ERC Consolidator Grant 2021
Part B2[1]

Section a. State-of-the-art and objectives

Spatial mobility (also referred to as *mobility* from here on) – defined as movement of individuals in geographic space that involves changes of primary place of residence – is an important instrument for regulating the housing and labour markets. Consequently, there is wide agreement among academics and policy-makers in the importance of understanding the individual-level factors and mechanisms supporting spatial mobility. For individuals, spatial mobility has traditionally been considered a way to adjust housing and location needs in relation to life transitions in family (e.g. larger housing in a child-friendly environment before the birth of a child) and career (e.g. the reduction of commuting distance when finding a job elsewhere) that are typical of each life cycle stage (Mulder and Hooimeijer 1999; Vidal and Huinink 2019). Such a view of linear progression over the life course is, however, increasingly contested. Sets of **more diverse and complex life pathways are emerging, in relation to growing social inequalities, that research on spatial mobility has only recently started to address** (Coulter et al. 2016; Bailey 2009; Aybek et al. 2015). For example, increasing difficulties to achieve owner-occupancy has led research to examine the more diverse housing pathways among young adults (Clapham et al. 2014). Similarly, research has addressed frequent relocation as a response to increased demands for job mobility, particularly among skilled workers (Schneider and Collet 2010), but also due to an inability to achieve residential stability, which is reflected in more and more young (and not-so-young) adults by circulating across dwellings and moving in and out of the parental home (Newman 2012). Clearly, our understanding of spatial mobility requires further scrutiny of the antecedents and mechanisms that set individuals into largely diverging pathways.

The growing socio-economic disparities across households are affecting children's resources and how they experience mobility. Spatial mobility, which is stressful and disruptive for children, often has a serious negative impact on cognitive, behavioural, and health outcomes for children, particularly among those from disadvantaged origins (Voight et al. 2012; Schmitt and Lipscomb 2016). However, spatial mobility does not always have negative consequences for children's development (Coley and Kull 2016; Swanson and Schneider 1999), and experiences that are deemed positive may contribute to building important resources and skills to support future mobility (Myers 1999; Bernard and Vidal 2020). Yet the extent to which such contrasting mobility experiences in childhood contribute to diversity in life paths and stratified outcomes in adulthood is yet to be set. **Paradoxically, there is no cross-fertilization between the voluminous bodies of research that study spatial mobility in childhood and in adulthood separately**. This limits our ability to understand how mobile (and immobile) childhoods shape life chances and outcomes in later life stages. Significantly, this overlooks well-established findings in family, occupational, and health research on the significant role of childhood experiences for later life outcomes (Hertzman 1999; Beller and Hout 2006; McLanahan 2004). Clearly there is a need to re-examine spatial mobility accounting for early life experiences.

LIFELONGMOVE is the first project to comprehensively and systematically examine spatial mobility from an early age into adulthood (or lifelong mobility). The project brings together and integrates separate bodies of research of spatial mobility in childhood and adulthood to provide new insights on the pathways, resources, and strategies that underlie lifelong mobility. These insights will lead to a paradigm shift in spatial mobility research and will help formulate alternatives to the conventional explanations of spatial mobility patterns, behaviours, and stratified outcomes over the life course. Along these lines, **LIFELONGMOVE addresses three main innovative objectives**:

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[1] Instructions for completing Part B2 can be found in the '*Information for Applicants to the Starting and Consolidator Grant 2021 Calls*'.

(i) to document the diverse and complex pathways of lifelong mobility (examining long-term trajectories from early childhood into adulthood);

(ii) to establish whether (and how) childhood mobility influence spatial mobility over the life course;

(iii) to document the impacts of lifelong mobility on life conditions, by focusing on socio-economic, family, and health outcomes.

To address these objectives, LIFELONGMOVE takes a new approach – the lifelong mobility perspective – where entire individual biographies, from an early age into adulthood, are the focus of the investigations. **LIFELONGMOVE breaks new ground by examining large-scale longitudinal datasets from integrated registers and panel surveys that recently enabled to follow mobility trajectories from birth into adulthood**, using a series of advanced quantitative methods. Since the major objective of the project is to contribute new insight on lifelong mobility, the key focus is not on a specific country or a comparative cross-country analysis. Country coverage varies according to data availability but it **provides an overview of lifelong mobility in a diverse range of contexts in Europe**.

This project considers both **short-distance moves** (or residential mobility) and **long-distance moves** (or migrations). It recognizes that, often in different ways, these types of moves can have significant consequences on individual life courses, both in childhood and in adulthood, which need further investigation (Pelikh and Kulu 2018; Vidal and Baxter 2018). Since longitudinal data covering the lives of international migrants is rare (Vidal and Lersch, *forthcoming*), our focus is mainly on moves within national borders. In substantive term, international mobility is uncommon, where only 3.5% of the world population qualified as international migrants in 2019 (International Organization for Migration 2019). With regards to the life stages, research has often made the distinction between childhood and adulthood based on legal definitions on the age of majority, most often age 18. **The role of mobility in critical developmental ages in childhood and adolescence will also be addressed**. The project also will **examine adult outcomes that are specific in the stages of early-, middle-, and late-adulthood**.

A lifelong mobility perspective

Typically, an individual's prior mobility has not played a prominent role for micro-level perspectives in spatial mobility research, from a range of social science disciplines (Bernard and Vidal 2020). Extant theorisations are based on overly simplified premises, where past mobility furthers future mobility, and lack thereof furthers a persistence in place (DaVanzo 1981; Morrison and Clark 2016). Childhood mobility is not even considered a particular type of prior mobility. Despite children are arguably passive actors in mobility decisions, **experiences of mobility (and immobility) in childhood can have a crucial influence in their resources and opportunities**, likely exerting long-lasting impacts in their lives (Anderson et al. 2014; Coley and Kull 2016; Mollborn et al. 2018).

Clearly, a novel perspective is necessary to respond new questions on spatial mobility as processes extending from birth to old age. This is the so-called lifelong mobility perspective, which rests on the central assumption that **the conditions, experiences, and context exposures from early age underlie the rationales, opportunities, and restrictions of mobility behaviour and the outcomes in a later age**. This innovative perspective situates mobility within a wider trajectory, recognizing that **spatial mobility is recursive** since it repeats over individuals' lifetime, **cumulative and self-reinforcing**, where earlier mobility experiences not only influence recent moves, but can also have long-lasting impacts on individuals' lives.

This perspective builds on the notion of the life course as a long-term process, where **the analytical focus is on entire life trajectories** or the sequences of multiple outcomes over an individual's lifetime (Aisenbrey and Fasang 2010). This has been paralleled by recent methodological developments in the analysis of long-term trajectories (Piccarreta and Studer 2019), which are part of the core methodologies used in this project. This enables a more thorough understanding of

diverse and complex life course inter-dependencies based on the examination of sets of key trajectory properties of duration, timing, and order of mobility events and residential episodes. Research has just started to acknowledge that spatial mobility trajectories are a good starting point to examine life course influences (Coulter et al. 2016; Vanhoutte et al. 2017; Vidal and Lutz 2018), but it has limited itself to the study of trajectories in childhood or in adulthood (as an exception: Falkingham et al. 2016).

Additionally, within this perspective, under-researched inter-dependencies between lifelong mobility and life outcomes can be interpreted through the prism of process-based life course mechanisms. The mechanism of **accumulation** suggest that advantages and disadvantages are accumulated over time, where small initial inequalities due to certain events and contexts may become larger inequalities in later stages of life (Dannefer 2003). For example, moving early to and growing up in a deprived area is suggested to set individuals on a path of cumulative disadvantage (Morris et al. 2018; van Ham et al. 2014). The mechanism of **critical periods** suggests that the point (e.g. age stages or life situation) at which an event happens can have relevant implications for later life. For example, moving at the time of school start can be particularly stressful and negatively impact on cognitive and behavioural outcomes (Vidal and Baxter 2018a). The mechanism of **normative sequences** suggests that disruptions to a normatively expected sequence of life transitions undermine individual resources and have a negative impact on life outcomes. Expected sequences of moves in childhood consist of few moves to child-friendly residential areas with better schools. In addition, the lifelong mobility perspective acknowledges that social **selection** shapes mobility trajectories of advantage and disadvantage (Warnes 1986). This builds on research of inter-generational transmission that suggests that the family (and the socio-spatial context) of origin strongly influence children's opportunities in life (McLanahan 2004; Torche 2015). The scrutiny of the role of the contexts of origin and inter-generational transmissions for lifelong mobility is a core challenge of this project.

Adopting a lifelong mobility perspective and inquiring large-scale longitudinal data sources, three sets of scientific challenges, corresponding with the main objectives of the project, will be addressed in the three main project components that are subsequently presented.

Component 1. From early age into adulthood – Mapping lifelong mobility

The first component of LIFELONGMOVE **provides, for first time, a systematic and comprehensive examination of relevant mobility pathways from an early age into adulthood**. Achieving this objective is now possible due to recent availability of adequate data infrastructure, consisting of large longitudinal datasets with detailed lifetime mobility information, and progress in algorithmic methods for the adequate identification of patterns in large-scale or big data. Results from this component will contribute to the formulation of better conceptualizations of lifelong mobility that will enable more accurate interpretations of the causes and consequences of spatial mobility.

Challenge 1: identifying the diversity in lifelong mobility pathways. One central challenge to this project is how to make accurate descriptions of spatial mobility trajectories, and **map the significant diversity in life pathways since an early age** across individuals. Researchers often deploy summary indicators, such as the duration of stay since the last move, or the number of moves within a lifetime or an age range, to assess the role of prior mobility for contemporary mobility. Despite their straightforward interpretations, single summary indicators oversimplify past trajectories and undermine our ability to understand regularities across (multiple) mobility events over individual life courses. For instance, the common finding that past moves positively associate with contemporary moves was recently found to depend on the age stage when individuals move (Bernard and Vidal 2020). Clearly, this calls for a more thorough examination of a range of theoretically and empirically relevant features that collectively contribute to diversity in spatial mobility over the life course. This includes the duration of the residential episodes, the socio-economic and other relevant features of contexts of residence, the frequency and age periods of

moves, the distances moved, and the motivations and life transitions underlying moves (Geist and McManus 2012; Carlson 2013; Sage et al. 2013; Bernard et al. 2016; Coulter et al. 2016).

Challenge 2: documenting continuities and changes in patterns of (dis)advantage. A large body of research examines complex patterns of spatial mobility and immobility that have an important impact on individual's lives, but the knowledge generated is largely specific to life stages in childhood and in adulthood. For example, **hypermobility** or frequent mobility in is an often-studied pattern in childhood, associated with households unable to achieve residential stability and negative impacts in the lives of children (Vogel et al. 2017; Vidal and Baxter 2018a). The extent to which such a pattern is reproduced or dissipates in adulthood is largely unknown, which limits our ability to understand how disadvantage accumulates through mobility. Similarly, **persistence in place** – referred to as long periods of stability in the residential area or region – particularly if involuntary, can also have negative impacts in outcomes. Research on neighbourhood choice has started to address inter-dependencies across life stages, finding that persistence in disadvantaged areas during childhood is reproduced in later life stages (Sharkey 2012; Chetty and Hendren 2018; Manley et al. 2020). This project will also contribute to debates on mobility and spatial processes by examining the reproduction (and other regularities across life stages) of a range of mobility patterns of advantage and disadvantage.

Challenge 3: documenting heterogeneity across population groups. There are relevant social gradients in childhood mobility patterns and outcomes. Children from lower socio-economic backgrounds will more likely experience mobility constrained by hardships, residential instability, and worse outcomes as a result (Pettit and McLanahan 2003; Anderson et al. 2014; Gambaro and Joshi 2016). Prior evidence also suggests that mobility patterns among the adult population differ by gender, often in relation to the family situation, and by migration or ethnic background, also in relation to socio-economic background (Finney and Catney 2016; Leopold et al. 2012). This calls for further scrutiny of how the diverse patterns of lifelong mobility vary across population groups and their intersections.

Component 2. Explaining lifelong mobility

The second component of LIFELONGMOVE **examines under-researched explanations of the role of childhood mobility experiences for lifelong mobility.** The focus is on three sets of under-researched mechanisms relating to (i) ties to places, (ii) attitudes, and capabilities for mobility, and (iii) the reproduction of early-life disadvantages. Results from this component will contribute to understand whether (and how) mobility decisions are embedded within mobility trajectories shaped since childhood.

Challenge 1: Understanding the role of ties to places. Previous research on repeat mobility has focused on explaining persistence in place and returns to previous places of residence based on the hypotheses of location-specific capital and place attachment (DaVanzo 1981; Fischer and Malmberg 2001; Morrison and Clark 2016). These approaches underscore the role of tangible and intangible assets, such as social networks and local businesses and properties, in reducing the cost of moving to specific places or increasing the cost of leaving them. Along these lines, the ERC FAMILYTIES project led by Clara Mulder furthers our knowledge on the role of family ties outside the household for long-distance mobility and immobility. No explicit predictions on the role of childhood moves are made from these perspectives, however, **moving (several times) early in life can substantially affect the distributions of place-based assets and attachments across locations** affecting mobility decisions in adulthood. Given their focus on ties to locations, these approaches cannot explain specific patterns, such as moves to distant locations with no connections to the individual, or moves within short distances that do not substantially vary access to local contacts or daily routines.

Challenge 2: Understanding the role of attitudes towards and the capabilities for mobility. An established research finding is that, independently of the specific opportunities and situations that lead individual to move, spatial mobility is conditional on having a positive attitude towards

mobility and a set of capabilities that equip an individual to plan and realize moves (Kley 2011; Huinink et al. 2014). Since adults' attitudes and capabilities are significantly shaped in childhood (Bandura 2010), it is not unlikely that **childhood mobility affects the development of attitudes and capabilities for mobility.** Whether and how mobility is a *learned* behaviour during childhood that support mobility in adult ages is yet to be empirically set (Myers 1999; Bernard and Vidal 2020). These associations, however, are not straightforward. Childhood mobility may enhance individual abilities to consider and realize future mobility under certain conditions, such as when moves are deemed positive due to improvements in living standards. In contrast, **moves that are more disruptive** with pre-relocation life and **generate higher stress in children might actually work against the development of attitudes and skills that favour mobility**, at least one that is voluntary and planned. The role of characteristics and contexts of childhood moves for the development of attitudes and capabilities supportive of mobility require investigation.

Challenge 3: Understanding the role of the reproduction of early-life disadvantages. Spatial mobility is socially specific, where the advantaged use mobility instrumentally to move up the housing ladder, access better areas to live, and get better jobs elsewhere (Rérat and Lees 2011; Clark et al. 2014). In contrast, the disadvantaged display residential instability (i.e. frequent, involuntary mobility) but persist in disadvantaged areas (Desmond and Perkins 2016). While the **inter-generational transmission** of socio-economic status (and other family background characteristics), from parents to children, can potentially explain relevant differences in mobility trajectories across individuals (Myers 1999), this mechanisms has been largely under-researched. Relatedly, recent evidence suggests within-family intergenerational transmission processes operating in housing tenure, housing type, and residential environment choice (Lersch and Luijkx 2015; Kley and Stenpaß 2020). Beyond the family, **exposures to socio-spatial contexts in childhood**, such as schools and neighbourhoods, are also decisive in determining access to opportunities, facilities, and services that support socio-economic attainment and to move across space. Research has started addressing how childhood exposure to spatial contexts influence persistence in disadvantaged neighbourhoods over the life course (Sharkey 2012; Manley et al. 2020). LIFELONGMOVE will further such knowledge by addressing a wider set of mobility patterns and complex interactions between family of origin and spatial context to explain lifelong mobility.

Component 3. Understanding outcomes of lifelong mobility

The third component of LIFELONGMOVE **examines the impact of lifelong mobility on a range of outcomes over the life course**. The focus is on three types of relevant life outcomes: socio-economic outcomes, family dynamics, and health outcomes. Acknowledging that **prior moves can have long-lasting impacts on individuals' lives** contributes to our understanding of life outcomes, which extant research largely attributes to the most recent move observed. Results will also highlight how findings from a sizeable body of research on a range of childhood outcomes as a result of spatial mobility in early life (Anderson et al. 2014; Coley and Kull 2016; Mollborn et al. 2018) can be valuable for research on the stratification of life outcomes in adult age. The consequences of childhood mobility for migrant- and native-born populations for family behaviour and health outcomes in Northern Europe are also addressed in the MYMOVE ERC-funded project led by Helga de Valk. LIFELONGMOVE will make additional contributions by addressing a wider range of outcomes, including socio-economic outcomes, and considering countries in Central and Southern Europe that feature lower childhood mobility than Northern Europe (Bernard and Vidal 2020).

Challenge 1: Documenting socio-economic outcomes of lifelong mobility. A large body of research documents important impacts of mobility on a range of childhood cognitive and behavioural outcomes that are relevant for future life chances (Schmitt et al. 2015; Coley and Kull 2016; Vidal and Baxter 2018a; Voight et al. 2020). Surprisingly, research has been largely silent about further impacts on adult socio-economic outcomes. Findings from a handful of studies suggest some

significant associations which call for a much more comprehensive investigation. For instance, in Norway frequent residential mobility, particularly in adolescence, is associated with low education and income in early adulthood (Tønnessen et al. 2016), which might partly relate to the context of childhood mobility. Evidence from neighbourhood research suggests that **persistence in disadvantaged areas correspond with worse socio-economic outcomes**, while moving out of high-poverty neighbourhoods increases educational attainment and income (Chetty et al. 2016; Chetty and Hendren 2018; Andersson et al. 2020). These initial results call for further scrutiny of the long-lasting impacts of childhood mobility for socio-economic disadvantage, and an investigation into other patterns that lead to advantage. The socio-economic outcomes studied will include education, income, occupation, wealth, and homeownership.

Challenge 2: Documenting family outcomes of lifelong mobility. Very few studies have addressed the role of childhood mobility for family outcomes in early adulthood, such as early childbearing and the formation of unions (Myers 2005; Tønnessen et al. 2016). However, these associations need further scrutiny, given that **childhood living arrangements and changing family compositions** (e.g. due to parental separation or starting living with an step-parent) **are often conducive to higher mobility in childhood** (McLanahan and Sandefur 1994; South et al. 1998), as well as to early mobility out of the parental home, early family formation, and relationship instability (Cherlin et al. 1995; Hiekel and Vidal 2020). Findings will contribute to current debates on the inter-generational reproduction of family behaviour and the role for children of the increased and sustained residential mobility of separated parents (Kulu et al. 2021). The family dynamics studied in this project include partnership dynamics (i.e. the formation of cohabiting unions, marriage, and separation), and pathways into parenthood.

Challenge 3: Documenting health outcomes of lifelong mobility. Research for health outcomes in the teenage years and early adulthood is extensive, addressing a range of measurements for overall health, physical health, mental health, chronic conditions, lifestyle or health behaviours, and premature mortality (Mok et al. 2016; Kuuire et al. 2019; Fuller-Thomson et al. 2016; Angel et al. 2010; Dong et al. 2005; Li et al. 2019; Gilman et al. 2003; Brown et al. 2012). Despite this, typical analytical set-ups deploy rather simplistic measures of frequency or age-stage of moves in childhood – largely ignoring important sources of heterogeneity in prior mobility trajectories – and do not adequately address that mobile individuals are often selected on factors that determine health outcomes (Morris et al. 2018). This project will offer a more thorough analysis in order to decipher the long-lasting impacts of childhood mobility on health outcomes in adulthood. It will also extend prior studies by **examining under-researched health outcomes specific in middle and late adulthood.** To this end, the project will use a new data source focused on populations at pre-retirement age, with detailed information on their life histories.

b. Methodology

b.1 Data

To address the study objectives, **this project examines individual-level microdata from a variety of large-scale, representative datasets from survey and register sources in several European national contexts**. All datasets contain longitudinal designs that collect information relating to both the childhood and adulthood stages of individuals. Preferably, we use prospective data collections (a.k.a. panel data) that are particularly suited to investigations of mobility processes and how their associated life outcomes develop with age (Vidal and Lersch, *forthcoming*). To enable the study of such diverse and complex lifelong mobility processes, all datasets boast large samples and detailed information of spatial mobility, including the spatial context (of origin and destination) and the timing (or age periods) of events. With few exceptions, the proposed data sources do not enable assessment of international migrations, since individuals are not followed outside the country of their data collection. To obtain more a complete picture of spatial mobility processes, information available before an emigration and after an immigration to the country of data collection is used. All

the data handled and analysed in this project have been authorized for secondary use and adequately anonymized so that individuals cannot be identified.

Integrated register and census data

For detailed descriptions of lifelong mobility processes, the project examines administrative data sources available for scientific purposes that record longitudinal information at the person level for *entire registered populations* of three large contexts: Belgium, Sweden and the Spanish region of Andalusia (between 8 and 11 million inhabitants each context). While previous research on spatial mobility examine the Belgian and Swedish data (including my own research: Vidal et al. 2017; Kulu et al. 2021), **this project innovates by using large-scale register data for the longitudinal analysis of spatial mobility in a Southern European context.** Privacy regulations prohibit taking micro-data from administrative registers out of the country. For this reason, most data handling and analyses will be executed in the countries themselves. Access to register data is granted through collaboration agreements (see b.4 Collaboration).

For **Sweden**, the data is based on micro-linkage between the population register (since 1969; with detailed information on registered moves and family outcomes overtime) and various registers containing additional information on background characteristics, as well as socio-economic and health outcomes. The data, which has already been linked for the analysis of spatial mobility, is made available by Statistics Sweden and will administered and accessed from the Institute for Analytical Sociology (IAS) at Linköping University. For **Belgium** and **Spain**, the data is based on micro-linkage between the population register (which contains longitudinal information of registered moves, household compositions, and vital statistics) and the census (which contains childhood background characteristics). The Belgian population register (since 1991) and the 1991 and 2001 censuses (and 2011 register-based census) have already been linked as part of a data request to analyse residential mobility and life course transitions and can be accessed in a secure sever at the Centre for Demographic Research (DEMO) at the Université Catholique de Louvain. Yearly information on income and family status are available for the study of outcomes overtime. The Andalusian population longitudinal database integrates the population register (since 1998) and the 2001 census (and 2011 register-based census). The data has already been linked and is available from the Andalusian Institute of Statistics and Cartography (IECA). As part of a collaboration with IECA (letter of commitment attached to this proposal), additional information from social security records and school registers will be linked to study socio-economic outcomes overtime.

Cohort studies

Cohort studies are longitudinal surveys that follow individuals from a given cohort defined by age. These enable to examine longlife mobility processes for contexts where register data is not available for scientific purposes, though with less detail in patterns and for population groups. They also contain variables not available in register data to study lifelong mobility mechanisms (Component 2) and outcomes (Component 3).

Cohort studies that follow individuals from a very young age into adulthood are examined here. These studies collect detailed measures of childhood contexts and development that have lasting impacts on individuals. Three British cohort studies following respondents from birth will be analysed in this project: The **National Child Development Study** (NCDS), the **British Cohort Study** (BCS), and the **Millennium Cohort Study** (MCS). The surveys are similar in design, with an approximate sample of 17,000–18,000 individuals at baseline each, and cover cohorts born in 1958 (NCDS), 1970 (BCS), and 2000 (MCS). The latest sweeps of data collection took place in 2020 and will enable studies to follow individuals up to age 62 in NCDS, age 50 in BCS, and age 20 in MCS (information up to age 22 in MCS will be available in early 2025).

I also examine cohort studies that follow individuals from an adult age, but contain detailed information on mobility histories. The following studies, which I have used in prior research (Bernard and Vidal 2020; Vidal et al. 2017), will be analysed in this project. The **Survey of Health Aging and Retirement in Europe** (SHARE) is a cohort study of population aged 50 or older from 28 European countries and Israel running since 2004. The study collected complete mobility

histories for more than 100,000 individuals using life-history grids. A key advantage of the data is that international moves can also be tracked, and through that study, though limited by country-specific sample sizes, processes can be compared across a large set of countries. Given its focus on aging, the study collects relevant information on key socio-economic and health outcomes at older ages. The **German Family Panel** (Pairfam) is an annual survey begun in 2008 in Germany that follows a representative sample of persons (at baseline 12,000) from three birth cohorts 1971–73, 1981–83, and 1991–93, supplemented with retrospectively collected information on mobility histories since birth. Given its focus on family, the survey collects detailed information on family processes and outcomes in early and middle adulthood.

Household panel studies

Household panel studies follow nationally representative samples of households, interviewing all adult household members on a regular basis, often annually. I propose to examine long-running panel studies that cover part of childhood and adulthood for some birth cohorts. The following studies, which I have used in prior research (Vidal et al. 2017; Vidal et al. 2020), will be analysed in this project: The **British Household Panel Study** (BHPS) and **Understanding Society** (US). BHPS is a survey representative of the British population between 1991 and 2008. The BHPS sample continued as part of the US study, begun in 2009. The **Socio-Economic Panel** (SOEP) is a nationally representative survey of the German population, which has been running since 1984. Although children are not directly interviewed in these studies, information is extracted from parents' reports before an individual turned 16, from questions on children and from retrospective histories. In addition, these studies have a genealogical design by which children are followed when they move out of the original sample household. Information for childhood and adulthood stages is available for about 3,000 repondents in BHPS/US and 8,000 respondents in SOEP. Of particular interest is that these studies collect regularly a wider range of measures on typical stressors and outcomes of spatial mobility in adult ages, including subjective measures of spatial mobility (i.e. desires, intentions, and motivations) and ties to locations (i.e. attachment to the local area). Additionally, the multi-actor design enables linking individuals to their parents and siblings to address mechanisms relating to family background (see b.3 Work plan).

b.2 Analytical methods

Given my ample methodological expertise, I will be able to use **advanced, state-of-the-art quantitative methods for the analysis of longitudinal** data for optimal analysis of the above datasets. To achieve the study objectives, a variety of analytical methods is needed, including algorithmic or data-driven methods (i.e. machine learning approaches) which are better equipped to examine patterns in individuals' long-term mobility trajectories, and model-based methods for longitudinal data that are better equipped to disentangle the effects of social causation and social selection.

Among the **algorithmic methodologies**, I will use *social sequence analysis* to examine lifelong mobility trajectories. Sequence analysis enables the study of life trajectories as sequences of residential states and mobility events. Typical descriptions of life trajectories include measures of within-sequence features in order to assess the complexity of individual trajectories and typologies to assess the underlying diversity in trajectory pathways (Ritschard and Studer 2018). Dyadic or polyadic sequence analysis (Vidal et al. 2020; Fasang and Raab 2014) will be applied to investigate regularities in the trajectories of siblings and context peers (i.e. individuals exposed to similar spatial context in childhood), to assess the role of family and context of origin for lifelong mobility trajectories. Additionally, I will deploy machine learning *feature selection algorithms*, such as regression trees (Boruta) and LASSO, to identify the combination of features in lifelong mobility trajectories that are relevant for specific mobility patterns and associated life outcomes (Bolano and Studer 2020).

A range of **multi-variate models for longitudinal data** are used to examine the mechanisms underlying the role of early childhood mobility for lifelong mobility, and the impact of lifelong

mobility on life outcomes. *Panel regression models*, such as random-effects growth-curve models and hybrid models (Allison 2009), will be used to estimate overtime changes in outcomes. Parametric and non-parametric *event-history models* (Singer and Willett 2003) are suitable to examine timed-outcomes, such as the birth of a child or the onset of a health condition. *Multi-level models* will be employed wherever individuals are clustered in spatial units to deal with context-level heterogeneity, and also address the fact that individuals can be classified in different contexts over time (Goldstein 2011). Similarly, *sibling and context-peers fixed-effects models* used to account for family- and context-level heterogeneity will be considered. More complex methods to establish clearer causal pathways will be deployed, including multi-process multi-level models to account for individual-level heterogeneity due to reverse causality between spatial mobility and other life course trajectories (Steele 2007). For a causal interpretation of estimated direct and indirect effects, I will use techniques for mediation analysis with time-varying exposures and mediators (VanderWeele 2016), along with the KBH method for non-linear models (Karlson and Holm 2011).

b3 Work plan

This is a five-year research project with three main components (see section a.2). I will recruit a **team of researchers with high quantitative skills** to work in the different components of the project (see section c). To accomplish all research objectives, I have allocated approximately four years to each component. The project will start with Component 1, whose outputs will inform the other two components. Components 2 and 3 will start in the second year. In the remaining of this section, I provide an overview of the proposed empirical analysis, with details on how the datasets will be employed to fulfil the objectives of each component of the project.

Component 1. From early ages into adulthood – Mapping lifelong mobility

The aim of the first component is to document the diverse and complex long-term mobility pathways from an early age into adulthood, or lifelong mobility.

A first major issue to address in Component 1 is **how to operationalize lifelong mobility**. Summary indicators for specific properties of mobility trajectories (e.g. the duration of stay or the number of moves within an age range) used in prior research run the risk of offering a simplistic view of complex life course inter-dependencies, and do not give insights on the diverse pathways underlying mobility trajectories that this projects aims to identify. To overcome this issues, LIFELONGMOVE adopts an analytical approach rooted in the data-mining culture that considers trajectories as the main analytical units (Piccarreta and Studer 2019). The main goal of this analytical approach is to describe trajectories and identify their most salient and distinctive features. Information from individuals' timed-events (or residential episodes) are then configured as sequences that enable the study of key properties collectively (e.g. timing, duration, sequencing). To gain more insight on the complex life course interdependencies, a range of sequence specifications will be examined using additional information on the distance, context, and life transitions underlying each move.

The project aims to **map the diversity of mobility pathways**, considering several features of mobility trajectories collectively. Register data is well-suited to examine the diversity in relevant trajectory features because information on dates and geo-coded places of all registered moves is available. The current datasets enable me to study lifelong mobility trajectories up to the early- and mid-20s in Spain and Belgium (for cohorts born in the 1990's) and up to age 50 in Sweden (for cohorts born in the 1970's; and shorter periods for more recent cohorts). As a limitation, international migrants can only be followed while they are registered in the country. To address the role of **international migration trajectories**, data from the SHARE survey that contains detailed information on mobility histories (including all reported international and sub-national moves) since birth up to age 50 will be examined. This will enable me to test relevant hypotheses on the links

between international and subnational mobility that remain largely under-researched (King and Skeldon 2010).

For the effective exploration of lifelong mobility trajectories, powerful visualization techniques that describe and summarize entire trajectories (Fasang and Liao 2014; Bürgin and Ritschard 2014), will be used. To **identify meaningful diversity in lifelong mobility pathways**, I will deploy sequence analysis algorithms and cluster analysis. A range of algorithms are available to assess dissimilarities across individual trajectories properly accounting for relevant differences in timing ("when"), sequencing ("in what order"), and duration ("how long") of residential episodes and mobility events throughout the entire trajectory (see e.g., Studer and Ritschard 2016). The choice of algorithm is based on the theoretical or practical interests in the specific features of the trajectories to be analysed. Then, cluster analysis will be used to obtain a typology of relevant pathways based on these dissimilarities. When theoretical expectations have been set, the resulting pathways will be contrasted with expected pathways.

The project also examines **links across life stages for relevant patterns** that have been separately established in childhood and in adulthood. Feature selection methods will enable me to identify the key properties of mobility trajectories that best predict a given outcome. The outcomes are specific mobility patterns in adulthood, such as frequent mobility, persistence in place, job-related long-distance mobility, and return and circular mobility, among others. To this end, I will extract a set of indicators measuring the key properties (timing, duration, and order) of the set of sequences. Then I will use a random forest approach (Boruta) and LASSO regression to identify the sets of features significantly linked with an outcome. In a final step, significant features will be introduced in a regression model to identify the direction of the associations.

The project proposes that **lifelong pathways are likely to vary by population groups** with specific attributes. Analysing specific population groups based on background characteristics (measured through parental education, gender and ethnic or migrant status, as well as their intersections), makes the foreseen analysis more demanding in terms of data. Therefore, understanding heterogeneity across population groups will be largely based on the analysis of register data from Belgium, Spain, and Sweden. Extensions to ANOVA concepts and permutation tests in sequence analysis will be deployed to evaluate the strength and statistical significance of the relationship between population groups and trajectories (Piccarreta and Billari 2007). In feature selection methods, population groups will be introduced as additional input variables in the models.

Component 2. Explaining lifelong mobility

The aim of the second component is to elaborate on and empirically test under-researched explanations of the role of childhood mobility experiences for mobility in adult ages.

The explanation based on the **reproduction of disadvantage** examines the role of the socio-spatial context and the family of origin as confounders of the study associations (or common determinants of mobility in childhood and adulthood). To address this explanation two approaches are proposed. Firstly, a quasi-experimental design to exploit the relationships among individuals from the same family or context of origin will be used to examine the role of childhood background on lifelong mobility trajectories. If close in age, siblings can be assumed to share inherited family characteristics, and contextual peers (matched by their spatial context of origin) can be assumed to share the same influence of the context of origin. Comparison of siblings, contextual peers and unrelated individuals using a within-dyad approach to sequence analysis will enable me to extract conclusions on the role of social background for a range of lifelong mobility patterns. I have previously used a similar approach to assess inter-generational status transmission in women's life courses (Vidal et al. 2020). Since the approach requires linking records of siblings and spatial context peers of similar ages, it would be accomplished with the register datasets where the subset of individuals with linked records are large enough for statistical analysis. Secondly, I will investigate the role of specific indicators of childhood background available in the survey data sources using regression approaches. Typical measures of parental education and parental

occupation are available in all survey data sources. Other typical measurements of the family of origin include the type of and changes to childhood living arrangements, parental divorce, and the number of (full-, half-, and step-) siblings.

The explanations based on ties to places, attitudes, and capabilities for mobility address the intermediary or mediating mechanisms by which childhood mobility experiences indirectly influence spatial mobility in adulthood. To tackle this mediating role I will adopt several analytical approaches. Firstly, using regression models I would examine changes in the mediators (i.e. ties to places/attitudes and capabilities) as a function of childhood mobility to assess whether the latter determined the former. Secondly, using structural equation models and hybrid panel models, I would examine whether adult mobility is substantively affected by childhood mobility (once controlling for the mediators) and quantify the direct and indirect associations. The data would be based on surveys that collect measurements for the mediators as well as for key model variables relating to individual attributes and life trajectories in career and family domains.

To test explanations based on **ties to places**, information collected recurrently in several measures for ties to family and friends outside the household and social involvement in the community from adult respondents in the BHPS/US and the SOEP. SOEP has also asked a general question on attachment to the local area in 2009 and 2014. The British cohort studies also collected in one sweep or irregularly information on geographical distance to parents, civic participation and interactions with members of the local community.

To test explanations about **attitudes and capabilities for mobility**, different sources of survey data will be used. The BHPS/US and NCDS contain longitudinal information collected prospectively on desires and their underlying motivations, for future mobility. Evidence from prior research on mobility decision-making suggests that desires are proximate measurement for behavioural attitudes (Huinink et al. 2014). The SOEP (also in the youth questionnaire), BHPS/US, NCDS, BCS, and MCS contain information on key capabilities of self-efficacy, locus of control, and risk aversion, which have been used in prior research on the propensity to move (Caliendo et al. 2019). These datasets also allow matching subjective evaluations with actual mobility observed in subsequent survey waves.

Component 3. Understanding outcomes of lifelong mobility

The aim of the third Component is to examine life outcomes associated with lifelong mobility, thereby shedding light on key associations and long-lasting impacts between childhood mobility and socio-economic, family, and health outcomes in different stages of adulthood.

The **socio-economic outcomes** that will be examined in the project include a range of aspects for an individual's quality of life and privileges in society. These include education, occupation, income, wealth, and home-ownership. Yearly information on earning and income is available in the register data (and education level in the Spanish and the Swedish data). British cohort studies enable studying educational and occupational outcomes since youth. The other survey datasets contain detailed information on employment and occupational careers, partly collected in retrospect. Information on wealth and homeownership is very detailed in five survey waves of SOEP and, in relation to retirement age, in SHARE.

The **family outcomes** that will be studied in the project relate to the dynamics of partnership formation and dissolution as well as fertility behaviour. Yearly information on vital statistics allow to examine the events of marriage, divorce and birth by parity as outcomes in the register data (and the formation of co-residential unions in the Swedish register). Similar information on partnership and fertility dynamics can be studied with the survey data sources.

Health outcomes are only available in survey data. The set of health measures collected around and after retirement age in the SHARE dataset is particularly relevant, as no prior study has documented how childhood mobility experiences and conditions have an impact. In addition, birth cohort studies

include information on physical and mental health since an early age into adulthood. The household panel studies and Pairfam contain measures on self-perceived health and illness conditions.

Due to its large size, **register data will enable me to examine outcomes of more specific lifelong mobility pathway without incurring problems of statistical power**. One current disadvantage is that the range of individual- or household-level control variables necessary to assess specific causal mechanisms is limited. Given this, analysis based on this data will aim at identifying the relevance of diversity in trajectories for adult outcomes. This will shed initial light on the role of accumulation, critical periods and normative trajectories of spatial mobility for life outcomes. To this end, sets of regression models will be used to predict outcomes as a function of typical lifelong mobility pathways and within-individual trajectory features extracted from the sequence analysis proposed in Component 1. Feature selection models will be deployed to identify the relevant sets of personal attributes, mobility history characteristics, and their interactions that best predict each specific life outcome.

Survey data will be used to examine the impact of more general lifelong mobility pathway on life outcomes (since its sample size is limited to address highly specific or rare patterns). **The proposed surveys contain information on sets of key model variables that act as confounder or intermediate variables for the study associations**. The household panel studies, SHARE, and Pairfam contain detailed individual- and household-level information of typical triggers of life outcomes, but this information is restricted or indirect for the childhood stages. The British Cohort Studies contain rich information on key variables measured in childhood, including information on childhood outcomes, that may show the relevant impact in adult outcomes. Analysis of survey data will include event-history models for timed-events as well as growth curve and other sets of panel regression models to analyse over-time changes and trajectories. I also consider deploying multi-level-multi-process models that account for individual unobserved heterogeneity and address reverse causality issues between spatial mobility processes and life outcomes.

b.4 Collaboration

The project will benefit from existing infrastructure and expertise on integrated register data through collaborations. Prof. Christine Schnor (Université Catholique de Lovain, Belgium), Prof. Maria Brandén (Linköping University, Sweden), and Prof. Francisco Viciana (University of Sevilla, Spain) have committed to working closely with the team to prepare and analyse the data, co-author publications, and host research stays (see annexed letters of collaboration). Register data handling and analyses of Belgian and Swedish registers will be executed in the countries themselves using existing infrastructures at Université Catholique de Lovain and Linköping University. The Spanish data can be accessed within the country, and will be stored in a secure server at the host institution. While not all the required register data for Spain has been linked, the Andalusian Institute of Statistics and Cartography (IECA) has committed to prepare the data request for this project (see annexed letter).

b.5 Feasibility, risks and potential impact

As LIFELONGMOVE poses research questions which have not been addressed before and takes an innovative approach that poses high data requirements, it is undoubtedly **a high risk/high gain** research undertaking. At the same time, this project is **feasible** because the data requirements necessary to conduct this project have been met by large-scale longitudinal datasets that enable us to follow individuals from early life into adulthood. In addition, **I am the right person** to conduct this project because: (i) I have a substantial track record of publications discussing the role of life course dynamics for spatial mobility, (ii) I have a strong background in advanced quantitative methods and ample experience analysing large-scale longitudinal data, (iii) my history of publications with outstanding researchers proves my ability to collaborate internationally, and (iv) my leadership skills ensures the ability to lead a research team. At CED I am currently leading a

research line on Generations and the Life Course, and I coordinate a team consisting of one post-doctoral researcher and two PhD students. I am in the right position to realise the objectives of this project.

Nevertheless, an innovative project always carries some risks that need to be addressed:

Withdrawal of collaborators. Collaborators play an important role for the effective use of register data sources. I have already worked with the proposed project collaborators, and they have shown strong commitment to collaborate in the project (see annexed letters of collaboration). The risk of withdrawal is further minimized by the fact that I know alternative collaborators whom I can approach or, due to my extensive international network, I know ways how to find them, in the unlikely event that they are needed.

Data quality. The novelty of the data needed to address trajectories across life stages also forms the main risk of the project. The backbone of the proposal is based on large-scale datasets that are used to address individuals' long-term trajectories, which minimizes the aforementioned risk. Three experienced collaborators will assist when preparing and analysing the three register data sources. Selective attrition can be an issue in prospective survey data collections if associated with mobility, and recall bias can be an issue in retrospective collection of mobility histories. While analysis of spatial mobility with the survey sources proposed suggests that attrition and recall bias are not substantive issues, I will address and use proper statistical methodologies to account for measurement errors. In addition, analysis of lifelong pathways (Component 1) will be largely based on register data sources where issues of attrition and recall bias are minimized.

Causal inference. Components 2 and 3 aim at establishing causality for the role of childhood mobility in the study associations. While unobserved heterogeneity due to reverse causation and self-selection are typical sources of bias in spatial mobility research, this should be less of an issue since children are largely passive actors in the decision to move house. Nevertheless, the risk of bias is not null, and for that reason I will deploy methodological strategies that address the issue of unobserved heterogeneity to make better causal assessments.

LIFELONGMOVE will make a **lasting contribution to our understanding of relevant aspects of spatial mobility that are of major academic and policy concern**. The project will lead a paradigm shift in the conceptualization of spatial mobility, and its findings will generate new insights into spatial mobility from early age into adulthood. Importantly, these insights will be used to assess the validity of extant research results on antecedent and outcomes from analyses based on specific life stages, and can ultimately contribute to theory-building on spatial mobility as a potential channel for the reproduction of advantage or disadvantage over an individual's life course and across generations, from parents to children. In addition, results from this project can be useful for design and evaluation of policies that support the development of "skills for mobility" and prevent negative consequences at the individual and social level.

b.6 Output
The findings of LIFELONGMOVE will be reported in 3 open-access doctoral dissertations and, at least 12, open-access articles in leading peer-reviewed journals in the fields of demography, population geography, sociology, and cognate disciplines. Pre-prints of all publications will be publicly available from repositories such as DDD hosted by the Universitat Autònoma de Barcelona, where the host institution is located. To promote the reproducibility of the project results, all the code used for the analysis of survey data will be available from the project website. Dissemination activities also include presentations at relevant international conferences including the European Population Conference, the Conference of the International Union for the Scientific Study of Population, the Annual Meeting of the Population Association of America, the Annual Conferences of the Society for Longitudinal and Life Course Studies, etc. Each team member will present in 2 conferences each year. Summaries of main findings and policy recommendations will be published as briefs and other publications for lay audiences in collaboration with Population

Europe (www.population-europe.eu). A workshop will be organized to disseminate and disscuss project results with academics and policy-makers.

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