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Older people and the smart city – Developing inclusive practices to protect and serve a vulnerable population

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Abstract: Despite increased interest in the development of smart cities and urban spaces that cater to the needs of their inhabitants, there is a significant lack of information and experience when it comes to working with older people. URBANAGE is a European H2020 project focused on supporting urban planners and policymakers in the decision-making process for age-friendly cities by developing new technologies for evidence-based decision-making. Older adults over 60 years of age, public servants and other relevant stakeholders were invited to co-create and test the solution to ensure that their needs and challenges were being addressed by the project. Decision-makers are facing major challenges in terms of understanding and addressing the needs of vulnerable population groups, such as older people, because of the lack of large enough datasets of disaggregated anonymised data. In this article, we report on the main challenges encountered during the implementation of the URBANAGE project, and the development of the components for big data analytics, visualisations, predictive algorithms and simulation. Using examples from three European locations – Helsinki, Flanders and Santander – we describe and discuss how we can gather personal data related to the daily lives of older people in terms of the existing privacy and data protection laws in the EU. The use of new technologies, such as location-based information devices, can provide up-to-date and precise information regarding problems that older people face while moving around the city, but they pose privacy concerns at the same time.

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Introduction

Europe, along with many other regions of the world, is facing an increase in its ageing population, and the challenges that come with it. According to some estimates, by 2050 the older population in Europe will increase by 39.3 million (Eurostat, 2020). At the same time, studies have noted that the rise in the proportion of older people in the total population has been accompanied by an increase in digital ageism, a new form of digital discrimination (Manor & Hersovici, 2021). These forms of discrimination may entail excluding older people from design considerations or as a potential user group of particular services. Digital ageism refers to the assumptions and stereotypes associated with the abilities of older people to use and learn to use digital technologies (Köttl & Mannheim, 2021). This trend poses new challenges for cities in developing services. In many cases, decision-makers and planners see technology as one possible solution to many of the challenges associated with ageing. Such solutions include care robots and other smart technologies, such as self-tracking and monitoring devices to help in everyday life. The development of smart city technologies has become an increasingly salient feature in urban planning and development. The development of digital twins for cities has been one example of how cities are seeking to implement new approaches to planning and design. Urban planning seeks to include a broader spec-

trum of actors in the development and design process. This includes the development and use of data-driven evidence-based decision-making tools (Angelidou, 2016).

In this article, we present the ongoing work that the URBANAGE project (Enhanced URBAN planning for AGE-friendly cities through disruptive technologies) is conducting. URBANAGE aims to assess the potential benefits, risks and impact of implementing a long-term sustainable framework for data-driven decision-making in the field of urban planning for age-friendly cities. Age-friendly refers to a more inclusive approach to city planning and development. Focusing on one type of vulnerable population allowed us to understand the specific needs of this target group. This model will be developed through an inclusive co-creation and testing strategy with relevant stakeholders (public servants) and users (older adults), based on a decision-support ecosystem that integrates multidimensional Big Data analysis, modelling and simulation with artificial intelligence (AI) algorithms, visualisation through Urban *Digital Twins* and gamification for enhanced engagement purposes. Based on a thorough understanding of users' needs, the project will validate its findings by piloting use cases in three local planning systems in Europe (Helsinki, Santander, and Flanders) (URBANAGE, 2022). We focus on the use of inclusive co-creation processes used to develop and guide age-friendly urban planning, and also highlight some of the social, legal and ethical considerations that have arisen and been examined during the project thus far.

Our work builds on and contributes to previous work on smart cities and citizen involvement by testing and implementing approaches and methods for including older people in planning and developing smart city technologies (Cardullo & Kitchin, 2018). More specifically, in this paper we focus on the legal aspects and concerns entailed in collecting and including data from older people to explore how an inclusive approach to planning and development can help to mitigate some of the risks associated with data collection. These approaches to inclusion are not new (cf. Arnstein, 1969), but require re-thinking some of the new technologies that are being developed and deployed in smart city development.

The inclusion of older citizens in urban planning reflects an interest in respecting basic human rights, as well as being more inclusive in decision-making. The role of digital governance and human rights has become a point of interest more recently, with programmes such as the United Nations Human Settlements Programme (UN-Habitat) calling for improved representation and inclusivity in the development and implementation of digital technologies in cities (UN-Habitat, 2022).

The inclusion of older people in planning also recognises the concrete need to consider the rising costs associated with an ageing population, thereby pre-emptively seeking solutions that may mitigate future expenses through planning. Given that urban planning and development are increasingly using and developing high-tech solutions and tools to help in planning, it is important to better understand how human rights, especially with reference to older people, need to be considered and respected. Given that demographic projections show that Europe's ageing population will peak in the coming decades, developing age-friendly cities is all the more important. Addressing the needs and challenges of older people requires a non-traditional approach where multiple disciplines work together in developing holistic solutions for addressing the complexity of the urban environment. In the same way, new "disruptive" technologies are required to support such complex systems. The URBANAGE project aims to support civil servants in creating age-friendly initiatives by developing and piloting such new "disruptive" technologies. In particular, we examine the different needs and interests of three pilot locations: Helsinki, Santander and Flanders. In these three locations, we recruited a diverse, albeit small, group of older people for interviews and co-creation sessions. In addition, we conducted interviews with civil servants to discuss the challenges that they had identified in relation to inclusive planning that also considered the needs of older people. The three cases provide insights into the varying needs of the older population in these different locations, as well as the various capabilities and processes that are taking place in urban environments with different geographical and cultural specificities. Cities tend to have diverse capacities in relation to the data that they are able to collect (Ylipulli & Luusua, 2020; Walravenz et al., 2019; Díaz-Díaz et al., 2017), but access to and use of data on vulnerable populations can be particularly difficult to obtain. Common to all three locations, however, is an interest in making decision-making more inclusive, coupled with respect for human rights in the development and implementation of new technologies.

Smart city initiatives have become prevalent during the past ten years, whereby cities see the increased use of digital technologies as the basis for improved decision-making and planning (Angelidou, 2017). At the same time, questions related to the increased datafication or intensification of data collection have renewed calls for discussions regarding rights and obligations, such as data justice (Wong et al., 2020; Dencik et al., 2019; Hoeyer 2016; Metcalf, 2015). These rights and obligations include the inclusion of affected populations in the design, development and implementation of new technologies.

Our article is structured as follows. First, we will discuss some of the challenges

that cities face when addressing the needs and challenges of older people in the urban environment. Second, we will present the most salient features of the legal framework at the EU level, which has a bearing on urban planning. Third, we will discuss the development and use of different strategies to support civil servants in enabling age-friendly cities. Finally, we discuss the challenges and opportunities that relate to a rights-based approach to inclusive planning. Our paper concludes with a call for a more inclusive design and development approach for cities and civil servants as a robust way of mitigating rising costs.

Challenges cities face when planning for older population groups

Cities across the globe have been increasing the attention they pay to their residents' well-being and flourishing as key factors in improving urban "liveability" (Cassarino et al., 2021). In part, this is a reaction to a perceived competition among cities to attract the brightest minds and most productive citizens, and therefore gain the best reputation (Florida & Mellander, 2015). Beyond that, it indicates a sincere ambition to provide all residents with the *capability* to "live a good life" (Lloyd-Sherlock, 2002), as called for in the United Nations *Sustainable Development Goals* (SDG) 3 ("Good health and well-being"), 10 ("Reduced inequalities") and 11 ("Sustainable cities and communities"), for example. It is particularly with the latter motivation in mind that decision-makers and planners alike take a closer look at what could make their cities more just, more equitable and more liveable places for vulnerable groups such as children, low-income residents and older people, to name just a few (Derr et al., 2013). Although our research focus is specifically on older people, they share many common characteristics with other marginalised and vulnerable groups in that their voice and perspectives are often overlooked in the planning processes.

Older people, despite representing a diverse and fuzzily delineated group, have become the focus of urban planners: their numbers are increasing (United Nations, 2019), and many of the challenges they encounter in their everyday lives could be averted or eased by appropriate urban interventions. For instance, many older people face challenges in realising their mobility needs, despite the ubiquitous opportunities of urban mobility. Accessing everyday places can be challenging for seniors, for instance, in a physical manner when it comes to long walking distances, poor infrastructure for active modes of transport or insufficient or inaccessible public transport. These factors also correspond to the most commonly voiced needs and wishes of older people participating in a series of focus groups de-

signed to inform the URBANAGE project. The social and psychological barriers to participating in local communities, in political and social life on an urban scale and to asking for assistance should not be underestimated either, but many factors that limit older people's lives could be dramatically improved with concerted efforts to increase the quality of physical urban space.

Cities, like most aspects of our lives, have undergone tremendous technological advancements in recent decades. Spatial data infrastructure(s) (SDE), once glorified centralised vaults of geospatial data accessible to all city departments, have evolved into smart city initiatives and digital urban twins: dynamic computer models mirror every detail of a city's physical, organisational, and social realities to inform policymakers, planners and decision-makers "in real-time" – possibly forecasting the impact of anticipated decisions and changes. However, while not entirely positivist or a reduction of a city to a single perspective, smart city infrastructures share a critical limitation with other data science approaches: what cannot be measured, cannot be recorded.

It is challenging to gather data on older people, or on other marginalised groups (Wang et al., 2021; Rose, 2020). Typically, the data collected and analysed emphasises the interests of the majority group. This is further aggravated by a legacy – among other things – of transport-planning models assuming a representative "average resident", who often implicitly ends up being white, middle-aged, male and middle class. More often than not, neither the model nor the data take marginalised groups and the most vulnerable residents into consideration (Wang et al., 2021).

However, the lack of data does not stem from disregard. There are concrete and tangible reasons and motivations, ranging from technological and practical to ethical and legal, why smart cities struggle to collect and provide data on older people. From a practical perspective, it is worth noting that older people are the least likely to engage in a digital lifestyle and thus do not leave a particularly strong footprint in the digital world. Data derived from social media, for instance, cannot provide insights into the daily itineraries of older people, nor can data from fitness trackers give estimates on older people's walking or cycling speeds. These pieces of data often exist, but when disaggregated by age, samples become too small for analysis, or certain groups are overrepresented. Willberg et al. (2021), for instance, found that young men and "super-users" are overrepresented in bike-sharing data. Along the same lines, Heikinheimo et al. (2020) observed that active athletes generate the most data on Strava, a fitness-tracking app. In datasets obtained by statistical bureaus or other data providers, such as telecom operators, data is min-

imised and aggregated to protect rights to privacy and prevent unwanted individual identification. Minority groups are thus not visible in such data: a side effect of "privacy engineering" practices that aim to translate the vague concept of privacy into concrete requirements (Rommetveit & van Dijk, 2022). This is both legally and ethically desirable, but leaves planners without robust ways to guide their work.

There is a growing consensus among scholars, practitioners and policymakers that urban planning and policy should strive to support their decisions with concrete evidence, also in order to improve residents' acceptance of decisions that are almost always the outcome of complex mediation and negotiation processes between many competing interests (Krizek et al., 2009). It is imperative that this evidence includes the voices and perspectives of vulnerable groups, but currently data often fails to represent them appropriately. New data need to be collected or derived, but legal, technological and practical concerns also need to be considered.

Legal questions related to gathering personal data from older people in terms of EU privacy and data protection laws

The need for mobility-based data from older people in urban planning

In her report on the enjoyment of all human rights by older persons, Mahler (2020, p. 6) highlights the problems relating to the lack of data on the everyday realities of older persons and their enjoyment of human rights. She emphasises that it is essential to have disaggregated data on older people for inclusive and effective public policy making. The problem is that it is difficult to obtain such data. One possible way is to collect mobility data on older people through smart devices. Such data are particularly sensitive, however. The devices link location data, environmental data and behavioural data with personal and physiological data, including health- specific data (Mahler, 2020, p.10). Such data is impossible to anonymise at the municipal and country levels. Disaggregation of such data may still be possible, depending on the parameters used, if we could demonstrate that disaggregated data could be regarded as necessary to prove possible inequality and discrimination (Mahler, 2020, p. 8).

The notion of disaggregative, anonymised data presupposes that anonymised data sets exist. However, when data collected through IoT devices comprises location data and can be linked to other data sources, anonymisation becomes virtually impossible. Farzanehfar et al. (2021) has shown that by using three months' worth of

location data, 93% of people are uniquely identifiable in a population of 60 million, using four points of auxiliary information.

In the following section, we analyse the process for gathering personal data about older people and their daily activities from the perspective of the EU's existing privacy and data protection laws. While recognising that properly anonymised disaggregated-level data would be the best method for urban planning, it may be extremely challenging given the sensitivity of mobility data. In the following, we explore to what extent data anonymisation could be utilised in urban planning, and which legal basis, in terms of gathering personal data from older people, could be utilised in data protection law.

Collection of mobility data in the URBANAGE use cases

In the URBANAGE use cases, the limited number of participants made any type of anonymisation process impossible. The GDPR defines *personal data* as encompassing both directly and indirectly identifiable data.[1] Any information relating to an identified or identifiable natural person is to be considered personal information. To determine whether a certain person is identifiable, an account should be taken of all the means likely to be used, such as singling out, either by a controller or by another person, to identify the natural person directly or indirectly (Recital 26, GDPR).

This means that even if a person cannot be identified by name, but that person can be pointed out in a crowd due to their mobility patterns, then the data relating to that person is personal data and subject to the GDPR. In addition to physical locations, location data from smartphones can also reveal interactions with other people. Thus, location data can be regarded as one of the most sensitive types of data (de Montjoye, 2013; EDPB/EDPS Joint opinion, 2022). Older people are not explicitly afforded special protection in EU privacy laws. However, Article 21 of the EU Charter of Fundamental Rights prohibits discrimination based on age, among other factors. The EU General Data Protection Regulation (GDPR) affords strengthened protection for certain sensitive groups of personal data, namely data revealing racial or ethnic origin, political opinions, religious or philosophical beliefs or trade union membership, as well as genetic data, biometric data for the purpose of uniquely identifying a natural person, data concerning health or data concerning a

1. According to Article 4.1 (1) '"personal data"' means any information relating to an identified or identifiable natural person ('"data subject"'); an identifiable natural person is one who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person.

natural person's sex life or sexual orientation (Art. 9.1 GDPR).

It is also specifically acknowledged in the GDPR that risks to the rights and freedoms of natural persons of varying likelihood and severity may result from processing personal data "where personal aspects are evaluated, in particular analysing or predicting aspects concerning [...] health, personal preferences or interests, reliability or behaviour, *location* or *movements*, in order to create or use personal profiles; where *personal data of vulnerable natural persons* [...] are processed [...]" (Recital 75; emphasis added).

The GDPR does not, however, exclude recognising older people as in need of extra protection. It is explicitly acknowledged that children constitute a vulnerable group of persons (Art. 8 in particular), but it is clear, albeit implicitly, that other groups of persons may also find themselves in a vulnerable position (Piasecki & Chen, 2022). From the point of view of those use cases, which focus on enhancing the possibilities offered by city planning, attention should also be given, in addition to direct identifiers, to the indirect identifiability attributes of an individual and the linkability of such data to other datasets. For example, if a person's location data, age and their possible elements of reduced mobility are collected, it might be possible to identify that person from their mobility patterns.

Recently, the Court of Justice of the EU (CJEU) confirmed that inferred data is to be considered personal data. The court stated that the publication of personal data liable to indirectly disclose the sexual orientation of a natural person, on the website of the public authority responsible for collecting and checking the content of declarations of private interests, constitutes the processing of special categories of personal data for the purposes of the provisions of the GDPR.[2] In URBANAGE, this has been considered only with the explicit consent of the participating person.

Data that is not directly identifiable, but consists instead of attributes enabling identification, is stored separately and referred to as pseudonymous data (Art. 4.1(5)). Pseudonymous data is always personal data and subject to the GDPR. In contrast, when personal data is irreversibly anonymised so that it can no longer be attributed to a specific individual, it is no longer subject to the GDPR (Finck & Pallas, 2020). It should, however, be emphasised that collecting personal data for anonymisation purposes entails the processing of personal data, which is subject to the GDPR and requires a legal basis.

2. CJEU Case C-184/20, ECLI:EU:C:2022:601.

Even if the basic assumption of the GDPR is that anonymisation should be irreversible, it is nevertheless recognised that in real-world conditions, this is not likely to be so clear-cut. According to the GDPR, "to determine whether a natural person is identifiable, account should be taken of all the means reasonably likely to be used, such as singling out, either by the controller or by another person to identify the natural person directly or indirectly". It further states that in determining how to assess which means are likely to lead to identifying a person, "all objective factors, such as the costs of and the amount of time required for identification, taking into consideration the available technology at the time of the processing and technological developments" should be taken into account (Recital 26) (cf. Data Protection Working Party, Opinion 05/2014; Purtova, 2022).

There are certain categories of personal data which are notoriously difficult to anonymise in a satisfactory manner. In the following, we address specific issues related to collecting location data in the use cases of URBANAGE.

Specific issues related to the use of location data

Two of the use cases collected location data from smartphone applications. In one case in Helsinki, mobility data was collected from a separate IoT device. Collecting location data is regulated at the EU level by the ePrivacy Directive (Directive 2002/58/EC). *Location data* is defined as "any data processed in an electronic communications network, indicating the geographic position of the terminal equipment of a user of a publicly available electronic communications service".

While the ePrivacy Directive primarily regulates the electronic communications sector, when communication is defined as any information exchanged or conveyed between a finite number of parties by means of a publicly available electronic communications service, it is also applied to situations in which an electronic communication network is used to store information, or gain access to information stored in the terminal equipment of a subscriber or user. This applies , for example, to cases in which information is retrieved and stored in an application on a mobile phone.

Storing or gaining access to such information presupposes that the user has given their active and specified consent as defined in Article 7 of the GDPR (Art. 5.3 of the ePrivacy Directive as amended by Directive 2009/136/EC). Full information related to the use of such data as required in Article 13 GDPR must be provided prior to asking for consent (see below). This means that the use of any information, such as the location data utilised in URBANAGE use cases, requires active and informed

consent from the application user whose data is being collected. Any further use of data also requires consent. However, preferably, the further use of data should occur in anonymised form, although it is generally recognised that anonymising location data is extremely difficult.[3] Even the pseudonymisation of location data is close to impossible, which is why alternatives other than pseudonymisation should be considered (de Montjoye et al., 2018).

Different types of consent

At a general level, we can make a distinction between two types of consent relevant to the use cases. So-called "ethical consent" is required when the participant agrees to take part in the research process. The GDPR-based consent provides a legal basis for processing personal data. Both types of consent are based on the individual's fundamental right to privacy and autonomy as guaranteed in the European Convention of Human Rights (Article 8) (Breen et al., 2020; Lee et al., 2019). Consent is also based on the EU Charter of Fundamental Rights, where the right to privacy (Article 7) and the right to data protection (Article 8) give comprehensive protection to individuals in relation to the privacy of their communications and the use of their personal data.

Both types of consent presuppose that they are freely given and based on all the available information regarding the processing of the collected data. However, the GDPR-based consent is strictly regulated when used as the basis for processing special categories of data, such as health data or data about ethnic origin. In most of the URBANAGE use cases, we need both kinds of consent: consent for participation in the research or other activity, and clear consent for data processing.

In order for a person's consent to participate in a research process, such as an interview, to be informed and freely given, full information with regard to the event, such as a co-creation session, and the further processing and use of their data after this event, must be given to the participant. In the URBANAGE use cases, participation in co-creation workshops was based on this kind of consent, which we can refer to as ethical consent.

According to the GDPR, consent as the basis for data processing means "any freely given, specific, informed and unambiguous indication of the data subject's wishes by which he or she, by a statement or by a clear affirmative action, signifies agreement to the processing of personal data relating to him or her" (Art. 4.11 GDPR). As

3. EDPB Guidelines 04/2020 on the use of location data and contact tracing tools in the context of the COVID-19 outbreak, 12 April 2020.

a legal basis in terms of Article 6, the consent must be given for one or more specific purposes (Art. 6.1(a)). In other words, the consent must specifically cover each intended data processing purpose.

When the data processing involves special categories of data in terms of Article 9,[4] the consent has to be explicit and specified for one or more purposes. If it is given in a written declaration, which also concerns other matters, the consent for the processing of personal data must be clearly distinguishable from those other matters, and it has to be written in clear and plain language (Art. 9.2 GDPR). For URBANAGE, this means that the consent for data processing is clearly distinguishable from the consent to participate in the research process, such as co-creation workshops. While no special categories of personal data were collected in the use cases, mobility tracking could reveal such information at a later stage, such as participation in political meetings or visits to specialised health clinics.

The data controller is accountable when it comes to ensuring that the general principles of data protection outlined in Article 5 of the GDPR are adhered to,[5] and in being able to demonstrate that the data subject has consented to the particular data processing operation. It should also be noted that consent should not provide a valid legal ground for the processing of personal data in a specific case where there is a clear imbalance between the data subject and the controller. This could be the case when the controller is a public authority. In assessing this, the specific circumstances of the case should be given consideration (Recital 43). This should not apply to public universities where no such imbalance in research projects usually exists. Given the differing vulnerabilities of older people in terms of understanding the information pertaining to the research process and, in particular, the processing of their personal data, the consent should be adapted to their specific capabilities in relation to collection via smart devices (Piasecki & Chen, 2022). The data controller should also introduce appropriate safeguards to address the risks related to the collection of data by smart devices from older people (Malgieri & Niklas, 2020, p. 16). This could be done, for example, by warning them about unnecessarily revealing sensitive information about themselves or other people when using voice-based communication enabled by a smart device. The project al-

4. Special categories of data in terms of Article 9 GDPR are data revealing racial or ethnic origin, political opinions, religious or philosophical beliefs, or trade union membership, as well as genetic data, biometric data when processed for the purpose of uniquely identifying a natural person, data concerning health or data concerning a natural person's sex life or sexual orientation.

5. These principles are 1) lawful, fair and transparent processing of data; 2) purpose limitation; 3) data minimisation; 4) accuracy of the data; 5) storage limitation; 6) integrity and confidentiality of the processed data (Article 5.1 GDPR).

so explored how well this could be explained (in a transparent manner) to the participants.

In order for the consent to be valid, it has to be informed in terms of the GDPR (Arts. 12–14). The transparent processing of personal data is one of the cornerstones of the GDPR and adhering to these provisions is obligatory when the data is acquired directly from the data subject, unless the controller can show that the data subject already has the information (Art. 13). When the data is acquired from other sources, the same applies with narrowly interpreted exceptions for scientific research, statistics or archiving purposes relating to situations when providing the information is impossible or extremely difficult (Art. 14.5).

When the controller intends to further process personal data for a purpose other than that for which the personal data was collected, the controller shall provide the data subject, prior to that further processing, with information on that other purpose, and with any relevant further information from the information stipulated above. When the processing of personal data is based on consent – should the original consent not cover that further processing purpose – new consent is required. If personal data is linked with other data sources, this should also be communicated to the data subject.

In URBANAGE use cases, AI is not used to profile individuals, nor for automated decision-making in relation to them. However, the use of AI may pose risks of singling out individuals according to their mobility patterns. In this case, their identity could be inferred from their everyday mobility practices (EDPB Guidelines 04/2020). This should be taken into account in the information leaflets distributed to participants, and be discussed during co-creation meetings and other stakeholder engagement.

Pathways to developing inclusive planning: Co-creation as a framework for evaluating user acceptance and willingness towards adoption

Stakeholder engagement is the key to effectively tackling urban challenges regarding the development and introduction of fit-for-purpose smart city solutions. By engaging all the relevant stakeholders (i.e., governments, research institutions, end users, private actors) in a co-creative manner, the solution will be tailored and tested to holistically address the needs and challenges of all the engaged actors.

As smart city solutions typically involve the collection and analysis of (personal)

data to support decision-making processes, new challenges arise that can affect their final adoption. Co-creation methodologies can play a key role in addressing these challenges by involving the end users (i.e., the data providers and subjects) and their perspectives in the development and evaluation of the transparency and trustability of the introduced solution.

In the context of the URBANAGE project, co-creation methodologies were implemented to collect and validate stakeholders' requirements, and to test the solution in the different development stages. Van Leeuwen et al. (2022) describe the details of the approach and its implementation in the project. The framework consisted of three phases: preparatory phase, three co-creation workshops with older adults and civil servants, and a final recommendation phase. The preparatory phase aimed to collect relevant information about the domain and context of the project. This was specifically aligned with the needs and interests of the three pilot sites. The co-creation workshops aimed to collect information on and validate the needs and challenges of adults and civil servants. Finally, the reporting phase collated the results into an actionable document with recommendations targeted at an implementation plan or policy.

To ensure that all relevant stakeholders were engaged in the co-creation and testing activities in all URBANAGE pilots, we developed a stakeholder engagement plan. In co-creation, time is reserved to engage with individual participants and explore urban planning and the developments that they are concerned about. Co-creation can also be used to encourage participants to ask questions about data collection and its possible subsequent uses, whereby planners and experts can gain a better understanding of the concerns and needs of vulnerable populations. Co-creative relationships with the data subjects would also make it possible to introduce dynamic consent into the devices that would communicate with the data subjects and give them information about new uses of data for which their consent was requested (Cf. Helbing et al., 2021).

In addition, considering the specific needs and characteristics of senior citizens, we developed a user engagement guide to support the different project activities with older citizens. Three co-creation workshops were organised in each of the three pilots. The first, with older citizens, aimed to ascertain the needs and challenges they faced when navigating the urban environment. The second, targeted at civil servants, aimed to validate the previously collected requirements and to ascertain the needs and challenges related to promoting age-friendly initiatives. The third, targeted at civil servants and older citizens, aimed to validate the requirements collected during the previous co-creation workshops by using user journeys. Each

of the three pilots, based on the technical feasibility and available data sources, then developed an implementation plan.

Each pilot decided to implement two complementary solutions: one solution tailored for civil servants and the other for the older citizens. The first solution consisted of the development of an urban digital twin to support civil servants in the age-friendly data-driven decision process. Two pilots (Flanders and Santander) developed a solution to support older people in navigating the city. The Helsinki pilot proposed a solution focusing on the use of IoT devices to collect data about the end-user's perception of the urban environments.

In all of the pilot implementation plans, it was clear that the available data sources were not sufficient to inform the designed solutions, due to a lack of disaggregated and anonymised location data. In some cases, this was because data providers did not collect information about specific segments of the population (e.g., age). In others, as in the case of the Flanders pilot, the law prohibited the data processor from accessing personal records and conducting anonymisation processes. Moreover, even when allowed, the legal and anonymisation procedures were too complex to be performed in the context of the project implementation. Finally, other types of open data (e.g., accessibility data) were not available in the required data format (e.g., pdf, cad files) and they could not be linked with other GIS data (e.g., roads, buildings).

As a result of this analysis, all the pilots decided to integrate an additional data collection process as a part of the application tailored to older citizens. This required the older citizens to provide consent for the collection and processing of their personal data for the purposes described.

Although the Covid-19 pandemic accelerated internet usage and technology adoption among the older population (Sixsmith et al., 2022), older citizens are increasingly more prone to cybersecurity concerns and scams because of their lack of digital skills and competences (Nicholson et al., 2019). This issue shows how technology adoption per se is not sufficient and needs to be supported by technology that is designed to be understandable and explainable.

In this phase, the co-creation methodologies played an additional fundamental role in educating the end users about the data collected, the processing procedures and their implications. This step was crucial in gaining trust in the transparency of the proposed solution, and hence in favouring its adoption. This was achieved by integrating trustability and transparency as a part of the requirements

in the early phases of design and development. Special attention has been devoted to the creation of dedicated consent forms that took into account the lack of digital proficiency by making them easy to understand for the end users. This iterative process also addresses more general aspects concerning the explainability of the technology (Helbing et al., 2021).

Given the inputs collected in these phases, the pilots are now proceeding in the development phase. Further testing activities with end users are foreseen during the different intermediate steps of the development, to inform them about, and help them adapt, to the subsequent iterations, with a view to informed and educated adoption.

Challenges of inclusive rights-based urban decision-making

With the rise of smart city technologies, the possibilities afforded to data collection and use in decision-making tools are increasing considerably. At the same time, GDPR and other legislation impose specific requirements on the legal basis for data collection and storage. The collection of data from vulnerable groups, such as older people, poses further challenges in that vulnerable groups ought to be afforded special protection. At the same time, data collection is essential in helping to identify ways in which the needs of vulnerable groups can be met.

Current approaches to data collection tend to view informed consent as a technical and legal process in which engagement with the data subject is minimised to formalised forms and documents. One of the goals of the URBANAGE project has been to highlight the robustness of ongoing engagement through processes of co-creation and testing.

An example of the strength of this approach relates to difficulties in the anonymisation of location data. Location data can prove to be sensitive in nature despite the best efforts to try to anonymise data. Consequently, the co-creation process used in the pilots helped to provide crucial information for developers on the possible privacy trade-offs and concerns that vulnerable groups may have regarding the use of such data. At the same time, the co-creation process also allowed the older participants time to ask questions and reflect on the nuances associated with location data and privacy. Although co-creation may not be scalable in relation to large datasets, using this approach with smaller focus groups and pilot studies can help to identify possible concerns, as well as provide an important engagement opportunity with vulnerable and marginalised communities. Although urban decision-making may not necessarily need high resolution in planning and develop-

ment, the process of engaging vulnerable groups helps to provide important insights that can be used in planning cities that are more inclusive. In the Flemish pilot, the outcomes of the co-creation workshops, together with the implementation challenges, provided meaningful insights for the cities and the region about how to develop their data platform to support age-friendly initiatives. During the early development phase of scoping for technologies, the Flemish developers understood that the collection of sensitive health data was not necessary for developing their pilot. Consequently, instead of seeking to collect sensitive health data, the pilot sought to ask users what types of outdoor environments they preferred to spend time in. This approach led to the development of an application in which users can anonymously identify outdoor areas that are shady and pleasant on hot summer days. Although the URBANAGE project has focused on older individuals, their approach can be useful for other stakeholders, regardless of age or possible vulnerability. The co-creation sessions organised in the three locations also allowed city planners to better understand the concerns and questions that older people may have with regard to privacy. For example, given the possible benefits that the research may provide, certain types of data collection or tracking were considered acceptable. As such, engagement with older people also provided important opportunities to better understand and implement design-based approaches to data protection (Rommetveit & van Dijk, 2022).

Current legislation requires that end users be able to understand the risks associated with any type of data collection. Given that the collection of location data – even when collected using a non-identifiable device – can lead to the identification of individuals, it is of utmost importance to explain and discuss these challenges in a transparent manner. This approach shows respect for participants and allows them to discuss and present any concerns or questions they might have. This is also an important form of empowerment for otherwise marginalised groups, such as older people.

Although smart city technologies rely heavily on automation for data collection and processing, the URBANAGE project highlights the need for and importance of human engagement in planning and development (Helbing et al., 2021). This is particularly important with regard to vulnerable populations such as older people. Although different cities have vastly different data collection capabilities and smart city implementations (Ylipulli & Luusua, 2020; Walravenz et al., 2019; Díaz-Díaz et al., 2017), this project has highlighted how co-creation can be used in multiple different contexts to better understand the needs of the older population.

Conclusion

With the URBANAGE project, we provide an example of how data from older people can be collected and used to inform age-friendly and inclusive decision-making tools. Although the scaling of data collection poses challenges for co-creation, our study suggests that co-creation is an excellent and feasible approach when piloting new studies and developing technologies that support the real needs of inhabitants and civil servants.

In many countries and cities which strive to adopt smart city technologies, data remains in silos, which poses a challenge for more effective data analysis regarding vulnerable population groups, such as older people. Current trends which emphasise data justice and data self-determination suggest that engagement with study populations can help address participants' concerns, especially when working with vulnerable population groups. Co-creation and engagement practices provide important benefits with regard to concerns over transparency, consent and anonymisation. When new technologies are used – such as location-based data collection – concerns may be raised regarding privacy and anonymity, and creating and maintaining spaces for dialogue. The co-creation sessions in the URBANAGE project help to address some of these issues.

More effort should be made to develop applications, programmes and smart city technologies that take better account of the specific needs of older people, so that policymakers can inform their decision-making with evidence from this vulnerable population group. The data collection components of such applications should be developed and facilitated with transparency, and keep ease of use and accessibility in mind to enable truly informed consent-giving.

References

Angelidou, M. (2016). Four European smart city strategies. *International Journal of Social Science Studies*, *4*(4), 18–30. https://doi.org/10.11114/ijsss.v4i4.1364

Angelidou, M. (2017). The role of smart city characteristics in the plans of fifteen cities. *Journal of Urban Technology*, *24*(4), 3–28. https://doi.org/10.1080/10630732.2017.1348880

Arnstein, S. R. (1969). A ladder of citizen participation. *Journal of the American Institute of Planners*, *35*(4), 216–224. https://doi.org/10.1080/01944366908977225

Bozzaro, C., Boldt, J., & Schweda, M. (2018). Are older people a vulnerable group? Philosophical and bioethical perspectives on ageing and vulnerability. *Bioethics*, *32*(4), 233–239. https://doi.org/10.1111/bioe.12440

Breen, S., Ouazzane, K., & Patel, P. (2020). GDPR: Is your consent valid? *Business Information Review*, *37*(1), 19–24. https://doi.org/10.1177/0266382120903254

Cardullo, P., & Kitchin, R. (2019). Being a 'citizen' in the smart city: Up and down the scaffold of smart citizen participation in Dublin, Ireland. *GeoJournal*, *84*(1), 1–13. https://doi.org/10.1007/s10708-018-9845-8

Cassarino, M., Shahab, S., & Biscaya, S. (2021). Envisioning happy places for all: A systematic review of the impact of transformations in the urban environment on the wellbeing of vulnerable groups. *Sustainability*, *13*(14), 8086. https://doi.org/10.3390/su13148086

Data Protection Working Party. (2014). *Opinion 05/2014 on anonymisation techniques* (pp. 1–37) [WP216]. set up under Article 29 by Directive 95/46/EC of the European Parliament and of the Council. https://ec.europa.eu/justice/article-29/documentation/opinion-recommendation/files/2014/wp216_en.pdf

de Montjoye, Y.-A., Gambs, S., Blondel, V., Canright, G., de Cordes, N., Deletaille, S., Engø-Monsen, K., Garcia-Herranz, M., Kendall, J., Kerry, C., Krings, G., Letouzé, E., Luengo-Oroz, M., Oliver, N., Rocher, L., Rutherford, A., Smoreda, Z., Steele, J., Wetter, E., … Bengtsson, L. (2018). On the privacy-conscientious use of mobile phone data. *Scientific Data*, *5*(1), 1–6. https://doi.org/10.1038/sdata.2018.286

de Montjoye, Y.-A., Hidalgo, C. A., Verleysen, M., & Blondel, V. D. (2013). Unique in the crowd: The privacy bounds of human mobility. *Scientific Reports*, *3*(1), 1376. https://doi.org/10.1038/srep01376

Dencik, L., Hintz, A., Redden, J., & Treré, E. (2019). Exploring data justice: Conceptions, applications and directions. *Information, Communication & Society*, *22*(7), 873–881. https://doi.org/10.1080/1369118X.2019.1606268

Derr, V., Chawla, L., Mintzer, M., Cushing, D., & Van Vliet, W. (2013). A city for all citizens: Integrating children and youth from marginalized populations into city planning. *Buildings*, *3*(3), 482–505. https://doi.org/10.3390/buildings3030482

Díaz-Díaz, R., Muñoz, L., & Pérez-González, D. (2017). Business model analysis of public services operating in the smart city ecosystem: The case of SmartSantander. *Future Generation Computer Systems*, *76*, 198–214. https://doi.org/10.1016/j.future.2017.01.032

European Data Protection Board. (2020). *EDPB Guidelines 04/2020 on the use of location data and contact tracing tools in the context of the covid-19 outbreak* (pp. 1–19) [Guidelines]. https://edpb.europa.eu/our-work-tools/our-documents/guidelines/guidelines-042020-use-location-data-and-contact-tracing_en

European Data Protection Board & European Data Protection Supervisor. (2022). *EDPB-EDPS Joint opinion 2/2022 on the Proposal of the European Parliament and of the Council on harmonised rules on fair access to and use of data (Data Act)* (pp. 1–28). https://edpb.europa.eu/our-work-tools/our-documents/edpbedps-joint-opinion/edpb-edps-joint-opinion-22022-proposal-european_en

Eurostat. (2020). *Ageing Europe — Statistics on population developments*. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Ageing_Europe_-_statistics_on_population_developments

Farzanehfar, A., Houssiau, F., & de Montjoye, Y.-A. (2021). The risk of re-identification remains high even in country-scale location datasets. *Patterns*, *2*(3), 1–7. https://doi.org/10.1016/j.patter.2021.100204

Finck, M., & Pallas, F. (2020). They who must not be identified — Distinguishing personal from non-personal data under the GDPR. *International Data Privacy Law*, *10*(1), 11–36. https://doi.org/10.109

3/idpl/ipz026

Florida, R., & Mellander, C. (2015). Talent, cities, and competitiveness. In D. B. Audretsch, A. N. Link, & M. Walshok, *The Oxford handbook of local competitiveness* (pp. 34–53). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199993307.013.3

Heikinheimo, V., Tenkanen, H., Bergroth, C., Järv, O., Hiippala, T., & Toivonen, T. (2020). Understanding the use of urban green spaces from user-generated geographic information. *Landscape and Urban Planning*, *201*, 103845. https://doi.org/10.1016/j.landurbplan.2020.103845

Helbing, D., Fanitabasi, F., Giannotti, F., Hänggli, R., Hausladen, C. I., van den Hoven, J., Mahajan, S., Pedreschi, D., & Pournaras, E. (2021). Ethics of smart cities: Towards value-sensitive design and co-evolving city life. *Sustainability*, *13*(20), 11162. https://doi.org/10.3390/su132011162

Hoeyer, K. (2016). Denmark at a crossroad? Intensified data sourcing in a research radical country. In B. D. Mittelstadt & L. Floridi, *The ethics of biomedical big data* (pp. 73–93). Springer.

Köttl, H., & Mannheim, I. (2021). *Ageism & digital technology: Policy measures to address ageism as a barrier to adoption and use of digital technology* (pp. 1–12) [Policy brief]. EuroAgeism. https://research.tilburguniversity.edu/en/publications/ageism-amp-digital-technology-policy-measures-to-address-ageism-a

Krizek, K., Forysth, A., & Slotterback, C. S. (2009). Is there a role for evidence-based practice in urban planning and policy? *Planning Theory & Practice*, *10*(4), 459–478. https://doi.org/10.1080/14649350903417241

Lee, G. Y., Cha, K. J., & Kim, H. J. (2019). Designing the GDPR compliant consent procedure for personal information collection in the IoT environment. *Proceedings of the 2019 IEEE International Congress on Internet of Things (ICIOT)*, 79–81. https://doi.org/10.1109/ICIOT.2019.00025

Lloyd-Sherlock, P. (2002). Nussbaum, capabilities and older people. *Journal of International Development*, *14*(8), 1163–1173. https://doi.org/10.1002/jid.958

Mahler, C. (2020). *Human rights of older persons: The data gap conundrum* (Report of the Independent Expert on the Enjoyment of All Human Rights by Older Persons A/HRC/45/14; pp. 1–19). United Nations General Assembly. https://www.ohchr.org/en/documents/thematic-reports/data-gap

Malgieri, G., & Niklas, J. (2020). Vulnerable data subjects. *Computer Law & Security Review*, *37*, 105415. https://doi.org/10.1016/j.clsr.2020.105415

Manor, S., & Herscovici, A. (2021). Digital ageism: A new kind of discrimination. *Human Behavior and Emerging Technologies*, *3*(5), 1084–1093. https://doi.org/10.1002/hbe2.299

Metcalf, J. (2015). *Human-subjects protections and big data: Open questions and changing landscapes* (pp. 1–13) [Report]. Data & Society Research Institute. https://bdes.datasociety.net/council-output/human-subjects-protections-and-big-data-open-questions-and-changing-landscapes/

Nicholson, J., Coventry, L., & Briggs, P. (2019). 'If it's important it will be a headline': Cybersecurity information seeking in older adults. *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*, 1–11. https://doi.org/10.1145/3290605.3300579

Piasecki, S., & Chen, J. (2022). Complying with the GDPR when vulnerable people use smart devices. *International Data Privacy Law*, *12*(2), 113–131. https://doi.org/10.1093/idpl/ipac001

Purtova, N. (2022). From knowing by name to targeting: The meaning of identification under the GDPR. *International Data Privacy Law*, *12*(3), 163–183. https://doi.org/10.1093/idpl/ipac013

Rommetveit, K., & van Dijk, N. (2022). Privacy engineering and the techno-regulatory imaginary. *Social Studies of Science*, *52*(6), 853–877. https://doi.org/10.1177/03063127221119424

Rose, G. (2020). Actually-existing sociality in a smart city: The social as sociological, neoliberal and cybernetic. *City*, *24*(3–4), 512–529. https://doi.org/10.1080/13604813.2020.1781412

Sixsmith, A., Horst, B. R., Simeonov, D., & Mihailidis, A. (2022). Older people's use of digital technology during the covid-19 pandemic. *Bulletin of Science, Technology & Society*, *42*(1–2), 19–24. https://doi.org/10.1177/02704676221094731

United Nations. (2019). *World population prospects 2019: Highlights*. https://www.un.org/development/desa/pd/news/world-population-prospects-2019-0

United Nations Human Settlements Programme (UN-Habitat). (2022). *Mainstreaming human rights in the digital transformation of cities – A guide for local governments* (Guide HS/033/22E; pp. 1–40). https://unhabitat.org/sites/default/files/2022/11/digital_rights_guide_web_version_14112022.pdf

van Leeuwen, C., Devis Clavijo, J., Mariën, I., & Jacobs, A. (2022). Invisible in the smart city: Using participatory design methods for age-friendly solutions. *Frontiers in Sustainable Cities*, *4*, 956787. https://doi.org/10.3389/frsc.2022.956787

Walravens, N., Compernolle, M. V., De Marez, L., Ballon, P., & Colpaert, P. (2019). Open data and the core competences of government: Lessons from Flanders, Belgium. *Proceedings of the TPRC47: The 47th Research Conference on Communication, Information and Internet Policy*. https://doi.org/10.2139/ssrn.3422151

Wang, C. (Herbert), Steinfeld, E., Maisel, J. L., & Kang, B. (2021). Is your smart city inclusive? Evaluating proposals from the U.S. Department of Transportation's Smart City Challenge. *Sustainable Cities and Society*, *74*, 103148. https://doi.org/10.1016/j.scs.2021.103148

Willberg, E., Salonen, M., & Toivonen, T. (2021). What do trip data reveal about bike-sharing system users? *Journal of Transport Geography*, *91*, 102971. https://doi.org/10.1016/j.jtrangeo.2021.102971

Wong, R. Y., Boyd, K., Metcalf, J., & Shilton, K. (2020). Beyond checklist approaches to ethics in design. *Conference Companion Publication of the 2020 ACM Conference on Computer Supported Cooperative Work and Social Computing*, 511–517. https://doi.org/10.1145/3406865.3418590

Ylipulli, J., & Luusua, A. (2020). Smart cities with a Nordic twist? Public sector digitalization in Finnish data-rich cities. *Telematics and Informatics*, *55*, 101457. https://doi.org/10.1016/j.tele.2020.101457

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