

Global Essay Competition 2026

Title:

Autonomous Mobility in Ageing Societies: When Artificial Intelligence Becomes Social Infrastructure

Essay:

Introduction: The Silent Mobility Crisis

“Mobility is a precondition for participation in society; when it declines, exclusion follows” [3]. This observation from European transport research has gained renewed urgency as societies age. Across much of Europe and other industrialized regions, demographic change is accelerating at a pace without historical precedent. By 2050, more than 30 percent of the European population will be over the age of 60, compared to around one fifth today. Europe will therefore age more in the next twenty-five years than it did in the previous fifty [2]. Public debate has largely framed this shift as a challenge for pension systems, healthcare provision and labour markets. One of its most consequential effects, however, has remained comparatively invisible: the gradual erosion of independent mobility. For older citizens, mobility is not an abstract policy variable. It is a condition of everyday autonomy. The ability to travel independently to medical appointments, visit friends, participate in community life, or decide spontaneously when and where to travel underpins social participation, economic independence and democratic inclusion. European transport systems, however, remain structurally designed around younger, able-bodied drivers. As physical and cognitive capacities decline with age, many older adults reduce or cease driving, often years before viable alternatives exist [3]. In suburban and rural regions, where public transport coverage is limited, the loss of a driving licence frequently marks a decisive tipping point. What follows is not merely inconvenience, but rising social isolation, deteriorating health outcomes and earlier institutionalization [4].

At the same time, mobility systems are undergoing a significant technological transformation. Advances in artificial intelligence are no longer confined to research laboratories but are increasingly deployed on public roads. In the United States, companies such as Waymo are operating fully driverless ride services in selected cities [5]. In China, firms such as Pony.ai are scaling autonomous fleets with strong state backing and close integration into urban transport systems [7]. These developments are often framed as milestones of technological progress or industrial competition. They also signal something more fundamental: autonomous mobility is emerging as a substitute for human driving at precisely the moment when ageing societies are losing the physical and cognitive capacity on which their transport systems have long relied. In Europe, autonomous vehicles are still discussed primarily as an industrial and regulatory project. Policy debates revolve around safety certification, innovation leadership and competitiveness [13]. Much less attention is paid to the question of who will depend on these systems and why. As populations age and human driving capacity declines, mobility increasingly becomes a welfare issue long before it becomes a fully deployed technological solution.

Why Existing Mobility Models Are Failing Ageing Societies

European mobility systems rest on assumptions that no longer hold. The first is the continued dominance of human drivers. Private car ownership remains the backbone of mobility across much of Europe, particularly outside dense urban centres. Yet age-related declines in reaction time, vision and cognitive processing make driving increasingly risky [3]. While licence restrictions and voluntary driving cessation improve road safety, they simultaneously strip older citizens of independence and reduce their ability to manage everyday life autonomously. A second assumption is that public transport can compensate for declining private driving. In practice, fixed-route systems struggle to serve low-density regions where demographic ageing is most pronounced. Even in cities, public transport often remains inaccessible for individuals with reduced mobility, sensory impairments, or health-related uncertainty [8]. Timetables, transfers and physical barriers reduce predictability and increase stress, making public transport an imperfect substitute for private mobility, particularly for older users with fluctuating health conditions. A third assumption is that families will absorb resulting mobility deficits. Informal caregiving, often unpaid and gendered, frequently fills the gap when older adults can no longer drive themselves. However, shrinking family sizes, increased female labour participation and geographic dispersion have weakened this safety net across Europe [9]. What emerges is a growing mismatch between mobility needs and available support structures. The consequences extend beyond inconvenience. Reduced independent mobility among older adults is strongly associated with social isolation, declining well-being and increased public healthcare expenditures [4]. Mobility, in this sense, already functions as a welfare issue, even though it remains structurally underrepresented in transport policy and infrastructure planning.

Mobility, Identity and the Limits of Forced Modal Shift

Policy debates on sustainable mobility often converge on a seemingly rational prescription: fewer privately owned vehicles and greater reliance on public transport. From a climate and efficiency perspective, this logic is compelling [13]. Yet in ageing societies, it repeatedly encounters resistance, not because the logic is flawed, but because it ignores identity and lived experience. For many older citizens, the private car is not merely a means of transportation. It represents autonomy, competence and continuity with earlier stages of life. Decades of driving embed the car deeply into personal identity. The ability to decide independently when to leave, where to go and how long to stay is closely associated with dignity and self-determination [10]. As physical or cognitive decline sets in, the prospect of abandoning driving is therefore experienced not simply as a modal shift, but as a loss of independence. Public transport systems, even when technically available, often fail to compensate for this loss. Fixed routes, schedules, transfers and crowding introduce friction that becomes increasingly burdensome with age [3]. Sensory impairments, reduced mobility and health uncertainty make predictability and control more valuable rather than less. This helps explain why decades of investment in public transport have not eliminated car dependence, particularly in suburban and rural Europe. Crucially, this resistance does not imply a rejection of sustainability. It reflects a rejection of imposed behavioural change. What ageing societies increasingly demand is individualized, on-demand mobility without the burden of ownership.

Shared mobility and ride-hailing models respond directly to this demand by preserving door-to-door travel, flexibility and privacy, while shifting ownership and maintenance away from individuals [8].

Autonomous Mobility as the Missing Link

Autonomous driving amplifies this logic. By removing the human driver, it allows shared, on-demand mobility to scale economically and demographically. What distinguishes the current phase from earlier waves of experimentation is not technological novelty alone, but economic viability. In fleet-based services, human drivers account for a substantial share of total operating costs, making autonomy particularly attractive for shared mobility models [11]. Robotaxi services translate this cost logic into a scalable business model. Instead of selling autonomy as a premium feature to individual car owners, firms deploy it in tightly managed fleets where vehicles operate for longer hours, serve multiple passengers per day, and are maintained centrally. Ride-hailing platforms can thus offer door-to-door mobility at lower marginal cost once driver wages are removed from the fare structure [11]. In practice, this shifts autonomy from a consumer add-on toward a service layer that competes directly with private car ownership.

Autonomous driving refers to systems in which perception, decision-making, and vehicle control are increasingly handled by artificial intelligence rather than a human driver. Using combinations of cameras, radar, and lidar, autonomous systems continuously monitor their surroundings, predict the behavior of other road users, and execute driving tasks in real time [15]. These systems are capable of reacting faster than humans, maintaining constant attention, and operating without fatigue. This has direct safety implications. Human error contributes to the vast majority of traffic accidents. Autonomous systems, when properly deployed, can reduce accident rates by eliminating risks related to distraction, delayed reaction times, or impaired driving [15]. At the system level, autonomous fleets can also coordinate movements, smooth traffic flow, and reduce congestion, thereby increasing overall efficiency and reliability. This cost and safety structure explains why autonomy is gaining traction first in fleet-based services rather than private ownership. It also explains why companies such as Waymo focus on geographically bounded deployments [5]. Autonomous mobility is emerging not as a luxury consumer product, but as a service layer that decouples mobility from individual driving capacity. Recent industrial developments reinforce this trajectory. In 2026, major automotive manufacturers began integrating high-performance AI computing platforms directly into production vehicles. The partnership between Nvidia and Mercedes-Benz illustrates how advanced AI systems are moving from experimental environments into everyday mobility [14]. These developments indicate that autonomous mobility is entering a new phase of real-world deployment. Seen from this perspective, autonomous driving functions less as a technological upgrade than as a structural response to demographic change. It offers a way to preserve autonomy without relying on human driving capacity, and without forcing older citizens into transport modes they experience as restrictive or undignified.

Autonomous Driving as Social Infrastructure

When deployed as shared and accessible services, autonomous vehicles increasingly resemble utilities rather than consumer products. Like electricity or broadband, they form a foundational layer on which other social systems depend. For ageing societies, this shift is critical. Autonomous mobility can sustain access to healthcare, maintain social participation and delay institutional care by extending independent living [9]. At the system level, autonomous mobility also offers efficiency gains. By optimizing routing, reducing idle time and enabling better integration with public transport networks, autonomous services can improve reliability while reducing emissions and infrastructure strain [15]. For older users, this translates into more predictable and accessible mobility without the physical and cognitive demands associated with driving. This reframes autonomous driving as a question of institutional design rather than technological readiness. If treated as social infrastructure, autonomous mobility can be integrated into healthcare systems, ageing policy and regional development strategies. If treated solely as a commercial product, deployment will primarily follow profitability, leaving structural mobility deficits unresolved.

Competing Governance Models: Europe and China

The global development of autonomous driving reflects divergent governance approaches. China has pursued an infrastructure-supported approach, embedding sensors, vehicle-to-infrastructure communication and centralized traffic management directly into the road environment [12]. This model enables rapid deployment and system-level coordination but relies on extensive data integration and centralized oversight. European countries, by contrast, have largely adopted a vehicle-centric approach. Intelligence is expected to reside primarily within the vehicle, reflecting normative commitments to decentralization, privacy and accountability [13]. While consistent with European regulatory traditions, this approach increases technical complexity and slows deployment. Neither model is inherently superior. The Chinese approach emphasizes speed and system efficiency. The European approach prioritizes rights, resilience and public trust. What matters for ageing societies is how this governance choices shape social outcomes over time.

Risks, Inequality and the Need for Public Governance

Despite its promise, autonomous mobility entails risks. Older adults often exhibit cautious attitudes toward automation, driven by concerns about safety, trust and loss of control [10]. Poorly designed interfaces or exclusionary service models risk marginalizing precisely those groups autonomous mobility is intended to serve. Data-intensive mobility systems also raise concerns about surveillance and misuse. Continuous tracking of movement patterns reveals sensitive information about health and daily routines. Without robust governance frameworks, autonomous mobility could erode privacy under the guise of efficiency [13]. Market-driven deployment further risks reinforcing spatial inequality. Autonomous services are likely to emerge first in dense urban areas, while rural and peripheral regions, where demographic ageing is often most pronounced, remain underserved [9]. High-profile incidents, such as

autonomous vehicles blocking roads during power outages, underline the need for public oversight and robust contingency planning [6].

A Publicly Governed Autonomous Mobility Layer

To maximize benefits and minimize risks, autonomous mobility must be governed as social infrastructure rather than consumer technology. A publicly governed Autonomous Mobility Layer could integrate autonomous services into European welfare, healthcare and transport policy. Under such a framework, public authorities would define standards for accessibility, interoperability and data governance, while private firms compete to provide vehicles and services within these rules. By shifting mobility provision from ownership to access, this approach aligns technological innovation with Europe's demographic reality and established social values.

Conclusion

Ageing societies now face a structural choice. Autonomous driving will shape future mobility systems, but its social consequences are not predetermined. Treated as a luxury technology, it risks entrenching inequality. Governed as social infrastructure, it can extend independence, stabilize welfare systems, and preserve social participation. Autonomous mobility, in the end, is not simply about transport. It reflects broader choices about how societies govern artificial intelligence once it becomes embedded in everyday life. Those that recognize this early, and act accordingly, will not only move faster, but move together.

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