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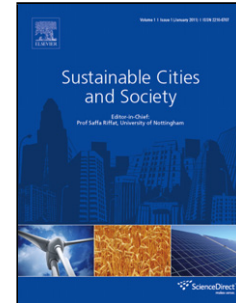
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Authors: Nataša Rebernik, Barbara Goličnik Marušić, Alfonso Bahillo, Eneko Osaba



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***A 4-dimensional Model and Combined Methodological Approach to
Inclusive Urban Planning and Design for ALL***

Nataša Rebernik, Barbara Goličnik Marušić, Alfonso Bahillo, Eneko Osaba, Nataša Rebernik

AUTHORS

Nataša Rebernik

*Faculty of Engineering, University of Deusto, Av. Universidades, 24, 48007 Bilbao, Spain
natasa.rebernik@deusto.es*

&

University of Antwerp, Faculty of Social Sciences, M, Sint-Jacobstraat 2, 2000 Antwerpen, Belgium

Barbara Goličnik Marušić

*Urban Planning Institute of the Republic of Slovenia, Trnovski pristan 2, 1000 Ljubljana, Slovenia
barbara.golicnik-marusic@uirsi.si*

Alfonso Bahillo

*Faculty of Engineering, University of Deusto, Av. Universidades, 24, 48007 Bilbao, Spain
alfonso.bahillo@deusto.es*

Eneko Osaba

*Tecnalia Research & Innovation, Parque Científico y Tecnológico de Bizkaia, Geldo Auzoa 700
Building, 48160 Derio, Spain eneko.osaba@tecnalia.com*

*CORRESPONDING AUTHOR

Nataša Rebernik

*Faculty of Engineering, University of Deusto, Av. Universidades, 24, 48007 Bilbao, Spain
natasa.rebernik@deusto.es*

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HIGHLIGHTS:

- Highlights of this paper can be introduced through an elaboration of the *four-dimensional model* and its materialization through *a combined methodological approach (CMA)* towards inclusive public spaces design to fit the needs of disabled citizens. The backbone of the *CMA* is an often overlooked bottom-up driven slow, small and deep-data oriented ethnographic research, to which we add environmental post-occupancy evaluation and behavioural mapping as two complementary methods. The *CMA* has been designed based on exploration within four study cases in two case study cities in Slovenia, bringing a set of contextual-based and methodology-based conclusions. The conclusions shed light on its advantages and show that it could in fact represent a powerful tool for stakeholders to gain deeper understanding of (disabled) citizens, their behaviours and needs within growing complexity of inclusive city planning and design.

ABSTRACT

Due to the emerging complexity of cities, this paper argues for a holistic, integrative and relational approach to more inclusive city planning and design to fit the needs of citizens with diverse impairments. It proposes and tests a new theoretical model called the combined methodological approach (CMA). The backbone of this model is an often-overlooked qualitative, bottom-up-driven, slow, small and deep-data-oriented ethnographic research, combined with components or phases of post-occupancy evaluation and behavioural mapping as two user-oriented techniques for assessing usage-space relationships. The paper is rather theoretical, as it focuses on the argumentation of different approaches in city planning, design and governance. However, tests of the proposed model were conducted in public open spaces of four pilot cases in two European cities (Maribor and Ljubljana, in Slovenia). The proposed CMA was tested against its applicability to real urban environments. The results, in accordance with the methodology used, showed that such a combination of often closely related, overlapping and complementary techniques can significantly enhance the understanding of complex relations and interactions between people, space and technology within the city. Hence, it can empower stakeholders towards more informative and responsive measures – and, finally, more inclusive, individualized, tailor-made cities.

ABBREVIATIONS

CMA – combined methodological approach; POE – post-occupancy evaluation; BM – behavioural mapping; ICT – information and communication technologies; IoT – internet of things; GNSS - Global Navigation Satellite System; EHSIS - European Health and Social Integration Survey; UNPF – United Nations Populations Fund; PBS – public spaces; PBSU – public-space users; PBSS – public-space stakeholders; PWD – persons with disability; PDCA approach – Plan, Do, Check, Act approach; UXD – User Experience Design; WCAG – Web Content Accessibility Guidelines.

KEYWORDS: Open space; Planning and design; Inclusion; Bottom-up; Ethnography; Behavioural mapping; Post-occupancy evaluation.

1. INTRODUCTION

The United Nations Population Fund (UNPF, 2017) reports that the urban population has already exceeded 50% of the global population and is expected to rapidly increase in the upcoming years and decades. Cities are becoming more and more complex, so city governments are facing great challenges in addressing both this complexity itself and a wide variety of citizens' needs. An individual's ability to integrate into the city, navigate the environment and understand the information provided affects the individual's health, well-being, ability to work and, finally, quality of life.

As a result of the growing urban population, modern societies also face an increase in the number of people with diverse impairment, be it physical, sensory or cognitive. Data from the European Health and Social Integration Survey (EHSIS) as reported by Eurostat, there were 70 million disabled people aged 15 and over in the EU-27 in 2012 (Eurostat, 2018), not taking into account children with special needs, who were differently categorized and whose study is ethically more sensitive. However, impairment and decreased functioning often cause significant disability within the social context and thus expose people to high risks of social exclusion, regardless of their age.

In this manner, nowadays most accepted biopsychosocial models of disability (ICF, 2001) and disablement (Nagi, 1991) acknowledge an individual with their abilities rather than disabilities, and following this principle, they discuss disability as a result of interconnected functioning between diverse factors. By improving or eliminating barriers within these interconnections, it should be possible to decrease the level of disability and empower an individual towards their personal and collective engagement. This is also the main point of inclusion. According to the International Classification of Functioning, Disability and Health (ICF, 2001) disability depends on a myriad of personal factors (e.g. socio-cultural background, education, demographic factors, individual attitudes and behavioural factors) and environmental factors (e.g. built environment, a city's accessibility strategies). Similarly, Nagi's disablement model, which originated in the 1960s, explains disability or

disablement as a “limitation in performing socially defined roles and tasks expected of an individual within a sociocultural and physical environment” (Nagi, 1991, p. 315).

The terms “impairment” and “disability” do not only refer to disabled people, such as the physically disabled, blind and visually impaired, deaf and hard of hearing, and people with cognitive impairments. They can also be significantly imprinted in the lives of people with long- or short-term illness, temporarily injured people, as well as the elderly who, with ageing, may partially or even fully lose their sight, hearing, and cognitive and/or physical abilities. The European Commission projects that by 2025 more than 20% of Europeans will be 65 or over (Eurostat, 2018). As the population is ageing, it is of great importance to acknowledge the elderly as a part of the group of citizens with impairments and thus take them into account when aiming to designing inclusive and accessible cities for all.

As summarized well by La Rosa, Takatori, Shimizu, and Privitera (2018, p. 346), accessibility is a “broad and flexible concept that can be defined as the ability to approach something by someone”. Accessibility can be perceived from a variety of perspectives, such as economic, physical, information and communication accessibility; accessibility to the internet; accessibility to medical services; and many others. Concerning disabled people, accessibility reflects the ability to reach and use a particular environment, product, service or information. It represents a strong tool for empowering disabled citizens to live a fulfilling life within their scope of abilities. Accessibility is thus a precondition for inclusive cities and societies. In this paper, the terms “inclusion” and “accessibility” primarily, but not exclusively, refer to the accessibility of public spaces and inclusive urban planning, design and governing practices, rather than the full scope of a city’s functioning.

Although there has been greater legislation enforcement, and there have been a large number of Smart City initiatives (e.g. Amsterdam, Madrid, Barcelona) over the last decade, cities are organic forms that still tend to be designed in a way to fit the needs of an active, fully abled person. Inclusive design as a theoretical concept lacks applicability and the ability to encompass a wide variety of needs that people face in public spaces (e.g. Hanson, 2004; Oliver & Barnes, 2010). For example,

whereas most modern infrastructure seems to be wheelchair accessible, there are lesser solutions to fit the needs of people with other types of impairments, such as the visually impaired. Audio and tactile solutions are rarely incorporated since visual and aesthetic components in design still prevail. Furthermore, the deaf and hard of hearing too often face a great deal of discrimination due to their invisible disability as well as the inability of the environment to deliver information and communication in visual representations, sign language and/or easy-to-read versions.

Exploring further, there are related issues, such as ignorance among relevant stakeholders and politicians, cultural heritage protection laws that prevent the proper adaptation of old buildings to the needs of impaired people, and poor elaboration of standards limited to basic physical accessibility guidelines, among others. So far, there is evidence that a great degree of diversity and disability is present among the urban population, which clearly calls for making services, spaces and information accessible, available and inclusive to all. Nevertheless, in this context, the main questions are how to approach inclusive city design with such a complexity, diversity and individuality of the citizens' needs, and how to approach it holistically. The hypothesis behind this paper and development of the *combined methodological approach (CMA)* is that a true understanding of the users and their needs, as well as creating partnerships with them based on a bottom-up approach, can significantly support the planning, design and decision-making processes. The following specific question is therefore addressed: *How can a CMA that merges different user-centred techniques with tools of ethnography and urban and environmental studies respond to the complexity of inclusive urban planning, design and governance, respecting the needs of disabled citizens in the most holistic way?*

This paper is structured as follows: Section 2 discusses theory by introducing the background, related work and existing concepts in current inclusive urban planning, design and governance practices. Section 3 pictures our *holistic and integrative vision* and elaborates the *4-dimensional model* towards tackling the societal challenges for the design of inclusive public spaces. Section 4 introduces the experimentation process and demonstrates the results of the four pilot case studies in

Maribor and Ljubljana, Slovenia. In section 5, we open up a discussion on the *4-dimensional model* and *the CMA*, firstly, within the scope of identified conceptual and methodological frameworks, and secondly, in the context of experimental results. In section 6, we provide some conclusions with future directions for the research.

2. BACKGROUND

2.1. Urban planning, design and governance – conceptual frameworks

In order to address this complexity and improve cities' functioning, safety, attractiveness, accessibility, inclusiveness and recognition as a Smart City, researchers have considered several holistic approaches and models. Examples include: a) modern city concepts, such as *placemaking* (Mackenzie, 2015), the *smart cities* concept (Smart cities, 2014), *city as a sustainable ecosystem* (Newman & Jennings, 2008), and *city as a complex adaptive system* (Albrechts, 2006); b) urban planning, design and governing concepts, such as a planning framework for green spaces (La Rosa et al., 2018), collaborative urbanism-oriented *framework for interrogative infrastructures* (Dyer, Gleeson, & Grey, 2017), and *an action-oriented holistic planning approach* introduced by Albrechts (2006); c) multi-stakeholder (Wai, Nitivattananon, & Kim, 2017), collaborative and participatory approaches (Castelnovo, 2015; Castelnovo, Misuraca, & Salvoldelli, 2015a, 2015b; Dionisio, Banwell, & Kingham, 2016; Dyer et al., 2017); d) multi-criteria evaluation models that support planning, design and decision-making processes (Cafuta, 2015; Dall'O, Bruni, Panza, Sarto, & Khayatian, 2017; La Rosa et al., 2018; Martinelli, Battisti, & Matzarakis, 2015), as well as user-centred methodological frameworks such as the ethnographic analytical framework introduced by Menezes and Smaniotto Costa (2016).

Three sets of gaps have been identified within the analysed conceptual models: a) lack of in-depth qualitative approaches compared to currently predominant quantitative (often big data-oriented) urban practices, b) lack of truly applicable user-centred, bottom-up actions, and c) lack of applicability to real-life situations, specifically in the context of inclusive design for disabled citizens.

Firstly, as seen in the above planning models, a quantitative big data-oriented mindset still prevails, providing generalized statistical insights and demonstrating the patterns and discrepancies in urban contexts. These approaches, however, mostly stay limited to their quantitative nature and therefore rarely further explore the reasons behind the quantitative results of the urban use. There are some exceptions, for example the qualitative *multi-stakeholder and multi-benefit analytical approach* tested by Wai et al. (2018); an in-depth *ethnographic analytical approach*, introduced by Menezes and Smaniotto Costa (2016); and a *perception-based inclusive design* by Lukman, Bridge, Dain, and Boon (2014). A human dimension is a central point in these examples, and a qualitative user-centred approach is the backbone of the methodology proposed.

Secondly, traditional planning has too often been led by a top-down approach (Pissourios, 2014; Wolff, Gooch, Mir, Caverio, & Gerd (2015). To encourage bottom-up approaches, Wolff et al. (2015) emphasize the role of citizens beyond just “citizens as users”, and even beyond “citizens as participants” toward their active role of “citizens as innovators”. Who knows a city better than its citizens? Such a clear rhetorical question motivates us even further to use bottom-up as a roadmap.

Finally, most of the analysed models do not consider socially vulnerable groups, such as children, the elderly, disabled citizens and others, and thus lack an inclusive perspective. These groups were only incorporated in several models identified (Deakin, 2012; La Rosa et al., 2018). An especially interesting study incorporating the inclusion perspective is *the planning framework for greenspaces* by La Rosa et al. (2018), in which they specifically consider demands and preferences for accessibility of different social groups. They use a four-phase planning process as a baseline, to which the assessment of accessibility to greenspaces is applied through spatially explicit GIS-based indicators. Other models seem to have consciously or not undertaken the modern “non-segregated approach”, not emphasizing the differences and thus segregation between the citizens. This could be praiseworthy if it were done consciously in a universal design manner. However, in the studied models, this was not the case, and as emphasized by Albrechts (2006), spatial planning should be selective, rather than trying to solve all problems at once. There is no *one-model-fits-all*. We

therefore tried to identify those models that would fit into our specific context of inclusive design for disabled citizens, fill in the gaps and ideate a novel approach. Hence, we first introduce a *4-dimensional model* (tailor-made for disabled citizens) addressing the societal challenges in the modern city, which then gives a framework to the practical qualitative, bottom-up-oriented *CMA*.

2.2. Urban research – methodological framework

The challenges that cities face in relation to deeper understanding of the citizens and their needs, behaviours, perceptions, and social categories have also been addressed through methodological approaches such as (urban) anthropology (Blanton, 1976; Rúa & Torres, 2012), (urban) ethnography (Menezes & Smaniotto Costa, 2016; Pardo & Prato, 2018), environmental post-occupancy evaluation (POE; Marcus & Francis, 1998), and behavioural mapping (BM; Goličnik Marušić, 2011, 2106; Goličnik Marušić & Ward Thompson, 2010). Each of them brings important contributions to the holistic understanding of citizens as users and drivers of the city, and contributes to the qualitative knowledge that we are seeking to gain. In this respect, Menezes and Smaniotto Costa (2016, pp. 167–180) provide an important baseline to our work when proposing a visionary *analytical ethnographic approach*. They envision an “ethnographic framework for assessing and validating data on social practices”, and also emphasize the importance of the “relationship between people, space and technology”.

Ethnography refers to a holistic and systematic study of people, groups and cultures of a certain time and place. It examines participants’ behaviours in specific social contexts and discusses the meaning of these behaviours (Sanjek, 1991). As a qualitative, user-centred, deep, slow and small-data-oriented methodology, (urban) ethnography can thus play a crucial role in the holistic understanding of how to approach the design of inclusive public spaces. Urban ethnography has in fact been argued to be the key to creating cities for people (Blanton, 1976; Rúa & Torres, 2012). Hence, with this paper we bring ethnography forth as a core methodological approach, using its rich repertoire of techniques and applicability options, emphasizing its core qualitative, user-centred, bottom-up nature. Ethnography gives a framework to our specific research phenomenon, in which

the exploration focuses on the design of inclusive public spaces for all from a user's perspective, the space-place, technology and the relations between these three according to the *4-dimensional model*. With the penetration of digital tools into everyday life, the old deep, qualitative ethnography has been enriched with these new digital tools (Favero & Theunissen, 2018, p. 163), easing the ethnographer's work. With cities becoming more and more digitalized, it is clear that digital tools do not only penetrate the citizens' lives but also the lives of researchers in urban environments. Technology has changed ethnographers' ways of taking notes and eternalizing the memories and stories within "time-place-people", and has also enriched ways of interacting with participants in the processes of collecting ethnographic data.

The digital dimension is a highly topical area of modern research and practice. Since its broad discussion is beyond the scope of this paper, we will further explore its potential through our future work. Nevertheless, the proposed *CMA* has been designed to, among other others, address the question of how digital tools can help stakeholders and citizens overcome barriers arising from modern societal challenges. Thus, we wish to outline here the potential of digital tools within urban practice and demonstrate their value within the proposed *4-dimensional model* and the *CMA*. The "digital" has been more and more discussed for enhanced inclusive urban planning and design (Abdel-Azziz, Abdel-Salam, & El-Sayad, 2016; Boob, 2015; Stadler, 2013). Challenges and constraints in the use of ICTs have been a subject of debate, from the perspectives of neuroscience (Klichowski, Patricio, Zammit, & Kenna, 2017), society, government, politics (Abdel-Azziz et al., 2016; Castelnovo, 2015; Mainka, Castelnovo, & Stock, 2016), and design (Brown, McGregor, & McMillan, 2014; IDF, 2004). Considering the abundance of challenges related to the use of digital tools in the city, it is clear that significant efforts will need to be undertaken in order to fully understand their use among disabled citizens, and their role in enhancing inclusive city planning, design and governance.

Among the methodological approaches identified within anthropological, environmental and urban studies – such as action research (McIntosh, 2010), grounded theory research (Glaser & Strauss, 2009), POE (Marcus & Francis, 1998), BM (Goličnik Marušić & Ward Thompson, 2010; Moore

& Cosco, 2010) – POE and BM proved to be the most interesting in our specific context. We found them more tangible, practice-oriented and applicable to the urban context. Through our case studies, they also demonstrated a great deal of overlap and complementarity with ethnographic research.

According to Marcus and Francis (1998), POE is a comparative approach that can give valuable “insights into consequences of past design decisions” (p. 345), and “considerable insight into the actual use of designed places ... with a very limited investment of time” (p. 346). It incorporates techniques similar to ethnography, but within the environmental psychology context, hence trying to understand the behaviours and use of spaces after they are built. As such, it aims to learn from the past (good and bad) experiences and plan better, more responsive and lively places (Thwaites, Porta, Romice, & Greaves, 2007). It can thus provide important lessons to planners, designers and governments for designing comparable places in the future. The observations are noted in field notes, compared preferably between two comparable settings, and can be followed up with interviews or questionnaires to reflect on the findings. POE “is systematic (recorded, analysed, written down), is based on function or use rather than on aesthetics alone” (p. 346), and may be perfectly designed to understand the environmental dimension as well as relations between the users and the space. POE uses a diverse set of techniques, such as activity and participant observation, shadowing, mapping, interviews and focus groups, that in their operative nature can be very close to ethnographic research and BM, but focus on the use of spaces by questioning “Who is doing what, where, and with whom?” (p. 346).

BM has been studied by many authors (Goličnik Marušić, 2011; Moore & Cosco, 2010) but not often applied to real urban practice (Bahillo, Goličnik Marušić, & Perallos, 2015). It is a technique similar to POE, also developed by environmental psychologists in the 1970s, that allows researchers to determine how participants use a designed space by recording their behaviours and/or tracking their movement within the space. It explores underlying patterns and discrepancies in users' movement and behaviour, either as a place-centred or individual-centred approach. It is mostly unobtrusive and should be applied over an extended period and comparatively analysed in order to

gain unbiased insights into how the space is being used during different time spans, such as a day, week, month, season or year. On the other hand, it can be obtrusive, especially if the individual-centred approach is applied. BM consists of a variety of techniques, such as participant observation and shadowing (individual-centred); activity, movement and behaviour observation (place-centred); and geo-tracking using digital tools (Clyne, 2018).

As our main question is how to plan and design cities for people, we conclude that POE and BM can be subordinated techniques, which can be applied within the “umbrella” of an ethnographic approach to the design of inclusive public spaces for all. A newly ideated conceptual and methodological framework is introduced in order to demonstrate how this combination of techniques can be applied to urban planning practice in the most systematic and practical way. The need to gain an in-depth understanding of this multidisciplinary, multi-stakeholder and dynamic area of research brought forth an idea of *a holistic approach and methodological framework*, responding to the main gaps identified in the current urban practice. An extensive literature review demonstrates that we are dealing with a hot topic, calling for further elaboration towards a) more applicable participatory and bottom-up-oriented approaches, b) in-depth qualitative and small-data explorative models, and c) incorporation of accessible and inclusive design into all aspects of the city as a complex system.

3. A NEWLY IDEATED CONCEPTUAL AND METHODOLOGICAL FRAMEWORK

In this section and those that follow, we attempt to introduce our specific conceptual and methodological contribution to the issues identified within the introduced concepts of a modern city.

3.1. Holistic and integrative approach to inclusive city design for all

This paper has been guided by our *vision of a smart and inclusive city for all* (Rebernik, Osaba, Bahillo, & Montero, 2017), which had been written as a response to struggles that disabled citizens still face when trying to access the city as a whole. This vision foresees the city as a complex system that should strive to holistically explore citizens’ needs, systematically approach identified barriers and actively respond to the challenges with informative, responsive actions.

As schematized briefly in Figure 1, within this model we build on a holistic view of the city first, as a system of subsystems, components and processes (e.g. employment, education, transport, public spaces, social and health system, tourism, legislation) that all incorporate inclusion principles throughout their functioning and integrate citizens as partners to city planning and design. Secondly, we tackle the importance of open-government participatory actions currently lacking in existing urban practices. The baseline is a bottom-up, user-centred and needs-driven approach that demands first and foremost an understanding of the citizens and their needs, and later focuses on the *relational aspects* between the users, governments, space and technology involved. It is neither realistic nor reasonable to always implement direct bottom-up participatory actions, as discussed by Pissourios (2014, p. 84). Therefore, to stretch the meaning of bottom-up, ensure real participation and, consequently, holistic inclusion in all aspects of the city's functioning, a three-level participatory approach is proposed: 1) user level, 2) association level and 3) advocacy level. In terms of structure and process, participatory actions are further organized into the following four levels: a) community level (focus groups, public disclosures, public opinions, direct collaborative practices, etc.), b) operational level (meetings, working groups, workshops, automated on-going collaboration within city offices), c) management level (city management meetings, governance openness to disability initiatives, disability representatives' involvement in decision making), d) political and strategic level (parliament and council sessions, disability representatives involvement in planning and strategic processes, groups, etc.). In such a holistic approach, the city is governed through both a bottom-up approach, with participatory actions, and a top-down approach, by highly proactive and dynamic governmental and political initiatives. Where bottom-up ends and top-down starts (or vice versa) is difficult to determine. However, these two approaches can be a winning combination, as long as they are user-centred, needs-driven and primarily focused on a human dimension, well intertwined, reflective and iterative.

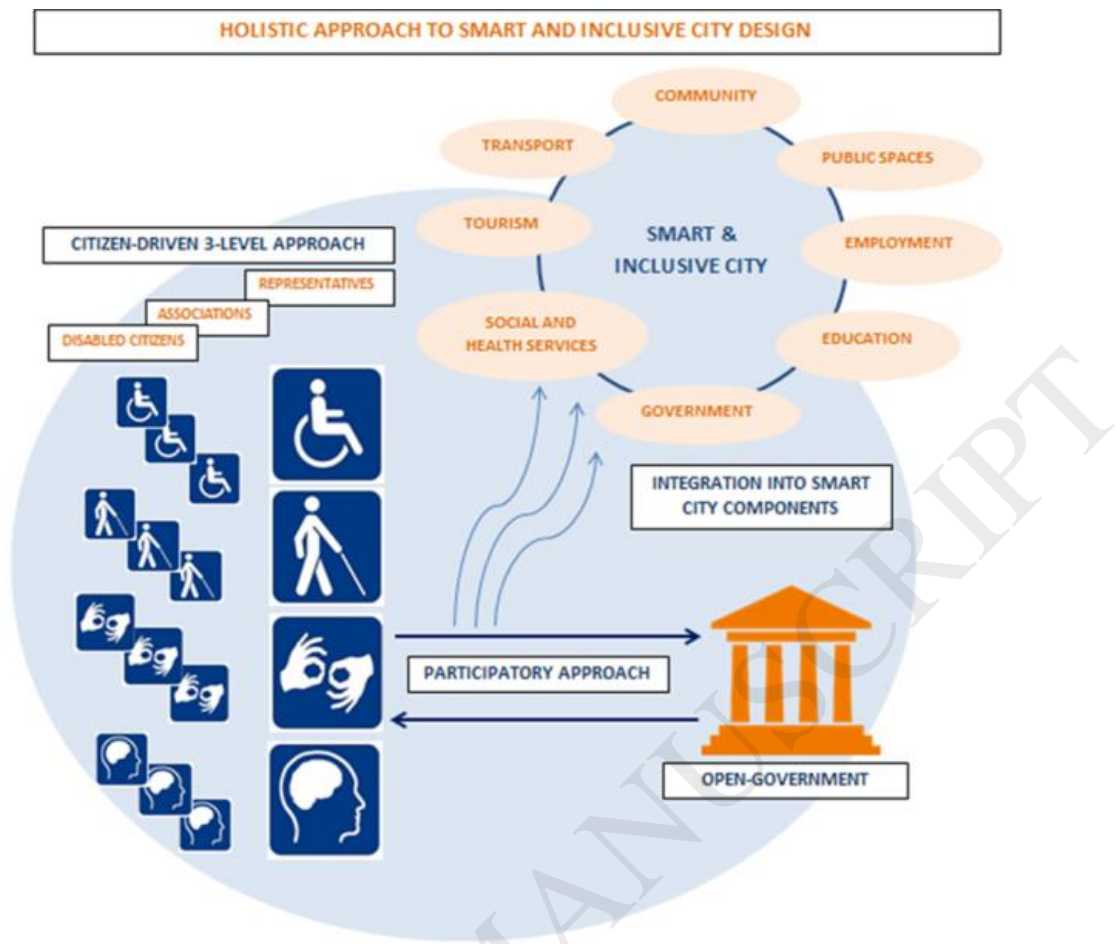


Figure 1. Holistic approach to smart and inclusive city design (Rebernik et al., 2017). The holistic approach to inclusive city design proposes a concept of a city: a) as a system composed of interrelated subsystems, components and processes that incorporate inclusion within each of the components of the city, and throughout the whole process of city planning, designing and governing; b) as a platform with strong participatory and collaborative actions, supported by open-government strategies and users as the central focus of exploration in order to identify their needs, and design-appropriate responsive measures.

To give an example, when thinking of inclusion of disabled citizens in the area of employment, a set of questions from a wide range of perspectives needs to be addressed, including employment opportunities (economic development, social responsibility, social and corporate awareness, etc.), accessible transportation to work (accessible public spaces, public transportation, accessible cars for autonomous individual use, etc.), accessible workplace (accessible infrastructure & equipment, accessible and acceptable climate, ergonomics principles, vocational and professional rehabilitation, professional development possibilities, etc.), available and accessible employment policy and governance (legislation, employment offices, accessible information and employment ads). All these areas need to be strategically planned, designed and implemented by involving disabled people

through public, policy and professional discussions, specifically in the initial discussions and planning, design and development of the programmes, monitoring of the implementation process, iterative revisions, evaluation and negotiations, and follow-ups. Our approach does not go into all these processes, nor does it explain such details on the level of a city as a whole, but rather it illustrates the vision and moves towards the exploration of urban planning and design practices through a practice-oriented *4-dimensional model*, and its methodological framework of *CMA*. This model, explained in the following section 3.2, can serve as a tool for stakeholders to qualitatively examine citizens and their needs in the specific context of designing inclusive public spaces.

3.2. The 4-dimensional model

Based on the recognition of the three important, interrelated factors that influence each other in the practice of modern urban planning and design, we grounded our model in the “*people-place-technology*” framework. It incorporates four dimensions or levels: a) human, b) spatial (including governmental aspects¹), c) technological and d) relational. As outlined by Menezes and Smaniotto Costa (2016, pp. 167–180), in the *analytical ethnographic approach*, relationships between the first three components are of paramount importance if the city wants to address the citizens’ needs and work as a system as a whole. Therefore, we consider the relational level as that with the main set of societal challenges to be addressed when striving for a holistic approach. Challenges and questions discussed on this level can lead to true understanding of relations between the users, the space (with the way it is designed, planned and governed), and the technology. Thus, we dedicate special focus to questioning the relations throughout the four levels.

The main question that guides the ideation of this model is: *How can we enhance the design of inclusive public spaces in a context of the growing complexity of cities and the arising societal challenges, as well as within the context of a strong interplay between people, places and digital*

¹ Spatial dimension refers to the SPACE and PLACE. In order to keep the model as practical and simplified as possible, we also incorporate the question of how the space is being planned, designed and governed. The governmental approach is a part of this process; hence, we refer to this dimension as a spatial/governmental dimension. This does not exclusively mean that in an even more elaborate model the two could not be discussed as separate dimensions. In order to simplify the model so as to maximize its usability and applicability, at this stage we follow the proposed 4D model instead of using five or more dimensions.

tools? Within each of the four dimensions (as further elaborated in Table 1), we understand the different societal challenges and related questions to be as follows:

- On the human level: Who are the public space users, and what are their needs and characteristics?
- On the spatial level: What kind of spaces do we investigate; how are they being planned, designed, governed; and what really makes a space a place?
- On the technological level: What kind of digital tools exist, how they are designed, and what are their technical features?
- On the relational level: We explore a wide array of relations between the users and the space, the users and technology, and the space and technology.

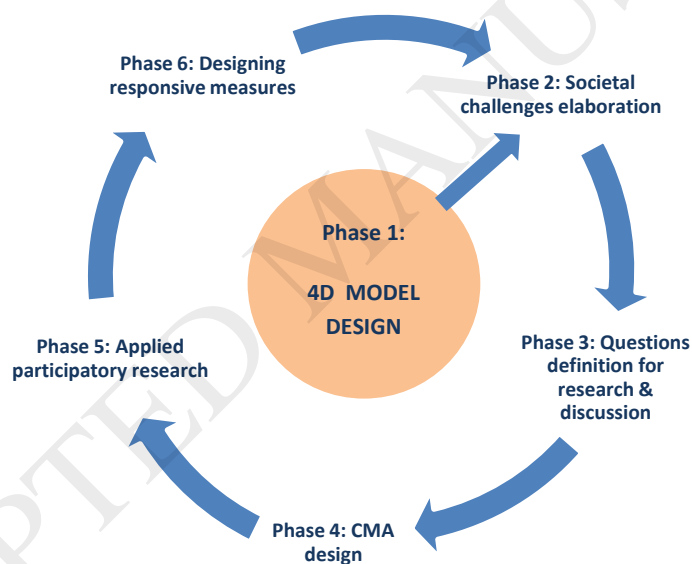


Figure 2. A schematic rendering of using the 4-dimensional model. The six phases aim to demonstrate how stakeholders can plan their steps in the proposed 4-dimensional model.

Figure 2 shows the six phases of how this model is used. The six phases are shown schematically and aim to demonstrate how stakeholders can plan their steps within the proposed *4-dimensional model* in a proactive, PDCA-oriented and iterative way. They were designed based on Albrecht's (2006) holistic, integrative and proactive approach to city planning. The first four phases are: (1) a four-pillar baseline model of the city components (*4-dimensional model*), (2) differentiation of the

societal challenges that the stakeholders and citizens face, (3) elaboration of questions related to the challenges identified in the four dimensions, and (4) a *CMA protocol* design and selection of concrete methodological techniques that will help further explore and respond adequately to the identified needs. The additional two phases are: (5) application of the *CMA* to real case studies (applied participatory research), following *the 4-dimensional model*, and (6) collecting data, interpreting results and designing responsive measures accordingly. In a real planning process, these phases should iterate continually in order to make the process primarily needs driven, dynamic, flexible and progress oriented.

The *4-dimensional model* represents a simple, well-structured model aimed at empowering the relevant stakeholders to address a specific set of challenges and related questions that they face in regard to the inclusiveness of their city. In practice, this means that participatory discussions and actions between the stakeholders and users (but also researchers as mediators and facilitators of the process) are to be enhanced in order to address the challenges that appear in the city as a multidimensional platform. The aim is to reflect on these challenges through a specific set of practical questions, analyse the real-life situations using a set of proposed methodological techniques, and design appropriate responsive measures for inclusive public-space design, as shown in Table 1. The tableTable 1. A 4-dimensional model complemented with the combined methodological approach shows how this process starts and iterates through a complex set of applicable questions that refer to the societal challenges within various levels of understanding the usage-space relationships: the user's perspective (human level); spatial articulation, provision of amenities and maintenance (spatial/governmental level); a variety of ICT support options or the ability to better understand the place or happily navigate through it (technological level); and the relations and interactions between these aspects themselves. In order to make the *4-dimensional model* truly applicable, we propose a compilation of methodological techniques and tools, and empirically test them through four pilot case studies in Slovenia. This aims to, first, derive a set of contextual insights into how inclusive city planning and design for all should be addressed by the

relevant stakeholders. Secondly, it explores the methodologies used and reflects on their potential use for this purpose, finally leading to the development of a novel approach called *CMA*. Through experimentation, we also sought to showcase that the proposed conceptual and methodological framework can in fact derive a great deal of meaningful insights about the users as well as the ways that different stakeholders and dimensions interrelate in reality. As such, the model with its *CMA* guides stakeholders in exploring why the spaces are used as they are and what needs to be improved in order to lead to a more inclusive urban design.

ACCEPTED MANUSCRIPT

Phase 1 →	Phase 2 →	Phase 3 →	Phase 4 → Phases 5 & 6 → iteration through all the phases
DIMENSION/ LEVEL	SOCIETAL CHALLENGES	QUESTIONS FOR FURTHER RESEARCH & DISCUSSION	METHODOLOGICAL TECHNIQUES FOR FURTHER RESEARCH & ENHANCED UNDERSTANDING OF SOCIETAL CHALLENGES
HUMAN	<ul style="list-style-type: none"> • Growing population • Ageing population • Increasing population of disabled • Diversity of needs • Individuality 	<ul style="list-style-type: none"> • Who are the users? • What are their characteristics and needs? • Are there any specific needs to consider? • Are there any individuality based needs to consider? 	<p>TECHNIQUES:</p> <ul style="list-style-type: none"> • Ethnographic (participant) observation • Ethnographic interviewing • POE participant observation • POE activity observation • Behavioural mapping • Complementary quant. methods (e.g. surveys, big-data-oriented statistical methods) <p>TOOLS:</p> <ul style="list-style-type: none"> • User-centred participatory practices and tools (e.g. observation/shadowing, interviews, focus groups, diary writing)
SPATIAL	<ul style="list-style-type: none"> • Design based on visual aesthetics rather than the function • Reasons for non-inclusive design: <ul style="list-style-type: none"> ○ old-school design, ○ places under cultural heritage protection, ○ planners, designers, architects “know best” • Existing planning & design practices lack holistic, participatory, user-centred approach • Legislation, standards, directives 	<ul style="list-style-type: none"> • What kind of space/place? • What are design characteristics of a space/place? • How inclusive is a space/place? • What are the knowledge and attitudes of planners, designers, architects? • What kind of governmental approach has been undertaken to ensure inclusive planning and design? • What legislation, standards and directives have been adopted? 	<p>TECHNIQUES:</p> <ul style="list-style-type: none"> • Ethnographic observation • Ethnographic interviewing • Digital tools elicitation • POE observation • Geo-mapping techniques (including BM) • Complementary quant. methods (e.g. surveys, geo-spatial techniques, spatial statistics) <p>TOOLS:</p> <ul style="list-style-type: none"> • Observation/shadowing • Interviews • Focus groups • Digital tools • Maps (also BM)
TECHNOLOGICAL	<ul style="list-style-type: none"> • Penetration of digital tools into everyday life • Extensive number of available digital tools • Diversity of digital tools • Digital tools standards (UXD, WCAG²) 	<ul style="list-style-type: none"> • What kinds of digital tools exist? • What digital tools are available for the specific purpose? • What are the technical features of the available tools? • How are the tools designed? • Do they follow standards such as UXC and WCAG? 	<p>TECHNIQUES:</p> <ul style="list-style-type: none"> • Digital tools research • Digital tools (comparative) analysis • Ethnographic (participant) observation • Ethnographic interviewing • Ethnographic focus groups/group interviewing • Complementary quant. methods (e.g. surveys) <p>TOOLS:</p> <ul style="list-style-type: none"> • Observation • Interviews • Focus groups • Digital tools

² <https://www.w3.org/TR/WCAG21/>

RELATIONAL LEVEL 1: Human & Spatial level	<ul style="list-style-type: none"> Public spaces still tend to be designed to fit the needs of a fully abled 40-year old man Disabled citizens still face barriers in accessing public spaces Diverse needs are not being fully incorporated in the process of public spaces' design Lack of holistic participatory interventions Places are not designed in a user friendly manner 	<ul style="list-style-type: none"> How is the place being used? Who is using the place? Where do they move, gravitate? What activities are being carried out? Are there any evident behavioural patterns? What makes a space a place that is used by people? What are the perceptions, attitudes, motivations and constraints of users towards the public space? What are the perceptions, attitudes, motivations and constraints of users towards governmental approaches and the enforcement of legislation, standards and directives? 	TECHNIQUES: <ul style="list-style-type: none"> POE activity observation POE participant observation POE mapping Behavioural mapping Ethnographic (participant) observation Ethnographic interviewing Ethnographic focus groups/group interviewing TOOLS: <ul style="list-style-type: none"> User-centred participatory practices (observation, interviews, focus groups, digital tools elicitation, diary writing, maps drawing) Behavioural maps
RELATIONAL LEVEL 2: Human & technological level	<ul style="list-style-type: none"> Acceptance & adoption of digital tools Confusion of users with the amount and diversity of digital tools Digital divide (age, disability) Non-compliance with standards: <ul style="list-style-type: none"> User experience design (UXD) Web accessibility standards (WCAG) 	<ul style="list-style-type: none"> Do people use digital tools? To what extent do they use digital tools? For what purpose do they use digital tools? Who uses digital tools? Is the use connected with demographic factors, personal characteristics, etc.? Are there any evident behavioural patterns? How open are they to technological innovations? What are the perceptions, attitudes, motivations and constraints of users towards the use of digital tools, specifically in public spaces? What kinds of tools, what kind of design and which features are considered most desirable? Are the tools user friendly and accessible? 	TECHNIQUES: <ul style="list-style-type: none"> Ethnographic (participant) observation Ethnographic interviewing Ethnographic focus groups/group interviewing POE activity observation POE participant observation Behavioural mapping Digital tools elicitation Digital tools (comparative) analysis TOOLS: <ul style="list-style-type: none"> User-centred participatory practices (e.g. interviews, focus groups, digital tools elicitation) Digital tools Behavioural maps
RELATIONAL LEVEL 3: Spatial & technological level	<ul style="list-style-type: none"> Digital infrastructure in the environment does not support the technological advancements and opportunities Digital tools are not sufficiently incorporated into inclusive planning and design practices Digital tools are not sufficiently mainstreamed and contextualized to be used by disabled people 	<ul style="list-style-type: none"> To what extent are digital tools used for inclusive planning and design practice? How can digital tools improve inclusive planning and design practice? To what extent are digital tools used by disabled people for the purpose of accessing and enjoying public spaces? How can digital tools support disabled people in accessing public spaces? How can we ensure sustainable use and mainstreaming of the digital tools to support inclusiveness of public spaces? 	TECHNIQUES: <ul style="list-style-type: none"> Environmental research techniques Ethnographic observation Ethnographic interviewing Ethnographic focus groups/group interviewing POE observation Geo-mapping techniques (including BM) Digital tools elicitation Digital tools (comparative) analysis Digital online desktop research TOOLS: <ul style="list-style-type: none"> Observation Interviews Focus groups Digital tools Maps

Table 1. A 4-dimensional model complemented with the combined methodological approach.

For illustration, let us suppose a city government wants to focus on a specific neighbourhood in order to improve its accessibility and to employ new technological solutions that will, on the one hand, support disabled citizens in accessing the spaces, and on the other hand, support the city planning, design and governing processes. The government plans to incorporate ICT infrastructure into the area, and motivate inhabitants to use the new infrastructure in a participatory way. In order to be able to plan appropriately, the officials need to first understand a diverse set of questions. When exploring the human level, they need to understand exactly who the members of the specific target group of interest are (for example, disabled people), what the types of disabilities are, the extent of their impairments, their needs, their personal characteristics, perceptions and motivations, among other things. On the spatial level, they will need to analyse the urban structure of a specific area, and how this area is currently built. On the relational level, they may be interested in how the selected group of citizens uses a specific neighbourhood/area, how it perceives that specific neighbourhood, how accessible it is for them, what barriers exist and what exactly needs to be done to improve the area's accessibility. Later, on the relational level between the user and technology, they may want to know how the users interact with digital tools in general, what kinds of tools and specifically which ones they use and prefer, what kinds of tools they avoid and why, which features they prioritize and for which purposes they mostly use them. On the relational level between environment and technology, they may want to know what kind of ICT infrastructure is already incorporated in the studied area, and what the potentials and limitations to innovation and future advancements are. The major part of this exploration goes beyond statistics, generalizations and patterns that can be acquired through quantitative research. Thus, complementary, more in-depth qualitative approaches are needed in order for stakeholders to be able to gain the necessary understanding. Therefore, for each of the dimensions, they need to ask a set of meaningful questions and select a combination of proposed qualitative methodological techniques that correspond to the aim of the questions under examination, as shown in Table 1. For example, to understand the users, they should engage with them through user-centred techniques, such as ethnographic participant

observations; ethnographic interviews; diary writing; and elicitation with videos, photos, newspaper articles and digital tools. To gain understanding of the space (and its use), the questions will most likely need to be explored through the lens of POE and BM research, but the main techniques could also be observation, inquiry and elicitation techniques, enriched with geotracking and geomapping. To gain understanding of more complex phenomena, such as diverse relations between the users, space and technology, a variety of the same or similar techniques can be used with a different purpose, depending on the questions being addressed. The presented story could be one of the real exemplary governmental actions applying the proposed model, using a variety of methodological techniques complemented with digital tools and participatory practice. The main idea is not in using separate techniques independently, but rather their interplay and the richness of combining them when exploring the questions through the *4-dimensional model*. We suggest a combination of techniques in a form of newly proposed *CMA*, aiming to cover a wide array and diversity of the questions corresponding to the complexity and profoundness of the identified societal challenges. The *CMA* is highly adaptable to diverse urban settings and is to be used in a flexible and, most importantly, in-depth and iterative way. There is no single universal combination. In the next section, we demonstrate how the *CMA* was explored in real-life scenarios and what conclusions this experimentation process brought in the context of the design of inclusive public spaces.

4. IMPLEMENTATION, VALIDATION AND EXPERIMENTATION

4.1. Implementation and experimentation protocol

The presented *4-dimensional model* with the selected methodology was tested in a real urban context. Due to the complexity of the studied societal challenges, the work was organized as a set of logical steps corresponding to one of three phases: a) preparation, b) implementation or c) data analysis and interpretation. The process was then formalized, proposing a *fieldwork protocol* of 11 steps (where possible, iterated), as seen in Table 2.

First, the main societal challenges (step 1) needed to be clarified, and an extensive list of specific research and practical questions was designed (step 2) for each of the four dimensions, as shown in

Table 1. The next steps, still a part of the preparatory work, were to identify the urban setting (step 3), identify the target group (step 4) and define the methodology for practical use (step 5). After it was tested, the methodology was systematically organized, proposing the *CMA protocol*.

IMPLEMENTATION & EXPERIMENTATION PROTOCOL		
PREPARATION PHASE	1.	Societal challenges definition (according to the <i>4-dimensional model</i>)
	2.	Practical & research questions definition (according to the <i>4-dimensional model</i>)
	3.	Urban settings definition
	4.	Target groups definition
	5.	Methodology definition & CMA design
IMPLEMENTATION PHASE	6.	Participants' recruitment & selection
	7.	Individually based, user-centred strategy definition (time plan, methodology, etc.)
	8.	Data collection & exploration using CMA
DATA ANALYSIS – INTERPRETATION PHASE	9.	Data organization, coding, analysis & interpretation
	10.	Report preparation
	11.	Drafting conclusions

Table 2. Implementation protocol.

Two small-sized European cities were selected as case study urban settings, namely Maribor, Slovenia, with approximately 120,000 inhabitants (Case study MB-I, II, III), and Ljubljana, Slovenia, with approximately 300,000 inhabitants (Case study LJ-I). Four case studies were conducted between December 2016 and September 2017, in total covering five months (1–1.5 months each). Participants, public space users and public space agents, were recruited from the researcher's existing network of disability organizations and NGOs, relevant governmental departments, and (disabled) individual acquaintances. Mainly, the disabled participants were members of one of three types of disability organizations: a) association of paraplegics, b) association of people with visual impairment or c) association of people with hearing impairment. Representatives of the Municipality

of Maribor, the Municipality of Ljubljana and the Urban Planning Institute of the Republic of Slovenia were involved as public stakeholders. For a more user-centred and individualized study, only a small sample of eleven (11) participants was selected. The sample is clearly too small, and hence non-representative for proof of concept. However, our main aim was not to demonstrate specific results but rather to test the methodology's applicability to real-life scenarios, and as a novel approach towards gaining such results. There were in total eleven (11) participants involved individually, of which four (4) were involved repeatedly. Five (5) alternated between the roles of stakeholder and public-space user. Hence, nine (9) participants were public-space users, of which six (6) were disabled and three (3) non-disabled; and seven (7) were public-space stakeholders, of which three (3) were disabled and four (4) non-disabled. In order to get a broader context and understanding of the situation in both cities, a few group activities were also carried out, such as observation, participant observation, and group interviews or focus groups. For example, interesting insights about inclusion governance in Maribor were gained by attending several working group meetings of the Council for Disabled People of the City of Maribor. Regarding disabled people and their communities, we gained insights by observing the development of weekly activities in their member associations. A few group meetings and one focus group were organized, discussing preset topics (e.g. physical accessibility of the city, digital inclusion of blind and visually impaired, etc.). In total, more than 50 participants were involved if group sessions are included. Taking into account the seven (7) people who alternated between roles, there were more than fifty (50) public-space users and sixteen (16) public-space stakeholders involved in the four case studies. However, the main insights were gained through intensive individual fieldwork with eleven (11) participants. These were given priority in terms of our dedication, time-place-method flexibility and the exploration of their individuality. Only in this way could the required degree of trust and participants' dedication be ensured to conduct a proper qualitative research, resulting in in-depth, individualized data. As will be shown in the conclusion, a great deal of detail has been gathered about the individuals themselves and their needs, behaviours, perceptions, motivations and constraints in relation to the use of spatial and digital tools. Such

information can greatly enrich the present knowledge, provide an opportunity to understand the gaps, and thus allow for designing informative measures by those who are in power to act upon.

	Case study MB-I	Case study MB-II	Case study MB-III	Case study LJ-I
PLACE	Maribor (Slo)	Maribor (Slo)	Maribor (Slo)	Ljubljana (Slo)
TIME	December 2016 – January 2017	April – May 2017	September 2017	September 2017
DURATION	1.5 months	1.5 months	1 month	1 month
PARTICIPANTS	5 disabled PBSU 0 non-disabled PBSU 4 PBSS + group sessions	5 disabled PBSU 0 non-disabled PBSU 2 PBSS + group sessions	4 disabled PBSU 1 non-disabled PBSU 1 PBSS	1 disabled PBSU 2 non-disabled PBSU 3 PBSS
TOTAL	> 50	> 50	5	3

Table 3. Overview of the participants involved in the experimentation. A total of 11 participants were involved individually (of them, four disabled users repeatedly). Five participants alternated between the roles of stakeholder and public-space user. In total, including the group sessions, more than 60 participants were involved.

Recruitment and selection of the participants (step 6) demanded a certain degree of effort. Furthermore, a great deal of flexibility, adaptability and creativity was deemed necessary in applying concrete research techniques while working with the selected individuals. For this purpose, techniques were used in different combinations, depending on each participant's profile, availability, willingness and comfort with the techniques proposed. Thus, an individually based fieldwork strategy (step 7), iteratively adapted according to individual needs, was considered necessary. An exploration of societal challenges and research questions was thus conducted in a variety of ways, taking into account this individuality and the myriad available methodological techniques, identified in step 5. Through an experimentation and data-collection phase (step 8), we worked with a combination of ethnographic, POE and BM techniques, supported with the use of digital tools. Finally, this brought us to designing a novel approach called *CMA* and its fieldwork protocol, as presented in subsection 4.2 and in Figure 4.

Through the post-fieldwork phase, the collected data was organized by date and participant, coded and chunked (categorized) following *the 4-dimensional model*, and accordingly interpreted (step 9) corresponding to the questions asked within each of the dimensions. Reports were prepared (step 10) using an ethnographic qualitative storytelling approach, and some insights and conclusions (step 11) were drafted, again following the questions raised within the four dimensions.

4.2. Setting the scene and organizing the fieldwork

The starting point to the experimentation was the identification of questions that needed to be understood, going as deep as possible within the available time, space and context. Lists of questions were iteratively outlined, depending on the purpose, technique and depth of exploration. The five main types of questions were: a) *guideline questions* (also main research questions), b) *inquiry questions*, c) *reflection questions*, d) *survey questions* (if applicable), and e) *guideline questions for participants* in case of individual activities (e.g. diary writing, auto-observation, etc.).

Guideline questions guided the researcher and kept the focus on the research by following the *4-dimensional model* (Table 1). They served as guidelines for selection of the activities and methodology used, elaboration of further inquiry questions, observation activities, note-taking and interpretation of the collected data. Practically, each activity observed, written down and interpreted was reflected through questions such as: What space is being observed? How is it designed, maintained and used? Who is using the space? Are we seeing many disabled people on the streets? What are they doing? Where do they gravitate? How do they use the space? Are there any patterns of use? What kinds of barriers do they face in public spaces? What are their attitudes towards their city and towards governmental actions? How, when and which digital tools do they use to support their engagement with the city? What influences their use of such tools?

Inquiry questions were asked, such as the following: How do you feel in the city? Do you feel comfortable, safe, accepted? What conditions need to exist in a city for it to be accessible in your view? Do you find your city accessible enough (why or why not)? Can you live fully according to your desires? What kinds of barriers represent the greatest challenge to you? Do you think that the city today is more accessible than it was 10 years ago (why or why not)? Do you have your favourite locations? If so, where and why? Do you feel engaged with the city? Do you know any ways you can collaborate with the city officials? Have you tried them out? What was the outcome? Do you use any digital tools for navigating and/or searching for information about the city? Which tools and why? How do you find them useful?

Later, the researcher often shifted between inquiry, observation and reflection in order to understand the observed phenomenon gradually in more and more depth. Hence, a set of *reflection questions* were asked, such as: How come you used that particular street? I noticed that you always take that route – why is that? How did you feel when you realized that there was no ramp to cross the street so your wheelchair needed to be pushed by someone? Why did you stop at that place? Do you regularly use the digital tool that you mentioned? What do you like about it? While going deeper and deeper, observation of “the unspoken” was an indispensable part of the ethnographic research process. Hence, the researcher also asked reflection questions to herself, such as: Does the participant avoid talking about certain topics? Does he or she enjoy moving around the city? Does the participant enjoy using digital tools? Does he or she offer excuses? What kind of excuses? Does the participant seem to feel uncomfortable/disappointed speaking about the urban authorities? Has the participant said anything that contradicts what he or she has already said or done? Do body language and facial expressions fit with what is said? How did the participant react in specific situations?

Survey questions were prepared in relation to digital tools, and were in our case very similar to the inquiry questions, but delivered in a more structured form. *Guidelines for the participants* served to instruct the participants in activities such as diary writing and/or self-observation while doing an autonomous city tour. These questions were a blend of guideline and inquiry questions, giving the participant the role of researcher and participant at the same time.

Experimentation with the proposed methodology consisted of four types of fieldwork activities: a) interview (individual and/or group), b) diary writing, c) outdoor activity and d) reflection interviews. Each of these activities aimed to address a set of research questions, aligned with the societal challenges under the *4-dimensional model*. Accordingly, diverse techniques and tools were used. In most cases, an informal friendly interview was used as the first of two initial sessions in order to introduce the research, get the participant’s consent, discuss the individually based fieldwork strategy, and start getting to know the participant and building the necessary trust through

non-structured inquiring. Following this, a participant was requested to engage in activities such as diary writing and/or an outdoor activity. An example of an outdoor activity was a city tour (random or geographically predefined) aimed at exploring the use of public spaces by the participant, the design and structure of the space, and the use of digital tools in public spaces, among other things. Thus, techniques such as participant observation, digital tools elicitation, geotracking and mapping were used while touring the urban environment. At the sessions, the researcher took personal notes, took photos, and used audio and video recording to produce her own multimodal materials. She also engaged the participants through elicitation techniques using their own mobile cameras, testing different proposed mobile apps and/or keeping a diary. Afterwards, the researcher sat down with the participant to reflect on the tour through further questioning and observation – as we call it here, the reflection interview. In addition, in most cases, a set of different digital tools was used in order to, on the one hand, simplify the work of a researcher, and on the other, experimentally support participants with their use of public spaces. A great amount of multimodal material was produced, including audios, videos, photos, manual and digital maps, diaries and researcher's notes. Following the outdoor activity, depending on the available time, reflection interviews were arranged in order to reflect through initial research questions.

4.3. Methodology definition and CMA design

During the fieldwork, certain combinations of techniques and tools were found more appropriate than others for exploring specific questions, be they focused on the user, the space or the technology. After experimenting with diverse techniques, we designed a *CMA* and its accompanying *recommended CMA protocol*. The *CMA* is based on techniques of a qualitative, bottom-up ethnographic approach, complementing it with the digital tools POE and BM. As explained in the background section 2.2, while ethnography is dedicated to in-depth exploration of people and their culture, both of the additionally proposed techniques are in their very nature designed to support the understanding of how the space is being used in order to make future informed actions. As such, they are well positioned within environmental and urban studies. The three methodological

approaches have in many aspects been identified as complementary, and can therefore greatly enrich the outcomes of the research. As seen in Figure 3, ethnography, with its wide range of techniques, can be used throughout the research, with the main focus on gaining an understanding of all four dimensions, primarily the users and the community, and later exploring the space, technology and all the complex interactions between them. When researching the space and interactions within the space, POE and BM get special importance in the CMA. BM techniques will be most beneficial for understanding the space itself as well as the interactions between the space and people. BM can, however, also support questions of how technology is present, used and exploited in the space and by people. POE will mainly examine how the places are used, when and by whom, and will compare different places to enhance their transformations. As an overall added value to this combination, digital tools will be used throughout the process wherever and whenever deemed necessary.

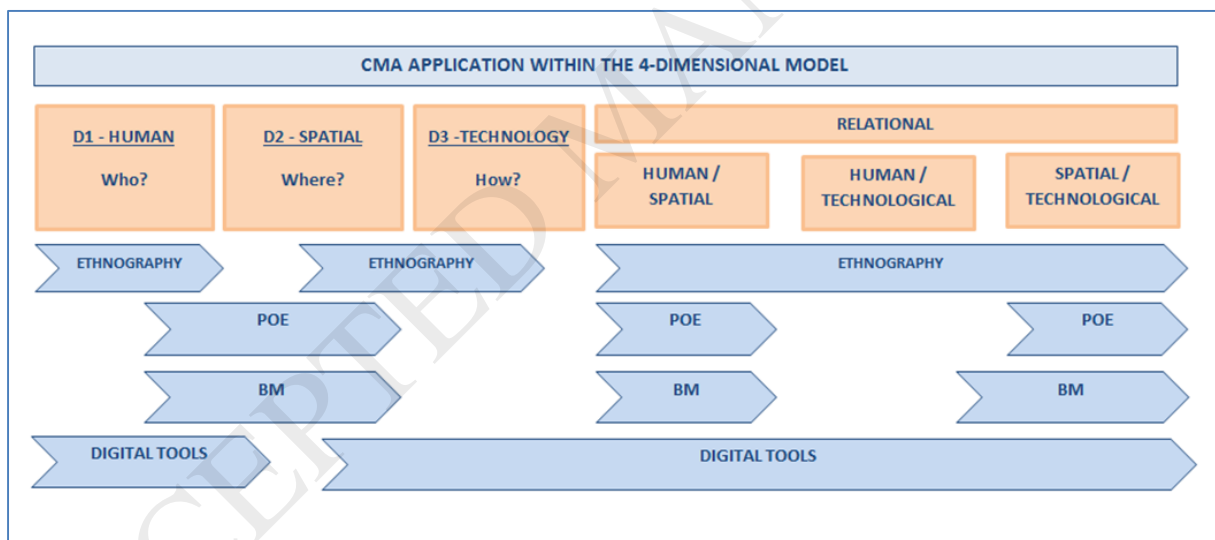


Figure 3. CMA application in the 4-dimensional model.

The main characteristics of the proposed approach can be summed up as follows: Firstly, the approach focuses on qualitatively collecting deep, slow and small data. Secondly, it uses participatory techniques, aimed at enhancing user engagement in order to better understand the users, their needs, attitudes, motivations and constraints in relation to the environment and the technology. Thirdly, it builds on three main methodological approaches: ethnography, POE and BM. Finally, it

incorporates the digital dimension, with the researchers, the stakeholders and the users using digital tools in a context of research, governance or use of public spaces. The following subsections of section 4 are dedicated to discussing its applicability in real urban practices in a specific context of disability, accessibility and inclusion.

4.4. Experimentation using *CMA* protocol principles

The *CMA protocol* was designed as a roadmap for the user-centred qualitative approach towards facilitating and enhancing the inclusive urban planning and design practice. It should serve as an insightful recommendation rather than as rigid guidelines. And most of all, it should be used considering individuality, originality and the specifics of situations under examination. The protocol is grounded in the concept of the *4-dimensional model*, within which it proposes a flexible combination of techniques and tools that can be used to explore specific societal challenges and research questions. It also consists of a collection of exemplary *CMA* questions, as set in subsection 4.2. To demonstrate one of the possibilities of the *CMA protocol's* applications, we will present a few further examples of how the fieldwork was implemented.

Within the four case studies, the users were contacted, met, interviewed and observed mainly individually, although several group interviews were organized as well. Group sessions were organized mostly at the beginning of the studies in order to attract the interest of individual participants and to observe behaviours of the target groups under study when joined in a community. In demonstrating the approach and its applicability, we focus here on the predominantly implemented individual activities. The sessions' intensity and frequency, as well as methods used for each of the sessions varied significantly, mostly in the need to adapt to participants' specific individual situations, and conditions such as weather and events. Thus, fieldwork strategy was defined as individually based, and its design process had to be very flexible and iterative.

Figure 4 outlines one of the possible *CMA protocols*. It recommends a research flow of several key fieldwork activities, such as interviews (individual or group), city tours, diary writing and

reflection interviews, finally enriching them by proposing the use of different combinations of techniques.

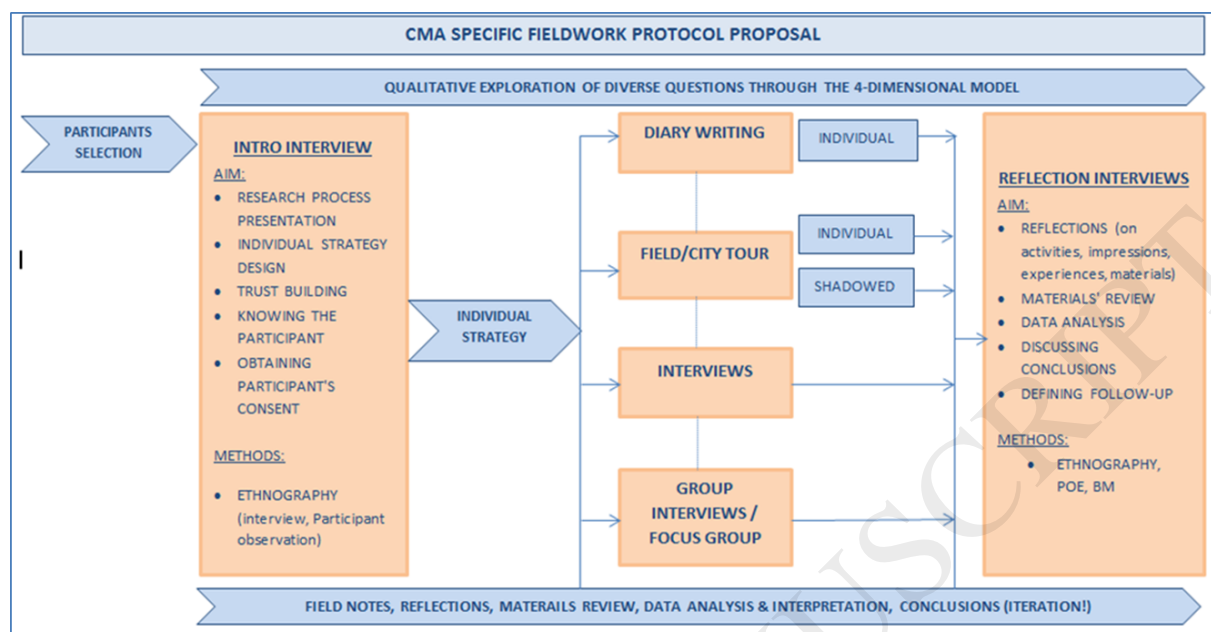


Figure 4. CMA specific fieldwork protocol.

For example, first one or more initial interviews were conducted, aimed at acquainting the participants with the research, signing the consent form, collaborating in and defining an individual fieldwork strategy plan, and initiating trust building. Then the participants were engaged further. They were accompanied on their usual path through public spaces (city tour), be it towards an agreed upon destination or by serendipitous choice. They were observed through ethnographic participant observation (which is inseparably intertwined with POE participant observation and BM shadowing). During the process, the ethnographer took notes. Notes accompanied all the researcher's work, aimed at only briefly sketching the activities, conversations, participants' behaviours and thoughts. With the participants' consent, the researcher recorded a series of multimodal materials, and spontaneously but thoughtfully questioned the participants during the tour to explore some of the observations in more depth. Throughout this process, the researcher also observed her own thoughts on the undergoing situations (autoethnography), observed "the unspoken" and, finally, iteratively processed the information through the research questions that she

had asked herself beforehand. On several occasions, the participants engaged with their own smart phone or with various mobile applications (normally downloaded to the researcher's smart phone), which supported fieldwork through producing multimedia, geotracking and providing accessibility information (Figure 5).



Figure 5. Digital tools engagement and elicitation during the case study MB-III, September 2017. (Photo by N. Rebernik)

After the tour, the researcher engaged with the participant, again individually, by sitting down and having a reflection based on the stored memories, comparing the notes taken, the maps and other materials recorded. The interviews were audio-recorded for further consultation post-fieldwork. As emphasized by Favero and Theunissen (2018) in their experimentation with digital ethnography and digital tools, memories are often emotionally coloured and can thus provide contradicting stories. Presenting the participants with what had been said and done in the field and examining the experience through further reflection interviews methodologically provided a strong opportunity for deepening the understanding of the “whole picture”. With most of the participants, such tours were repeated, with or without the researcher. In the latter case, they took photos and

notes, prepared maps and delivered them to the researcher together with extended notes in diverse multimodal forms. When feasible, reflection interviews followed.

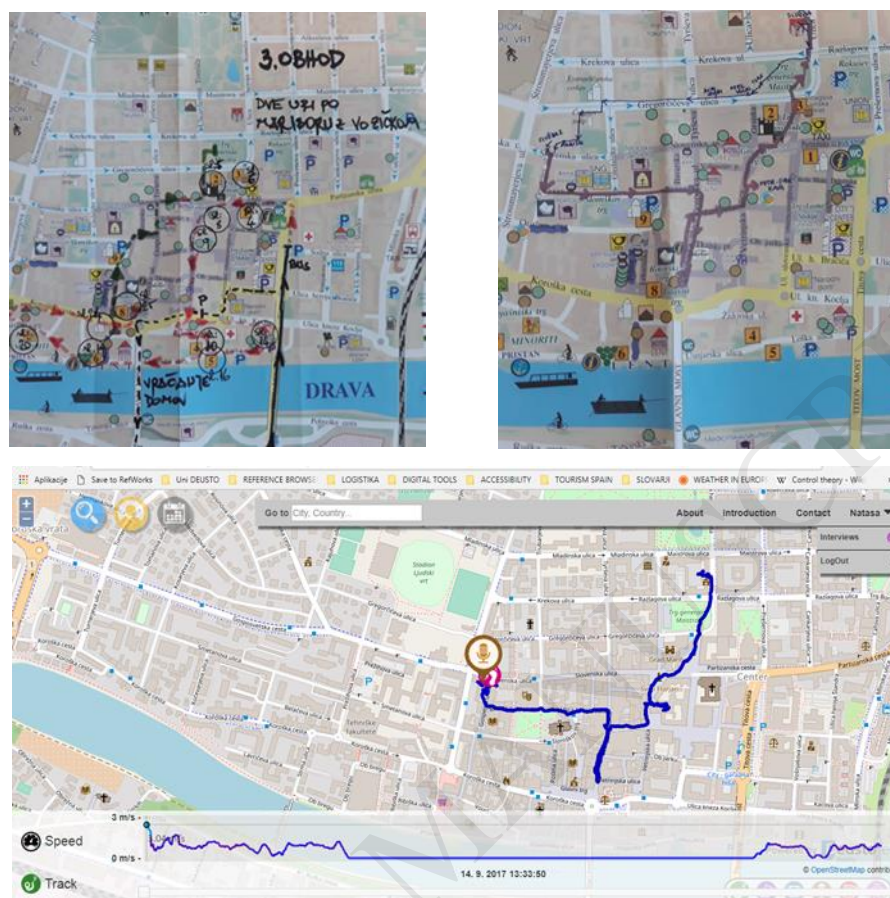


Figure 6. Personal maps, produced during case studies MB-II and MB-III: a) left, manually produced by a wheelchair-using participant; b) right, manually produced by a visually impaired participant; c) below, digitally produced through EthnoAally mobile app by the researcher accompanying a visually impaired participant.

Not to be lost in the flood of information, extending field notes was a significant part of post-fieldwork activities. In addition, the researcher reviewed the materials, coded the collected information, analysed them and, where possible, subjected them to a comparative analysis in order to gain valuable insights and draft conclusions. In such a way, for example, maps that were digitally or manually (Figure 6) produced during the ethnographic fieldwork actually served as behavioural maps that can, in combination with other techniques, result in valuable insights into the individuals themselves, their usage of space and the technology used. In particular, we observed which spaces were more or less commonly used in the selected urban setting, how they were used by different individuals, and whether there were common reasons for use and non-use. In addition, on a small

sample, we could also compare whether the use by disabled and non-disabled people was any different.



Figure 7. Maribor, Slovenia – Stairs combined with a steep slope present an example of a significant barrier, excluding both physically and visually impaired people. During an ethnographic tour around the city of Maribor, this place represented an insurmountable obstacle to one of the wheelchair-using participants, who had never visited this place before. During the tour, he was assisted by the researcher and, for the first time, entered the plateau overlooking the river, the city and the mountain. This was said to be an invaluable experience for him. It also opened up an interesting emotional conversation with the participant reflecting on how it is to live with a disability, how the rights of PWD need to be negotiated in most cases, and how little has in fact changed during the decades he has had the impairment. Hence, one such experience offered to the researcher much more than an array of surveys ever could have. (Photo by N. Rebernik)

One of the invaluable characteristics of the *CMA* is an opportunity to compare such geo-referenced data provided by maps with other materials, such as ethnographic notes, audio recordings and photos, which provide other types of information. They create additional records of data that can, for example, demonstrate the barriers in the space (as seen in Figure 7), reflect on the reasons for using certain paths rather than others, or even tell us about the emotional colour given to a place by a participant. Often such a combination of techniques proves a true dedication, engagement and interest in the user, consequently strengthening the trust between participant and researcher, and providing the researcher with even more in-depth information than expected. When accomplishing this, participants often stop at a meaningful place and explain their emotional state (e.g. they feel comfortable there because of the benches, trees, birds singing, etc.). They share

memories such as those of a love story, an accidental fall or just an interesting event, but they can also evidently share anger, sadness or sarcasm when noting a significant barrier that is still there disabling people with impairments despite years or even decades of awareness-raising activities. This combined approach to research, and a comparative analysis of such diverse data, offers great potential for in-depth, valuable insights and can enrich the ways that stakeholders can gain understanding; empathize with the users; and plan, design and act through informative actions.

4.5. Validation

Finally, the extensive data collection was analysed and compared, followed by a detailed fieldwork report preparation. Personal records of each of the participants were built, allowing for comparison of their inputs. The aim of such an approach was to gain a deeper understanding of the two research premises: contextual and methodological. In this paper, we mainly focus on the methodology-based conclusions, reflecting on the strengths and weaknesses, benefits, usefulness and usability of the proposed *CMA*. Table 5 outlines these methodology-based conclusions; therein, we demonstrate the advantages of the *CMA*, and reflect on the benefits of each of the techniques combined within it.

On the other hand, as shown in Table 6, a list of context-based conclusions (organized by the four dimensions) was created in order to demonstrate how such a combined methodological approach can bring in-depth insights about participants, public space, technology and the relations between the three, and can truly create an informative platform for stakeholders to be able to undertake informative responsive measures towards creating an inclusive city.

4.5.1. Methodology-based discussion

This section provides a brief analysis and comparison of the methodological techniques used, and discusses their position within the *CMA*. Firstly, Table 4 reflects their main advantages, disadvantages and complementarity, as well as some interesting overlap between the tested techniques.

First, *ethnography*, in its very essence *slow and small-data-oriented qualitative research*, served as an invaluable methodology that can enrich most common quantitative approaches in urban

planning and design practice. The latter provide statistics, patterns, generalizations and the answer to the question of what is happening. They also might have a potential to explore how it is happening. But rarely do they give any solid interpretations of the identified phenomena. Ethnography, although slow and time-consuming, should, in our view, follow up the quantitative approaches by questioning why something is happening and how it can be approached in order to enhance the progress.

Ethnography			
Advantages, Benefits, Opportunities	Disadvantages, Risks	Complementarity & Overlapping	
<ul style="list-style-type: none"> a) In-depth, qualitative b) Complements quantitative research c) User-centred, participatory and collaborative d) Aiming at gaining insights about the people and their culture, needs, behaviours, opinions, perceptions, etc. e) Diverse range of techniques and tools available; hence, flexibility f) Trust-based, reliable g) Long-term partnership h) Obtrusive and non-obtrusive options i) Flexible and adaptive to diverse socio-cultural settings 	<ul style="list-style-type: none"> a) Sample limitations b) Time-consuming c) Non-structured and without clear guidelines d) Extensive qualitative data collection which makes analysis and interpretation difficult 	<p><u>Complementarity:</u></p> <ul style="list-style-type: none"> a) All ethnographic techniques applicable across disciplines in order to gain in-depth insights of the studied topic b) POE & BM protocol c) Digital tools within ethnography, POE & BM <p><u>Interesting overlap:</u></p> <ul style="list-style-type: none"> a) Ethnographic interviews, POE & BM interviews b) Ethnographic participant observation, POE & BM shadowing c) Geotracking & mapping within ethnography, POE & BM mapping techniques 	
POE			
Advantages	Disadvantages		
<ul style="list-style-type: none"> a) Quantitative & qualitative b) Space-centred & user-centred c) Comparative approach between the spaces d) Aimed at informative redesign of existing spaces or design of future spaces based on past experiences e) Insights into the space f) Insights into relations between the space and its users g) Obtrusive and non-obtrusive options h) Protocol-based 	<ul style="list-style-type: none"> a) Focused on patterns b) In practice, it lacks the application of in-depth qualitative techniques (although available) 		
Behavioural mapping			
Advantages	Disadvantages		
<ul style="list-style-type: none"> a) Quantitative & qualitative b) Space-centred & user-centred c) Comparative approach between the individuals and/or spaces d) Behavioural patterns in the usage of space e) Insights into the ways people use a certain space and/or ways that different spaces are being used by one or more users f) Obtrusive and non-obtrusive options g) Protocol-based 	<ul style="list-style-type: none"> a) Focused on patterns b) In practice, it lacks the application of in-depth qualitative techniques (although available) 		

Table 4. Methodology analysis and complementarity.

The more in depth the research, the more questions arise. Ethnography offers an opportunity to gain in-depth understanding of the users, their characteristics, socio-cultural categories, behaviours, perceptions, inclinations, opinions, attitudes and finally their needs. Hence, within our pilot experimentation, we considered a wide array of aspects that influence the perception of one's city and society, as well as themselves, traditions, novelties and innovations, in order to avoid hasty and generalized assumptions.

Ethnography in itself is based on a strong *user-centred, individual-based approach*. It uses participatory and/or collaborative techniques, by which the participant may only be observed, or is closely participating or actively engaged in collaborative work with the ethnographer. The participants may be aware (obtrusive research) or not (unobtrusive research) of the presence of the researcher, which gives a wider array of research options. As such, participatory and collaborative ethnography demands building trust and thus carries great potential for contributing to long-term *user-researcher-stakeholder* collaborative partnerships.

Secondly, POE was selected as a method for systematic evaluation of a designed and occupied setting from the perspective of those who use it. It is a method for researching existing outdoor spaces – how they are used, what seems to work, which elements are overlooked and the like – and as such is proposed especially for focusing on exploring the space and the place. POE can be complemented well with a diverse range of ethnographic techniques. For example, it also proved to overlap in techniques such as shadowing and interviews, and with BM it shares space-centred protocols. In fact, the more structured protocol approach, used in POE and BM, can greatly complement ethnography to give it another dimension in the *CMA*.

Thirdly, BM is offered as a complementary alternative when studying a place (place-centred) or the users as individuals (individual-centred). It is similar to POE in its orientation towards finding the best ways to design a place. The two also share the concept of structured and schematized protocols to be followed. This differs from what we can see in a flexible, non- or semi-structured ethnographic exploration. In addition, BM in some cases overlaps and/or can be complemented with ethnographic

observation, interviews and digital tools elicitation (for producing maps). While the value of BM as a primary space-centred method is demonstrated after its continuous application during a certain period of time and/or periodic repetitions in different time spans in order to understand the patterns and discrepancies and conduct a proper comparative analysis, in some cases its value is higher as an interpretative tool. In this case, the maps are recorded, overlapped and interpreted in terms of the use of spaces as well as the movements and behaviours of participants involved in the research. In fact, our research resulted in both manual and digital maps. As such, the production of behavioural maps was an automatic outcome of ethnographic geotracking and geomapping, although this was not intentionally incorporated in the fieldwork itself. Hence, BM was used not as a primary method but rather as an interpretative tool. As seen in the work of Goličnik Marušić (2011, 2016) and Goličnik Marušić & Ward Thompson (2010), behavioural maps can provide valuable information about user and space relations, as well as about the users themselves. Thus, they represent a promising methodology, technique and tool for improving the perception of potential and actual use of public space.

Finally, our study was enriched with different digital tools, first, to support the researcher and, second, to explore the use of digital tools among the users, and how the digital dimension can in fact support the production of inclusive urban spaces. Digital tools can offer a wide range of possibilities for all the involved agents. Technologically speaking, their potential is unlimited. When applied with the main aim of serving humans, their benefits can truly be of great value. In fact, humanizing technology should be the main roadmap for its development, which is the main reason for such a strong impact of technology on our work. Through the process, we managed to identify numerous digital tools that are potentially valuable for inclusive public spaces planning, design and governance that will be introduced systematically in our future work. Some of these tools were further explored, and a few even tested, in the four pilot case studies. A few are worth noting here: *Ethos* (<https://www.ethosapp.com>), *EthnoAlly* (<http://cloud.mobility.deustotech.eu/ethnoally>; Favero & Theunissen, 2018) and *Way-CyberParks* (<http://cyberparks-project.eu/app>), which were designed for

ethnographic studies research, as well as generally accepted apps such as Runtastic (<https://www.runtastic.com>) and Google Maps (<https://www.google.com/maps>), which we used for geotracking and geomapping. The value of these tools has been demonstrated not only from the researcher's perspective of managing great amounts of material and data, and the production of diverse multimodal results (Favero & Theunissen, 2018). As multimodal, multisensory and multi-stakeholder-oriented research tools, they can also become collaborative tools while supporting communication between users, researchers and relevant stakeholders. On the other hand, there are already numerous social and participatory digital tools available on the market that enable communication between public space users themselves (e.g. social media, crowdsourcing tools) and/or with public space stakeholders (e.g. collaborative platforms). Some of the tools even include accessibility features and as such support disabled people in moving around public spaces (e.g. accessibility enabling tools). Namely, a few of these tools are *Moovit* (<https://moovitapp.com>), *BlindSquare* (<http://www.blindsquare.com>) and *WheelMap* (<https://wheelmap.org>), as well as some national ones, such as *Izboljšajmo Maribor* (<https://izboljsajmo.maribor.si>), *Dostopnost.uirs* (<http://www.dostopnost.uirs>) and *Pridem.si* (<http://www.pridem.si>) for the two Slovenian case studies. A few of them were also tested to observe their use, usability and usefulness.

Thus, digital tools played an important role in our methodological conceptualization. Through *digital ethnography* (Collins et al., 2017; Favero & Bahillo, 2016; Favero & Theunissen, 2018), we engaged with our participants through the use of digital tools and elicitation techniques, geo-tracking and geo-mapping, resulting in multimedia production (photo, video, audio, maps, databases, etc.). On the one hand, such tools supported the researcher in minimizing the efforts in data collection, analysis and interpretation, and on the other hand, they supported the production of behavioural maps already when employing the main ethnographic techniques.

Summarizing, Table 5 gives an insight into a short SWOT analysis of the tested *CMA* and offers some insights into the usability of the proposed methodology as a whole. The methodology discussed in this paper gives a wide array of possibilities for urban planning practice. Its benefits

include enriching the existing quantitative practices with qualitative ones, complementing the traditional techniques, adding the new digital dimension, flexibly combining diverse techniques and tools (originating from either human-centred or space-centred research), the production of various multimodal materials, and many more. This all allows for the enhancement of collaboration between stakeholders and citizens, to gain in-depth insights into a variety of research questions, and to contribute to methodological approaches in existing urban practices.

Strengths	Weaknesses
<ul style="list-style-type: none"> a) Needs-driven by real-life needs and existing societal challenges b) A diverse range of societal challenges & needs that can be tackled, including the most vulnerable groups of citizens c) Ethnography-based, user-centred and strong participatory approach d) Deep, slow and small-data-oriented research aimed at deeper understanding of the research phenomena e) POE & BM support spatial dimension f) Enriched data collection & multimodal material creation for comparative analysis and enriched understanding of the phenomena g) Behavioural patterns identification for deeper understanding of how the city is being used h) Digital dimension included to enhance communication between all the stakeholders involved i) Simplification & automatization of the entire process due to the use of digital tools j) Blended approach combining strengths and benefits of diverse methodological approaches k) Holistic and integrative approach l) Simple and well-structured model 	<ul style="list-style-type: none"> a) Time-consuming nature b) Extensive efforts to deal with deep, individualized data from the field c) Long trust-building period between the citizens and stakeholders d) CMA evaluation limited to small pilot testing e) CMA evaluation limited to testing within only one national context (comparative approach needed) f) Limited sample of participants g) Great efforts needed to ensure sufficient and continuous user engagement h) Flexibility in choosing varied combinations of techniques and tools may cause uncertainty with stakeholders in initial stages i) The flood of digital tools on the market j) Citizens may face constraints in using digital tools; adaptation period needed
Opportunities	Threats
<ul style="list-style-type: none"> a) Deeper understanding of citizens and their needs b) Individualized and tailor-made urban planning c) Building trust among citizens and their governments, greater citizens' motivation and thus engagement d) Integration of the methodology into design of a governmental strategic approach e) Spreading to diverse national contexts (e.g. Spain, Belgium) f) Usability through the whole process from pre-planning, to planning, design and implementation, as well as post-occupancy evaluation and designing responsive measures 	<ul style="list-style-type: none"> a) Non-recognition among city governments due to its time-consuming nature and other identified weaknesses b) Lack of motivation and trust among citizens due to previous experiences with non-inclusive city design c) Constraints in using digital innovations due to lack of knowledge, comfort, trust, UXD, etc. d) Data protection and privacy issues

Table 5. Methodology-based conclusions through SWOT analysis.

Until now, the methodology discussed has been explored only through four small pilot cases; hence, the conclusions provided should be considered preliminary. However, they show that the CMA can serve as an interesting tool for inclusive city design where bridging the communication gap

between city governments and citizens is of paramount importance. To confirm this claim, future research and further testing in real urban environments is strongly encouraged.

4.5.2. Context-based discussion

This section presents the results of the conducted fieldwork from the contextual perspective of inclusive city design. Conclusions in Table 6 follow the structure of *the 4-dimensional model* and address some of the questions posed under each of the four dimensions, as noted in Table 1.

ACCEPTED MANUSCRIPT

DIMENSION	PRELIMINARY CONCLUSIONS
HUMAN	<p>CONCLUSIONS (content-wise):</p> <ul style="list-style-type: none"> • Public space users include a wide array of citizens, both with and without impairments. • Public space users with impairments are not only those with disabilities, but also the elderly, the long-term ill, the injured, pregnant women, parents with small children, etc., and each of them has a certain level of special needs when using public spaces. • Public space users with disabilities live with diverse disabilities, be they physical, sensory, mental or cognitive, and the diversity within each of the groups is significant as well. • The needs of disabled citizens reflect the diversity recognized within the groups of disability. • In addition, there is a significant level of individuality expressed through individuals' characteristics, attitudes and motivations, as well as constraints towards themselves, their (dis)abilities, their lives and their community, the environment in which they live, etc. <p>CONCLUSIONS (process-wise; typology of materials gained):</p> <ul style="list-style-type: none"> • A detailed folder of digitally and manually produced multimodal material, collected for and by participants with identified demographic and personal data. • Researcher's diary with observations of the users.
SPATIAL	<p>CONCLUSIONS (content-wise):</p> <ul style="list-style-type: none"> • Public spaces still tend to be designed to fit the needs of a fully abled adult male, thus creating barriers for a great array of citizens with different impairments. • Urban planning design still focuses mainly on visual aspects of the environment, thus primarily creating visually attractive but non-inclusive public spaces. As a result, it discriminates to a large extent against visually impaired people, who rely on senses other than vision. • Nevertheless, in recent years, progress in increasing the accessibility of public spaces in the two cities has significantly increased for the physically impaired. For the visually impaired, accessibility of public spaces has improved, but many barriers can still be detected. • The most evident problem regarding inaccessibility in both cities is the lack of wheelchair-accessible public toilets. • Planning, designing and governing processes (specifically in the city of Maribor) still lack a holistic, systematic and fully integrative approach that would motivate all the governmental services and officials to follow a specific inclusive design procedure. Participatory initiatives are implemented on a random and <i>ad hoc</i> basis. • In many cases, architects and designers have the attitude of "knowing all about the inclusive design" although its application to projects shows that their knowledge is often limited to basic physical accessibility. • On the other hand, many governmental officials seek contacts with disabled people in order to understand their needs and incorporate inclusive measures in their everyday work. <p>CONCLUSIONS (process-wise; typology of materials gained):</p> <ul style="list-style-type: none"> • Folder of ethnographic semi-structured interviews with public-space stakeholders and public-space users. • Digitally and manually produced multimodal materials. • Researcher's diary with observations of the environment.
TECHNOLOGICAL	<p>CONCLUSIONS (content-wise):</p> <ul style="list-style-type: none"> • A great number of digital tools are available on the market for qualitative research that could support inclusive urban planning, design and governing. • There are many marketing- and customer-research-oriented digital tools available that could potentially be used for urban ethnographic research purposes. They mostly have a strong participatory component and exhibit other similarities with the existing ethnographic digital tools. They seem to have better UXD, but are closed for general and even academic use since they are mostly profit-oriented.

	<ul style="list-style-type: none"> • A considerable number of tools are available whose owners state are available free of charge, at least for academic and non-profit purposes, but in the research it was difficult to actually get the free access without contacting the administrators. Even in this case, their responsiveness towards our request for free access was extremely low. • Most of the tools are available in a mobile app version; support media production, GNSS tracking and/or mapping; are of participatory nature; enable offline use, etc. • Most of the tools enable a certain level of media downloading or uploading and cross-platform data transferability, but these options should be extended in order to ensure data control, backup and external storage, as well as data processing, analysis and interpretation with other, possibly compatible digital tools. • Most of the tools seem to be designed at least partially according to UXD principles. However, in practice, pre-testing and testing showed that in many cases the design should be significantly improved in order for the tools to fully serve the user. Tutorials and guidelines are missing in many cases. • Inclusion and user-engagement-supporting digital tools that were studied have proven to be interesting and useful, but did not completely satisfy the needs or expectations of public-space users for whom they were designed. <p>CONCLUSIONS (process-wise; typology of materials gained):</p> <ul style="list-style-type: none"> • Researcher's diary with observations of the technology used. • Desktop research data collection. • Digitally produced multimodal materials.
RELATIONAL LEVEL 1: Human & spatial level	<p>CONCLUSIONS (content-wise):</p> <ul style="list-style-type: none"> • Participants with disabilities used public spaces differently than those with no impairments. Their selection of the streets was different mainly due to present barriers. • Participants seem to have established routine pathways that have previously been recognized as accessible and enable them a smooth transit. • All the public-space users, regardless of their impairment, prefer to use open bright spaces, connecting squares and parks, and they all like smooth, well maintained surfaces without stairs or pavement edges. On the other hand, wherever possible, they all tend to take short cuts, which is clearly shown, whether in selecting streets, crossing squares or using ramps on crossroads, by not only the physically disabled but also the non-impaired participants. • Participants were on the one hand mostly satisfied with the accessibility of both city centres, but their satisfaction with the government's approach to the planning, design and maintenance of public spaces was especially critical for the city of Maribor. Thus, the participants showed a certain level of distrust, scepticism and sarcasm towards the government's approach to accessible and inclusive public-space design. • The general opinion of all the participants is that they would be willing to collaborate in future governmental actions, if they were well designed and implemented with the dedication. • Fieldwork resulted in detailed diaries, maps and lists of barriers from the perspective of physical and visual accessibility. <p>CONCLUSIONS (process-wise; typology of materials gained):</p> <ul style="list-style-type: none"> • A detailed folder of digitally and manually produced multimodal material, collected for and by the participants that identifies attitudes and actions towards the use of public spaces. • Researcher's diary with observations of the relations between the user and the environment.
RELATIONAL LEVEL 2: Human & technological level	<p>CONCLUSIONS (content-wise):</p> <ul style="list-style-type: none"> • The average participants are in principle open to engagement with digital tools, but in practice this engagement rarely goes far beyond their comfort zones. Rarely are they willing to fight through initial user-experience challenges faced during the learning process. In the case studies, all the participants expressed interest in using and testing the proposed tools; however, when required to take action, different excuses (e.g. "I am not a very technical type.") and constraints appeared (e.g.

	<p>using the tool to a minimum extent, not really dedicating the time to properly understanding the benefits and seeing how it can actually serve them in their everyday life).</p> <ul style="list-style-type: none"> • On the other hand, when spending time with the researcher, thus being technically and morally supported, the real readiness to “play and discover” the tools increased for most of the participants. This leads us to conclude that social interaction, as well as moral and technical support, releases the anxiety and fear, and increases curiosity, openness to novelties and playfulness. • The practitioners are in principle more ready to use digital tools, and will try to find a way to overcome user-experience challenges faced during the learning process. • Most of the participants had difficulties finding their way through the interface of the apps, as well as platforms. Over time they understood basic functions, but all the options of the tool remained undiscovered due to a lack of UXD. • The main aim of smart-phone use is for phone calls and text messages. Use of the internet is also common for searching information. However, only in individual cases is the use frequent on a regular basis. Mobile apps are rarely explored and used. Mostly, preset Google or iOS apps for navigation, photos, weather, etc. are used. • Reluctance to using (new) digital tools has proven to be connected with age, disability and experience with digital tools through work. • The testing itself brought up many usability challenges and technology-based issues that will need to be further explored. <p>CONCLUSIONS (process-wise; typology of materials gained):</p> <ul style="list-style-type: none"> • A detailed folder of digitally and manually produced multimodal material, collected for and by the participants, that identifies attitudes and actions towards the use of technology. • Researcher’s diary with observations of the relations between the user and the environment.
<p>RELATIONAL LEVEL 3: Spatial & technological level</p>	<p>CONCLUSIONS (content-wise):</p> <ul style="list-style-type: none"> • In both cities, there have been several (governmental) projects and attempts to incorporate technology into participatory design of public spaces (e.g. Izboljšajmo Maribor), as well as to provide accessibility-related information online (e.g. Dostopnost.uirs), but the usability and usefulness has not shown its effects due to many reasons, some of which are: time-limited projects, design of apps without involving participants in the design process, and lack of funds for a holistic approach. • Smart City digital tools that can support both the stakeholders and users are gradually being incorporated in the cities’ functioning – e.g. parking apps, public transportation apps, central management systems, etc. Although both the cities are striving to attain accessibility and inclusion of disabled citizens, it would be unfair to say that inclusion has already been fully incorporated in the implementation of the cities’ strategies. • Good practice examples can be found especially in the city of Ljubljana, where public transportation and parking are supported by digital tools and related ICT services; in addition, the government’s approach to inclusive city design is more systematic and coherent in following inclusive participatory practices. <p>CONCLUSIONS (process-wise; typology of materials gained):</p> <ul style="list-style-type: none"> • Researcher’s diary with observations of the relations between the environment/governments and the technology. • Folder of ethnographic semi-structured interviews with public-space stakeholders and public-space users. • Desktop research data collection. • Digitally and manually produced multimodal material.

Table 6. Context-based conclusions, following the 4-dimensional model.

Contextual results from the studied cities, as presented in Table 6, show many details. Nevertheless, we can highlight some of the main messages. For example, in the *human dimension*, conclusions demonstrate a great diversity among public-space users and their needs. In the *spatial dimension*, we can clearly say that public spaces still tend to be designed to fit the needs of a fully abled adult male, thus creating barriers for an array of citizens with various short-, mid- or long-term impairments. When combining the two dimensions in the *relational dimension 1 (human & spatial)*, it soon becomes clear that persons with disabilities use public spaces differently than those with no impairments; hence, understanding their different behaviours in the urban planning process is of paramount importance. In the *technological dimension*, we detected an incredible amount of potentially useful digital tools for participatory urban practice. As then further explored in the *relational dimension 2 (human & technological)*, the average public-space user often expressed full openness towards new digital tools. However, in practice, the introduction and use of new tools faced rejection more than acceptance. Among the reasons, we can mention a flood of tools available in the market and users' scepticism in regard to their usefulness. But the rejection has also proven to be connected with age, disability and previous experience with digital tools. Last but not least, when addressing the *relational level 3 (spatial & technological level)*, the main conclusions that we were able to draw were that both cities had attempted to approach inclusive city design through Smart City projects, introduction of new participatory digital tools, and other initiatives. Hence, good examples can be found, but all in all, the planning, designing and governing processes in the studied cities still lack a holistic, systematic and fully integrative approach to inclusive city design.

5. RESULTS AND DISCUSSION

The proposed *4-dimensional model* and *CMA*, explored in this paper, are based on the modern concept of a Smart City and its components, usually clustered and contextualized as three main pillars: a) technology, b) people and c) institutions/governments (Nam & Pardo, 2011). With the proposed model, the Smart City concept is complemented by what is of paramount importance: on

the one hand, by adding the dimension of space, we enable the activities to be positioned somewhere and thus actually able to happen, and on the other hand, by adding the relational level, we explore interactions between the other three dimensions. The latter represents a dimension within which a real complexity appears and a diverse range of societal challenges can be tackled. On this level, we explore in more depth the relations between: a) the users and the space, b) the users and technology, and c) the space and the technology (Rebernik et al., 2017).

For this purpose, we argue that no single methodological approach can cover the complexity of inclusive city design, so we propose a newly designed *CMA* to utilize the *4-dimensional model*. After reviewing several methodological approaches in anthropology as well as urban and environmental studies, we have identified a set of methodological techniques and tools especially complementary and beneficial for urban planning, design and governing practice. We selected ethnography, POE and BM. Although each of these approaches could by themselves represent a valuable contribution to the area of designing inclusive public spaces, we go a step further by identifying their advantages and disadvantages, the areas where they complement each other and the ways they overlap, hence bringing out their strengths and eliminating their weaknesses as stand-alone techniques.

At the very start of our exploration using ethnography, it was soon clear that this would be the backbone of our methodological approach. Why? Because the main aim was to understand the (disabled) citizens, their needs, their characteristics, their motivations, constraints, opinions and attitudes towards themselves and others, the space where they interact and technology. Ethnography can offer a deeper understanding of the citizens as main drivers of the city as a culture. It collects deep, slow and small data using participatory techniques. And such in-depth exploration of people requires intensive fieldwork.

Although well recognized as qualitative research methodology, ethnography is still an unusual approach in urban planning, design and governing practice. The fact that it is a highly time-consuming approach is its main weakness. In needing to make the city efficient, ethnography could be seen as a vague discipline, lacking orientation towards goals, action plans and design of future

measures. Nevertheless, based on previous research, as well as the pilot testing presented here, it can indeed offer a completely new and mostly deep understanding of how the city is used in order to be able to design its structure accordingly.

Specifically, (urban) ethnography and the digital dimension are combined by encouraging the participants involved to engage with a few of the selected mobile apps, such as EthnoAlly (<http://cloud.mobility.deustotech.eu/ethnoally>), Way-CyberParks (<http://cyberparks-project.eu/app>), WheelMap (<https://wheelmap.org>) and Google Maps (<https://www.google.com/maps>), the most frequently used. The principles of digital ethnography are used as a modern approach to complement the old, traditional ethnographic techniques, such as participant observation, interviews, focus groups and diary writing. The benefits of such approach proved to be multilayered. Firstly, the ease of data collection and management was evident. Secondly, we hoped for establishing a more engaging approach with the participants, and partially we indeed have. And thirdly, we aimed at gaining deeper understanding of the questions of whether and how these tools can enhance communication with urban planners, designers and governmental officials, as well as simplify, automate and improve the process of urban planning and design. In both, the digital tools proved beneficial to a certain degree.

However, engagement with digital tools among the participants involved in the case studies unfortunately did not go as smoothly as planned. Already, the recruitment and engagement process itself was a matter of taking time to build trust and to initiate motivation among participants. Furthermore, in most cases, (disabled) participants were fairly reserved when offered engagement with completely new digital tools. A good deal of time was needed for building trust, combined with the use of soft motivational techniques to encourage the participants to actually try the proposed digital tools. Interestingly, when the ice was broken, most of the participants recognized the usability of the tested mobile apps. However, the question remains as to whether they would be willing to use such tools regularly, consistently and in the long term, as it may be needed for successful urban planning practice. Although the benefits of digital tools are generally evident, at least for research,

professional and utilization purposes (Brighenti, 2012), and their rapid penetration is in progress, we conclude our research with great concerns related to the actual role of technology in participatory urban planning, design and governing practice. People still seem to prefer personal contact over digital tools (in which the trust-building ethnography fills in the gap), and as noted by Klichowski et al. (2017), the human brain is still not ready to use technology outdoors. In addition, with disabled people, the specifics of their impairment need to be respected. This poses additional concerns in relation to user engagement and the digital elicitation process.

To go a step further, the proposed methodological model complements ethnographic principles with POE techniques, which from the methodological perspective resemble ethnographic participatory techniques, but with nuances in their purpose and focus. POE is a method for systematic evaluation of a designed and occupied setting from the perspective of those who use it and is a methods used for research on existing outdoor spaces – how they are used, what seems to work, which elements are overlooked and the like. POE can give valuable “insights into consequences of past design decisions” (Marcus, & Francis, 1998, p. 345). POE may offer a structured protocol approach, and may be perfectly designed to understand the environmental dimension, as well as relations between the users and the space, similarly to BM. However, in practice, they both lack a holistic approach and the in-depth qualitative dimension through which they would be able to cover all the aspects of societal challenges that have been introduced in the *4-dimensional model*. With this model, we offer exactly this: a complementary combination of techniques, falling into a well-defined multidimensional and multimethodological approach towards inclusive city design. In our research, POE has been applied as part of a holistic ethnography-based experimentation. What was found is that many of the ethnographic techniques and tools significantly overlap and can be complemented with POE techniques, focused on the exploration of the space. When aiming to understand how public spaces are designed (and, for example, identify and locate the barriers that prevent disabled people from using the space), POE shadowing techniques were used in combination with (ethnographic) interviews, diary writing, multimodal material production (photos, video and audio

recordings, texts and maps), and mapping techniques. As a result, for example, we produced a detailed snapshot of existing barriers, and learned a great deal about the use of the observed space.

Finally, the two methodologies of ethnography and POE are complemented with BM, which carries within it the power to identify patterns and discrepancies in the use of space. It can also tell us more about the users who occupy the space, and can in combination with diverse techniques further explore the reasons behind the recorded patterns. What we found especially interesting is that BM was actually an outcome of the ethnographic production of individual-centred maps. As such, we further examined and interpreted them through BM as a methodological technique and as an interpretative tool. This approach is also not a standard approach to urban planning, design and governing. BM follows a specific protocol and aims to gain an understanding of behavioural patterns and diversity of the use of the space. However, as a result of our work, we found that BM in the chain of methods (within the *CMA*) can be used at the very end of the process to interpret the findings collected by other tools and methods, instead of being used in a traditional way, namely for observing and recording. As noted, in our study, BM was used as an interpretative tool to interpret the manually and digitally produced maps. These were a result of ethnographic and POE activities, such as conducting a daily-routine tour or a barrier-detection city tour. They were produced either by using a mobile app or by drawing the conducted paths onto a printed-out map as part of a diary-writing technique. Interpretation showed patterns and differences in the use of the space between disabled and non-disabled participants, as well as between space users and space stakeholders involved in the research. A list of findings was collected in this way, some of which are included in this paper. For example, participants seem to have established routine pathways. In particular, disabled people use well-known routes that have previously been identified as accessible, hence enabling smooth transit. In general, participants prefer to use open bright spaces; they avoid narrow, dark, shadowy streets; they tend to cross parks and squares; and they tend to take shortcuts wherever possible. Non-disabled people subconsciously do not notice the barriers that disabled people are faced with, but they soon become more aware and sympathetic when they are requested

to observe the surroundings. These are just a few of the content-based findings of a pilot study to demonstrate the direction of results. Supported with in-depth ethnographic and POE material, these findings can be further explained and compared between different national and socio-cultural settings. With more time, the initial findings could be even further explored in order to gain a deeper and more detailed understanding.

Digital techniques, technologies and tools were also examined as a part of our experimentation, but mostly for exploring the options of data collection. A rich collection of multimodal data was produced. Due to its diversity, data organization, analysis and interpretation were done manually, although some specialized digital tools could have undoubtedly contributed to simplification and automatization of the data processing. Unfortunately, the tools we identified and tested did not cover all the functionalities we needed beyond data collection. Nevertheless, they could have a significant contribution to collaborative urban planning and design in the future. With specific advancements, they could in fact be used to optimize a demanding process of deep, slow and small-data collection, analysis and interpretation. The usability of digital tools for enhanced inclusive spatial design is still more complex, and thus will be a matter of future research.

In addition to the three methodologies combined for our research aims, our work was greatly inspired by the work of several previous scholars. Especially interesting for its efforts in finding applicable ways to approach complex urban planning and design practice was the *analytical ethnographic approach*, introduced by Menezes and Smaniotto Costa (2016, pp. 167–180), also using urban ethnography principles. This idea similarly elaborates a great number of real-life questions on relational levels between the users, the spaces and the technology, which is of paramount importance. Although a source of great inspiration, it is structured in such a way that is too complex and it lacks clarity between the societal challenges addressed, questions posed and methodology proposed. Finally, to our knowledge, it has not been tested and evaluated yet, thus lacking direct applicability to real-life scenarios. We also believe that it jumps too quickly from a simple, clear and well-structured baseline model towards a complex set of questions to be studied through an

ethnographic approach. We undertake another, simpler and yet highly applicable approach, following the logic of societal challenges grouped in four dimensions and supported with an accompanying methodological framework, proposed for stakeholders to be able to tackle these challenges. In addition, the approach is based on user engagement and participation, and supported with digital tools. As shown in section 4, specifically 4.5.1, the experimentation with this model shows an array of strengths versus the stand-alone use of methodological techniques. The SWOT analysis also gives an idea of some of its weaknesses and threats, but overall the advantages prevail at this point.

6. CONCLUSIONS

As shown, societal challenges related to the design of inclusive public spaces have been addressed through European frameworks, diverse visionary concepts and methodological approaches. Nevertheless, the question of holistic design and applicability still seems to remain unanswered. With this paper, we investigate and attempt to respond to the question, “How to approach the applicability of such a complex phenomenon as a *one-size-fits-all* inclusive public spaces design?” We argue that qualitative, bottom-up, small-data-oriented approaches should be incorporated as a core principle in inclusive urban planning, design and governance practices. For this purpose, the *CMA*, and the *4-dimensional model* have been proposed. The two have been extensively elaborated through a set of specific societal challenges and questions that city governments face when trying to design cities to fit the needs of all their citizens, including disabled people. The paper thus provides a set of methodological and contextual conclusions, and aims to demonstrate the applicability of the *CMA* to our specific context of inclusive city design for all. The originality of this paper lies specifically in designing the *CMA* as a new, highly applicable methodological approach in comparison to the existing urban practice towards inclusive city design. Its main idea is an in-depth qualitative exploration of the users, the spaces and the technology through a combination of techniques, grounded in a bottom-up ethnographic approach, exploring the potential complementarity with environmental and urban-studies techniques, such as POE and BM, and digital

tools. The combination of the three methodologies is iteratively intertwined with participatory actions and participants' engagement with diverse digital tools. Such an approach supports user engagement; enhances communication between stakeholders; and eases data collection, management, analysis and interpretation.

The model proposed may be time-consuming and demands full dedication from city governments. On the other hand, it represents a highly applicable and firm complementary framework to serve urban planning and design researchers and practitioners in establishing closer connections with citizens, gaining their trust, enhancing their engagement and, finally, gaining an overall deeper understanding of their needs. Especially when it concerns understanding the (disabled) citizens' needs and how they use a space, what motivates them to use it and what prevents them from using it, the methodology proposed can go far beyond current practice, offering a way for governments to make informative and responsive decisions. A variety of methodological techniques and tools may at first confuse stakeholders, but the *CMA* is also designed in a simple, well-structured way to create an iterative flow between the identified needs, societal challenges and questions that need to be addressed in order to tackle any urban design challenge. It goes in depth and if applied with dedication it opens the door to iterative collaborative planning. With a clear governmental strategy, a little practice and time, the methodology proposed can become a part of an increasingly tailor-made and individualized urban practice. As for its applicability, what concerns us the most is exactly the risk of not being recognized by city governments. Based on the case studies and our previous experience, on the one hand, governments recognize the importance of citizens as drivers of the city, but they neglect the importance of deep understanding, thus striving for fast and efficient ways of designing cities. This is clearly an issue to be explored in future experimental user-practice-research-oriented initiatives.

The experimentation has been done on a small, non-representative sample of four case studies within one national context. Its aim was to demonstrate the methodology proposed rather than provide contextual results and act as a proof of concept. Thus, contextual conclusions are preliminary

in nature. At this stage, the conclusions cannot be generalized, but they give some exemplary insights into similar specific challenges and questions that cities face nowadays in regard to inclusive urban design. The research shows that current urban and planning practice still needs much encouragement for the implementation of such time-consuming and laborious approaches. Our future work thus should include additional testing within different national environments, further developing evaluation indicators and assessment criteria, exploring benefits and opportunities of the CMA, communicating these via relevant target audiences, and exploring further the digital dimension of urban planning and design.

Although slow and time-consuming, this approach (CMA) fills in the gaps of mainstream quantitative approaches, and offers in-depth qualitative insights. As such, it represents a specific, original viewpoint to the research. As shown by enhancing the understanding of citizens, their needs, perceptions and behaviours, it is possible to enhance informative governmental actions towards inclusive city design.

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