods and, for each individual, measuring the proportion of time spent in each situation per period**.** The matrix thus computed is then submitted to a Correspondance Factor Analysis and a clustering method is used to construct a typology of trajectories (Robette, Thibault, 2007).

Having identified ten configurations of the activity space (Table 9), we chose to concentrate on couples living together for at least 5 years, as a shorter duration would not contribute much in terms of the evolution of the couple's activity space[4]. The sample is finally made of 2,109 couples. The couples' activity space trajectories are here split into 5 periods of equal range[5]. For each of these 5 periods, the proportion of the period duration spent in any of the identified configurations are computed for each couple: the matrix size is 5x10=50 elements.

These matrix elements are then submitted to a Correspondence Factor Analysis followed by a Hierarchical Cluster Analysis to obtain a typology. Six clusters are presented in Table 10. They were determined so that each cluster grouped at least a hundred trajectories. The classification procedure groups likely trajectories on the basis of the duration spent in one situation, here each of the clusters is characterized by a situation which lasted on average between 59% and 74% (Appendix B) of the total duration of the union (it might have been interrupted). This situation appears in Table 10 labelled as '*mainly'*. Other configurations of the activity space during the union lasted less than 18% of its total length even though more than half of the cluster trajectories present this configuration at one point during the union. Another clue to the diversity of the trajectories is the fact that between 1.21 and 1.41 episodes correspond to the main situation, which confirms that it was interrupted (Appendix C).

Table 10: Six types of couples' activity space trajectories

Cluster	Profiles Main Characteristics		Number of couples	%	Intra-cluster inertia*
	Mostly	*with mainly*			
6	*Bi-active couples*	*Three distinct locations*	843	40,0%	0,50
1	*Woman inactive*	*Man **not** working in the commune of residence*	647	30,7%	0,90
2	*Bi-active couples*	*Woman working in the commune of residence*	263	12,5%	0,44
4	*Bi-active couples*	*Spouses working in the commune of residence*	146	6,9%	0,11
3	*Bi-active couples*	*Spouses working in the same commune*	106	5,0%	0,08
5	*Bi-active couples*	*Man working in the commune of residence*	103	4,9%	0,09

*the larger the inertia the wider the intra-cluster dispersion.

The two main profiles (cluster 1 and 6), which represents 71% of the trajectories, correspond to two earners *versus* man sole earner couples' activity spaces in which the three/two places are located in distinct *communes* and they are very heterogeneous clusters: a large proportion of men retire before the time of the survey, the proximity of work places to the residence varies and some men have periods of inactivity.

The third cluster (n°2) groups 12.5% of the trajectories, representing bi-active couples where women work closer to home. An important number of the men of this cluster retire before the

[4] We also excluded the few couples for whom the year of the beginning of the relationship is unknown (0,5%) or those with imprecise locations (1%).

[5] The chosen number of periods represent a compromise between a relevant synthesis of the data and a sufficient degree of precision. The variable durations of the respondents' unions between 5 and 53 years led to the choice of 5 periods allowing the shorter trajectories to be distributed across all the periods.

time of the survey.

The last three clusters comprise respectively bi-active couples in which both spouses work in their *commune* of residence (6,9%), spouses work in the same *commune* (5%) and men work in their *commune* of residence (4,9%). These are the most homogeneous clusters.

Looking at the variations in cluster homogeneity over time, by calculating an entropy index, we can see that the clusters are more homogeneous in the middle of the couples' histories (see Appendix C). Situations are more diverse at the end of trajectories, mainly because of retirement and, above all, at the beginning of couples' histories, probably owing to the birth of children and to the necessary adaptation period when starting a relationship.

Finally, when we rapidly examine some attributes of the different clusters (Appendix B), such as the location of the couple's residence at the beginning of the union, their residential mobility, the proportion of older couple members and the number of their children, a clear distinction emerges between the older couples where the man is the breadwinner (cluster 1), migrants to the Paris region from abroad or the provinces and with a larger number of children; and cluster 3, dual-earners from the Paris region, who have seldom moved and have fewer than two children on average.

Most couples in their reproductive lives are faced with residential choices which are in part influenced by their family and occupational choices. Whether both couple members work outside their home, or only one of them, whether they have children or not, the territory defined by their place(s) of residence and place(s) of work results from an equation in terms of gender roles, distances, career strategy, etc…

Conclusion

We have given here a detailed overview of different methodologies that can be used to describe, and measure the territories to which individuals relate over time. Revisiting types of territories identified in previous geographical, sociological or demographical studies, has provided the opportunity to explore different aspects of the measurements which were then tested on the rich data collected by the *Biographies et entourage* survey.

Four reference territories were presented: the ***territory of origin*** *"where people come from"* summed up by the six places of birth of their parents and grand-parents; the ***childhood reference space*** "*where people grew up"* consisting of a portion of residential history before the age of 14*;* the ***life space at the time of the survey*** combining different types of locations (residence, work, residence of family members, places visited regularly, etc.) and finally, the ***couple's activity space*** comprising the locations of residence and work of both members of a couple. Each calls for a different methodological approach as they each present varied challenges.

Relying on data analysis techniques, we suggest indicators and ways of building relevant typologies. They now need to be more thoroughly applied than is the case for the rapid tests performed here in order to validate their robustness.

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Appendix A - Most Frequent Transitions in the evolution of couples' activity spaces

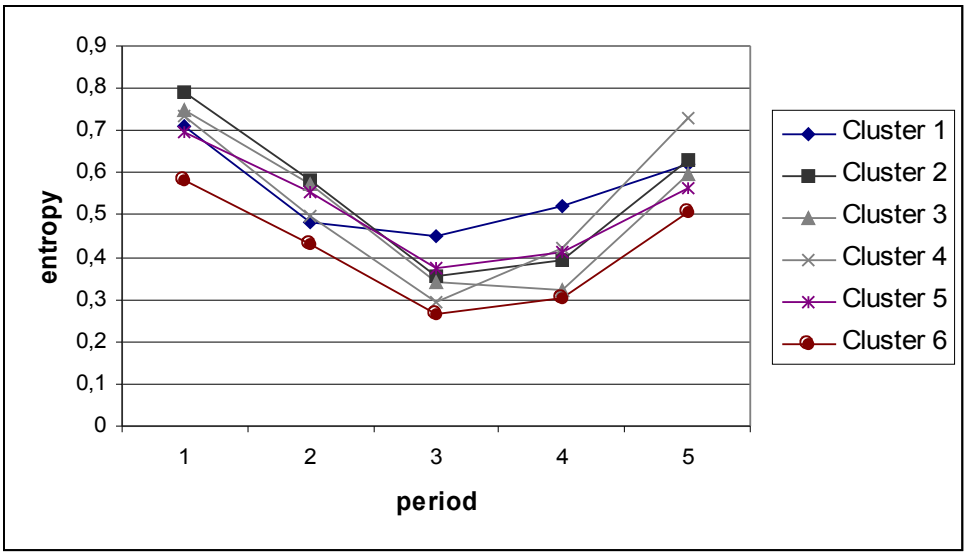
Residential move	**Men's workplace**	**women's workplace**		**Frequency**	**Percent**	**Cumulative percent**
no change	**change**	*no change*		1541	14,8	14,8
no change	*no change*	**change**		1146	11,0	25,8
change	*no change*	*no change*		1074	10,3	36,1
no change	*no change*	Exit		933	9,0	45,1
change	*no change*	*no activity*		798	7,7	**52,8**
no change	*no change*	Re-entry		701	6,7	59,5
no change	**change**	*no activity*		679	6,5	66,1
change	**change**	*no activity*		498	4,8	70,8
no change	Exit	*no change*		490	4,7	**75,6**
				10,405		100 %

Data: Biographies et entourage, 2001, INED. 2,222 respondents living in a couple at the time of the survey.

Appendix B – Clusters description

Cluster		Total	1	2	3	4	5	6
N		2108	647	263	106	146	103	843
Duration spent in (proportion)								
1 location	-	0,03	0,07	0,01	0,01	0,01	0,01	0,01
2 locations	R = Mw	0,07	0,18	0,02	0,02	0,07	0,04	0,01
2 locations	R ≠ Mw	0,24	**0,59**	0,11	0,10	0,04	0,02	0,08
2 locations	R = Ww	0,02	0,01	0,08	0,00	0,04	0,01	0,00
2 locations	R ≠ Ww	0,04	0,01	0,02	0,03	0,02	0,03	0,07
3 locations	R = Mw = Ww	0,06	0,02	0,03	0,05	**0,66**	0,04	0,01
3 locations	R = Mw	0,05	0,01	0,01	0,01	0,04	**0,62**	0,02
3 locations	R = Ww	0,10	0,03	**0,60**	0,01	0,05	0,02	0,03
3 locations	Mw = Ww	0,05	0,01	0,01	**0,64**	0,03	0,01	0,02
3 locations	all ≠	0,35	0,08	0,12	0,10	0,05	0,16	**0,74**
At least one episode in state (proportion)								
1 location	-	0,15	0,33	0,07	0,09	0,08	0,07	0,06
2 locations	R = Mw	0,24	0,50	0,11	0,11	0,38	0,29	0,06
2 locations	R ≠ Mw	0,57	**0,93**	0,54	0,47	0,23	0,17	0,42
2 locations	R = Ww	0,09	0,06	0,31	0,04	0,23	0,04	0,03
2 locations	R ≠ Ww	0,21	0,11	0,13	0,25	0,13	0,22	0,33
3 locations	R = Mw = Ww	0,19	0,12	0,19	0,29	**1,00**	0,26	0,09
3 locations	R = Mw	0,18	0,10	0,11	0,09	0,32	**1,00**	0,15
3 locations	R = Ww	0,31	0,21	**0,97**	0,14	0,30	0,12	0,23
3 locations	Mw = Ww	0,17	0,09	0,09	**1,00**	0,16	0,11	0,16
3 locations	all ≠	0,67	0,41	0,56	0,48	0,36	0,63	**0,99**
Number of episodes in state								
1 location	-	0,17	0,39	0,08	0,09	0,08	0,09	0,06
2 locations	R = Mw	0,30	0,65	0,13	0,13	0,43	0,36	0,06
2 locations	R ≠ Mw	0,78	**1,34**	0,73	0,62	0,26	0,20	0,55
2 locations	R = Ww	0,10	0,06	0,37	0,04	0,24	0,04	0,04
2 locations	R ≠ Ww	0,24	0,11	0,15	0,26	0,15	0,27	0,38
3 locations	R = Mw = Ww	0,24	0,15	0,22	0,32	**1,33**	0,32	0,11
3 locations	R = Mw	0,21	0,11	0,12	0,09	0,38	**1,32**	0,17
3 locations	R = Ww	0,40	0,25	**1,36**	0,15	0,39	0,15	0,27
3 locations	Mw = Ww	0,19	0,09	0,10	**1,21**	0,18	0,11	0,17
3 locations	all ≠	0,93	0,53	0,79	0,64	0,41	0,82	**1,41**
Total number of episodes		3,55	3,68	4,04	3,57	3,86	3,67	3,23
Total number of transitions		2,55	2,68	3,04	2,57	2,86	2,67	2,23
Residence at the beginning of the union								
Paris region		0,80	0,71	0,79	0,89	0,72	0,81	0,87
province		0,11	0,15	0,12	0,05	0,12	0,10	0,08
abroad		0,09	0,13	0,08	0,07	0,15	0,10	0,04
Total number of moves		1,74	2,21	1,64	1,50	1,33	1,54	1,53
proportion >=60 years old								
men		0,46	0,55	0,44	0,45	0,47	0,36	0,40
women		0,33	0,40	0,33	0,36	0,34	0,29	0,27
Number of children		2,07	2,81	1,96	1,73	2,01	1,75	1,63

Appendix C – Entropy index of the clusters of couples' activity space trajectories:



Summary :
Migration is usually studied as a simple change of residence. However, the fact that individuals interact with a large number of different locations throughout their life, their activities or their social network, and that these places shape their mobility is undisputed. Theoretical definitions of these territories can be found in the literature, but empirical research is scarcer due to the lack of quantitative information. In this article we present different methodological proposals to describe and measure the territories to which individuals relate over time, taking advantage of a rich data source, the *Biographies et entourage* survey.
We successively examine four territories which present increasing levels of complexity, and proceed gradually, starting with static territories such as the territory of origin, the childhood reference space, the life space at one point in time. We then proceed to tackle the dynamics of a specific territory: the 'activity space' of a couple defined as the territory covered by their place(s) of residence and place(s) of work since the beginning of their union. Using Data Analysis such as Hierarchical Cluster Analysis (HCA) and Qualitative Harmonic Analysis (QHA), we set a framework for describing the structure of life spaces at one point in time and for exploring typologies of their evolution over time.