1. Introduction

The mainstream vision of justice provided by the utilitarian framework (cf. Bentham, 1789) advocates for maximising the overall well-being of society. Rawls' approach (1958) suggests an alternative by proposing that justice is more a matter of “equity”, achieved through maximising the situation of the most disadvantaged. Sen (1979) enriches this perspective by recommending an examination of the distribution of effective accessible opportunities, studying the *capabilities* of each individual.

Mobility has become a required norm, shaping the social life (Urry, 1999). Hence, as indispensable as it is to participate to society, mobility inherently carries the risk of inequalities (Orfeuil & Ripoll, 2015). Although transportation issues were initially addressed by engineering sciences emphasising the need for better planning automobile developments in the United States, social sciences also seized the question. They transpose the theoretical framework around the central notion of justice and fairness provided by Rawls and Sen into the field of transportation.

The ability to move emerges as a primary good, intrinsically linked to individual *capabilities*. So, it became an essential condition for accessing effective *opportunities*. Sociologist Kaufmann (2004), drawing a parallel with capital approaches, introduced the *motility* notion to capture this. The urban planner Martens (2016) develops that accessibility, as a “potential for interaction”, depends on “both context (transportation systems and land use patterns) and personal attributes (such as vehicle ownership, income levels, abilities)” (Martens, 2016, p. 13). This study focuses on the “context” level of a specific territory: disadvantaged neighbourhoods in France.

Indeed, mobility within disadvantaged neighbourhoods emerges as a paramount concern. Since the late 1970s, urban planners (Wachs & Kumagai, 1973) and economists (Kain, 1968) have delved into the links between physical accessibility and socioeconomic status. The *spatial mismatch hypothesis,* formulated by Kain in 1968, establishes for the first time a connection between unemployment and disparities in spatial accessibility to employment experienced by inhabitants of low-income neighbourhoods in the United States. It subsequently gives rise to abundant research and empirical evidence within the context of the United States.

More recently, Taylor & Ong (1995) developed an alternative hypothesis to spatial mismatch: the *automobile mismatch*. Initially through the analysis of commuting characteristics at the American scale in this foundational study, this hypothesis will later be validated at conurbation scales (Grengs, 2010; Kawabata, 2003). To explain inequalities in accessibility, the automobile mismatch hypothesis focuses on disparities in generalised speeds, stemming from the interaction of three factors: (i) inequalities in motorisation that predominantly push the disadvantaged populations toward public transportation (ii) the low efficiency of public transportation services relative to car use (Kawabata & Shen, 2007), and (iii) the very poor transit service in low-skilled job areas (Kawabata, 2003).

In France, the fight against urban inequalities is mainly place-based. Termed *"politique de la ville"* for "urban policy", its operational zones are the *"quartiers de la politique de la ville (QPV)"* for "neighbourhoods of urban policy". It operates on a national scale, with significant adjustment to local specificities in partnership with local stakeholders. The issue of mobility is increasingly prominent in political discourse regarding poor neighbourhoods. The discourse is marked by frequent references to the issue of “urban isolation” (cf. the *“Marseille en Grand”* discourses of the French president in 2021 and 2023). Public policies, through urban policy, also exponentially focus on the issue of transportation, now placing it at the heart of their concerns (cf. the French Dijon Act (“Pacte de Dijon”) in 2018).

In France, as elsewhere, disadvantaged neighbourhoods take on multiple forms. This has been emphasised by several typologies of QPV, the most recent dating back to 2016 (Sala, 2016). This typology crafted by a government department attempts for the first time to integrate the issue of "urban isolation". Although, it is still in a preliminary stage. Indeed, the proxy used is the distance by car to reach the town hall from the neighbourhood centre. While this constitutes a welcome initial approach, there is still much work to be done in order to more effectively guide this policy. Public transportation plays a central role for inhabitants of disadvantaged neighbourhoods, and this mode also benefits from a strong public service vision in France. However, there is limited information regarding this mode.

Accessibility indexes provide a spatial estimation of the potential accessibility conferred by a territory. These indexes take into account its transport network in addition to its efficiency, and its amenities that are present. A simple form is the formulation of accessibility based on a threshold to an amenity: more specifically the calculation of the number of accessible amenities per individual in a predefined time frame. A more sophisticated manifestation is embodied in the gravity model (Hansen, 1959).

Paradoxically, estimating public transportation accessibility is significantly more challenging than for other modes. Creating a route requires more than simply directing each individual through the road network; it also involves considering all the details of the public transport network (stop locations, schedules, etc.). Policymakers in urban policy and mobility planners, aiming to address the "isolation" of disadvantaged neighbourhoods through public transportation, face this technical challenge. This is likely partly due to this fact that research focusing on accessibility inequalities in French cities (e.g. Bouzouina et al., 2014; Caubel, 2006; Korsu & Wenglenski, 2010; Viguié et al., 2023) mostly concentrate on solely one urban area.

So, the research question of this study aims to enhance the understanding of accessibility by public transit in deprived neighbourhoods. Specifically, we will investigate if disadvantaged neighbourhoods experience reduced accessibility compared to other comparable (but less impoverished) areas. Additionally, a cross-cities approach will allow us to explore whether neighbourhoods with varying levels of accessibility share common characteristics across different urban agglomerations.

2. Data and Methodology:

As mentioned earlier, the predominant theories of access inequalities in disadvantaged neighbourhoods focus on employment accessibility. Therefore, we estimate a model of employment accessibility across multiple French regional urban areas. While the present list is currently tentative, it will include at least the urban areas of the city of Nantes and the old mining area (the Artois conurbation) to the south of the city of Lille. Because of their very different histories, these two urban areas differ significantly in terms of urban planning, socio-economic attributes, and cultural aspects.

We use an internally developed accessibility tool within the Transdev company. This tool relies on an efficient public transportation route calculation based on General Transit Feed Specification (GTFS) files.

Each urban area is then divided into a grid of n squares measuring 200 x 200 metres. Routes connecting each square to others are calculated, resulting in n^2 routes. This process is iterated 50 times over a two-day period, followed by averaging the time required to travel from each square to another using public transit during these two days (when a public transit route is viable). The total number of jobs available in each square is then summed, facilitated by the SIRENE database, which records French companies. This allows, for each n square in space, to obtain the mean time required to access each job within the area, allowing us to deduce accessibility thresholds or gravity models.

3. Analyses

We begin by addressing whether, under the conditions of this test, poor neighbourhoods face accessibility disadvantages concerning employment. Subsequently, employing statistical classification methods such as Hierarchical Clustering or K-means, we aim to identify potential redundancies within the poor neighbourhoods of the various selected urban areas. Based on this, we will consider the possibility of grouping disadvantaged neighbourhoods into broader classes within a typology that incorporates various socio-economic and urban factors, alongside their accessibility by public transportation.

4. Discussion and Conclusion

This study provides planners with a more comprehensive understanding of "urban isolation". By striving for generalisations through examples from very diverse urban areas, and integrating variables categorising the territory, identifying types of disadvantaged neighbourhoods can contribute to the considerations of planners across France and beyond. However, this presentation represents barely the first step in a construction process that lies ahead.

Various possible extensions emerge from this work. Initial steps could involve a nationwide generalisation wherever GTFS (General Transit Feed Specification) data is available. This would enhance the typology presented here. Once transformed into accessible data visualisations for planners, it could precisely target neighbourhoods in each urban area for intervention. To delve even deeper into this targeting, a predictive model of modal choice could help identify neighbourhoods with underutilisation of public transportation. This would allow questioning transportation planners about the "why" behind this underutilisation and the less visible constraints residents face when using public transport (e.g. cost, societal barriers, inadequate service to suitable employment, etc.).

An extension also involves a more in-depth analysis of accessibility inequalities. Here, we compare accessibility in disadvantaged neighbourhoods with the rest of the urban unit, overlooking the specificities of less qualified jobs, which are more prevalent in these kinds of neighbourhoods. That suppose possible time and space specificities in deprived neighbourhoods. This assumption implies potential temporal and spatial commuting specificities within deprived neighbourhoods. If we consider that work rhythms differ, with more staggered hours, for example, and that jobs are concentrated in specific areas, these factors could be incorporated into subsequent analyses.

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